

PROPOSAL

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 1501

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

TO BE COMPLETED BY CONTRACTORS SUBMITTING A BID ON S35114-06GR – GENERAL CONSTRUCTION						
ITEM NO.	APPROX. QUANTITIES	ITEMS BID WITH PRICE WRITTEN IN WORDS				
1.	Lump Sum	Base Bid for furnishing all Labor, Materials and Equipment required for all Construction work ready for operation. _____				
2.	Allowance	Lump sum purchase, delivery, and start-up/testing of the portable truck scale system as specified in Section 14250 – Portable Truck Scales. Installation by others. _____				
3.	Deduct Alternate	Lump sum amount for demolition and removal of existing ballasted roof and installation of new modified bituminous roofing system and new exterior canopy and structural steel framing. _____				

PROPOSAL

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 1501

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

<hr/>
<hr/>

<hr/>
<hr/>

<hr/>
<hr/>

PROPOSAL

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 1501

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

ALLOWANCES

It is expressly understood and agreed that the total Bid presented in this Proposal is the basis for establishing the amount of the Bid Security and includes the following allowances:

- Item No. 2: An allowance of twenty thousand dollars (\$20,000.00) for the purchase, delivery and start-up/testing of the portable truck scale system as specified in Section 14250 – Portable Truck Scales. Installation by others.

All in accordance with the requirements of Division 1, Special Conditions; Section 01010, Summary of Work; Section 01020, Allowances; and Section 01500, Temporary Facilities and Controls.

Final Contract Payment for allowance items shall be based upon actual payments, and not on the approximate amounts cited herein.

ALTERNATES

It is expressly understood and agreed that the total Bid presented in this Proposal is the basis for establishing the amount of the Bid Security. The following Deduct Alternate bid items may be eliminated by the Owner in the order listed prior to finalizing the Contract Agreement, which will potentially decrease the total Bid presented in this Proposal and be the basis for establishing the amount of the Bid Security:

- Item No. 3: A deduct alternate for all related materials, supplies, labor, equipment and operations necessary to conduct and complete the removal of the existing ballasted roofing system and installation of the new modified bituminous roofing system at the DAF building and structural steel framing and roof canopy system located in the existing sludge transfer area located on the west side of the existing DAF building.

All in accordance with the requirements of Division 1, Special Conditions; Section 01010, Summary of Work; Section 01030; Alternates; and Section 01500, Temporary Facilities and Controls.

Final Contract Payment for allowance items shall be based upon actual payments, and not on the approximate amounts cited herein.

DETERMINATION OF LOW BID

Determination of low Bid will be made by comparing the total Bid which shall include the lump sum Base Bid price, unit price totals and allowances, minus the Deduct Alternate(s), taken in order, or none of them, whichever amount(s) shall be judged by the Commissioner of Public Works to be in the best interest of the County.

MAJOR EQUIPMENT ITEMS

The Bidder shall fill the name and address of the one proposed system supplier for each major equipment item tabulated hereinafter. It is expressly understood that the furnishing of this information will not relieve the Bidder of any requirements of the Contract Documents and failure to fill out properly is grounds for rejection.

PROPOSAL

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 1501

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

Specification Number	Description	Manufacturer and/or Supplier
11318	Progressive Cavity Pumps	
11331	Top Opening Inline Sludge Macerators	
11350	Sludge Dewatering Equipment	
11352	Polymer Blending and Feed Equipment	
14500	Shaftless Screw Conveyor	

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 1501

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

GENERAL CONDITIONS – INDEX

ARTICLE GC1 - APPLICATION OF GENERAL CONDITIONS	1
ARTICLE GC2 - CORRELATION AND INTENT OF DOCUMENTS	1
ARTICLE GC3 - ORAL MODIFICATIONS.....	1
ARTICLE GC4 - KNOWLEDGE OF CONDITIONS	1
ARTICLE GC5 - DRAWINGS AND SPECIFICATIONS.....	1
ARTICLE GC6 - OWNERSHIP OF DRAWINGS AND SPECIFICATIONS	2
ARTICLE GC7 - COORDINATION WITH OTHER CONTRACTORS	2
ARTICLE GC8 - MEETINGS.....	3
ARTICLE GC9 - BID BREAKDOWN.....	4
ARTICLE GC10 - SUPERINTENDENCE AND WORKMEN	4
ARTICLE GC11 - LAWS AND ORDINANCES	4
ARTICLE GC12 - PERMITS	5
ARTICLE GC13 - ACCIDENTS.....	5
ARTICLE GC14 - CONTRACTOR SUBMISSIONS.....	5
ARTICLE GC15 - SAMPLES	13
ARTICLE GC16 - TEMPLATES AND PATTERNS.....	14
ARTICLE GC17 - MATERIALS AND EQUIPMENT, APPROVALS, SUBSTITUTIONS AND DEVIATIONS	14
ARTICLE GC18 - CONTRACTOR COSTS FOR ENGINEERING SERVICES	21
ARTICLE GC19 - INSPECTION AND TESTING	21
ARTICLE GC20 - NOT USED.....	25
ARTICLE GC21 - PROTECTION REQUIREMENTS	25
ARTICLE GC22 - ACCESS ROADS AND PARKING AREAS	27
ARTICLE GC23 - TRAFFIC REGULATIONS	28
ARTICLE GC24 - BARRICADES, WARNING SIGNS AND LIGHTS	28
ARTICLE GC25 - DUST CONTROL AND SPILLAGE.....	28
ARTICLE GC26 - VERMIN CONTROL.....	28
ARTICLE GC27 - FIRST AID FACILITIES.....	28
ARTICLE GC28 - LAYOUT AND LEVELS.....	29
ARTICLE GC29 - CUTTING AND PATCHING	30
ARTICLE GC30 - OPENINGS AND CHASES.....	30
ARTICLE GC31 - SLEEVES, INSERTS AND WALL CASTINGS	31
ARTICLE GC32 - SCAFFOLDING, RIGGING AND HOISTING.....	31
ARTICLE GC33 - CLEANING	31
ARTICLE GC34 - PIPING AND EQUIPMENT IDENTIFICATION	32

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 1501

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

ARTICLE GC35 - OPERATION AND MAINTENANCE MANUALS.....	32
ARTICLE GC36 - RECORD DRAWINGS.....	32
ARTICLE GC37 - PHOTOGRAPHS	33
ARTICLE GC38 - PROJECT CLOSEOUT.....	34
ARTICLE GC39 - DEWATERING.....	34
ARTICLE GC40 - PRESERVATION OF WETLANDS AND WATERWAYS	35
ARTICLE GC41 - NOTIFICATION OF SUBCONTRACTOR.....	35
ARTICLE GC42 - JURISDICTIONAL DISPUTES.....	35

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

ARTICLE GC1 - APPLICATION OF GENERAL CONDITIONS

The provisions of the General Conditions as hereinafter stipulated shall form a part of each Prime Contract and/or separate trade specification except insofar as any such provision or provisions may be manifestly not applicable to any such trade specification.

It shall be the duty of the Contractors to fully familiarize themselves with all of the provisions of the Contract Documents.

ARTICLE GC2 - CORRELATION AND INTENT OF DOCUMENTS

The Contract Documents are complementary, and what is called for by any one shall be as binding as if called for by all.

The intent of the Contract Documents is to include everything necessary for the proper execution of the complete finished Work.

ARTICLE GC3 - ORAL MODIFICATIONS

No oral statement of any person shall be allowed in any manner or degree to modify or otherwise affect the terms of the Contract.

ARTICLE GC4 - KNOWLEDGE OF CONDITIONS

(See Instructions to Bidders, Section B, Bidder's Obligations.)

ARTICLE GC5 - DRAWINGS AND SPECIFICATIONS

- A. The Drawings and Specifications prepared by the Engineer are intended to agree and anything shown or called for on the Drawings and not mentioned in the Specifications, or vice versa, or any Work or materials necessary to, and usually included in, the complete finish of the Work and/or materials of the character to be furnished by the Contractors, shall be considered to be included herein and shall be performed and furnished by the Contractors without any extra charge, as though the same were both shown and specified.

The Engineer will furnish in addition to the Drawings listed in the Contract Documents, such other and additional Drawings and such explanations in writing as may, in the Engineer's opinion, be necessary for the performance of the Work by the Contractors, and all such details and explanations shall be binding upon and shall be strictly followed and complied with by the Contractors. All such Drawings shall be consistent with the Contract Documents, true developments thereof, and reasonably inferential therefrom.

- B. All Drawings, and such notes, interlineations, figures and details, as may be noted thereon, shall be considered as a part of and complementary to the Specifications. Full size Drawings and large-scale details shall, in general, govern and take precedence over the small scale Drawings which they are intended to amplify. Figure dimensions shall govern in laying out the Work, and no Work shall be executed from dimensions obtained by scaling the Drawings.

While the Specifications are subdivided into trades, (but only for the purpose of facilitating the Work) Contractors shall, nevertheless, furnish all labor and materials necessary to complete all the Work in accordance with the Contract despite the fact that it may not appear under the Work specified for the particular trade under which it would be normally classified.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

- C. The Contractors shall check all supplementary information furnished them immediately upon their receipt. The supplementary information shall not be altered by the Contractors, but should any error or inconsistency appear, or in the event of any doubt or question arising in respect to the true meaning and intent of the Drawings or Specifications, or should anything be omitted from the Drawings or Specifications which is necessary to a clear understanding of the Work, they shall report same in writing within five (5) days to the Engineer who will make any necessary rectification and decisions.

If, in the Contractor's opinion, any Work is shown on the Drawings or called for in the Specifications in such a manner to make it impossible for him to produce or guarantee a first-class piece of Work, he shall refer the same in writing to the Engineer before proceeding.

- D. If, at any time, the County shall fail to supply sufficient or clear information to enable the Contractor to proceed with the Work, the Contractor shall immediately notify the Engineer in writing, and in no case, will the lack of such information, or failure to understand the Drawings or Specifications, or ignorance of the contents of either, be considered or received as an excuse for improper or inferior construction, workmanship or materials, or for any delay in performing the Work, or as a justification for any claim for Extra Work or materials.

Should any question or disagreement arise concerning the meaning of Drawings or Specifications, such question or disagreement shall be settled by the Engineer, whose decision in writing shall be final.

- E. The Contractor(s) will be furnished by the County, without charge, the following:

CONTRACT	
General Construction	CD with Contract Documents (pdf)
	CD with Auto CADD Contract Documents

- F. The Contractors shall keep at least one copy of all Drawings and Specifications at the Site in good order and available to the County, the Engineer, or their representatives. These Drawings and Specifications shall be kept up to date at all times and show all changes.

ARTICLE GC6 - OWNERSHIP OF DRAWINGS AND SPECIFICATIONS

All Drawings and Specifications are and shall remain the property of the County. These are furnished to the Contractors as instruments of service. They are not to be used on any other work.

ARTICLE GC7 - COORDINATION WITH OTHER CONTRACTORS

- A. During the progress of the Work on this Contract, other contractors may be engaged in performing Work within the Contract area and in areas adjacent to this Contract area.
1. The Contractor's attention is specifically directed to the fact that because of the work on other contracts within and adjacent to the limits of this Contract he may not have exclusive occupancy of the territory within or adjacent to the limits of this Contract.
 2. The Contractor will be required to cooperate with other Prime Contractors and the owners of the various utilities and to coordinate and arrange the sequence of his Work in such a manner that all work, proposed or in progress within or adjacent to the limits of the Contract, can be progressed with as little interference as possible.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

3. In case of interference between the operations of a Contractor and/or utility owners and/or other Contractors, the Commissioner shall be the sole judge of the rights of each party and of the sequence for Work necessary to expedite the completion of all the work progressed or about to be progressed within or adjacent to the Contract limits.
- B. The direction of the Commissioner on the order and sequence of the Work shall not in itself constitute a basis for extra compensation or an Extension of Time.

ARTICLE GC8 - MEETINGS

A. Pre-Award Meeting

During the Pre-Award meeting with the contractor(s), a County Official from the Office of Minority Affairs will discuss the Minority Business Enterprise/Women's Business Enterprise (M/WBE) "Best Effort" requirement discussed in Appendix EE of the Agreement Section of the project specifications.

B. Pre-Construction Meetings

1. After the Contract has been awarded, but prior to the start of actual construction, two separate and distinct Pre-Construction Meetings will be scheduled by the Engineer.
2. One conference will include representatives of the New York State Department of Environmental Conservation and the Nassau County Department of Public Works, Contractors, Subcontractors as requested, and the Engineer. The purpose of this Meeting will be generally administrative and will include but not necessarily be limited to discussion of State requirements, use of Subcontractors, submissions required from the Contractor prior to start of Work, major equipment deliveries and priorities, construction procedures, payment criteria, time for completion, and any specific or unique criteria to be followed.
3. The second Meeting will involve the Nassau County Department of Public Works, Local Municipalities, Police and Fire Department, New York State Department of Transportation, Utility Companies, the Contractors and the Engineer. The prime purpose of this conference is to acquaint local officials, highway departments, and utilities with the proposed Contract limits, construction procedures, maintenance of traffic, and areas where utilities may be affected.

C. Progress Meetings

1. Regular Meetings will be held bi-monthly at the County Field Office during the performances of the Work of this Contract. Additional Meetings may be called as progress of the Work dictates.
2. Responsible representation from major equipment manufacturers will be the Contractors' responsibility at Progress Meetings on demand from the County. Refer to all Divisions of the Technical Specifications for other requirements.
3. Attendance:
 - a. County
 - b. Engineer
 - c. Contractor

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

- d. Subcontractors, only with Engineer's approval or request, as pertinent to the agenda.
- 4. Minimum Agenda
 - a. Review minutes of previous meetings.
 - b. Review progress of Work since last meeting.
 - c. Note and identify problems which impede planned progress.
 - d. Develop corrective measures and procedures to regain planned Schedule.
 - e. Revise construction Schedule as indicated and plan progress during next Work period.
 - f. Maintaining of quality and work standards.
 - g. Complete other current business.

ARTICLE GC9 - BID BREAKDOWN

(See Agreement, Article XXXIV, "Submission of Bid Breakdown".)

ARTICLE GC10 - SUPERINTENDENCE AND WORKMEN

(See Agreement, Articles XXIX, "Character and Competency" and XXX, "Superintendence".)

ARTICLE GC11 - LAWS AND ORDINANCES

The Contractors accept the Drawings and Specifications and other Contract Documents, submitted by the Engineer, on the basis that such Drawings, Specifications and other Contract Documents do not constitute a release of responsibility on the part of the Contractors to know and supervise the actual construction in all its parts so that such construction complies with all legal regulations. The Contractors shall be held to be both responsible and accountable for any damage which the County may suffer as a result of non-compliance with any or all legal regulations.

The Work shall be performed by the Contractors, in all respects, in strict conformity to all laws, rules, regulations, requirements and ordinances of the federal, state, and local governments and all departments and bureaus thereof, and of the National Fire Protection Association. Should the Drawings or the Specifications conflict with the law, the Contractors shall immediately notify the Engineer in writing of such conflict, and shall thereafter follow the written instructions of the Engineer in respect thereto; or should the Drawings or Specifications require more than the law requires, the Drawings and Specifications shall be followed nevertheless.

The Prime Contractor shall obtain and pay for all permits and fees required by the Work performed under his Contract. Notwithstanding the requirements of the preceding paragraphs, all Contractors shall be additionally governed by OSHA requirements. All electrical Work shall comply with the N.E.C. and the respective Contractor will be required to furnish for his Work, Underwriters Certificates issued by Underwriters Laboratories for compliance.

Compliance with the foregoing requirements shall not relieve the Contractors of any other of their obligations under this Contract. (See Agreement, Articles III, "Contractor's Responsibility" and IV, "Compliance with Laws".)

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

ARTICLE GC12 - PERMITS

(See Agreement, Article IV, "Compliance with Laws".)

ARTICLE GC13 - ACCIDENTS

- A. If death, serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Commissioner and the Engineer.
- B. Contractor shall promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance of the Work, which cause death, personal injury or property damage, giving full details and statements of witnesses.
- C. If any claim is made by anyone against the Contractor or Subcontractor on account of any accidents, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

ARTICLE GC14 - CONTRACTOR SUBMISSIONS

In accordance with the requirements of the Contract Documents, the Contractor shall furnish all required submittals which shall include, but not be limited to, the following tabulation of Contractor submissions.

A. Materials and Equipment

1. Suppliers and Manufacturers

Within fifteen (15) days after Notice to Proceed, the Contractor shall submit to the Commissioner and the Engineer a list of materials and equipment suppliers and manufacturers for approval in accordance with the requirements of the General Conditions, Article GC-17. "Materials and Equipment Approvals, Substitutions, and Deviations".

2. Material and Equipment Orders Schedule

- a. Within fifteen (15) days after Notice to Proceed, Contractor shall prepare and submit his tabulation of principal items of equipment and materials to be purchased to the Engineer for review and approval.

The schedule shall be revised as required prior to approval by the Engineer.

- b. Ten (10) updated copies of the schedule shall be submitted to the Engineer with the application for partial payment.
- c. The schedule shall be updated biweekly and one copy submitted to the Engineer.
- d. Schedule shall be submitted until all of the data is incorporated into the CPM Scheduling for the project.

3. Form of Schedule

Schedule shall be in tabular form with appropriate spaces to insert the following information for principal items of equipment and materials:

- a. Date on which shop drawings are requested and received from the manufacturer.
- b. Dates on which certification is received from the manufacturer and transmitted to the Engineer.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

- c. Dates on which shop drawings are submitted to the Engineer and returned by the Engineer for revision.
- d. Dates on which shop drawings are revised by manufacturer and resubmitted to the Engineer.
- e. Date on which shop drawings are returned by Engineer annotated either "Approved" or "Approved as Noted".
- f. Date on which accepted shop drawings are transmitted to manufacturer.
- g. Date of manufacturer's scheduled delivery.
- h. Date on which delivery is actually made.

B. Substitutions

- 1. Within a fifteen (15) day period from the Notice to Proceed, requests for substitutes may be proposed to the Commissioner. This period for submitting requests will be strictly enforced. Such requests shall conform to the requirements of General Conditions, Article GC-17, "Materials and Equipment, Approvals, Substitutions and Deviations".
- 2. Requests for substitutions will be received and considered from Prime Contractors only and not from manufacturers, suppliers, subcontractors, or other parties.

C. Shop Drawings

- 1. Within fifteen (15) days after the Notice to Proceed, the Contractor shall prepare and submit fifteen (15) copies of his schedule of shop drawings submissions of the Engineer for review and approval.
- 2. In order to maintain the construction schedule for this project the Contractor shall submit all shop drawings within forty-five days after the Notice to Proceed as indicated in Division 1, Special Conditions to the Technical Specifications and the Contractor's schedule of shop drawing submissions shall conform to these requirements.
- 3. Shop drawings shall be submitted without fail in time to permit correction, resubmission and final approval, as hereinafter specified, without causing any delay in the construction of any work. The Contractors may begin the preparation of shop drawings as soon as possible after signing of the Contract. Formal submission of shop drawings will begin after execution of the Contract by the County Executive.

D. Coordination Drawings

- 1. Coordination Drawings shall be completed by all Contractors within ninety (90) days from the Notice to Proceed.
- 2. Coordination Drawings shall be initiated, completed and submitted for distribution so as not to delay the construction.

E. Layout and Installation Drawings

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

1. Layout and installation drawings shall be completed by all Contractors within one hundred and twenty (120) days from the Notice to Proceed.
2. Layout and installation, drawings submitted for review by the Engineer shall include all pipes, valves, fittings, sewers, drains, heating and ventilation ducts, all electrical, heating, ventilating and other conduits, plumbing lines, electrical cable trays, lighting fixture layouts, and circuiting, instrumentation, communications power supply, alarm circuits, etc., under this Contract.

F. Operations and Maintenance Manuals

1. For special requirements for Final Operations and Maintenance Manuals, see Division 1, Special Conditions of the Technical Specifications.

G. Maintenance and Lubrication Schedules

1. A maintenance and lubrication schedule for each piece of equipment shall be submitted with the shop drawings. Submission shall be fifteen (15) copies.
2. The schedules shall provide the information and be in the form indicated in Division 1, Special Conditions of the Technical Specifications.

H. Samples

1. Samples and Shop Drawings which are related to the same unit of work or Specification Section shall be submitted at the same time. If related shop drawings and samples are submitted at different times, they cannot be reviewed until both are furnished to the Engineer.
2. All samples are to be submitted in accordance with the requirements of General Conditions, Article GC-15, "Samples".

I. Shop Drawing Requirements

1. Where the nature of the work of the Contract makes it necessary, or where so required by the Engineer, Contractors shall submit scale and full size shop drawings of their work for the approval of the Engineer. The shop drawings shall be complete in every detail including provisions required of various trades, connections with other work, all cutting, fitting and drilling required and any and all other necessary information in accordance with usual trade practice as particularly required for any special purposes.
2. Shop drawings include, but are not limited to, shop drawings, layout and installation drawings in plan and elevation, certified wiring diagrams, interconnecting wiring diagrams, manufacturer's data, etc. Contractor shall be responsible for securing all of the information, details, dimensions, drawings, etc., necessary to prepare the Shop Drawings required and necessary under this Contract and to fulfill all other requirements of his Contract. Contractor shall secure such information, details, drawings etc. from all possible sources including the Contract Drawings, drawings prepared by subcontractors, suppliers, etc.
3. All shop drawings submitted by the Contractors which involve a change at variance with the Contract Drawings shall be noted by the Contractors by advising the Engineer in writing as to the recommended change and the reason therefor.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

4. Contract Drawings are for engineering and general arrangement purposes only and are not to be used as shop drawings.
5. Shop drawings shall accurately and clearly present the following:
 - a. All working and installation dimensions.
 - b. Arrangement and sectional views.
 - c. Units of equipment in the proposed positions for installation details of required attachments and connections and dimensioned locations between units and in relation to the structures.
 - d. Necessary details and information for making connections between the various trades including, but not limited to, power supplies and interconnecting wiring between units, accessories appurtenances, etc.
6. Structural and all other layout drawings prepared specifically for the Project shall have a plan scale of not less than 1/4-inch equal to 1 foot and they shall be not larger than the size of the Contract Drawings.
7. Where manufacturer's publications in the form of catalogs, brochures, illustrations, compliance certificates, or other data sheets are submitted in lieu of prepared shop drawings, such submissions shall specifically indicate the item for which approval is requested. Identification of items shall be made in ink, and submissions showing only general information are not acceptable.
8. The Contractor shall provide all required copies for the use of the various trades and at the site, and one (1) copy of approved shop drawings shall be provided by the Contractor to the other Prime Contractors.
9. A submittal record form shall accompany each submittal. A facsimile copy of the record form will be provided by the County. This is the only form to be used by the Contractor for his submittals.
10. Contractor Responsibilities
 - a. Before submitting shop drawings to the Engineer all submittals from subcontractors, manufacturers or suppliers shall be sent directly to the Contractor for preliminary review, coordination and checking. Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of material or equipment. Contractor shall thoroughly check all drawings for accuracy and conformance to the intent of the Contract Documents. Drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors, manufactures, or suppliers by the Contractor for correction.
 - b. All submittals, including shop prepared by or under the direction of the various Contractors, shall be thoroughly checked by the Contractor for accuracy and conformance to the intent of the Contract Documents before being submitted to the Engineer and shall bear the Contractor's signature of approval certifying that they have been so checked. Submittals without the Contractor's signature of approval will not be reviewed by the Engineer and will be returned to the Contractor stamped "Rejected". Before submitting them to the Engineer, all submittals shall be bound,

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

properly labeled and consecutively numbered. In a clear space above the title block, or on the back, the Contractor shall hand stamp the following, and enter the required information:

"NASSAU COUNTY

NAME OF PROJECT

Date _____

Contract No. _____

Equipment Identification No. _____

Contract Drawings No. _____

Specification Section _____

This document has been reviewed, coordinated and checked in detail for accuracy of content and for compliance with the Contract Documents and is hereby approved. The information contained herein has been coordinated with all involved Contractors.

Contractor _____

Signed _____"

- c. Shop Drawings shall be submitted as a single package including all associated drawings for any operating system and shall include all items of equipment and any mechanical units involved or necessary for the functioning of such system. Where applicable, the submittal shall include elementary wiring diagrams showing circuit functioning and necessary interconnection wiring diagrams for construction.
- d. If the submittals contain any departures from the Contract Documents, specific mention thereof shall be made in the Contractor's letter of transmittal. Otherwise, the review of such submittals shall not constitute approval of the departure. The Contractor shall call the Engineer's attention to any changes by the use of large rubber stamp, or by larger letters on shop drawings. If this is not done, even if the work is incorporated in the construction, it will not be accepted by the Engineer even if shop drawings are "Approved".
- e. No materials or equipment shall be ordered, fabricated or shipped or any work performed until the Engineer returns to the Contractor the submittals herein required, annotated "Approved".
- f. Where errors, deviations, and/or omissions are discovered at a later date in any of the submittals, the Engineer's prior review of the submittals does not relive the Contractor of the responsibility for correcting all errors deviations and/or omissions.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

11. Procedure for Review

- a. Shop Drawings will be checked for design conformance with the Contract Documents and general arrangement only.
- b. Submittals shall be transmitted in sufficient time to allow the Engineer adequate time for review and processing so as not to delay the Project.
- c. Contractor shall transmit one (1) reproducible transparency and seven (7) prints of each submittal to the Engineer for review for all drawings greater than 8-1/2 inches by 11-inches in size. The Contractor shall submit fifteen (15) copies of all other submittals. Prints from the reproducible transparencies shall be legible with a sharp, clear definition of all line work and lettering. Reproducible transparencies and resultant prints which in the opinion of the Engineer are not legible will not be reviewed and will be returned to the Contractor annotated "Rejected".
- d. Submittals shall be accompanied by a submittal record form hereinbefore specified and shall be accompanied with any notification of departures and any pertinent data to facilitate review. If data for more than one Section of the specifications is submitted, a separate transmittal letter shall accompany the data submitted for each Section. A number shall be assigned to each submittal by the Contractor starting with the Number 1 and thence numbered consecutively. Resubmittals shall be identified by the same number followed by the suffix "A" for the first Resubmittals and the suffix "B" for the second Resubmittals, etc.
- e. Submittals will be annotated by the Engineer in one of the following ways:

"Approved" - no exceptions are taken.

"Approved as Noted" - minor corrections are noted and shall be made and a Resubmittals is required.

"Disapproved" - major corrections are noted and shall be made and a Resubmittals is required.

"Rejected" - Based on the information submitted, the submission is not in conformance with the Contract Documents. The deviations from the Contract Documents are too numerous to list and a completely revised submission of the proposed equipment or a submission of other equipment is required.

or

Reproducible transparencies and resultant prints are not legible and will not be reviewed and a Resubmittal is required.
- f. If a submittal is satisfactory to the Engineer, the Engineer will annotate the submittal, "Approved" and return three (3) copies to the Contractor. If reproducible transparencies are submitted, the Engineer will retain the copies and return the reproducible transparencies to the Contractor, plus two prints.
- g. If a Resubmittal is required, the Engineer will annotate the submittal "Approved as Noted" or "Disapproved" or "Rejected" and return three (3) copies to the Contractor for appropriate action. If reproducible transparencies are submitted, the Engineer

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

will retain the copies and return the reproducible transparencies to the Contractor, plus two prints. The Contractor shall resubmit in accordance with paragraph D.3, hereof.

- h. Contractor shall revise and resubmit submittals as required by the Engineer until submittals are "Approved" by the Engineer.
- i. Approval of a Shop Drawing by the Engineer will constitute approval of the subject matter for which the Drawing was submitted and not for any other structure, material, equipment or appurtenances shown.

J. Coordination Drawings Requirements

1. The General Construction Contractor shall initiate coordinating the installations of all the Contract Work by means of Coordination Drawings, as specified herein. The Coordination Drawings may lack complete data in certain instances pending receipt of shop drawings, but sufficient space shall be allotted for the items affected. When final information is received, such data shall be promptly inserted on the Coordination Drawings.
2. The General Construction Contractor shall prepare a set of mylar transparencies, indicating equipment and appurtenances, at not less than 3/8-inches scale. The Drawings shall also show beams, ceiling heights, walls, floor to floor dimensions, floors, partitions, columns, windows, door and other major architectural and structural features shown on the General Construction Drawings. Site coordination drawings shall be at not less than 1"-20' scale. Two sets of prints from the transparencies shall be furnished to the County's review for conformance with the intent of this Section. Corrections, if required, shall be made to the transparencies.
4. In the preparation of all the Coordination Drawings, composite drawings, large scale details as well as cross and longitudinal sections shall be made as required, or as directed by the Engineer, to fully delineate all conditions. Particular attention shall be given to the locations, size and clearance dimensions of equipment items, shafts and similar features. In preparing the Coordination Drawings, minor changes in duct, pipe or conduit routings that do not affect the intended function may be made as required to avoid space conflicts, when mutually agreed, but items may not be resized or exposed items relocated without the County's approval. No changes shall be made in any wall or chase locations, ceiling heights, door swings or locations, windows or other openings, or other features affecting the function or aesthetic effect of the building. During this period, the Contractors shall make a good faith effort to coordinate work among themselves. If conflicts or interferences cannot be satisfactorily resolved, the County shall be notified and its decision obtained.
5. No preference or advantage shall be given to any Contractor in considering resolution of conflicts, or grant priority to any one Contractor in the allocation of space. If the Contractors are unable to reach agreement on a matter of interference, the matter shall be submitted to the County for its binding decision. Should any problems of coordination require architectural or structural change of design, the change shall be submitted to the County for resolution. At the completion of this phase of the Coordination Drawings preparation, the County shall hold coordination meetings with the Prime Contractors to eliminate any interference among the trades that the Drawings indicate and to avoid any conflicts during installation of the work.
6. At the completion of these meetings, and after the General Construction Contractor's set of mylars has been coordinated and all necessary changes have been made, the County shall hold a final coordination meeting where these Drawings shall then be signed-off by each of

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

the Contractors, indicating their awareness of, and agreement with, the indicated routings and layouts and their inter-relationship with the adjoining or contiguous work of all Contracts.

Thereafter no unauthorized deviations will be permitted and if made without the knowledge or agreement of the County or other affected contractors, will be subject to removal and correction at no additional cost to the County.

7. After the final Coordination Drawings have been agreed upon and signed by all Contractors, the General Construction Contractor shall provide and distribute four (4) copies to each of the Contractors and fifteen (15) copies to the County, for reference and record purposes. Contractors desiring additional copies of such drawings, beyond the basic distribution indicated above, shall arrange and pay for cost of same.
8. The record copies of final Coordination Drawings shall be retained by each Contractor as a working reference. All shop drawings, prior to their submittal to the County, shall be compared with the Coordination Drawings and developed accordingly by the Contractor responsible. Any revisions to the Coordination Drawings which may become necessary during the progress of the work shall be noted by all Contractors and shall be neatly and accurately recorded on the recorded copies. Each Contractor shall be responsible for the up-to-date maintenance of his own record copies of the Coordination Drawings and to keep one copy available at the Site. The Coordination Drawings and any subsequent changes thereto, shall be utilized by each Contractor in the development of his as-built drawings.
9. No extra compensation will be paid by the County to any Contractor for relocating any duct, pipe, conduit or other material that has been installed without proper coordination among all the Contractors and the trades involved. If any improperly coordinated work, or work installed that is not in accordance with the approved Coordination Drawings, necessitates additional work by the other Contractors, the costs of such additional work shall be assessed to the Contractor responsible, as determined by the County.
10. All changes in the work on any Contract, whether a change in price is given or not, shall be shown on the Coordination Drawings.
11. All work on the Coordination Drawings shall be performed by competent draftsmen, in clear, legible manner. The County shall be the sole judge of the acceptability of the Coordination Drawings.
12. Coordination Drawings shall not be used for "as-built" drawings.

K. Layout and Installation Drawings Requirements

1. Layout and installation drawings are to be submitted in accordance with the requirements hereinbefore specified under Paragraph I, Shop Drawings Requirements.
2. Layout and installation drawings, are required for both interior and exterior piping, valves, fittings, sewers, drains, heating and ventilation ducts, conduits, plumbing lines, electrical cable trays, etc. The final dimensions, elevations, locations, etc. of the various items may depend upon the dimensions of equipment, valves, etc. to be furnished by the Contractor.
3. Layout and installation drawings shall show connections to structures, equipment, sleeves, valves, fittings, etc.
4. Drawings shall show the location and type of all supports, hangers, foundations, etc. and the required clearances to operate valves, equipment, etc.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

5. The drawings for pipes, ducts, conduits, etc. shall show all electrical conduits and pressure piping, electrical cable trays, heating and ventilation ducts or pipes, structures, manholes or any other feature within four (4) feet (measured as the clear dimension) from the pipe, duct, conduit, etc. for which the profile is drawn.

ARTICLE GC15 - SAMPLES

A. General

1. Where required in the specifications for the various trades or otherwise requested by the County or Engineer, samples of any material to be used and of the finish to be applied in the work, shall be submitted by the Contractor for approval in accordance with the General Conditions, Article GC-14, "Contractor Submissions". Samples shall be of such a nature to fully illustrate the character of the finished work or as may be more fully described in the trade specifications.
2. Samples shall be furnished so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted.
3. Contractor shall store and protect large samples and mock-ups until the Project is complete or until a time approved by the Engineer.
4. Accepted samples will establish the standards by which the completed work will be judged.

B. Samples

1. Samples shall be of sufficient size or quantity to clearly illustrate the quality, type range of color, finish or texture and shall be properly identified.
2. Samples shall be checked by the Contractor for conformance to the Contract Documents before being submitted to the Engineer and shall bear the Contractor's stamp of approval certifying that they have been checked.
3. Samples shall be submitted in triplicate and each sample shall be identified with the name and number of the project, reference to Specification Section, Contract Drawings number, nature of the material, trade name of manufacturer and the location of its intended placement. Written approval shall be obtained, and the work furnished shall conform strictly to the samples approved by the Engineer. No approval of a sample shall be taken in itself to change or modify any of the requirements of the Contract.
4. Transportation charges on samples submitted to the Engineer shall be prepaid by the Contractor. Samples shall be delivered to the Engineer's field office. If the Contractor requires a sample for his use, he shall notify the Engineer in writing.
5. If samples are disapproved, the Contractor shall make all corrections required and shall resubmit the required number of new samples until approval is received.

C. Job Mock-Ups

1. Job mock-ups (sample panels) shall be constructed on Site by the Contractor and only one of each type will be required. Mock-ups shall be constructed only after the individual samples and components used in the mock-up have been approved by the Engineer. If a mock-up is not approved, Contractor shall construct additional ones until approval is received.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

D. Samples for Tests

1. Contractor shall furnish such samples of material as may be required for examination and test. All samples of material for tests shall be taken according to standard methods and as required by the Contract Drawings.

ARTICLE GC16 - TEMPLATES AND PATTERNS

Templates and patterns shall be prepared and provided as required for the proper execution of the Work under the various Prime Contracts, by the various trades.

ARTICLE GC17 - MATERIALS AND EQUIPMENT, APPROVALS, SUBSTITUTIONS AND DEVIATIONS

A. Approval of Materials and Equipment Suppliers and Manufacturers

1. The Contractor shall submit to the Commissioner and the Engineer for approval a list of materials and equipment suppliers and manufacturers who are to furnish items of materials or equipment. This submission is to be made in accordance with the time conditions stipulated in General Conditions, Article GC-14, "Contractor Submissions".
2. Where the acceptability of any equipment or material specified herein is conditioned upon that item having a record of satisfactory operation for a specified period of time, such acceptability may be considered lacking such record, only if the manufacturer and/or supplier can provide a bond or cash deposit which will guarantee replacement at no cost to the County in the event of failure occurring prior to the expiration of the experience record term specified. The item proposed must meet all other technical requirements stipulated in the Specifications.
3. If the materials and equipment submitted are offered as substitutes to the Contract Documents the Contractor shall advise the County and the Engineer of the substitutions and comply with the requirements hereinafter specified in this Article.

B. Storage and Protection of Equipment and Materials

The Contractor shall make every effort to minimize extended storage periods for materials and equipment at the site by judiciously scheduling deliveries to coincide with construction needs. The Contractor shall store his material and equipment in accordance with the requirements of Division 1, Special Conditions of the Technical Specifications. The Contractor shall not store unnecessary materials or equipment at the site and shall take care to prevent any structure from being loaded with a weight which will endanger its integrity or the safety of persons. The Contractor shall follow the instructions of the Engineer, regarding the posting of regulatory signs for loading on structures and other safety precautions. The Contractor shall obtain from the equipment manufacturers a letter detailing the method of storage and the maintenance of the stored equipment for the Engineers review. All storage and methods of protection for material and equipment at the site shall be subject to the prior approval of the Engineer. Any costs associated with the storage and protection of materials and equipment shall be deemed to be included under the Contract and no additional payment will be made.

1. Materials

- a. Materials may be stored out of doors if supported on wood runners above ground surface and protected with approved, effective durable covers.
- b. Materials shall not be placed within ten (10) feet of fire hydrants.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

- c. Avenues for personnel and vehicular movement, gutters, drainage channels and inlets shall be kept unobstructed at all times.

2. Major Equipment

- a. No Major Equipment Item shall be brought to the site until the following conditions are met:
 - (1) The County must have received the manufacturer's recommendations for on site storage in writing.
 - (2) The structure in which the equipment is to be installed is roofed (roofing must be watertight) and has such protection of doorways, windows and other openings that will provide reasonable protection from the weather.
- b. The manufacturer must certify to the County, in writing, that the equipment has been properly stored.

3. Special Equipment

- a. The storage of special equipment shall be in accordance with the requirements specified in Division 1 of the Technical Specifications.

4. Equipment other than Major Equipment

- a. The Contractor shall not ship any equipment to the site until approval is received from the County. Under no circumstances shall equipment be delivered to the Site more than one month prior to installation without written authorization from the County.
- b. Storage of any mechanical or electrical equipment out of doors at any time is absolutely prohibited regardless of the protection furnished. Storage of mechanical and electrical equipment within structures at the Site will not be permitted until all structural work has been completed and the structure is made weathertight.
- c. All mechanical and electrical equipment shall be coated, wrapped and otherwise protected from snow, rain, drippings of any sort, dust, dirt, condensed water vapor, etc. during shipment, storage, and subsequent to installation and until placed in service.
- d. Should storage of mechanical and electrical equipment become necessary before it can be stored at the Site, the Contractor shall provide storage in a weatherproof warehouse.
- e. All costs for equipment protection including warehousing or other work to meet the scheduled completion date shall be deemed to be included under the Contract and no additional payment will be made.
- f. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the County, until such time as the equipment is be installed.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

- g. All equipment shall be stored fully lubricated with oil, grease, etc., unless otherwise instructed by the manufacturer.
- h. Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the County by him. These instructions shall be carefully followed and a written record of this kept by the Contractor.
- i. Moving parts shall be rotated a minimum once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.
- j. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.
- k. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its conditions has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.
- l. Where equipment must be installed before the erection of adequate protective structures, the Contractor, without additional compensation shall provide approved, effective and durable covers and provide such other protection as required for fully protecting such equipment from damage from the elements or other causes.

C. Installation of Equipment

1. General

- a. Contractor shall have on hand sufficient personnel, proper equipment, and machinery of ample capacity of facilitate the work.
- b. Contractor shall be responsible for locating, aligning and leveling all equipment and shall employ a licensed surveyor to set all lines and levels of equipment to the accuracy required.
- c. Complete manufacturer's installation instructions, including permissible tolerances, shall be furnished in duplicate with each unit of equipment or set of identical units before installation.
- d. All equipment shall be installed in accordance with the approved shop drawings: inclusive of manufacturer's specifications, drawings and tolerances; under the direct supervision of the required manufacturer's engineer. In no instance shall the directions of the manufacturer's engineer contravene the Engineers direction.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

- e. Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the drawings unless directed otherwise by the engineer during installation.

2. Installation

- a. Special care shall be used in locating, aligning and leveling all equipment and parts thereof to insure that each item is in the proper position relative to other equipment, and that all parts are aligned within allowable tolerances. The Contractor shall be responsible for this accuracy, and shall notify the Engineer of any conditions in prior work which would prevent this alignment before proceeding with the work. The Contractor shall employ a licensed surveyor to set all lines and levels of equipment to the accuracy required.
- b. Concrete foundations for equipment shall be approved design and shall be adequate in size, suitable for the equipment erected thereon.

D. Nameplates

- 1. Each unit of equipment shall have the manufacturer's name or trademark on a corrosion-resistant nameplate securely affixed in a conspicuous place. The manufacturer's name or trademark may be cast integrally, stamped, or otherwise permanently marked upon the item of equipment.
- 2. Such other information as the manufacturer may consider necessary to complete identification, or as specified, shall be shown on the nameplate.

E. Painting

- 1. Except as otherwise specified or required, equipment shall be primed and finish painted at the factory, in accordance with the recommendations of the approved manufacturer.
- 2. Necessary field painting, as assigned to the individual Prime Contractors, shall be in accordance with the requirements of the painting specifications in the General Construction Contract. Any damage to shop coatings shall be corrected to the satisfaction of the Engineer.

F. Damage During Tests and Instruction Periods

Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and he shall neither have nor make any claim for damage which may occur to equipment prior to the time when the County formally takes over the operation thereof.

G. Services of Manufacturer's Engineers

The contract price shall include the cost of furnishing competent engineers or superintendents from each company manufacturing equipment for the Project to:

- 1. Assist the Contractor to install, adjust and test the equipment in conformity with the Contract Documents.
- 2. Supervise start-up operations and adequately instruct designated employees of the County in the proper operation and maintenance procedures of equipment installed.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

3. The manufacturer's engineers shall devote, as a minimum, the full time specified in the detailed equipment specifications. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor. The manufacturer's representatives shall sign in and out in a book kept by the Engineer on every occasion they are on the site and shall indicate time of arrival and departure.
4. Be available to check equipment operation and maintenance procedures, when required by the County, throughout the guarantee period of the equipment.

H. Equipment Manufacturers Certification

As a condition precedent to acceptance of equipment installed and operating, the Contractor will provide the County with written certification, obtained from each company manufacturing equipment for the Project, that the equipment is installed and does operate in accordance with the specifications and manufacturer's recommendations.

I. Substitutions

1. Unless otherwise specified, all materials and equipment incorporated in the work under these Contracts shall be new.
2. Whenever specific references are made in the Specifications, to manufacturer's or brand names, the intent is to establish a standard of type, quality and function of the required material or equipment. Where several of such specific references are given for any item of material or equipment, at least one will include a specific catalog number or other identifying designation. The products of the other listed manufacturers must in the opinion of the Commissioner, be equivalent to the product so identified. The fact that one or more of the other manufactures listed does not provide material essentially meeting the standards of the referenced manufacturer or other Specifications requirements shall not relieve the Contractor of responsibility for providing materials complying with such requirements. The fact that manufacturer's names are specified for any item shall not be constructed as implying that such item need not comply with any additional performance, construction or other requirements specified for the item. In all cases, the Specifications requirements shall take precedence over the manufacturer's standard.
3. Requests for substitutions of equipment or materials shall be made in accordance with the time conditions stipulated in General Conditions, Article GC-14, "Contractor Submissions". This period for submitting requests will be strictly enforced. Such requests shall conform to the following requirements:
 - a. Contractor shall submit for each proposed substitution sufficient details, complete descriptive literature and performance data together with samples of the materials, where feasible, to enable the Commissioner to determine if the proposed substitution is equal.
 - b. Contractor shall submit certified tests, where applicable, by an independent laboratory attesting that the proposed substitution is equal.
 - c. A list of installations where the proposed substitution is equal to the specified piece of equipment or materials.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

- d. Requests for substitutions shall include full information concerning differences in cost, and any savings in cost resulting from such substitutions shall be passed on to the County.
4. Requests for substitutions after the period stipulated in General Conditions, Article GC-14, "Contractor Submissions", will not be accepted for evaluation except in case of strikes, discontinuance of manufacturer or other reason deemed valid by the Commissioner whereby the specified products or those approved are unobtainable. In such case the Contractor shall provide substantial proof that the acceptable products are unavailable.
5. Where the approval of a substitution requires revision or redesign of any part of work, including that of other Contracts, all such revision and redesign, and all new drawings and details required therefore, shall be provided by the Contractor at his own cost and expense, and shall be subject to the approval of the Commissioner.
6. In the event that the Engineer is required to provide additional engineering services, then the Engineer's charges for such additional services shall be charged to the Contractor by the County in accordance with the requirements of the General Conditions, Article GC-18, "Contractor Costs for Engineering Services".
7. Any modifications in the work required under other Contracts to accommodate the changed design will be incorporated in the appropriate Contracts and any resulting increases in Contract prices will be deducted by the County from payments otherwise due the Contractor who initiated the changed design.
8. In all cases the commissioner shall be the judge as to whether a proposed substitution is to be approved. The Contractor shall abide by his decision when proposed substitute items are judged to be unacceptable and shall in such instances furnish the item specified or indicated. No substitute items shall be used in the work without written approval of the Commissioner.
9. In making request for substitution, Contractor represents that:
 - a. Contractor has investigated proposed substitution, and determined that is equal to or superior in all respects to the product, manufacturer or method specified.
 - b. Contractor will provide the same or better warranties or bonds for proposed substitution as for product, manufacturer or method specified.
 - c. Contractor waives all claims for additional costs or extension of time related to proposed substitution that subsequently may become apparent.
 - d. Contractor shall have and made no claim for an extension of time or for damages by reason of the time taken by the County and Engineer in considering a substitution proposed by the Contractor or by reason of the failure of the County and Engineer to approve a substitution proposed by the Contractor. Any delays arising out of consideration for an approval of a substitution shall be the sole responsibility of the Contractor requesting that substitution and he shall arrange his operations to make up the time lost.
10. Proposed substitutions will not be accepted if:
 - a. Acceptance will require substantial revision of Contract Documents.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

- b. They will change design concepts or Technical Specifications.
 - c. They will delay completion of the work, or the work of other Contractors.
 - d. They are indicated or implied on a Shop Drawing and are not accompanied by a formal request for substitution from Contractor.
11. Only those products originally specified and/or added by approved requests for substitutions submitted in accordance with the preceding paragraphs may be used in the work. Whenever requests for substitutions are approved, it shall be understood that such approval is conditional upon strict conformance with all requirements of the Contract and further subject to the following:
- a. Any material or article submitted for approval in accordance with the above procedure must be equal, in the sole opinion of the Commissioner, to the material or article specified. It must be readily available in sufficient quantity to prevent delay of any work, inspection of tests; it must be available in a reasonably equivalent range of colors, textures, dimensions, gauges, types and finishes as the material or article specified; it must be equal to the specified item in strength, durability, efficiency, serviceability, compatibility with existing systems, ease and cost of maintenance; it must be compatible with the design and not necessitate design modifications by the Engineer; its use must not impose additional work, or require changes in, the work of any other Contractor without the written agreement of such Contractor. Availability of spare parts shall be assured for the useful life of the Project.
 - b. Request for all substitutions shall be accompanied by all information needed for the Commissioner to make an evaluation, including manufacturer's brand to trade names, model numbers, description of specification of item, performance data, test reports, samples, history of service, and other data as applicable.
 - c. The Commissioner reserves the right to disapprove, for aesthetic reasons, any material or equipment on the basis of design or color considerations alone, without prejudice to the quality of the material or equipment, if the manufacturer cannot meet the required colors or design.
 - d. All requests for substitutions of materials or other changes from the Contract requirements, shall be accompanied by an itemized list of all other items affected by such substitution or change. The Commissioner shall have the right, if such is not done, to rescind any approvals for substitutes or changes and to order such work removed and replaced with work conforming to requirements of the Contract, all at the Contractor's expense, or to assess all additional costs resulting from the substitution to the Contractor.
12. Approval of a substitution will not relieve Contractor from the requirement for submission of Shop Drawings or any of the provisions of the Contract Documents.

J. Deviations

1. Within fifteen (15) days after the Notice to Proceed, requests for deviations from the Contract Documents and the reasons therefore, may be proposed to the Commissioner. This period for submitting requests will be strictly enforced. The Contractor waives all claims for additional costs or extension of time related to proposed deviations that subsequently may become apparent.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

2. Deviations shall mean the departure by the Contractor from the performance of his work in accordance with the Contract Documents.
3. In all cases the Commissioner shall be the judge as to whether a proposed deviation is to be approved. The Contractor shall abide by his decision when proposed deviations are rejected and shall in such instances perform the work in accordance with the meaning and intent of the Contract Documents.
4. Any delays arising out of consideration for an approval of a deviation shall be the sole responsibility of the Contractor, and he shall arrange his operations to make up the time lost.

ARTICLE GC18 - CONTRACTOR COSTS FOR ENGINEERING SERVICES

- A. In the event that the Engineer is required to provide additional engineering services as a result of substitution of materials or equipment which are not "or equal" by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or as a result of Contractor's errors, omissions or failure to conform to the requirements of the Contract Documents, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the County.
- B. Structural design shown on the Drawings is based upon the configuration of and maximum loading for major items of equipment as indicated on the Drawings and specified. If the equipment furnished differs from said features, the Contractor shall assume the responsibility for all costs of redesign and for any construction changes required to accommodate the equipment furnished, including the Engineer's charges in connection therewith.
- C. The Contractor shall respond to required submittals with complete information and accuracy to achieve required approvals within three (3) submissions. All costs to the Engineer involved with subsequent submissions of Shop Drawings, Samples or other items requiring approval, will be back charged to the Contractor, at the rate by deducting such costs from payments due for Work completed. In the event an approved item is requested by the Contractor to be changed or substituted for, all involved costs in the reviewing and approval process will likewise be back charged to the Contractor unless judged by the Engineer that the need for such deviation from previously approved data is beyond the control of the Contractor.

ARTICLE GC19 - INSPECTION AND TESTING

Inspection shall be as specified in the Agreement, Article V, "Inspection", and as hereinafter stipulated.

A. Testing Laboratory Services

1. General

- a. The County will perform the following tests; concrete slump, concrete cylinder, concrete materials, concrete air content, soils density tests, and paving materials. The Contractor shall plan and conduct his operations to permit taking of field samples and test specimens, as required, and to allow adequate time for laboratory tests by the County. The collection, field preparation and storage of field samples and test specimens shall be as directed by the County and Engineer, and shall be the responsibility of the Contractor.
- b. The Contractor shall provide and pay for all other laboratory testing and checking required by the Technical Specifications, including the cost of transporting all

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

Samples and test specimens. The Contractor shall submit the names of three experienced testing laboratories, one of which will be chosen by the County to conduct the testing specified.

- c. Tests performed by the County shall not relieve the Contractor from the responsibility of supplying certificates from manufacturers or suppliers to demonstrate conformance with the Specifications.
- d. The County reserves the right to test any and all materials being manufactured expressly for this Project, offered to be furnished or delivered at the Site, or installed in place.

2. Test Reports

- a. During the progress of the Work, four copies of all test reports shall be submitted directly to the Engineer from the testing laboratory, as they are completed, with a copy sent to the Contractor.
- b. Each test report shall be signed and certified by a responsible officer of the testing laboratory.

3. Significance of Tests

Test results shall be binding on both the Contractor and the County, and shall be considered irrefutable evidence of compliance or non-compliance with the Specification requirements, unless supplementary testing shall prove, to the satisfaction of the County, that the initial Samples were not representative of actual conditions.

4. Supplementary and Other Testing

The Contractor may conduct additional tests as he may require. Should the Contractor at any time request the County to consider such test results, the test reports shall be certified by an independent testing laboratory acceptable to the County. Testing of this nature shall be conducted at the Contractor's expense.

B. Watertightness of Structures

1. General

- a. It is the intent of these Specifications that all concrete Work, sealing Work around built-in items and penetrations be performed as required to insure that:
 - (1) Groundwater, surface water, and water or liquids in liquid retainment structures will not intrude into any equipment rooms, pipe galleries, habitable areas or other generally dry areas.
 - (2) leakage in process tankage or other liquid retainment structures does not exfiltrate through to the exterior.
- b. The required watertightness shall be achieved by quality construction, proper sealing of all joints and penetrations and repair of existing joints and penetrations.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

- c. Each unit shall be tested separately and the leakage tests shall be made prior to backfilling and before equipment is installed. Only potable water shall be used for the tests unless specified otherwise.
- d. The General Construction Contractor shall provide at his own expense all labor, material, temporary bulkheads, pumps, water, measuring devices, etc. necessary to perform the required tests unless specified otherwise.

2. Built-in Items and Penetrations

- a. All pipe sleeves, built-in items and penetrations shall be sealed as detailed and as required to insure a continuous watertight seal.
- b. Penetration through built-up roofing areas shall be made prior to application of the built-up roofing utilizing suitable sleeves and flashings as required. If roofing surfaces are penetrated after roofing has been applied, the waterproofing integrity shall be restored by the roofer and paid for by the Contractor responsible for the penetration.

3. Enclosing Structures

- a. All underground structures enclosing operational and other dry areas to be constructed under this Contract shall be repaired by the General Construction Contractor where there are visible internal signs of leakage. Particular attention to this matter is required when dewatering activities are terminated and the groundwater table returns to natural levels.
- b. If required, such Work shall be performed on exterior surfaces of the structures and shall include the necessary excavation, sheeting, dewatering, repair, backfill, etc., associated with the repair.

4. Leak Repair

The General Construction Contractor shall perform remedial work required to eliminate or reduce leaks to allowable amounts per the Specifications. If the General Construction Contractor fails to comply, the County shall have the authority to have these leaks repaired by others. The cost of repairs, by others, shall be deducted from monies due or to become due to the General Construction Contractor.

C. Field Testing of Equipment

1. General

All equipment shall be set, aligned, assembled and tested in conformance with the approved Shop Drawings, manufacturer's drawings and instructions, and as indicated in the Specifications.

2. Field Tests

- a. Upon completion of the installation, and at a time approved by the Engineer, equipment will be tested by operating it as a unit with all related piping, ducting, electrical controls and mechanical operations.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

- b. All costs in connection with such tests including all materials, equipment, instruments, labor, etc. shall be borne by the Contractor.

D. Shop Witness Testing and Certification

1. Each item of equipment or material for which pressure, head, capacity, rating, efficiency, performance, function or special requirements are specified or implied shall be tested at the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents and applicable test codes and standards.
2. a. When the Technical Specifications require witness shop tests at the point of manufacture, or other approved facility, the only tests which will be accepted are those made in the presence of the Engineer or his representative. The Contractor shall give the Engineer written notice thirty (30) consecutive calendar days in advance of the time when the equipment will be ready for the witness shop tests or for required inspections. This notification shall include a diagram of testing set-up and a list of instruments the manufacturer proposes to use for the tests. All instruments shall be of ranges suitable for the quantities to be measured, with approved laboratory calibration. Seven (7) copies of witness shop test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company, shall be forwarded to the Engineer for approval.

All equipment and material to be witness shop tested shall be identified with serial numbers and/or approved permanent type identification marks.

- b. The Engineer shall be available Tuesday, Wednesday and Thursday to witness shop testing during normal business hours which defined herein as an eight-hour period between 8:00 a.m. and 6:00 p.m. with a one hour break for lunch. In the event dangerous or hazardous conditions exist at the test facility or if adequate lighting has not been provided, the test will be terminated until the conditions are corrected. Witness shall be provided with protection from the element and sanitary facilities and drinking water shall be available for their use.

Testing shall be conducted in an expeditious manner and it is expected that each day's testing shall start as scheduled. Excessive or repetitious delays will be considered cause for the witnesses to terminate and reschedule the witnessing of the tests.

All costs, including travel and subsistence expenses, incurred by the Engineer or his representative because of termination of the tests, will be back charged to the Contractor by deducting such costs from payment due for work completed.

3. When the Technical Specifications do not require witness shop tests of such equipment at the point of manufacture, or other approved facility, or when witness shop tests specified in the Technical Specifications are waived by the Engineer, seven (7) copies of the manufacturer's actual test data and the interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company, shall be forwarded to the Engineer for approval.
4. In the event any equipment or material fails to meet the test requirements, the manufacturer shall make all necessary changes, adjustments and replacements and the tests shall be

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

repeated, at no additional cost to the County, until the equipment or material test requirements are acceptable to the County.

5. No equipment or material shall be shipped to the Project until the Engineer notifies the Contractor, in writing, that the shop test reports are acceptable.

E. Inspection of Manufacturer's Facilities

In accordance with the terms of Article V of the Agreement, the Engineer may inspect the manufacture or fabrication of any material or equipment that will be utilized in the Work. The Contractor shall advise the Engineer on the status of the progress of the manufacture or fabrication of such material or equipment. Sufficient advance notice shall be given of various stages in the manufacturing or fabrication process so that the Engineer may schedule inspections of the facility engaged in the performance of the work.

ARTICLE GC20 - NOT USED

ARTICLE GC21 - PROTECTION REQUIREMENTS

The Contractor shall be responsible for protection against vandalism, theft or malicious mischief of all of his Work, materials and equipment at all times from the start to Final Acceptance of the Work.

A. Protection of Property

1. Contractor shall be responsible for the preservation and protection of property on or adjacent to the Work Site against damage or injury as a result of his operations under this Contract. Any damage or injury occurring on account of any act, omission or neglect on the part of the Contractor shall be restored in a proper and satisfactory manner or replaced by and at the expense of the Contractor to an equal or superior condition than previously existed.
2. In the event of any claims for damage or alleged damage to property as a result of Work under this Contract, the Contractor shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of Work in the vicinity of property adjacent to the Work Site, the Contractor at his own expense shall take such surveys as may be necessary to establish the existing condition of the property. Before Final Payment can be made, the Contractor shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims to have been placed in escrow, or that an adequate bond to cover such claims has been obtained.
3. Contractor shall not, except after written consent from proper parties, enter or occupy with men, tools, materials or equipment, privately-owned land except on easements provided herein. In the event that the Contractor has trespassed upon private property in the prosecution of the Work of this Contract, the County may withhold payment for the value of the claim, but in any case no less than a sum of five hundred dollars (\$500) for each incident, until the Contractor has secured a release from the property owner upon whose property the trespass was committed.
4. Contractor expressly undertakes to place upon the Work, or any part thereof, only such loads as are consistent with the safety of that portion of the Work.

B. Open Excavations

1. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the County. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the County may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street, and requiring that the trench shall not remain open overnight.

2. The Contractor shall take precautions to prevent injury to the public and County personnel due to open trenches. All trenches, excavated material, equipment or other obstacles which could be dangerous to the public and County personnel shall be well-lighted at night.

C. Fire Protection

1. Contractor shall take all necessary precautions to prevent fires at or adjacent to the Work, buildings, etc. and shall provide adequate facilities for extinguishing fires which do occur. No burning of trash or debris will be permitted.
2. When fire or explosion hazards are created in the vicinity of the Work as a result of the locations of fuel tanks, or similar hazardous utilities or devices, the Contractor shall immediately alert the Nassau County Fire Marshall and the Engineer of such hazards. The Contractor shall exercise all safety precautions and shall comply with all instructions issued by the Fire Marshall and the Engineer to prevent the occurrence of fire or explosion.

D. Chemicals

All chemicals used during Project construction or furnished for Project operation, whether herbicide, pesticide, disinfectant, polymer, or reactant of other classification, must show approval of the EPA and other recognized certifying Agencies. Use of all such chemicals and disposal of residues shall be in strict conformance with regulatory requirements.

E. Explosives

Use of explosives is prohibited unless approved by the County.

F. Protection of Persons

The Contractor shall take all necessary precautions for the safety of employees on the Work and shall comply with all applicable provisions of federal, state and municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the Work is being performed. He shall erect and properly maintain at all times, as required by the conditions and progress of the Work, all necessary safeguards for the protection of workman and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways, trenches, and other excavations, and falling materials and he shall designate a responsible member of his organization on the Work, whose duty shall be the prevention of accidents. The name and position of any person so designated shall be reported to the Engineer by the Contractor. The person so designated shall be available by phone during non-working hours.

G. Contractor's Right to Act

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

1. In case of an emergency which threatens loss or injury of property and/or safety of life, the Contractor will be allowed to act, without previous instructions from the County, in a diligent manner. He shall notify the County immediately thereafter.
2. The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided in the Agreement, Article XXII, "Extra Work."

ARTICLE GC22 - ACCESS ROADS AND PARKING AREAS

A. Access Roads

1. The General Construction Contractor shall construct and maintain such temporary access roads as required to perform his Work and that of all other Contractors on the Project. Access roads must be installed and continuously maintained in a condition that will allow passage of all vehicles under their own power. The General Construction Contractor will be responsible for all damages resulting from his failure to perform as herein required.
2. Access roads, where possible, shall be located over the areas of the future road system and relocated and replaced as necessary to accommodate the progress of the Work.
3. Access roads shall be located within the property lines of the plant unless the Contractor, with the approval of the County, independently secures easement for his use and convenience.
4. The Contractor shall keep the above roads clean and serviceable at all times. Use of mechanical sweeper at least once per week is required.
5. Dust resulting from construction operations shall be controlled by Contractor to prevent a nuisance on the Site or in adjacent areas. Use of water will not be permitted when it results in hazardous or objectionable conditions such as ice, mud, ponds and pollution.

B. Maintenance of Traffic

1. Unless permission to close a plant road is received in writing from the County, all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the County.
2. Detours around construction will be subject to the approval of the County. Periods when traffic is being detoured will be subject to approval of the County.
3. Requests for road closings or detours shall be submitted to the County for approval a minimum of seven (7) days prior to the proposed closing or detour. Requests shall be accompanied by a schedule indicating the duration of closing or detour.

C. Parking Areas

See Division 1, Special Conditions of the Technical Specifications, for provisions for suitable parking areas for each Contractor's use.

D. Restoration

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

At the completion of the Work, the surfaces of land used for access roads and parking areas shall be restored by the General Construction Contractor as per the requirements of the Contract Documents. In the absence of specific requirements, the General Construction Contractor shall restore the surfaces to their original condition.

ARTICLE GC23 - TRAFFIC REGULATIONS

- A. Contractor shall obey all traffic laws and comply with all the requirements, rules and regulations of the New York Department of Transportation and local authorities having jurisdiction to maintain adequate warning signs, lights, barriers, etc. for the protection of traffic on public roadways.
- B. The Contractor vehicles and mobile equipment shall adhere to the speed limits posted in the Project area. The General Construction Contractor shall post the necessary speed limit signs.
- C. The Contractor shall provide flagmen at junctions of public traffic and Contractor vehicles and equipment.

ARTICLE GC24 - BARRICADES, WARNING SIGNS AND LIGHTS

- A. Each Contractor shall provide, erect and maintain as necessary for his Work, strong and suitable barricades, danger signs and warning lights along all roads accessible to the public, as required by the authority having jurisdiction, to insure safety to the public. All barricades and obstructions along public roads shall be illuminated at night and all lights for this purpose shall be kept burning from sunset to sunrise. Sufficient barricades shall be erected to keep vehicles from being driven on or into Work under construction. Contractor shall furnish watchmen in sufficient numbers to protect the Work. Contractor's responsibility for the maintenance of barricades, signs, lights, and for providing watchmen shall continue until the Project is accepted by the County.
- B. Each Contractor shall provide and maintain such other warning signs and barricades in other areas and around their respective Work as may be required for the safety of all those employed in the Work, plant operating personnel, or those visiting the Site or plant.

ARTICLE GC25 - DUST CONTROL AND SPILLAGE

- A. Each Contractor shall take all necessary measures to control dust from his operations and to prevent spillage of excavated materials on roads.
- B. Each Contractor shall remove all spillage of excavated materials, debris or dust from roads by methods as approved by the Engineer.
- C. The General Construction Contractor shall sprinkle calcium chloride at locations and in such quantities and at such frequencies as may be required to control dust as directed by the Engineer.

ARTICLE GC26 - VERMIN CONTROL

All piping, ducts, conduit, etc. passing through walls, floors, ceiling and/or other solid construction, shall be sealed to prevent the passage of vermin.

Seals shall be made by means of rock wool or other approved inert materials, packed sleeves or other approved construction.

ARTICLE GC27 - FIRST AID FACILITIES

The Contractor shall provide at the Site such equipment and facilities as are necessary to supply first aid to any of his personnel who may be injured in connection with the Work.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

ARTICLE GC28 - LAYOUT AND LEVELS

A. Buildings and Structures

The location of the buildings and structures is shown on the plot plan.

1. The Contractor for General Construction Work shall lay out the buildings and structures correctly and shall be responsible for any damage caused the County due to incorrect laying out of the Work.
2. The Contractor for General Construction Work shall verify all grades, lines levels and dimensions as shown on the Drawings and he shall report any errors or inconsistencies in them to the Engineer before commencing Work.
3. The Contractor for General Construction Work shall establish bench marks in not less than two widely separated places. As the Work progresses he shall establish bench marks at each floor, giving the exact levels of the floors.
4. The Contractor for General Construction Work shall employ a licensed surveyor to lay out the building or structure, establish bench marks and give levels of floors to which all measurements shall be referred.
5. The Contractor for General Construction Work shall employ a licensed surveyor to scribe bench marks on all columns, where they exist, and on all exterior walls, exactly 4 feet above the finished floor.
6. Before starting construction Work the Contractor for General Construction Work shall submit to the Engineer for approval three (3) copies of a complete "Construction Stake Layout" of the building or structure at all corners and angles.
7. Upon completion of foundation walls, the Contractor for General Construction Work shall prepare and deliver to the Engineer three (3) copies of a certified survey showing that all dimensions, elevations, and angles and the location of the building or structure is in accordance with the Plans.
8. Each Prime Contractor shall have the responsibility to carefully preserve the bench marks, reference points and stakes, and in the case of destruction thereof by the Contractor or resulting from his negligence the Contractor shall be charged with the expense and damage resulting therefrom and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes.
9. Existing or new control points, property markers and monuments that will be or are destroyed during the normal course of construction shall be reestablished by the General Construction Contractor and all reference ties recorded therefore shall be furnished to the Engineer. All computations necessary to establish the exact position of the Work shall be made and preserved by the General Construction Contractor.
10. The Engineer may check all or any portion of the Work and the General Construction Contractor shall afford all necessary assistance to the Engineer in carrying out such checks. Any necessary corrections to the Work shall be immediately made by the General Construction Contractor. Such checking by the Engineer shall not relieve the General Construction Contractor of any responsibilities for the accuracy or completeness of his Work.

B. All Other Work

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

Each Contractor is responsible for layout of his Work including but not limited to, substructures foundations, manholes, utility lines, equipment pads based upon the reference lines and grades established herein.

1. Contractor shall keep neat legible notes of all measurements and calculations made by him while surveying and laying out the Work.
2. Two copies of all notes and other records shall be furnished to the County monthly. Furnish complete notes upon final completion.

ARTICLE GC29 - CUTTING AND PATCHING

A. Contractor Requirements

1. Contractors shall perform all cutting and patching necessary for the Work of the Contract in accordance with the requirements of the Drawings and Specifications. Work performed by another contractor shall not be cut or altered without the approval of the Engineer.
2. Before doing any cutting, the Contractor shall obtain the approval of the Engineer as to the location, size and method of making such openings.
3. All cutting and rough patching as defined by the Engineer will be performed by each respective Prime Contractor. All finish patching shall be performed by the General Construction Contractor.
4. All cutting shall be performed in such a manner as to limit the extent of patching.
5. All patching shall be done in a manner to match the surrounding existing surfaces as closely as possible.
6. All painted surfaces which are patched shall have the patch painted to match the existing wall surfaces as closely as possible. The Engineer shall be the sole judge of the color/texture match of finish.
7. All holes cut through concrete walls or slabs shall be core drilled unless otherwise specified or shown. Prior to core drilling, Contractor shall drill sufficient number of small exploratory holes to establish that the area to be core drilled is free of existing embedded conduits. No structural members shall be cut without approval of the Engineer and all such cutting shall be done in a manner directed by him. No holes, except for small screws, may be drilled in beams or other structural members without obtaining prior approval. All Work shall be done in a neat manner by mechanics skilled in their trades and as approved.
8. Contractors shall install sleeves for their Work for all pipes and conduits passing through any wall or floor slab.

B. Errors and Omissions

Details and procedures are as stipulated in Paragraph A of this Article. Contractor responsible for error or omission will be responsible for all costs associated with cutting and patching.

ARTICLE GC30 - OPENINGS AND CHASES

- A. The General Construction Contractor shall provide all openings and chases in his Work to fit his own Work and that of any other Contractors. All such openings or chases shown on the Contract

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

Drawings, or reasonably implied thereby, or as confirmed or modified by Shop Drawings approved by the Engineer, shall be provided by the General Construction Contractor.

- B. Where equipment frames or supports are to be installed as integral parts of an opening, the opening frames or supports shall be furnished and installed by the Contractors installing the equipment.
- C. When required by the Progress Schedule or requested by the General Construction Contractor, the Contractor installing the equipment frames and supports and Contractors who require openings or chases in slabs and walls for passage of ducts, mounting of equipment, etc., shall furnish all necessary information and instruction of the required openings, chases, frames, etc. When such items are secured in position by the installing Contractor and just prior to construction of the surrounding slab or wall, the installing Contractor shall ascertain the proper number, locations and settings thereof; and the General Construction Contractor shall schedule his operations so as to provide a reasonable opportunity and time interval for such inspection.
- D. Any cost resulting from correction and defective, ill-timed, or mislocated Work, or for subsequent Work which becomes necessary because of omitted openings, chases, frames, etc., shall be borne by the Contractor responsible therefor. To this end, no Contractor shall arbitrarily cut, drill, alter, damage, or otherwise endanger the Work of another Contractor. The nature and extent of any corrective or additional Work shall be subject to the approval of the Engineer following consultation with the Contractors involved.

ARTICLE GC31 - SLEEVES, INSERTS AND WALL CASTINGS

Each Contractor shall furnish and install in place, conduits, outlets, piping sleeves, boxes, inserts, other materials and equipment necessary to be built into Work to be performed by the Contractor for General Construction as soon as the requirements of the Progress Schedule require them.

All Contractors shall cooperate fully in connection with the performance of the above Work, as cutting into new Work is neither contemplated nor will it be tolerated.

In the event timely delivery of sleeves or other materials cannot be made, if approved by the Engineer, and to avoid delay, the affected Contractor shall arrange to have boxes or forms set at locations where piping or other material is to pass through or in slabs, walls or other Work. Upon subsequent installation of sleeves or other material, the General Construction Contractor shall fill around them with materials as required by Contract or by the Engineer. Necessary expenditure incurred for boxing out or filling shall be borne without extra costs to the County by Contractor or Contractors responsible therefor.

ARTICLE GC32 - SCAFFOLDING, RIGGING AND HOISTING

Each Contractor shall furnish all adequately designed scaffolding, rigging, hoisting and services necessary for erection and delivery or removal of any equipment and apparatus under his Contract. The Contractor shall remove same from Work involved when no longer required.

Each Contractor involved in this type of activity shall take all precautions to prevent accidents or damage to persons or property about the Work involved and shall erect and maintain proper warning signs and guard rails, barricades, etc. In the event of the Contractor's negligence, he shall indemnify the County against all claims, suits, damages and judgements, including counsel fees and disbursements incurred in the defense of any action to which he may be subjected by reason of such negligence.

ARTICLE GC33 - CLEANING

- A. Rubbish Removal and Cleaning

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

The General Construction Contractor shall remove from the Project, and dispose of, all debris and rubbish resulting from the Work of all Contractors, at least once a week and more often if same interferes with the Work under any contract, plant operations or presents a fire hazard. All debris and rubbish shall be removed from the County property and legally disposed of. Each Contractor shall be responsible for consolidating all debris and rubbish resulting from his Work to one location in his work area. During course of demolition or new construction, the General Construction Contractor shall maintain and keep free of debris or building material required egress in accord with Fire Safety Regulations and the Nassau County Fire Marshall.

B. County's Right to Clean

Should the Contractor fail, refuse or neglect to remove rubbish and waste materials and temporary Work or clean the building and premises as required herein, then the County may or shall, without obligation to do so, remove and dispose of the said rubbish, waste materials and temporary work, clean the building and premises and deduct the cost thereof from any money due, or to become due, the Contractor under this Contract.

ARTICLE GC34 - PIPING AND EQUIPMENT IDENTIFICATION

Each Prime Contractor shall furnish and install all components of the system for identification of piping and equipment as specified. The system shall include the placing of identification signs, direction-of-flow arrows, identification tags, etc. on plant piping, equipment and structures.

ARTICLE GC35 - OPERATION AND MAINTENANCE MANUALS

Federal regulations and County requirements stipulate time limitations for submittal and approval of operations and maintenance manuals. See Division 1, Special Conditions of the Technical Specifications, for specific requirements.

ARTICLE GC36 - RECORD DRAWINGS

The County shall furnish to each Prime Contractor a set of mylar reproducible of the Contract Drawings for his Contract.

Each Prime Contractor shall maintain in the construction office at the job a set of prints of the Contract Drawings. A daily record in red pencil, shall be kept on these prints of the Work installed and all modifications or changes therein. This set of prints shall be available at all times to the Engineer for inspection.

During the progress of the construction, each Contractor shall transfer once each month all information from field prints to the tracings and submit to the Engineer with his monthly payment request, two (2) prints of the tracings showing the Work completed and highlighting the changes made. When roughing is completed, it must be shown. The use of approved shop drawings for record drawings is not acceptable.

All Work installed shall be shown on Drawings to a scale of at least 1/4 inch equals 1 foot. Where the Contract Drawings are to a smaller scale, or do not show the area of Work involved, the Contractor shall prepare Drawings, as required, to that larger scale showing the outline of the structure. These additional Drawings shall be on mylar reproducible and shall be referenced on the smaller scale Drawings to show the area covered. The Contractor shall submit a print of the outline on the additional Drawings for approval before entering any of the installed Work thereon. The sheet size of the additional Drawings shall be the exact same size as that of the Contract Drawings.

All details on Drawings must also be corrected for changes and/or modifications.

Upon completion of all Work each Contractor shall complete the mylar reproducible and sign them indicating that the Work was installed as shown. One set of paper prints shall be submitted to the Engineer for review

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

and acceptance. Upon receipt of the Engineer's acceptance, the Contractor shall submit the mylar reproducible and two sets of paper prints stamped "Record Drawings of Work as Built", stamped and certified.

The submittal of Record Drawing acceptable to the Engineer as specified herein, shall be a condition precedent to payments to the Contractor that may otherwise be then due.

ARTICLE GC37 - PHOTOGRAPHS

A. The Contractor for General Construction shall engage the services of an experienced photographer, approved by the Commissioner, to take job photographs. The photographer will be required to take preliminary photographs of the Site prior to the commencement of Work as directed by the Engineer. Subsequent photographs as determined by the Engineer shall be taken during the construction phase. The price bid shall be based on the following:

1. The photographer visiting the Site twenty-five (25) times as directed by the engineer. As the work progresses, additional visits may be required.
2. Taking a total of five hundred (500) color photographs for the purpose of this section, a photograph shall be defined as one exposure. The Commissioner shall reserve the right to reject any photograph that is not clear or definitive. Any photograph so rejected shall be subtracted from the total exposure before computations for payment or credit under this section.
3. Supplying three (3) 8-inch by 10-inch prints and one (1) negative of each photograph.
4. Included shall be photographs of electrical installations underneath or in floor slabs prior to backfilling or placing concrete. Photographs shall be labeled to identify:
 - a. Conduit size
 - b. Conduit Identification: Number, label, etc. conforming to record drawing identification.
 - c. Service(s).
 - d. Locations: Referenced to structures, roadways, etc.

B. In the event that less than five hundred photographs are required, the Contractor shall credit the County fifteen (\$15.00) dollars for each photograph under five hundred photographs. Should more than five hundred photographs be required, the Contractor will be paid twenty (\$20.00) dollars for each photograph over five hundred photographs.

C. Three 8-inch by 10-inch matte finish prints and 4-inch by 4-inch negative of each photograph shall be submitted to the Engineer with the Contractor's monthly estimate. The prints shall be mounted on a cloth with a flap for binding and shall have indelibly printed on their reverse side the following:

Project Name

Photo Number

View and description, indicating location of camera, general description of what photograph represents and whether this is a preliminary or construction photograph.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

The Contractor shall also furnish a sufficient number of hard-back binders for each of the three sets of prints and the negatives.

- D. No separate payment will be made for job photographs; payment shall be included in the lump sum bid for the General Construction Contract.
- E. Digital photo files can be submitted in lieu of negatives.

ARTICLE GC38 - PROJECT CLOSEOUT

Division 1, Special conditions, and the other provisions of the Technical Specifications stipulate requirements for Project closeout. Items such as final cleaning, lubrication survey, spare parts and special tools, equipment start-up services and other items specified are included. Final Payment will be contingent on each Contractor complying with these requirements.

ARTICLE GC39 - DEWATERING

- A. Any proposed dewatering operation must be carried out by only licensed well drillers in accordance with Section 15-1525 of the New York State Environmental Conservation Law.

The Contractor is responsible for notifying the New York State Department of Environment Conservation prior to the proposed starting date of the dewatering operation and obtaining the necessary permits, giving the following details in full: the name of the licensed well driller, the details of the dewatering system to be installed, including the size, the number and the spacing of the well points, the pump capacity, the pumping rate and the expected volume of water to be withdrawn.

Also to be included, will be the amount of water table drawdown, the final disposition of the water, and the expected duration of the operation.

- B. Before any dewatering operation is to begin, approval of all the aforementioned items is required. If any unforeseen emergency construction arises, the Contractor must notify the New York State Department of Environmental Conservation as soon as possible that dewatering under such circumstances has been started.

Notification will be made to the following:

New York State Department of Environmental Conservation (NYSDEC)
Building No. 40
Stony Brook, NY 11790
516-444-0405

The entire dewatering operation and the apparatus connected therewith must, at all reasonable hours, be open to inspection and test by duly accredited representatives of the New York State Department of Environmental Conservation.

- C. Where private wells, used for water supply, have become dry or cease to produce potable water due to the dewatering operation, the Contractor will be responsible for providing the necessary water at no cost to the County.
- D. When dewatering systems utilizing central pumping stations are used, these stations will be acoustically shielded from neighboring residences. Styrofoam or other sound absorbing material will be used on the inside of the enclosure surrounding the pump. IN addition, an exhaust stack extension will be provided when required by the Engineer. The use of old pumps generating

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

excessive emissions and/or noise will not be permitted by the Engineer. The noise level twenty-five (25) feet from the pump shall not exceed sixty (60) decibels.

- E. The contractor will not be allowed to discharge water containing sediments directly to storm sewers or streams without treating it with filtration or sediment trapping devices.

The Contractor shall not discharge groundwater directly into creeks, ponds, lakes or waterways without first obtaining the proper permit from the New York State Department of Environmental Conservation. Every effort shall be made to discharge groundwater into existing recharge basins. The use of dewatering systems utilizing central pumping stations header or discharge lines which remain in place at one location for more than six (6) weeks will not be permitted unless approved in writing by the Engineer. All well point header and discharge lines must not remain in place beyond the period for which they are required to perform Work in their immediate vicinity, nor shall they be placed far in advance of their use. All dewatering systems shall be subject to the approval of the Engineer who shall be the sole judge as to the conformance with the above requirements, and any additional requirements which may be specified in Division 2 of the Technical Specifications.

ARTICLE GC40 - PRESERVATION OF WETLANDS AND WATERWAYS

No Contractor is permitted to dump spoil onto those areas designated as wetlands or waterways. Further, the Contractor shall not stockpile or store spoil, materials, tools or equipment on wetlands. Surplus excavated material, either unsatisfactory for or over and above that require for backfilling, shall be disposed of by the Contractor at his own expense, off the Site of Work in a lawful manner. The Contractor must contact Alfred T. Keller, NYS Department of Environmental Conservation at (516) 751-7900 for approval of any proposed disposal site.

ARTICLE GC41 - NOTIFICATION OF SUBCONTRACTOR

Each Prime 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.

Each Prime 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 Contract estimated start and completion dates and the crafts which will perform Work under the Subcontract.

ARTICLE GC42 - JURISDICTIONAL DISPUTES

It shall be the responsibility of the Contractor to pay all costs that may be required to perform any of the Work shown on the Drawings or specified herein in order to avoid any Work stoppages due to jurisdictional disputes. The basis for subletting Work in question, if any, shall conform with precedent agreements and decisions on record with the Building and Construction Trades Department, AFL-CIO, date June, 1973, including any amendments thereto.

GENERAL CONDITIONS

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

+ + NO TEXT ON THIS PAGE + +

CERTIFICATION REGARDING LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 28 CFR Part 69, for persons entering into a grant or cooperative agreement over \$100,000, as defined by 28 CFR Part 69, the State must include the language of the certification below in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts) and require all subrecipients to certify and disclose accordingly. Subrecipients should refer to the regulations cited above and should also review the instructions included in the regulations before completing this form.

The subrecipient certifies, to the best of its knowledge and belief, that

(a) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the making of any Federal grant, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;

(b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete and submit Standard form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions;

(c) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each failure.

Name and Title of Authorized Representative

Signature

Date m/d/yy

Name and Address of Organization

+ + NO TEXT ON THIS PAGE + +

Project Labor Agreement

BETWEEN

NASSAU COUNTY, NY

and the

**NASSAU SUFFOLK BUILDING AND CONSTRUCTION TRADES
COUNCIL AND ITS AFFILIATED LOCAL UNIONS**

+ + NO TEXT ON THIS PAGE + +

TABLE OF CONTENTS	PAGE
RECITALS	5
AGREEMENT	6
ARTICLE I.	6
SECTION 1 - PARTIES TO THE AGREEMENT	6
ARTICLE II.	6
SECTION 1 – DEFINITIONS	6
SECTION 2 - CONDITIONS FOR AGREEMENT TO BECOME EFFECTIVE	7
SECTION 3 - ENTITIES BOUND & ADMINISTRATION OF AGREEMENT	7
SECTION 4 - SUPREMACY CLAUSE	Error! Bookmark not defined.
SECTION 5 – LIABILITY	8
SECTION 6 - BID SPECIFICATIONS	8
SECTION 7 - AVAILABILITY AND APPLICABILITY TO ALL SUCCESSFUL_BIDDERS	8
ARTICLE III. SCOPE OF THE AGREEMENT	8
SECTION 1 - THE COVERED WORK	9
SECTION 2 - TIME LIMITATIONS	9
SECTION 3 - EXCLUDED EMPLOYEES	9
SECTION 4 – LIMITATIONS	10
ARTICLE IV. UNION RECOGNITION AND EMPLOYMENT	11
SECTION 1 - PRE-HIRE RECOGNITION	11
SECTION 2 - UNION REFERRAL	11
SECTION 3 - NON-DISCRIMINATION	11
SECTION 4 - MINORITY AND FEMALE REFERRALS	12
SECTION 5 - UNION DUES	12
SECTION 6 - CRAFT FOREPERSONS AND GENERAL FOREPERSONS	12
SECTION 7 - HELMETS TO HARDHATS	12
ARTICLE V. UNION REPRESENTATION	12
SECTION 1 - LOCAL UNION REPRESENTATIVE	12
SECTION 2 – STEWARDS	13
ARTICLE VI. MANAGEMENT'S RIGHTS	13
SECTION 1 - RESERVATION OF RIGHTS	13
SECTION 2 - NO LIMITATION ON CONSTRUCTION METHODOLOGIES	13
SECTION 3 - TEMPORARY UTILITIES	14
ARTICLE VII. WORK STOPPAGES AND LOCKOUTS	14
SECTION 1 - NO STRIKES -- NO LOCK OUT	14
SECTION 2 - DISCHARGE FOR VIOLATIONS	14

SECTION 3 - EXPEDITED ARBITRATION	14
SECTION 4 - ARBITRATION OR DISCHARGES FOR VIOLATION	16
ARTICLE VIII. LABOR MANAGEMENT COMMITTEE.....	16
SECTION 1 – SUBJECTS.....	16
SECTION 2 – COMPOSITION.....	16
ARTICLE IX. GRIEVANCE AND ARBITRATION PROCEDURE.....	16
SECTION 1 - PROCEDURE FOR RESOLUTION OR GRIEVANCES	16
SECTION 2 - LIMITED RETROACTIVE EFFECT OF AWARDS.....	18
SECTION 3 - PARTICIPATION BY JACOBS	18
ARTICLE X. JURISDICTIONAL DISPUTES	18
SECTION 1 - NO DISRUPTIONS.....	18
SECTION 2 – ASSIGNMENT	18
SECTION 3 - PROCEDURE FOR SETTLEMENT OF JURISDICTIONAL DISPUTES	18
SECTION 4 – AWARD.....	19
SECTION 5 - NO INTERFERENCE WITH WORK	19
SECTION 6 – LIMITATIONS.....	19
ARTICLE XI. WAGES AND BENEFITS.....	19
SECTION 1 - CLASSIFICATION AND WAGES.....	20
SECTION 2 - EMPLOYEE FRINGE BENEFITS/SUPPLEMENTS	20
ARTICLE XII. HOURS OF WORK PREMIUM PAYMENTS, SHIFTS AND HOLIDAYS.....	21
SECTION 1 - WORK WEEK AND WORK DAY	21
SECTION 2 – OVERTIME	21
SECTION 3 – SHIFTS	22
SECTION 4 – HOLIDAYS	22
SECTION 5 - REPORTING PAY	22
SECTION 6 - PAYMENT OF WAGES	23
SECTION 7 - EMERGENCY WORK SUSPENSION.....	23
SECTION 8 - INJURY/DISABILITY	23
SECTION 9 - TIME KEEPING.....	23
ARTICLE XIII. APPRENTICES	23
SECTION 1 - PROGRAMS FOR APPRENTICES.....	23
SECTION 2 - DEPARTMENT OF LABOR.....	24
ARTICLE XIV. SAFE PROTECTION OF PERSON AND PROPERTY	24
SECTION 1 - SAFETY REQUIREMENTS	24
SECTION 2 - SITE SERVICES.....	24
SECTION 4 – INSPECTIONS	24
ARTICLE XV. NO DISCRIMINATION.....	25

SECTION 1 - COOPERATIVE EFFORT	25
SECTION 2 - LANGUAGE OF AGREEMENT	25
ARTICLE XVI. GENERAL TERMS	25
SECTION 1 - PROJECT RULES	25
SECTION 2 - TOOLS OF THE TRADE	25
SECTION 3 – SUPERVISION	25
SECTION 4 - TRAVEL ALLOWANCES	25
SECTION 5 – FULL WORKDAY	26
SECTION 6 - COOPERATION AND CONSENT OF DEPARTMENT OF LABOR	26
SECTION 7 - UNION CONTRACTORS	26
ARTICLE XVII. SAVINGS AND SEPARABILITY	26
SECTION 1 - THIS AGREEMENT.....	26
SECTION 2 - THE COUNTY'S CONTRACT DOCUMENTS	26
SECTION 3 - NON-LIABILITY.....	27
SECTION 4 – NO WAIVER OF NO STRIKE-NO LOCK OUT PROVISION.....	27
ARTICLE XVIII. FUTURE CHANGES IN APPENDIX "A" AGREEMENTS.....	27
SECTION 1 - CHANGES TO AREA CONTRACTS	27
SECTION 2 - LABOR DISPUTES DURING AREA CONTRACT NEGOTIATIONS	27
APPENDIX "A" _Collective Bargaining Agreements.....	32
EXHIBIT "A" Letter of Assent	33
EXHIBIT "B" PROCEDURAL RULES AND REGULATIONS FOR THE PLAN FOR THE SETTLEMENT OF JURISDICTIONAL DISPUTES IN THE CONSTRUCTION INDUSTRY.....	34

This is a Project Labor Agreement between Nassau County and the Nassau Suffolk Building and Construction Trades Council and its affiliated local unions, dated February 2011, for the use on projects being undertaken by Nassau County (the "County").

RECITALS

Pursuant to County Executive Order No. 1-1994, dated February 11, 1994 (herein after "the Executive Order"), all County Departments, Boards, Agencies and Commissions were directed to consider, examine, and determine, with respect to all major construction projects under their respective jurisdictions, whether the use of a PLA would benefit and enhance the interests of the County in the timely and efficient completion of the projects.

As construction of new buildings, facilities and plant or renovation of existing buildings, facilities and plant are a significant undertaking for the County, the County desires that their Projects are constructed to the highest standards, in a timely fashion, and without impacts and delays arising out of labor disputes.

The County has utilized PLAs on many of their significant projects constructed over the last 20 years and has found in all cases that the Cost, Time and Quality performance of the project was enhanced through the use of a PLA.

For each project to be constructed under the guidelines of this PLA, a project specific Addendum to this Agreement must be approved by Nassau County and the Nassau Suffolk Building and Construction Trades Council on behalf of itself and its affiliated Local Unions. Each project-specific addendum is to outline and include the following:

- A. The Name of the Construction Manager or Consultant who performed the Feasibility Analysis.
- B. The general findings of the Feasibility Analysis used as the basis of the recommendation to utilize a PLA on the project.
- C. The name of the Construction Manager or Consultant who will be the County's designated PLA Administrator for the specific project.
- D. Any and all adjustments to the PLA for implementation on the specific project.
- E. A description of the project being undertaken by the County, which must include a description of "Covered Work", as elsewhere defined in this Agreement.
- F. A determination whether the project is subject to Wicks Law, and if so, whether the project will be constructed utilizing a Single Prime Contractor or Multiple Prime contractors, as permissible.
- G. Anticipated project Schedule and Milestones
- H. Project Location
- I. Project Architect and/or Engineers
- J. Project Specific Letter of Assent

Included with this Agreement is Addendum 001 – The Project Specific Addition of the Restoration of the Nassau County Aquatic Center Project to the PLA, for approval by the County and the Council.

The County has determined that the Nassau Suffolk Building and Construction Trades Council (the Council) is the appropriate representative of labor in the Nassau County area for

purposes of construction projects. First, the trade unions affiliated with the Council include all of the skilled trades required for the construction of County projects. No other collective of unions in the Nassau County area is similarly constituted. Second, the Council has the ability, in connection with its constituent trade unions, to make the numerous and important concessions required by the County for the projects. Third, the Council acting with approval of its constituent unions has the ability to ensure labor peace at the projects, by agreeing not to engage in otherwise protected concerted conduct with respect to the projects.

The County has approved the PLA set forth below, and has directed that it be included in the Contract Documents for specific projects which will be added by addendum, with the stipulation that all successful bidders, and all levels of subcontractors together with their respective sureties, shall abide by the Agreement with respect to the performance of all work on the projects and that any failure to comply with the Agreement fully shall be considered a material breach of the Contractor's (as elsewhere defined) agreement for the respective project with the County, justifying, among other remedies, immediate termination of the Contractor and demand upon its surety.

NOW, THEREFORE, based on the Recitals set forth above, the County and the Council submits this Agreement for approval by all parties.

AGREEMENT

ARTICLE I.

SECTION 1 - PARTIES TO THE AGREEMENT

This Agreement is by and among Nassau County, the Nassau Suffolk Building and Construction Trades Council, acting for itself, the signatory local unions, acting for themselves and their members, and all contractors, and their subcontractors of every tier, performing work covered by this Agreement on a specific project added by addendum to the Agreement. The County will designate a PLA Administrator on behalf of, and with full authority of, the County for the performance of tasks under this agreement for which the County is responsible. The Agreement may be amended with the mutual consent of the County and the Nassau Suffolk Building and Construction Trades Council acting for itself and the signatory local unions.

ARTICLE II.

SECTION 1 – DEFINITIONS

A local union signing this Agreement is referred to in this Agreement as a "Signatory Union". Similarly, a contractor signing a contract with the County incorporating this agreement including all of its subcontractors of every tier, engaged in Project construction work, as defined in Article III of this Agreement, is referred to in this Agreement as a "Contractor." Each "Project" shall be a project added by addendum to this PLA, and further defined in the agreement between the County and Contractor/s. Work covered by this Agreement is defined in Article III and is referred to in this Agreement as "Covered Work."

SECTION 2 - CONDITIONS FOR AGREEMENT TO BECOME EFFECTIVE

This Agreement shall not become effective unless each of the following conditions are met:

- (i) the Agreement is signed by the Council, having received authorization from its parent organization, the AFL-CIO Building Trades Department;
- (ii) the Agreement is signed by each involved local union representing craft employees potentially needed for the Project;
- (iii) the Agreement is approved by the County and the County Attorney.
- (iv) each signatory to this Agreement represents that it possesses the legal capacity to enter into this Agreement and to perform fully the obligations imposed upon it by this Agreement; and
- (v) the Agreement is signed by the County.
- (vi) A Project-Specific Addendum is approved by the Council and the County for each project on which this agreement is implemented

SECTION 3 - ENTITIES BOUND & ADMINISTRATION OF AGREEMENT

This Agreement shall bind all Signatory Unions and all Contractors performing construction work at the Project, including site preparation work, which comprises Covered Work as defined in Article III. Further, the Contractors shall require, in all subcontracts pertaining to Covered Work, that the subcontractor of whatever tier also become bound by this Agreement, as though signatory thereto. This Agreement shall also be binding upon any contractor subsequently engaged by any surety pursuant to the terms of any applicable Performance Bond to complete any portion of the Covered Work as a result of the default, termination or other failure or inability of the original contractor to complete the Covered Work. The Contractor(s) and all subcontractors shall execute a Letter of Assent, in a form similar to that annexed hereto as Exhibit "A".

The PLA Administrator is a professional services provider engaged by the County as an agency Construction Manager and will not be performing any portion of the Covered Work with either direct labor forces or subcontractors, except as provided elsewhere in this Agreement (see Article III, Section 3). The County's CM or designated Consultant will administer the Project Labor Agreement on the behalf of, and with full authority of, Nassau County. The PLA Administrator will also provide a contact person who will be the project communication contact for all parties of this agreement. The County will direct the CM or Consultant under the terms of their agreement with the County to perform the responsibilities of PLA Administrator in accordance with the above. The PLA Administrator will be designated within the project specific Addendum adding a project to the terms and conditions of this PLA Agreement.

SECTION 4 - SUPREMACY CLAUSE

This Agreement is part of the Contract Documents for the Project defined in Section 1 (Definitions) of the County Contract Agreement and General Conditions. This Agreement, all other parts of the Contract Documents, and the local collective bargaining agreements referenced in Appendix "A" to this Agreement (collectively, the Appendix A Agreements), express the complete understanding of all signatories with respect to this Project. In the event of any conflict between provisions of this Agreement and applicable Appendix "A" Agreements

and/or other provisions of the Contract Documents, the provisions of this Agreement shall prevail. It is further agreed that, where there is a conflict, the terms and conditions of this Project Labor Agreement shall supersede and override terms and conditions of any and all other national, area or local Collective Bargaining Agreements. To the extent applicable to any project work, the NTL Articles of Agreement, The National Stack/Chimney Agreement, the National Cooling Tower Agreement, the UA/IBEW Joint National Agreement for Instrument and Control Systems Technicians, and the National Agreement of the International Union of Elevator Constructors Agreements, and provided that a contractor performing project work and an affiliate of the Council is party to said Agreements, those Agreements shall apply, except with respect to the dispute resolution mechanisms contained in this agreement, including Article VII, Sec. 3, Articles IX and X.

SECTION 5 – LIABILITY

The PLA Administrator and the County shall not be liable for any violations of this Agreement by a Contractor or a Signatory Union. The Council shall not be liable for any violations of this Agreement by any Signatory Union. Signatory Unions or Contractors shall only be liable for their own violations of this Agreement and shall not be vicariously liable for the violations of others.

SECTION 6 - BID SPECIFICATIONS

Each Project's Contract Documents shall require that all successful bidders, and their subcontractors of any tier, performing Covered Work for the Project, shall be bound by this Agreement, as a condition precedent to award of the contract or the County's approval of the contractor/subcontractor in question. Nothing in this Agreement shall be construed as limiting the County's otherwise lawful exercise of its right in determining which Contractors shall be awarded contracts for the Project. Similarly, nothing in this Agreement shall be construed as limiting the County's otherwise lawful exercise of its right, at any time, to terminate, delay or suspend the work, in whole or part, on the Project.

SECTION 7 - AVAILABILITY AND APPLICABILITY TO ALL SUCCESSFUL BIDDERS

This Agreement will be provided to all bidders and will fully apply to all successful bidders on the Project and their subcontractors of every tier. This Agreement shall not apply to the work of any Contractor performing at any location other than the Project site, as defined in Article III, Section 1, or to any work not covered by this Agreement performed by employees of the County at the Project site, or of contractors retained by the County under existing or "annual" contracts not specifically, or exclusively, related to the Project, or the work of other employees performing work and/or services for the County, other than Covered Work. Other employees may be excluded as set forth in Article III, Section 3.

ARTICLE III. SCOPE OF THE AGREEMENT

Covered Work under this Agreement shall be as defined and limited as follows:

SECTION 1 - THE COVERED WORK

Covered Work shall be the construction of the Project described in the project specific Addendum and more specifically described by the Bid Documents for the subject Project.

This Agreement shall apply, during its effective period, only to the

- (i) on-site construction work at the Project; and
- (ii) off-site work on components or elements of the Project, (including delivery of those products) dedicated and fabricated specifically for the Project, but only to the extent presently provided for by prevailing practices under the applicable Appendix "A" Agreements, required to complete the physical work shown on the Drawings (Plans) and Specifications.
- (iii) In addition, with regard to furniture, fixtures and equipment ("FF&E") purchased directly by the County, and such items assembled and/or permanently attached on site after substantial completion of the Project or a portion of the Project are not covered under this section. FF & E is defined as movable furniture, fixtures or other equipment that have no permanent connection to the structure of a building, its systems and/or utilities. That this provision for FF&E shall not be construed to exclude equipment required for the operation of any systems, machinery or utilities, plumbing and lighting fixtures; floor and/or wall finishes; built in place cabinetry, counters, or similar built-ins; and such items are within the scope of this agreement.

SECTION 2 - TIME LIMITATIONS

Subject to other provisions of this Agreement, which may provide for the earlier termination of this Agreement with respect to specific Contractors, this Agreement shall terminate upon the completion and acceptance by the County of the Covered Work in its entirety, unless the County elects, in writing, to terminate all or part of the Covered Work before completion. In such case, the Agreement shall terminate immediately upon issuance, of the written statement by the County confirming the cessation of Covered Work.

SECTION 3 - EXCLUDED EMPLOYEES

Notwithstanding any other provision of this Agreement, including the provisions of any Appendix "A" Agreement, the following persons and items are specifically excluded from coverage by this Agreement:

(i) Employees of the County and their consultants, including the County's PLA Administrator, the County's Architects, Engineers, Construction Managers, and the Project, Superintendents, Supervisors, and Inspectors (excluding craft and general forepersons and field craft surveyors specifically covered by a Appendix "A" Agreement), staff engineers, inspectors and testers, quality assurance personnel, mail carriers, clerks, office workers, messengers, security personnel, non-manual employees, emergency medical and first aid technicians, and other professional, engineering, administrative and management personnel, and all annual/on-call contracts administered by the County;

(ii) Equipment and machinery owned or operated by the County at the Project which is not being used to perform Covered Work;

(iii) Laboratory or specialty testing or inspections not ordinarily done by a Signatory

Union;

(iv) Non-construction technical support services contracted by the County or the Construction Manager for the Project;

(v) Employees engaged in on-site equipment or material warranty work in the employ of the equipment or material manufacturer or supplier, provided those employees work in concert with other employees from the appropriate craft or trade hired under this Agreement (provided, in cases of conflict with Article IV, Section 2, such latter provision shall apply);

(vi) Employees and entities engaged in off-site manufacture, modification, repair, maintenance alteration or deliveries to and from the job site of building equipment, materials or components (except to the extent such employees or entities are performing off-site work recognized as part of the Covered Work under Section 1 of this Article).

(vii) Employees of third parties engaged in work ancillary to the Covered Work at the Project sites, such as employees of gas, water or electric utilities, among others that may install their work to a demarcation point determined by Contract Documents; provided, further, however, that the Construction Manager may employ up to two (2) craft workers to perform Covered Work under this Agreement, in which case those workers shall be covered by this Agreement.

This Agreement shall not apply to the parents, affiliates, subsidiaries, joint enterprises or other joint or sole ventures of any Contractor or subcontractor which do not perform work at the Project, provided such other entities are not used as a device or intermediary by such Contractor or subcontractor to avoid its obligations under this Agreement. This Agreement shall not be construed to create any joint employment status between or among the County, the Construction Manager and any Contractor. This Agreement shall also not be construed to prohibit or restrict the County, or its employees, or any integral part of the County, from performing on or off-site work not forming a part of the Covered Work. No county employee shall be permitted to perform covered work as described in the Project Bid Documents.

SECTION 4 – LIMITATIONS

This Agreement by the County and the Council, shall not have any force or application, including as a collective bargaining relationship or otherwise, to any other projects or work performed by any of the signatories whether on the Project site or not. This Agreement also shall not be construed to establish or acknowledge a collective bargaining relationship between any Contractor and the Council or a Signatory Union with respect to any project or any work other than the Covered Work, which does not otherwise exist. This Agreement shall have no further force or effect on items or areas of Covered Work after the Contractor responsible for performing such items or areas is declared by the County to have achieved final completion of its scope of work under its contract, except to the extent that the Contractor is directed by the County to engage in check-out and/or warranty functions related to such items or areas pursuant to its contract with the County.

ARTICLE IV. UNION RECOGNITION AND EMPLOYMENT

SECTION 1 - PRE-HIRE RECOGNITION

The Council and the Signatory Unions shall be recognized by all Contractors on the Project as the sole and exclusive collective bargaining representatives of all craft employees with respect to Covered Work for the Project.

SECTION 2 - UNION REFERRAL

(i) All Contractors shall employ, hire and utilize for the duration of the Project, craft employees who are referred through the job referral systems, hiring halls or related-job placement practices established by the applicable Appendix "A" Agreement. Notwithstanding this requirement, every Contractor shall have the sole right to determine (a) the number of employees required; (b) the competency of all referred employees; (c) which employees are to be laid-off, subject to the requirements of this Agreement; and (d) whether to reject any referred employees, subject to the applicable Appendix "A" Agreement.

(ii) If a Signatory Union is unable to fill any request for qualified employees within two (2) working days after the request is made by the Contractor, the Contractor may employ qualified applicants from any other available source. If a Signatory Union does not have a job referral system, the Contractor shall give the Signatory Union preference to refer applicants, subject to the non-discrimination and other provisions of this Article. The Contractor shall notify the appropriate Signatory Union of craft employees hired within its jurisdiction from any source other than referral by that Signatory Union.

(iii) The Signatory Unions shall exert their utmost efforts to recruit sufficient numbers of skilled craft workers to fulfill the manpower requirements of each Contractor. The signatories to this Agreement support the development of increased numbers of skilled construction workers to meet the need of the Project and of the industry generally. Toward that end, the Signatory Unions agree that any recognized job referral system shall give priority to qualified residents from Suffolk and Nassau Counties and their immediate vicinity, to the extent consistent with applicable law. The Signatory Unions shall not knowingly refer to a Contractor an employee then employed by another Contractor under this Agreement.

SECTION 3 - NON-DISCRIMINATION

The Signatory Unions represent that their hiring halls, referral systems and related job placement practices will be operated in a non-discriminatory manner and in full compliance with all applicable federal, state and local laws and regulations which require equal employment opportunities. Referrals shall not be affected in any way by the rules, regulations, by-laws, constitutional provisions or any other aspects or obligations of union membership, policies or requirements. Referrals shall be subject to such other conditions as are established in this Article. No employment applicant shall be discriminated against by any referral system, hiring hall or related job-placement practice, because of the applicant's union membership, or lack thereof.

SECTION 4 - MINORITY AND FEMALE REFERRALS

If a Signatory Union either fails, or is unable, to refer qualified minority or female applicants with 48 hours in percentages equaling Protect-affirmative action goals set in the Contract Documents, the Contractor may employ qualified minority or female applicants from any other available source.

SECTION 5 - UNION DUES

All employees covered by this Agreement shall be subject to the union security provisions contained in the applicable Appendix "A" Agreement, as amended from time to time, but only for the period of time during which they are performing Covered Work and only to the extent of rendering payment of the applicable monthly union dues uniformly required for union membership in the Signatory Union which represents the craft in which the employee is performing Covered Work. No employee shall be discriminated against at the Project because of the employee's union membership or lack thereof. In the case of unaffiliated employees, the dues payment will be received by the Signatory Union as an agency shop fee.

SECTION 6 - CRAFT FOREPERSONS AND GENERAL FOREPERSONS

The selection of craft forepersons and general forepersons, and the number of forepersons required, shall be at the discretion of the Contractors, except where such selection is otherwise provided by specific provisions of an applicable Appendix "A" Agreement. All forepersons shall take orders exclusively from the designated Contractor representatives. Craft forepersons shall be designated as working forepersons.

SECTION 7 - HELMETS TO HARDHATS

(i) The Employers and the Unions recognize a desire to facilitate the entry into the building and construction trades of veterans who are interested in careers in the building and construction industry. The Employers and Unions agree to utilize the services of the Center for Military Recruitment, Assessment and Veterans Employment (hereinafter "Center") and the Center's "Helmets to Hardhats" program to serve as a resource for preliminary orientation, assessment of construction aptitude, referral to apprenticeship programs or hiring halls, counseling and mentoring, support network, employment opportunities and other needs as identified by the parties.

(ii) The Unions and Employers agree to coordinate with the Center to create and maintain an integrated database of veterans interested in working on this Project and of apprenticeship and employment opportunities for this Project. To the extent permitted by law, the Unions will give credit to such veterans for bona fide, provable past experience.

ARTICLE V. UNION REPRESENTATION

SECTION 1 - LOCAL UNION REPRESENTATIVE

Each Signatory Union representing employees performing Covered Work shall be entitled to designate one (1) representative, and one (1) alternate, who shall be afforded access to the Project. Such designation shall be in writing, which shall be provided to the Construction Manager and the Contractor involved.

SECTION 2 – STEWARDS

(i) Each Signatory Union shall have the right to designate a working journeyperson as a Steward, lead engineer or other designee as the case may be, and an alternate (collectively, Stewards), in accordance with the practices as set forth in the applicable Appendix "A" Agreement. Each Signatory Union also shall notify the involved Contractor and the Construction Manager of the identity of the Stewards and alternate prior to their assumption of such duties. Stewards and any alternate while performing as a Steward shall not exercise any supervisory functions and shall receive the regular rate of pay for their craft classifications.

(ii) In addition to their obligation to perform the ordinary work of their craft or trade, Stewards shall know and understand the conditions and requirements of the PLA Agreement and shall be available to receive complaints or grievances and to discuss and assist in their adjustment with the Contractors appropriate supervisor. Each Steward shall be entitled to act only with respect to the employees of their trade contractor(s) and, if applicable, subcontractors of that Contractor. Contractors shall not discriminate against Stewards by reason of their proper performance of their duties under this Article.

(iii) Stewards shall have no right to determine when, and by whom, overtime shall be worked, except that Stewards may oversee the equitable distribution of overtime opportunities to all employees.

(iv) If a Steward is protected against layoff or discharge by any provisions in a Appendix "A" Agreement, such provisions shall be recognized to the extent the Steward possesses the necessary qualifications to perform the work required. In any case where a Steward is discharged or disciplined for just cause, the Signatory Union shall be notified immediately by the Contractor.

ARTICLE VI. MANAGEMENT'S RIGHTS

SECTION 1 - RESERVATION OF RIGHTS

Except to the extent expressly limited by a specific provision of this Agreement, and subject to anything otherwise expressly provided in the Contract Documents, Contractors shall retain full and exclusive authority for the management of their Project operations including, but not limited to: the right to direct the work force, including determining the number of employees to be hired and their requisite qualifications; the promotion, transfer, and layoff of its employees, the discipline or discharge for cause of its employees; the assignment and schedule of work; the promulgation of reasonable Project work rules; and the requirement, timing, and number of employees to be utilized for overtime work. No rules, customs or practices which limit or restrict productivity or efficiency of individual workers, as determined by the Contractor or the Construction Manager, and/or joint working efforts with other employees, shall be permitted or observed.

SECTION 2 - NO LIMITATION ON CONSTRUCTION METHODOLOGIES

Provided there is compliance with the Contract Documents, including the Project Plans and Specifications, and applicable law, there shall be no limitation or restriction upon the Contractors' choice of means or methods for performing their work, including, regardless of

source or location, upon the use and installation of equipment, machinery, package units, precast, pre-fabricated, pre-finished, or pre-assembled materials, components of the work, tools, or other labor-saving devices, provided such means and methods are not inconsistent with industry practice and custom in Nassau and Suffolk Counties and, to the extent applicable, the provisions of the applicable Appendix "A" Agreement. The on-site installation or application of such items shall be performed by the craft having jurisdiction over such work; provided, however, it is recognized that other personnel having special qualifications may participate, in a supervisory capacity, in the installation, check-off or testing of specified or unusual equipment or facilities as designated by the Contractor.

SECTION 3 - TEMPORARY UTILITIES

Dedicated temporary utility coverage shall not be required during normal working hours. Standby coverage during non-working hours shall be requested from the trades based upon operating conditions and requirements. There shall be no stacking of trades on temporary services. In the event that a temporary utility system is in use on the site and is claimed by multiple trades, the claims shall be submitted to the labor Management Committee for mediation. Absent a resolution, the claims will be resolved in accordance with the provisions for the resolution of jurisdictional claims set forth in Article X herein. The temporary utility system(s) shall be continued to be utilized without interruption, as/if deemed necessary by the Construction Manager, pending resolution of the dispute.

ARTICLE VII. WORK STOPPAGES AND LOCKOUTS

SECTION 1 - NO STRIKES -- NO LOCK OUT

There shall be no strikes, work stoppages, hand billing, picketing, slowdowns or other disruptive activity at the Project for any reason by any Signatory Union or employee against any Contractor or employer performing project work.. There shall be no other union, concerted or employee activity, which disrupts or interferes with project work operations at the Project. There shall be no lockout at the Project by any Contractor. The Council, Contractors and Signatory Unions shall take all steps necessary to ensure compliance with this Article.

SECTION 2 - DISCHARGE FOR VIOLATIONS

A Contractor may discharge any employee violating Article VII, Section 1, above, for cause however; such employee shall be eligible for subsequent referral under this Agreement.

SECTION 3 - EXPEDITED ARBITRATION

Any Contractor or Signatory Union alleging a violation of Section 1 of this Article may utilize the expedited procedure set forth below:

(i) A party invoking this procedure shall give notice in writing to the County and the PLA Administrator. The County, acting by its designee, shall serve as a member of an Arbitration Panel, together with a Council representative, and with a third-party neutral arbitrator to be selected by agreement of the Council and County. The County and Council representatives may, alternatively, designate a sole arbitrator from the American Arbitration Association to hear the case. In either event, the County, Council representative, or their respective designees, shall

provide copies of such notification to the alleged violator, the Council and the PLA Administrator.

(ii) In all cases where it is contended that a violation of Section 1 of this Article is ongoing, the Arbitrator or Arbitration Panel, as the case may be, shall promptly schedule and hold a hearing within forty-eight (48) hours of receipt of the written notice of the alleged violation, or as soon thereafter as is reasonably practical.

(iii) All notices pursuant to this Article shall be in writing and shall be served by hand or fax transmission, confirmed by overnight delivery, addressed to the Arbitrator or Arbitration Panel, Contractors and/or Signatory Unions involved. The hearing may be held on any day, including Saturdays or Sundays. The hearing shall be completed in one (1) session which shall not exceed eight (8) hours duration (no more than four (4) hours being allowed to either side to present their case and to conduct their cross-examination), unless otherwise agreed. A failure of any Union or Contractor to attend the hearing shall not delay the hearing of evidence by those present or the issuance of an award by the Arbitrator or Arbitration Panel.

(iv) The sole issue at the hearing shall be whether a violation of this Article has occurred. If a violation is found to have occurred, the Arbitrator or Arbitration Panel shall issue a Cease and Desist Award, restraining such violation (the Award), granting such other relief as deemed appropriate and serve copies of the Award on the Contractors and Signatory Unions involved. The Arbitrator or the Arbitration Panel shall not have any authority to consider any matter in justification, explanation or mitigation of such violation, or to award any relief other than a cease and desist order, with all other remedies being reserved by the respective parties. At any time before the issuance of the Award, the Arbitrator or the Arbitration Panel may attempt to mediate a settlement of the matter by informal discussions among the affiliated parties without delaying, however, any of the time constraints established under this Article. The Award shall be issued in writing within three (3) hours after the close of the hearing, and may be issued without written supporting opinion. If any involved party desires such an opinion, one shall be issued within fifteen (15) calendar days after receipt of a written demand, but its issuance shall not delay compliance with, or enforcement of, the Award.

(v) An Award issued under this procedure shall be final and binding and may be enforced by any court of competent jurisdiction upon the filing of this Agreement together with the Award. Notice of the filing of such enforcement proceedings shall be given to the Signatory Union or Contractor involved.

(vi) Any rights created by statute or law governing arbitration proceedings which are inconsistent with the procedure set forth in this Article, or which interfere with compliance with this Article, are waived by the Contractors and Signatory Unions.

(vii) The fees and expenses, if any, of each Arbitrator shall be equally divided between the Contractor and Signatory Union involved, regardless of outcome, except that employees of the County who serve as Arbitrators under this Article shall be compensated and reimbursed by the County alone and employees of the Council who serve as Arbitrators under this Article shall be compensated and reimbursed by the Council alone.

SECTION 4 - ARBITRATION OR DISCHARGES FOR VIOLATION

The grievance and arbitration procedures contained in Article IX shall not be applicable to any alleged violation of this Article, with the sole exception that an employee discharged for an alleged violation of Section 1 of this Article may invoke the procedures of Article IX to determine only if the employee did, in fact, violate the provisions of Section 1 of this Article, but not for the purpose of modifying the discipline imposed where a violation is found to have occurred.

ARTICLE VIII. LABOR MANAGEMENT COMMITTEE

SECTION 1 – SUBJECTS

A Project Labor Management Committee shall be established consisting of one (1) representative, and a designated alternate from the PLA Administrator, the Council and the County. The Committee will meet on a regular basis to: promote harmonious relations among the Contractors and Signatory Unions; enhance safety awareness, cost effectiveness and productivity of construction operations; protect the public interest; discuss matters relating to staffing and scheduling with safety and productivity as considerations; review affirmative action and equal employment opportunity matters pertaining to the Project; monitor and ensure timely completion; assist in ensuring that a high degree of skill and quality of workmanship is attained at the Project; and to address, in advance, any potential work assignment issues.

SECTION 2 – COMPOSITION

The Committee may be jointly chaired by the representatives of the PLA Administrator, the Council and the County. The Signatory Unions and Contractors may be requested by the Committee to designate representatives to assist in discussing any issues being addressed at any meeting. The Committee may elect to establish subcommittees to assist in the performance of its duties.

ARTICLE IX. GRIEVANCE AND ARBITRATION PROCEDURE

SECTION 1 - PROCEDURE FOR RESOLUTION OR GRIEVANCES

Any question, dispute or claim arising out of, or involving, the interpretation or application of this Agreement (other than jurisdictional disputes or alleged violations of Article VII, Section 1 shall be considered a grievance and shall be resolved pursuant to the exclusive procedure described below: provided, in all cases, that the question, dispute, or claim must have arisen during the term of this Agreement.

Step 1:

(i) When an employee covered by this Agreement feels aggrieved by a claimed violation of this Agreement the employee shall, through the Signatory Union business representative or Steward, give notice of the claimed violation to the work site representative of the involved Contractor. To be timely, such notice of the grievance must be given within ten (10) calendar days after the act, occurrence, or event giving rise to the grievance. The business representative of the Signatory Union or Steward and the work site representative of the

Contractor involved shall meet and endeavor to adjust the matter within three (3) calendar days after timely notice has been given. If they fail to resolve the matter within the prescribed period, the grieving party, may, within seven calendar days thereafter, pursue Step 2 of the grievance procedure, by serving the Contractor and the PLA Administrator with written copies of the grievance, setting forth a description of the claimed violation, the date on which the grievance occurred, and the provisions of the Agreement alleged to have been violated. Grievances and disputes settled at Step 1 are non-precedential, except as to the specific Signatory Union, the employee and Contractor involved, unless the settlement is accepted in writing by the PLA Administrator as creating a precedent.

(ii) Should any signatory to this Agreement have a dispute (excepting jurisdictional disputes or alleged violations of Article VII, Section 1) with any other signatory to this Agreement, and if, after conferring, a settlement is not promptly reached, the dispute shall be reduced to writing and, shall proceed to Step 2 in the same manner as outlined in Subparagraph (a) for the adjustment of employee grievances.

Step 2:

The Business Manager or designee of the involved Signatory Union, together with representatives of the Council, the involved Contractor, and the PLA Administrator shall meet in Step 2 within two (2) calendar days of service of the written grievance, to arrive at a satisfactory settlement.

Step 3:

(i) If the grievance has been submitted but not resolved in Step 2, any of the participating Step 2 entities may, within three (3) calendar days after the initial Step 2 meeting, submit the grievance in writing (copies to other participants) to the County. The County, acting by its designee, shall serve as a member of a three-member Arbitration Panel, together with a Council representative together with a third-party neutral Arbitrator to be selected upon agreement of the Council and the County. The County and Council representatives may alternatively, designate a sole arbitrator to hear the case. The Expedited Labor Arbitration Rules of the American Arbitration Association shall govern the conduct of the arbitration hearing, at which all Step 2 participants shall be parties. The decision of the Arbitrator or Arbitration Panel shall be final and binding on the Contractor, Signatory Union and employee involved. The fees and expenses, if any, of each Arbitrator shall be equally divided between the Contractor and Signatory Union involved, regardless of outcome, except that employees of the County who serve as Arbitrators under this Article shall be compensated and reimbursed by the County alone, and employees of the Council who serve as Arbitrators under this Article shall be compensated and reimbursed by the Council alone.

(ii) The failure of the grieving party to adhere to the time limits set forth in this Article shall render the grievance null and void. The time limits may be extended only with the written consent of the PLA Administrator, the Contractor and the Signatory Union affected by the extension. In the event a step involves the Arbitrator or Arbitration Panel, then the written consent of the Arbitrator also shall be required. The Arbitrator shall have authority to make decisions only on the issues presented to him, and shall not have the authority to change, add to, delete or modify any provisions of this Agreement or the Contract Documents.

SECTION 2 - LIMITED RETROACTIVE EFFECT OF AWARDS

No arbitration decision or award under this Article may have retroactive effect for a period exceeding sixty (60) days prior to completion of submission of the initial written grievance by the Contractor and Signatory Union involved.

SECTION 3 - PARTICIPATION BY JACOBS

The PLA Administrator shall be notified by the involved Contractor of all actions at Steps 2 and 3 and, at its election, may participate in full in all proceedings at these Steps, including Step 3 arbitration when directed to do so by the County.

ARTICLE X. JURISDICTIONAL DISPUTES

SECTION 1 - NO DISRUPTIONS

There will be no strikes, sympathy strikes, work stoppages, slowdowns, picketing or other disruptive activity of any kind arising out of any jurisdictional dispute. Pending the resolution of the dispute, the work shall continue uninterrupted and as assigned by the Contractor. No jurisdictional dispute shall excuse a violation of Article VII. Notwithstanding any other provision of this Agreement, every party shall be entitled to seek, without delay or prior recourse to the Plan for the Settlement of Jurisdictional Disputes in the Construction Industry referenced in this Article, injunctive and/or other appropriate relief, to the extent permitted by applicable law, to address a violation of this Section.

SECTION 2 – ASSIGNMENT

All Project work assignments shall be made by each Contractor pursuant to law and in consideration of industry custom and practice in Nassau and Suffolk Counties, including relevant provisions of applicable Appendix "A" Agreements concerning such custom and practice. All work assignments shall be in accordance with Article IV of this Agreement.

SECTION 3 - PROCEDURE FOR SETTLEMENT OF JURISDICTIONAL DISPUTES

(i) Any Signatory Union having a jurisdictional dispute with respect to an aspect of the Covered Work assigned to another Signatory Union will submit the dispute, in writing, to the Administrator, Plan for the Settlement of Jurisdictional Disputes in the Construction Industry (the Plan), within seventy-two (72) hours and send a copy of the letter to the other Signatory Union involved, the Council, the Contractor involved, the PLA Administrator and the County. Upon receipt of a dispute letter from a Signatory Union, the Administrator shall invoke the procedures set forth in the Procedural Rules and Regulations to the Plan to resolve the jurisdictional dispute. The jurisdictional dispute letter shall contain the information described in Article IV of the Procedural Rules and Regulations for the Plan. A copy of the Plan and its Procedural Rules and Regulations are attached to this Agreement as Exhibit B.

(ii) Within two (2) calendar days of the receipt of the dispute letter, there shall be a meeting of the Signatory Unions involved the Council, the PLA Administrator and the County for the purpose of resolving the jurisdictional dispute.

(iii) If the dispute remains unresolved after this meeting, the parties will proceed to final and binding arbitration in accordance with the principles and procedures set forth in the rules of the Plan and its Procedural Rules and Regulations.

(iv) The Arbitrator shall render a short-form written decision within three (3) days of the hearing based upon the evidence submitted at the hearing. The Arbitrator shall not be permitted under any circumstance, to direct an assignment of an aspect of the Covered Work in violation of applicable local, state or federal law, rule or regulation.

(v) This Jurisdictional Dispute Resolution Procedure will apply only to work performed by the Signatory Unions at the Project. Further, no party, by reason of its execution of this Agreement, shall have any obligation under the Plan, or its Rules or Regulations, with respect to any other project or with respect to the Project beyond the effective period of this Agreement.

(vi) Any Signatory Union involved in a jurisdictional dispute on the Project shall continue working in accordance with Section 2 of this Article and without disruption of any kind.

SECTION 4 – AWARD

Any jurisdictional award pursuant to Section 3 of this Article shall be final and binding on the disputing Signatory Unions and the Contractor on this Project only, and may be enforced in any court of competent jurisdiction. Such award or resolution shall not establish a precedent on any other construction work not covered by this Agreement. In all disputes under this Article, the PLA Administrator and the affected Contractor shall be considered parties in interest and shall be sent contemporaneous copies of all notifications required under these Articles and, at their option, may participate fully as a party in any proceeding initiated under these Articles.

SECTION 5 - NO INTERFERENCE WITH WORK

There shall be no interference or interruption of any kind with the work of the Project while any jurisdictional dispute is being resolved. The work shall proceed as assigned by the Contractor until finally resolved under the applicable procedure of this Article. The award shall be confirmed in writing to the involved parties. There shall be no strike, work stoppage or interruption in protest of any such award. The award, which shall be adhered to by the Contractor, shall not provide for any award of damages or other expenses against the County, or the Contractor based on its prior jurisdictional designation: provided, however, that this provision shall not be interpreted to preclude otherwise existing rights for an award of monetary damages against the Contractor based on its jurisdictional designation.

SECTION 6 – LIMITATIONS

Any arbitration panel convened for the purpose of resolving jurisdictional disputes shall have no authority to assign work to a crew of more employees than the minimum required by the Contractor; nor to assign the work to employees who are not qualified to perform the work involved. This does not prohibit the establishment, with the agreement of the involved Contractor of composite crews where more than one (1) employee is needed for the job. The aforesaid determinations shall decide only to whom the disputed work belongs.

ARTICLE XI. WAGES AND BENEFITS

SECTION 1 - CLASSIFICATION AND WAGES

All employees covered by this Agreement shall be classified in accordance with their work performed and paid wages and benefits for those classifications set forth in the Appendix "A" Agreements, as amended during this Agreement, except as otherwise provided in this Agreement.

SECTION 2 - EMPLOYEE FRINGE BENEFITS/SUPPLEMENTS

A. Employees shall be paid fringe benefits/supplements in accordance with the Appendix "A" Agreements and the time requirements therein, except to the extent otherwise provided in this Agreement, by law or other agreement. Delinquency of payments shall be subject to the expedited arbitration process pursuant to Article VII, Section 1.

B. Nothing in this Agreement shall preclude the right of any fund or entity from lawfully collecting fringe benefits/supplements for employees performing covered work to utilize the applicable rights and remedies afforded under the New York Lien Law. Any issue regarding the failure or refusal by a Contractor and/or subcontractor to pay appropriate wages and/or fringe benefits, on a timely basis, shall be subject to the provisions of the respective Collective Bargaining Agreement (CBA), addressing this issue and shall be subject to the expedited arbitration process under this Agreement including the time requirements there under. Any Signatory Union alleging a failure to pay appropriate wages and fringe benefits shall give immediate written notice in writing to the Council, the County and the PLA Administrator of the alleged failure in order to initiate the expedited arbitration process.

C. It is agreed, in order to ensure the full and timely remittance of all union dues and fringe benefits/supplements due the affiliated signatory Unions as provided for in the Schedule "A" Agreements, that the Prime Contractor shall be responsible to immediately withhold payment on all monies due or which may become due to the delinquent Contractor up to the amount alleged to be owed from this Project, upon notification of not more than fifteen (15) days from the date of a default from any affiliated signatory Union of the delinquency on this Project. The withheld funds shall be held in an interest bearing escrow account to be applied against the amounts owed by the delinquent Contractor. Before such payment is made, the Prime shall first advise the delinquent Contractor in writing of the complaint made by the signatory Union and the amounts claimed by the Union. The delinquent Contractor shall be allowed a period of ten (10) days from the date of notification to produce a written letter signed by the Business Manager of the complaining Signatory Union that either (a) the delinquency has been paid in full and the Contractor is current in remittance of Funds; or (b) providing a bona-fide explanation acceptable to the complaining Signatory Union of why in the Contractor's opinion the amounts are not due as alleged. In the event of such a bona-fide dispute, the Prime will be required to use its best effort to act as an initial arbiter and take action it then deems appropriate.

D. In the event such a letter is not delivered to the Prime within ten (10) days from the date of notification to the delinquent Contractor, the Construction Manager shall immediately pay over to the Fund Administrator of the complaining Signatory Union all monies due the defaulting Contractor to the extent necessary to satisfy the amounts payable to the Contractor by the Construction Manager for the Project.

E. No monies shall be paid to the delinquent Contractor during the pendency of a request to arbitrate the dispute in accordance with Article IX herein.

F. None of the foregoing is to be construed as having created a debt on the part of the Construction Manager or the Primes to the Signatory Union for unpaid Funds by defaulting Contractors except to the extent that funds are payable to the Contractors and overdue to the Signatory Unions for this Project and with proper notice as herein provided. There will be no strike, work stoppage or disruption pending resolution of the dispute.

G. Notwithstanding the foregoing provisions of this Article, including any provisions to arbitrate disputes, in the event the Prime fails to perform its obligations under this Article for forty-five (45) days, the members of a Signatory Union, on five (5) days written notice of the right to cure from the complaining Signatory Union to the delinquent Contractor and the Construction Manager and Prime, with copies to the President of the Building and Construction Trades Council, can elect to refuse to perform services for the delinquent Contractor. Upon the curing of such delinquency, all work shall immediately recommence and the parties shall return to the *status quo ante*. The provisions of Article VII shall remain in full force and effect with respect to all other Signatory Union members working on the Project. If a Contractor fails to contribute to a Signatory Union's benefit/supplement funds because of the Contractor's inability to collect payment from the Owner for work performed on the Project, it is agreed that the Contractor will not be removed from the job for non-performance which results from a Signatory Union's members refusing to perform services as set forth in this Section.

ARTICLE XII. HOURS OF WORK PREMIUM PAYMENTS, SHIFTS AND HOLIDAYS

SECTION 1 - WORK WEEK AND WORK DAY

The regular workweek shall consist of Monday through Friday forty-hours (40) at straight-time rates for pay and fringe benefits/supplements, The standard work day shall consist of eight (8) hours, with a Project start time uniformly set by the Contractors at 7:00 a.m. or 8:00 a.m., with one half (1/2) hour unpaid lunch period, to commence no earlier than 11:30 a.m. and no later than 12:00 p.m., which shall not be counted as part of the eight (8) hour workday. If operational considerations warrant, with one (1) week advance notice, the workday may be further changed by agreement among the Contractor and the Signatory Union and such agreement shall not be unreasonably withheld. Nothing herein shall be construed to provide for a Saturday make-up day at straight time rates.

SECTION 2 – OVERTIME

The rate of pay for overtime hours worked during the period Monday through Friday (excluding recognized holidays) outside the eight (8) hour workday established in Section 1 of this Article shall be at time and one-half the regular hourly rate. The rate or amount of fringe benefits/supplements for overtime hours worked during the period Monday through Friday (excluding recognized holidays) outside the eight (8) hour work day established in Section 1 of this Article shall be at the rate or amount provided under the applicable Appendix "A" Agreements. The rate of pay and rate (or amount) for all other overtime hours shall be in accordance with the applicable Appendix "A" Agreements. There will be no restriction upon the Contractor's scheduling of overtime or the non-discriminatory designation of employees who shall perform such overtime work.

SECTION 3 – SHIFTS

(i) Flexible Schedules - Scheduling of shift work shall remain flexible in order to meet Project schedules and existing Project conditions. It is not necessary to work a day shift in order to schedule a second shift. Shifts must be worked a minimum of five (5) consecutive work days, must have prior approval and must be scheduled with no less than five (5) work days notice to the Signatory Union. Shifts shall be eight (8) hours in duration and employees working an eight (8) hour shift on the Second or Third shift shall be paid nine (9) hours of pay for wages and fringes at the straight time rate. The overtime provisions of the respective Appendix "A" Agreements shall be applicable, subject to Section 2 of this Article.

(ii) Flexible Starting Times - Shift starting times shall be adjusted by the Contractor as necessary to fulfill Project requirements, and, in case of emergency, shall be subject to the notice requirements of the Appendix "A" Agreements.

(iii) A Contractor shall schedule an unpaid period of not more than one-half (1/2) hour duration at the work location between the third (3rd) and fourth (4th) hour of the scheduled shift, which shall not be counted as part of the standard eight (8) hour work day. A contractor may for efficiency of operation, establish a schedule, which coordinates the meal periods of two (2) or more crafts. If an employee is required to work through the meal period, the employee shall be compensated in a manner established in the applicable Appendix "A" Agreement.

SECTION 4 – HOLIDAYS

(i) Recognized holidays on this Project shall be the following:

- | | |
|------------------|-----------------------------|
| - New Years Day | - Veterans Day |
| - Presidents Day | - Thanksgiving |
| - Memorial Day | - Friday after Thanksgiving |
| - 4th of July | - Christmas Day |
| - Labor Day | |

(ii) Payment - Regular holiday pay, if any, and/or premium pay for work performed on such a recognized holiday shall be in accordance with the applicable Appendix "A" Agreements.

(iii.) Holidays that fall on Sunday shall be observed on the following Monday. Holidays that fall on Saturday shall be observed on the previous Friday.

SECTION 5 - REPORTING PAY

(i) Employees who report to the work location pursuant to the regular schedule and who are not provided with work, or whose work is terminated early by a Contractor, for whatever reason, shall receive reporting pay in accordance with the applicable Appendix "A" Agreement.

(ii) When an employee, who has completed his/her scheduled shift and left the Project site, is "called out" to perform special work of a casual, incidental or irregular nature, the employee shall receive pay for actual hours worked with a minimum guarantee, as required by the applicable Appendix "A" Agreement, at the employee's straight time rate.

(iii) When an employee leaves the job or work location of their own volition or is discharged for use or is not working as a result of the Contractor's invocation of Section 7 of this Article, they shall be paid only for the actual time worked.

SECTION 6 - PAYMENT OF WAGES

(i) Payday - Payment shall be made by check, drawn on a New York bank with branches located within commuting distance of the Project site. Paychecks shall be issued by the Contractor at the job site in accordance with prevailing practices for the applicable trade. Not more than three (3) days wages shall be held back in any pay period. Paycheck stubs shall contain the name and business address of the Contractor, together with an itemization of deductions from gross wages.

(ii) Termination - Employees who are laid off or discharged for cause shall be paid in full for that which is due them at the time of termination. The Contractor shall also provide the employee with a written statement setting forth the date of lay off or discharge.

SECTION 7 - EMERGENCY WORK SUSPENSION

A Contractor may, if considered necessary for the protection of life and/or safety of employees or others, suspend all or a portion of Project work, with pay, to be subject to the applicable Appendix "A" Agreement.

SECTION 8 - INJURY/DISABILITY

An employee, who, after commencing work, suffers a work-related injury or disability, while performing work duties, shall receive no less than eight (8) hours wages for that day.

SECTION 9 - TIME KEEPING

A Contractor may utilize conventional systems to check employees in and out, so long as it occurs on Company time. Each employee must check in and out. The Contractor will provide adequate facilities for checking in and out in an expeditious manner.

ARTICLE XIII. APPRENTICES

SECTION 1 - PROGRAMS FOR APPRENTICES

Recognizing the need to maintain continuing supportive programs designed to develop adequate numbers of competent workers in the construction industry in the Nassau/Suffolk area and to provide craft-entry opportunities for minorities, women and economically disadvantaged non-minority males, Contractors will employ apprentices in their respective crafts at designated ratios to perform such work as is within their capabilities and which is customarily performed by the craft in which they are indentured. Contractors shall utilize apprentices and such other appropriate classifications as are contained in the applicable Appendix "A" Agreements.

SECTION 2 - DEPARTMENT OF LABOR

To assist the Contractors in attaining a maximum effort on this Project, the Signatory Unions agree to work in close cooperation with, and accept monitoring by, the New York State Department of Labor and the Nassau County Department of Labor to ensure that minorities and women are afforded every opportunity to participate in apprenticeship programs which result in the placement of apprentices on this Project. The Signatory Unions shall cooperate with Contractor requests for minority, women or economically disadvantaged referrals to meet this Contractor effort to the extent consistent with the operating rules and regulations of the union and governing law.

ARTICLE XIV. SAFE PROTECTION OF PERSON AND PROPERTY

SECTION 1 - SAFETY REQUIREMENTS

Each Contractor shall ensure that applicable OSHA requirements are at all times maintained on the Project. The Contractors and Signatory Unions agree to cooperate fully with these efforts. Employees must perform their work at all times in a safe manner and protect themselves and the property of the Contractor and the County from injury or harm. Failure to do so will be grounds for discipline, including discharge.

SECTION 2 - SITE SERVICES

The Contractors, Signatory Unions and the Council agree that in the event the Construction Manager employs craft workers for the Project such employees shall be permitted to perform all types of work at the Project site within the recognized work jurisdiction of their respective crafts, including site safety duties and general clean-up duties, among other duties; provided that the appropriate affiliate shall be assigned all general conditions work.

SECTION 3 - CONTRACTOR RULES

Employees covered by this Agreement shall at all times be bound by the safety, security, and visitor rules as established jointly by the Contractors and the PLA Administrator, the Council and the Signatory Unions. Such rules shall be published and posted in conspicuous places. In the event the parties disagree as to the interpretation and application of such rules, the dispute shall be submitted to the Labor Management Committee for resolution and if the dispute remains unresolved, it shall be submitted to arbitration pursuant to this Agreement and all parties shall be bound by such resolution.

SECTION 4 – INSPECTIONS

The Contractors, the Construction Manager and the County retain the right to inspect incoming shipments of equipment, apparatus, machinery and construction materials, and the work, of every kind, using employees not covered by this Agreement.

ARTICLE XV. NO DISCRIMINATION

SECTION 1 - COOPERATIVE EFFORT

The Contractors and Signatory Unions agree that they will not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, disability or age in any manner prohibited by law or regulation. It is recognized that special procedures may be established by Contractors and Signatory Unions and the New York State Department of Labor for the training and employment of persons who have not previously qualified to be employed on construction projects of the type covered by this Agreement. The parties to this Agreement will assist in such programs and agree to use their best efforts to ensure that the goals for female and minority employment are met on this Project.

SECTION 2 - LANGUAGE OF AGREEMENT

The use of the masculine or feminine gender in this Agreement shall be construed as including both genders.

ARTICLE XVI. GENERAL TERMS

SECTION 1 - PROJECT RULES

The PLA Administrator, the Contractors, the Council and the Signatory Unions shall jointly establish such reasonable Project rules as are appropriate for the good order of the Project through the Project Labor Management Committee. Consistent with appropriate safety precautions, the County may elect to do random drug and alcohol testing if warranted based upon observed conditions. These rules shall be explained at the preconstruction conference and posted at the Project site and may be amended thereafter as necessary. Failure of an employee to observe these rules and regulations shall be grounds for discipline, including discharge. The fact that no order was posted prohibiting a certain type of conduct shall not be a defense to an employee disciplined or discharged for such conduct when the action taken is for cause.

SECTION 2 - TOOLS OF THE TRADE

There shall be no restrictions on the emergency use of any tools or equipment by any qualified employee or on the use of any tools or equipment for the performance of work within the employee's jurisdiction, provided such tools or equipment do not present a safety risk not commonly accepted and accommodated in industry practice in Nassau and Suffolk Counties. The limits of the emergency shall be approved by the Labor Management Committee.

SECTION 3 – SUPERVISION

Employees shall work under the supervision of the craft foreperson or general foreperson.

SECTION 4 - TRAVEL ALLOWANCES

There shall be no requirement for payments for travel expenses, travel time, subsistence allowance or other such reimbursements.

SECTION 5 – FULL WORKDAY

Employees shall be at their designated staging area at the starting time established by the Contractor and shall be returned to their designated staging area by quitting time after performing their assigned functions under the supervision of the Contractor. The signatories reaffirm their policy of a fair day's work for a fair day's wage.

SECTION 6 - COOPERATION AND CONSENT OF DEPARTMENT OF LABOR

The PLA Administrator, the Council, the Contractors and the Signatory Unions shall cooperate at all times to achieve the purposes of this Agreement, including promptly executing any reasonable documentation and jointly seeking whatever approvals of the New York State Department of Labor that may be required.

SECTION 7 - UNION CONTRACTORS

In order to avoid a competitive disadvantage against Union Contractors, Contractors who are awarded work on the Project that currently have agreements with Labor Unions (Union Contractors) shall be entitled to perform work under the terms of this Agreement without discrimination on this Project and without adverse effect on other projects current or future. Work under this PLA shall not trigger the application of any Most Favored Nations clause in any Appendix "A" Agreement.

ARTICLE XVII. SAVINGS AND SEPARABILITY

SECTION 1 - THIS AGREEMENT

In the event that the application of any provisions of this Agreement is enjoined, on either an interlocutory or permanent basis, or otherwise found in violation of law, the provision involved shall be rendered, temporarily or permanently, null and void, but the remainder of the Agreement shall remain in full force and effect at the discretion of the County. In such event, the Agreement shall remain in effect for contracts already bid and awarded or in construction where the Contractor voluntarily accepts the Agreement. The parties to this Agreement will enter into negotiations for a substitute provision in conformity with the law and the intent of the parties.

SECTION 2 - THE COUNTY'S CONTRACT DOCUMENTS

In the event that the provisions of the Contract Documents, or other action, requiring that a successful bidder become a signatory to this Agreement, are found to be in violation of law, such requirement shall be rendered, temporarily or permanently, null and void, but the Agreement shall otherwise remain in full force and effect to the extent allowed by law, and shall remain in effect for contracts already bid and awarded or in construction where the contractor voluntarily accepts the Agreement. The parties may enter into negotiations as to modifications to the Agreement to reflect the court action taken and the intent of the parties.

SECTION 3 - NON-LIABILITY

In the event of an occurrence referenced in Section 1 or Section 2 of this Article, neither the County, the PLA Administrator, any Contractor, nor any Signatory Union shall be liable, directly or indirectly, for any action taken, or not taken, to comply with any court order, injunction or determination. The Contract Documents shall be issued, or revised, in conformance with court orders then in effect and no retroactive payments or other action will be required if the original court determination is ultimately reversed.

SECTION 4 – NO WAIVER OF NO STRIKE-NO LOCK OUT PROVISION

Nothing in this Article shall be construed to waive the prohibitions of Article VII.

ARTICLE XVIII. FUTURE CHANGES IN APPENDIX "A" AGREEMENTS

SECTION 1 - CHANGES TO AREA CONTRACTS

(i) Appendix "A" Agreements shall continue in full force and effect, until a Contractor and/or Signatory Union subject to the Area Collective Bargaining Agreements, which is the basis for the particular Appendix "A" Agreement in question, notifies the PLA Administrator in writing of the existence of changes in provisions of such agreements which are applicable to the Project and their effective dates.

(ii) It is agreed that no modification in Appendix "A" Agreements will apply to work on this Project if that modified provision is less favorable to this Project than that uniformly required of contractors for construction work normally covered by those agreements; nor shall any provision be recognized or applied on this Project if it may be construed to apply exclusively, or predominantly, to work covered by this Project Agreement.

(iii) Any disagreement between signatories to this Agreement over the incorporation into an Appendix "A" Agreement of provisions agreed upon in the renegotiation of Area Collective Bargaining Agreements shall be resolved in accordance with the procedure set forth in Article IX of this Agreement.

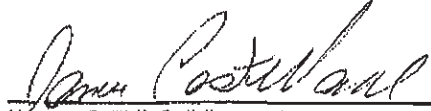
SECTION 2 - LABOR DISPUTES DURING AREA CONTRACT NEGOTIATIONS

The Signatory Unions agree that there will be no strikes, work stoppages, slowdowns or other disruptive activity or other violations of Article VII affecting the Project by any Signatory Union involved in the renegotiation of Area Local Collective Bargaining Agreements, nor shall there be any lock-out on this Project affecting a Signatory Union during the course of such renegotiations.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed and
effective as of the 18 day of May 2011.



Nassau County Department of Public Works
By: Ms. Shila Shah-Gavroudis, Commissioner NCDPW



Nassau Suffolk Building and Construction Trades Council
By: James Castellane, President

[See attached for affiliate signatures]

Boilermakers Local 5

By: _____

Date: _____

Engineers Local 15-D

By: _____

Date: _____

Bricklayers Local 1

By: _____

Date: _____

Engineers Local 30

By: _____

Date: _____

Cement Masons Local 780

By: *Angel Scagnelli*

Date: *8/31/11 (no time on one half)*

Engineers Local 138

By: _____

Date: _____

Dock & Pier Carpenters Local 1456

By: _____

Date: _____

Glaziers Local 1281

By: _____

Date: _____

I.B.E.W. Local 25

By: _____

Date: _____

Heat & Frost Insulators Local 12

By: _____

Date: _____

Elevator Constructors Local 1

By: _____

Date: _____

Heat & Frost Insulators Local 12A

By: _____

Date: _____

Boilermakers Local 5

By: _____

Date: _____

Engineers Local 15-D

By: _____

Date: _____

Bricklayers Local 1

By: _____

Date: _____

Engineers Local 30

By: _____

Date: _____

Cement Masons Local 780

By: _____

Date: _____

Engineers Local 138

By: _____

Date: _____

Dock & Pier Carpenters Local 1456

By: _____

Date: _____

Glaziers Local 1281

By: _____

Date: _____

I.B.E.W. Local 25

By: _____

Date: _____

Heat & Frost Insulators Local 12

By: _____

Date: _____

Elevator Constructors Local 1

By: _____

Date: 9/19/11

Heat & Frost Insulators Local 12A

By: _____

Date: _____

JUN-16-2011 13:43 From:

To: 17188490070

P.2/2

**Empire State Regional Council of
Carpenters**

By: _____

Date: _____

Iron Workers Local 361By: Richard O'HaneDate: May 10th, 2011**Iron Workers Local 580**By: [Signature]Date: 5/31/11**Plasterers Local 262**By: John P. SweeneyDate: 5/11/11**Laborers Local 66**

By: _____

Date: _____

Plumbers Local 200By: [Signature]Date: 5/12/2011**Laborers Local 78, MTDC, LUNA**By: [Signature]Date: 6/3/11**Resilient Floor Coverers Local 2287**By: John T. McKelveyDate: 6/9/11**Laborers Local 1298**By: [Signature]Date: MAY 31 2011**Roofers Local 154**

By: _____

Date: _____

Lathers Local 46

By: _____

Date: _____

Sheet Metal Workers Local 28

By: _____

Date: _____

Millwrights Local 740By: [Signature]

Nassau County PLA - April 2011

Sheet Metal Workers Local 137By: [Signature] **SIGNE & GRAPHICS**Date: 5.31.11
Page 30 of 52

**Empire State Regional Council of
Carpenters**

By: _____

Date: _____

Iron Workers Local 361

By: _____

Date: _____

Iron Workers Local 580

By: _____

Date: _____

Plasterers Local 262

By: _____

Date: _____

Laborers Local 66

By: _____

Date: _____

Plumbers Local 200

By: _____

Date: _____

Laborers Local 78, MTDC, LIUNA

By: _____

Date: _____

Resilient Floor Coverers Local 2287

By: _____

Date: _____

Laborers Local 1298

By: _____

Date: _____

Roofers Local 154

By: _____

Date: _____

Lathers Local 46By:  _____Date: 8/24/11**Sheet Metal Workers Local 28**

By: _____

Date: _____

Millwrights Local 740

By: _____

Sheet Metal Workers Local 137

By: _____

Boilermakers Local 5

By: _____

Date: _____

Engineers Local 15-D

By: _____

Date: _____

Bricklayers Local 1

By: _____

Date: _____

Engineers Local 30

By: _____

Date: _____

Cement Masons Local 780

By: _____

Date: _____

Engineers Local 138

By: _____

Date: _____

*Dock Builders & Timbermen
LOCAL 1556*By: *Joseph Steyer*Date: *9/1/11***Glaziers Local 1281**

By: _____

Date: _____

I.B.E.W. Local 25

By: _____

Date: _____

Heat & Frost Insulators Local 12

By: _____

Date: _____

Elevator Constructors Local 1

By: _____

Date: _____

Heat & Frost Insulators Local 12A

By: _____

Date: _____

Boilermakers Local 5

By: [Signature]Date: 5/21/11

Engineers Local 15-D

By: _____

Date: _____

Bricklayers Local 1

By: [Signature]Date: 5/12/11

Engineers Local 30

By: _____

Date: _____

Cement Masons Local 780

By: _____

Date: _____

Dock & Pier Carpenters Local 1456

By: _____

Date: _____

Glaziers Local 1281

By: [Signature]Date: 6/16/11

I.B.E.W. Local 25

By: _____

Date: _____

Heat & Frost Insulators Local 12

By: [Signature]Date: 5/16/11

Elevator Constructors Local 1

By: _____

Date: _____

Heat & Frost Insulators Local 12A

By: [Signature]Date: 5-31-2011

**Empire State Regional Council of
Carpenters**

By: _____

Date: _____

Iron Workers Local 361By: Richard O'KaneDate: May 10th, 2011**Iron Workers Local 580**By: [Signature]Date: 5/31/11**Plasterers Local 262**By: John P. SullivanDate: 5/11/11**Laborers Local 66**By: [Signature]Date: 6/16/11**Plumbers Local 200**By: [Signature]Date: 5/19/2011**Laborers Local 78, MTDC, IUNA**By: [Signature]Date: 6/3/11**Resilient Floor Coverers Local 2287**By: John T. McKelveyDate: 6/9/11**Laborers Local 1298**By: [Signature]Date: May 31 2011**Roofers Local 154**

By: _____

Date: _____

Lathers Local 46

By: _____

Date: _____

Sheet Metal Workers Local 28

By: _____

Date: _____

Millwrights Local 740

By: _____

Sheet Metal Workers Local 137By: [Signature]**SIGN & GRAPHICS**
5.31.11

Nassau County PLA - April 2011

Page 30 of 52

Date: _____

Painters D.C.9, Tapers, Paperhangers

By: [Signature]

Date: MAY 24, 2011

Date: _____

Steamfitters Local 638

By: [Signature]

Date: MAY 17, 2011

Stone Derricks Local 197

By: [Signature]

Date: 5/10/11

Teamsters Local 814

By: [Signature]

Date: 6/8/2011

Teamsters Local 282

By: Thomas Seavaldi

Date: 6/8/11

Tile, Marble & Terrazzo B.A.C. Local 7

By: Thomas Lane

Date: 5/16/11

Teamsters Local 813

By: [Signature]

Date: 5-13-11

JUN-16-2011 13:34 From:

- IBEW 425

To:2734773

P.2/2

Boilemmakers Local 5

By: [Signature]Date: 5/31/11

Engineers Local 15-D

By: _____

Date: _____

Bricklayers Local 1

By: Jeremiah SullivanDate: 5/12/11

Engineers Local 30

By: _____

Date: _____

Cement Masons Local 780

By: _____

Date: _____

Dock & Pier Carpenters Local 1456

By: _____

Date: _____

Glaziers Local 1281

By: _____

Date: _____

I.B.E.W. Local 25

By: John M. HarveyDate: 06/20/11 ✓

Heat & Frost Insulators Local 12

By: Donna ImpolitoDate: 5/16/11

Elevator Constructors Local 1

By: _____

Date: _____

Heat & Frost Insulators Local 12A

By: Antonio VegaDate: 5-31-2011

Empire State Regional Council of
Carpenters

By: W.H. L.
Date: 7/8/11

Iron Workers Local 361

By: _____
Date: _____

Iron Workers Local 580

By: _____
Date: _____

Plasterers Local 262

By: _____
Date: _____

Laborers Local 66

By: _____
Date: _____

Plumbers Local 200

By: _____
Date: _____

Laborers Local 78, MTDC, LIUNA

By: _____
Date: _____

Resilient Floor Coverers Local 2287

By: _____
Date: _____

Laborers Local 1298

By: _____
Date: _____

Roofers Local 154

By: _____
Date: _____

Lathers Local 46

By: _____
Date: _____

Sheet Metal Workers Local 28

By: _____
Date: _____

Millwrights Local 740

By: _____

Sheet Metal Workers Local 137

By: _____

MAY-31-2011 13:29 From:

To:6314350262

P.2/2

**Empire State Regional Council of
Carpenters**

By: _____

Date: _____

Iron Workers Local 361By: Richard O'KaneDate: May 10th 2011**Iron Workers Local 580**

By: _____

Date: _____

Plasterers Local 262By: John P. SullivanDate: 5/11/11**Laborers Local 66**

By: _____

Date: _____

Plumbers Local 200By: Sammy GradyDate: 5/19/2011**Laborers Local 78, MTDC, LIUNA**

By: _____

Date: _____

Resilient Floor Coverers Local 2287

By: _____

Date: _____

Laborers Local 1298

By: _____

Date: _____

Roofers Local 154By: Tom CorbettDate: 5/31/11**Lathers Local 46**

By: _____

Date: _____

Sheet Metal Workers Local 28

By: _____

Date: _____

Millwrights Local 740

By: _____

Sheet Metal Workers Local 137

By: _____

Nassau County PLA - April 2011

Page 30 of 52

ENXCO SUFFOLK SOLAR PLA

Iron Workers Local 580

By: _____

Date: _____

Laborers Local 66By:  _____

Date: _____

Notary Public State of New York
No. 01LA5214380
Qualified in Nassau County
Commission Expires Dec. 2, 2013

Laborers Local 78, MTDC, LIUNA

By: _____

Date: _____

Laborers Local 1298

By: _____

Date: _____

Lathers Local 46

By: _____

Date: _____

Millwrights Local 740

By: _____

Date: _____

Painters D.C.9, Tapers, Paperhangers

By: _____

Date: _____

Plasterers Local 262

By: _____

Date: _____

Plumbers Local 200

By: _____

Date: _____

Resilient Floor Coverers Local 2287

By: _____

Date: _____

Roofers Local 154

By: _____

Date: _____

Sheet Metal Workers Local 28

By: _____

Date: _____

Sheet Metal Workers Local 137

By: _____

Date: _____

Steamfitters Local 638

By: _____

Date: _____

**Empire State Regional Council of
Carpenters**

By: _____

Date: _____

Iron Workers Local 580

By: _____

Date: _____

Laborers Local 66

By: _____

Date: _____

Laborers Local 78, MTDC, LIUNA

By: _____

Date: _____

Laborers Local 1298

By: _____

Date: _____

Lathers Local 46

By: _____

Date: _____

Millwrights Local 740

By: _____

Iron Workers Local 361

By: _____

Date: _____

Plasterers Local 262

By: _____

Date: _____

Plumbers Local 200

By: _____

Date: _____

Resilient Floor Coverers Local 2287

By: _____

Date: _____

Roofers Local 154

By: _____

Date: _____

Sheet Metal Workers Local 28

By: Robert F. D. [Signature]

Date: 9-13-11

Sheet Metal Workers Local 137

By: _____

Boilermakers Local 5

By: _____

Date: _____

Engineers Local 15-D

By: _____

Date: _____

Bricklayers Local 1

By: _____

Date: _____

Engineers Local 30

By: *William Sykes*

Date: *8/17/11*

Cement Masons Local 780

By: _____

Date: _____

Dock & Pier Carpenters Local 1456

By: _____

Date: _____

Glaziers Local 1281

By: _____

Date: _____

I.B.E.W. Local 25

By: _____

Date: _____

Heat & Frost Insulators Local 12

By: *James J. J. J.*

Date: *5/16/11*

Elevator Constructors Local 1

By: _____

Date: _____

Heat & Frost Insulators Local 12A

By: _____

Date: _____

NO TEXT ON THIS PAGE

APPENDIX "A"

Collective Bargaining Agreements

The Collective Bargaining Agreements are on file at the following locations:

- 1.** Nassau County office of Department of Public Works
- 2.** The PLA Administrator's or Construction Manager's office at the project site
- 3.** At the various Locals signatory to this agreement

The complete list of Collective Bargaining Agreements is as follows:

EXHIBIT A
Letter of Assent
Nassau County Project Labor Agreement – Letter of Assent

The undersigned party confirms that it agrees to be a party to and be bound by the Nassau County Project Labor Agreement, NCM-PLA, for the designated Project added to the Agreement by Addendum _____ Dated _____ as such agreement may, from time to time, be amended by the parties or interpreted pursuant to its terms. The terms of the NCM-PLA, Schedules, Addenda and Exhibits are hereby incorporated by reference herein.

The undersigned, as a Contractor or Subcontractor (hereinafter Contractor) on the specific project added by the prior stated addendum (hereinafter PROJECT), for and in consideration of the award to it of a contract to perform work on said PROJECT, and in further consideration of the mutual promises made in the NCM-PLA, a copy of which was received and is acknowledged, hereby:

1. Accepts and agrees to be bound by the terms and conditions of the Agreement, together with any and all schedules; amendments and supplements now existing or which are later made thereto. Agrees to be bound by the legally established collective bargaining agreements and local trust agreements to the extent set forth in the NCM-PLA.
2. Authorizes the parties to such local trust agreements to appoint trustees and successor trustees to administer the trust funds and hereby ratifies and accepts the trustees so appointed as if made by the Contractor.
3. Certifies that it has no commitments or agreements that would preclude its full and complete compliance with the terms and conditions of said NCM-PLA.
4. Agrees to employ labor that can work in harmony with all other labor on the Project and shall require labor harmony from every lower tier subcontractor it engaged to work on the Project, Labor harmony disputes/issues shall be subject to the Labor Management Committee's Pre-Job conference provisions.
5. Agrees to secure from any Contractor(s) (as defined in said Agreement) which is or becomes a Subcontractor (of any tier), to it, a duly executed Agreement to be Bound in form identical to this document.
6. Agrees that it will not invoke the Most Favored Nations Clause that may be contained in any of its Collective Bargaining Agreements with affiliated unions as a result of the application of this NCM-PLA to this project.

(Print name of officer of contractor)

Subscribed and sworn to before
this _____ day of _____, 20__

(Signature of officer of contractor)

Notary Public

Company Name

Address and Telephone Number

EXHIBIT B
PROCEDURAL RULES AND REGULATIONS FOR
THE PLAN FOR THE SETTLEMENT OF JURISDICTIONAL DISPUTES IN THE
CONSTRUCTION INDUSTRY

These procedures shall apply to:

A. Employers who employ members of the organizations affiliated with the Mining and Construction Trades Department, AFL-CIO, and who signed a stipulation setting forth that they are willing to be bound by the terms of the agreement establishing the Plan for the Settlement of Jurisdictional Disputes in the Construction Industry, or who are members of a stipulated association of employers with authority to bind its members, or who are parties to a collective bargaining agreement providing for the settlement of jurisdictional disputes under the procedures herein set forth.

B. All National and International Unions affiliated with the Building and Construction Trades Department, AFL-CIO, and their local constituent bodies.
The stipulation form adopted by the Joint Administrative Committee Follows:

STIPULATION

In signing this stipulation, the undersigned (employer) (employer association on behalf of its members) agrees to be bound by all the terms and provisions of the Agreement establishing procedures for the resolution of jurisdictional disputes in the construction Industry known as the Plan for the Settlement of Jurisdictional Disputes in the Construction Industry. In particular, the undersigned agrees to abide by those provisions of the Plan requiring compliance with the decisions and awards of the Administrator, arbitrators or National Arbitration Panels established under the Plan, and to fulfill the obligations of the Employer set forth in the Agreement.

This stipulation shall run for the term of the Agreement and shall continue in effect for each year thereafter unless specifically terminated effective upon the anniversary date of said Agreement in accordance with the notice provisions contained in the Agreement. The effective date of this stipulation shall be:

(Signed) _____
Company _____
Date _____

To facilitate expeditious processing of jurisdictional disputes, employer parties to the Plan are encouraged to file signed Stipulation forms with the Administrator.

ARTICLE 1

CONTRACTORS RESPONSIBILITY

1. The contractor who has the responsibility for the performance and installation shall make a specific assignment of the work which is included in his contract. For instance, if contractor A subcontracts certain work to contractor B, then contractor B shall have the responsibility for making the specific assignments for the work included in his contract.

If contractor B, in turn, shall subcontract certain work to contractor C, then contractor C shall have the responsibility for making the specific assignment for the work included in his contract. After work has been assigned, such assignment will be maintained even though the assigning contractor is replaced and such work is subcontracted to another contractor. It is a violation of the Plan for the contractor to hold up disputed work or shut down a project because of a jurisdictional dispute.

2. When a contractor has made an assignment of work he shall continue the assignment without alteration unless otherwise directed by an arbitrator or there is agreement between the National and International Unions involved.

a. Unloading and/or handling of materials to stockpile or storage by a trade for the convenience of the responsible contractor when his employees are not on the job site, or in an emergency situation, shall not be considered to be an original assignment to that trade.

b. Starting of work by a trade without a specific assignment by an authorized representative of the responsible contractor shall not be considered an original assignment to that trade, provided that the responsible contractor, or his authorized representative, promptly, and, in any event, within eight (8) working hours following the start of work, takes positive steps to stop further unauthorized performance of the work by that trade.

c. The Administrator shall determine all questions of original assignment of work and render decisions regarding same. An appeal of the Administrator's determination of original assignment may be made to an arbitrator in a hearing under the terms and provisions of Article V of the Plan. Notice of the appeal shall be filed with the Administrator within seven (7) days of issuance of the determination. The appeal shall be processed only if the responsible contractor has complied with the Administrator's determination.

d. Criteria to be used in making assignments of work are set forth in Article V, Section 8, of the Plan.

ARTICLE II

UNIONS RESPONSIBLY

1. The Plan provides (Article VI, Section 1) that during the existence of the Plan there shall be no strikes work stoppages or picketing arising out of any Jurisdictional dispute.

2. When a contractor has made a specific work assignment, all unions shall remain at work and process any complaint over a jurisdictional dispute in accordance with the procedures herein established by the Administrator. Any union which protests that a contractor has failed to assign work in accordance with the procedures specified above, shall remain at work and process the complaint through its International office. The Administrator is prohibited from taking action on protests or requests to discuss jurisdictional matters from local unions or building and construction trades councils.

ARTICLE III

STRIKES AND IMPEDIMENT TO JOB PROGRESS

1. When it is alleged in a written notice, by a stipulated employer directly affected by the dispute, or the signatory Employer Association representing such employer, that a work stoppage, slowdown, or other impediment to job progress is taking place, the Administrator shall proceed as set forth in Article VI of the Plan.
2. Notice to the Administrator shall include.
 - a. Union engaged in strike, slowdown, or impediment to job progress [specify].
 - b. Other union or unions directly involved (in most cases, trade receiving original assignment).
 - c. Brief description of work in dispute.
 - d. Name and city and state location of project.
 - e. Contractor and subcontractor, if any, directly involved, and mailing address, phone number and facsimile number of each.
 - f. A statement detailing how the responsible contractor is stipulated to be bound to the Plan and these procedures.

REQUIRED FORMAT FOR NOTICE

[Name of Union] is [state basis for claim of violation, e.g., strike] in jurisdictional dispute with [Name of Union] over [Briefly describe work and name of job] project, [City and State or Province], [Name of Contractor], [Mailing Address, Phone Number and Facsimile Number], [Name of Subcontractor], [Mailing Address, Phone Number and Facsimile Number].

This contractor is stipulated to the Plan and these procedures by virtue of (provision in collective bargaining agreement or signed stipulation on file in plan office).

3. Impediments to job progress shall include, but not be limited to:
 - a. Filing a grievance under a collective bargaining agreement, or under a local plan for the settlement of jurisdictional disputes not recognized by the Department, where an issue is a case, dispute or controversy involving a jurisdictional dispute or assignment of work by a stipulated contractor, or by a stipulated subcontractor. Provided, that it shall not be considered an impediment to job progress if the responsible contractor is not, stipulated to the Plan.
 - b. Filing an unfair labor practice charge with the National Labor Relations Board, or appropriate Canadian equivalent, as determined by the Administrator, or action in any court against a stipulated employer by a National or International Union, or local affiliate thereof, where an issue is a case, dispute or controversy involving a jurisdictional dispute or assignment of work. Provided, that it shall not be considered an impediment to job progress if the responsible contractor is not stipulated to the Plan.

ARTICLE IV

FILING A COMPLAINT

1. When a dispute over an assignment of work arises, the National or International Union challenging the assignment, or the employer directly affected by the Jurisdictional dispute, or the signatory Employer Association representing such employer, shall notify the Administrator in writing. Such notice shall include the following Information:

- a. Unions involved.
- b. A full and complete description of the work in dispute.
- c. Name and location of project.
- d. Contractors involved and their mailing addresses, telephone number and facsimile number.
- e. The assignment of work and the contractor who made the assignment.
- f. A statement detailing how the responsible contractor is stipulated to the Plan and these procedures. Effective stipulation shall be either a collective bargaining agreement provision recognizing the Plan or a current signed stipulation form on file at the Plan office.
- g. A statement whether the representatives of the National and International Unions have met or attempted to meet at the local level in an effort to resolve the matter.
- h. A statement whether the National and International Unions Involved in the dispute have voluntarily agreed to mediation.

2. The notice shall be in writing and sent to:

For Projects in the United States:

Administrator
Plan for the Settlement of Jurisdictional
Disputes in the Construction Industry
Suite 801
1125 15th Street, NW
Washington, DC 20005
Fax; (202) 775-1950

For Projects in Canada:

Administrator
Plan for the Settlement of Jurisdictional
Disputes in the Construction Industry
c/o Office of the Executive Secretary
Building and Construction Trades Department, AFL-CIO
350 Sparks Street
Suite 910
Ottawa, Ontario
K1R 7S8
Fax: (613) 230-5138

ARTICLE V

TIME CONSTRAINTS UNDER THE PLAN

In computing any period of time prescribed in the Plan or the procedural rules, the day from which the designated period of time begins to run shall not be included. The last day of

the period so computed shall be included, unless it is a Saturday, a Sunday, or a legal holiday, in which event the period runs until the end of the next day which is not a Saturday, a Sunday, or a legal holiday. When the period of time described or allowed is less than 7 days, intermediate Saturdays, Sundays, and legal holidays shall be excluded in the computation. As used herein, legal holiday in the United States includes New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, Christmas Day, and any other day designated as a holiday by the Administrator "Legal holiday" In Canada includes New Year's Day, Victoria Day, Labor Day, Remembrance Day, Boxing Day, Good Friday, Canada Day (Dominion Day), Thanksgiving Day, Christmas Day, Civic Holiday, and any other designated as a holiday by the Administrator.

ARTICLE VI

DIRECT RESOLUTION

1. Within two (2) days following receipt of a properly filed notice, the Administrator shall notify, by facsimile, all directly affected National and International Unions and employers that a dispute exists between local parties.
2. If the directly affected National and International Unions and employers parties to the dispute, are able to settle the dispute, each shall inform the Administrator, in writing, signed by an authorized representative of each party, that a settlement has been reached.
3. If the directly affected National and International Unions and employers are unable to resolve the dispute, any of the directly affected parties may request arbitration of the dispute within five (5) days from the date the matter was referred by the Administrator, by filing a notice in writing to arbitrate with the Administrator, with copies to all directly affected parties.

ARTICLE VII

SELECTING AN ARBITRATOR

1. Upon receipt of a request to arbitrate, the Administrator shall send to all directly affected parties a list of impartial arbitrators, knowledgeable about the construction industry, chosen by the Joint Administrative Committee.
2. The directly affected National and International Unions and the responsible contractor(s) will each have three days in which to cross off the name of one arbitrator to which it objects, number the remaining names to indicate the order of preference and return the list to the Administrator. If a party does not return the list within the time specified, all persons named therein shall be deemed acceptable. From among the persons who have been approved on each party's list, and in accordance with the designated order of mutual preference, the Administrator shall notify the parties of the arbitrator selected who is able to schedule a hearing within the time constraints set forth in the Plan.
3. If the parties are unable to select an arbitrator, the Administrator shall appoint an arbitrator.

ARTICLE VIII

RESOLUTION BY ARBITRATION

1. Upon his selection, the arbitrator, with the assistance of the Administrator, shall set and hold a hearing within seven (7) days.
2. The Administrator shall notify the responsible contractor(s) and the appropriate National and International Unions and signatory association(s) by facsimile of the place and time chosen for the hearing. Said hearing shall be held in Washington, DC or, for a dispute arising in Canada, in Eastern, Central or Western Canada as determined by the Administrator.
3. Attendance at arbitration hearings by the parties shall be limited to one fulltime employee of each National or International Union party, or its affiliate, as designated by the President of each National or international Union and one fulltime employee of, the responsible contractor party. On appeals from Local Boards, each party may also have in attendance the individual who presented that party's case to the Local Board. Failure to attend by a party shall not delay a hearing, the taking of evidence, or the issuance of a decision.
4. Presentations shall be in writing with copies for each party, the arbitrator, and a file copy.
5. The arbitrator shall issue his decision within three (3) days after the case has been closed. The decision of the arbitrator shall be final and binding on all parties to the dispute.
6. Each party to the arbitration shall bear its own expenses for the arbitration and agrees that the fees and expenses of the arbitrator shall be borne by the losing party or parties as determined by the arbitrator.
7. Following the issuance of the decision, the Administrator will send a statement to the losing party or parties allocating the arbitrator's fees and expenses. Such statement shall be payable within ten (10) days of receipt. If payment is not received within thirty (30) days, a late fee of \$500 will be assessed on the delinquent party. A future request by a delinquent party to process a case will be held by the Administrator until all outstanding fees and expenses, including any late fee have been paid.

ARTICLE IX

POLICY REGARDING DIRECTIVES

1. The Plan and the Procedural Rules and Regulations provide for the settlement of a jurisdictional dispute on a specific job by agreement or understanding between or among the National and International Unions involved.
2. The Procedural Rules also provide that an assignment of work may be changed by the responsible contractor(s) to conform to the terms of same, upon notification by the Administrator. Such notification shall be made by means of a directive sent to the responsible contractor(s) by the Administrator.
3. In order to give effect to the procedure set forth above, and before a directive may be sent to the affected contractor(s) by the Administrator, the National or International Unions involved shall submit for the records of the Plan the following:

- a. A statement of by what document the responsible contractor is stipulated to the agreement.
 - b. A statement of the exact terms of the agreement or understanding reached. Such statement is to be jointly signed by authorized representatives of each of the National or International Unions involved. If separate communications are submitted by the parties, the terms of the agreement or understanding must be identical in each communication.
 - c. A statement regarding the notification to the responsible contractor(s) of the agreement or understanding reached. If objection to the agreement or understanding was made by the contractor(s) or representatives, the nature of the objection must be stated.
4. In accordance with the Plan and the Procedural Rules, any directive from the Administrator shall be complied with by the affected contractor(s) unless, and within 24 hours following receipt of such directive, the contractor(s) notifies the Administrator that he elects not to comply with the directive, and requests that the jurisdictional dispute be processed through arbitration to a decision. Such decision shall be made in accordance with the provisions of Article V of the Plan.

ARTICLE X

APPEALS FROM DECISIONS OF RECOGNIZED LOCAL BOARDS

1. Appeals from local settlements, agreements, or decisions issued by a Plan for the settlement of jurisdictional disputes that has been recognized by the Department, may be filed with the Administrator within seven (7) days of issuance by the National or International Unions directly affected, or by the responsible contractor(s), or a signatory Employers Association representing such employer.
 - a. Such filing shall include a copy of the local settlement, agreement, or decision being appealed and the specific basis for the appeal. Simultaneous notice shall be given to all other parties.
2. The authority of the Administrator to refer an appeal to arbitration is discretionary. The Administrator shall, in exercising his authority, consider whether the parties were afforded opportunity to present evidence at a hearing conducted for that purpose under the Plan and in conformity with generally recognized procedures not incompatible with the provisions and procedures of this Plan.
3. Appeals referred to arbitration will be processed in accordance with Article V of the Agreement.
4. Presentations shall be in writing and limited to that which was presented at the recognized local Plan for the settlement of jurisdictional disputes.

PLAN FOR THE SETTLEMENT OF JURISDICTIONAL DISPUTES IN THE CONSTRUCTION INDUSTRY

PREAMBLE

This Agreement is entered into by and among the Building and Construction Trades Department, AFL-CIO on behalf of its constituent National and International Unions (referred to hereinafter as the Department) and the Employer Associations signatory to this Agreement (referred to hereinafter as the Employer Associations).

The parties to this Agreement dedicate their efforts to improving the construction industry by providing machinery for the handling of disputes over work assignments without strikes or work stoppages thus stabilizing employment in the Industry at the same time increasing both its efficiency and capacity to furnish construction services to the public at reasonable cost.

ARTICLE I

SCOPE OF APPLICATION

The procedure shall apply to:

(a) Employers who employ members of the organizations affiliated with the Department and who have signed a stipulation setting forth that they are willing to be bound by the terms of this Agreement or who are members of stipulated association of employers with authority to bind its members, or who are parties to a collective bargaining agreement providing for the settlement of jurisdictional disputes under these procedures herein set forth or any predecessor Plan.

The essence of this Plan assumes voluntary participation. National Employer Associations shall encourage participation in this Plan by their chapters and members, but no contractor stipulation or agreement shall be recognized by the Administrator if it is shown to the satisfaction of the Administrator that it is the result of unlawful strikes, work stoppages or other coercive activity or any activity which is contrary to the voluntary nature of this Plan, by a labor organization affiliated with the Department. Notwithstanding any other provision of this Plan should such action be taken against any chapter or member of any participating Employer Association to compel stipulation to the Plan, its parent association, if it is signatory to this Plan, shall thereby have the option to terminate its participation upon written notice to the Administrator within thirty (30) days of such action or occurrence, provided that notice of the action or occurrence has been afforded to the Department by the parent association during the thirty (30) day period and prior to any notice of termination.

(b) All National and International Unions affiliated with the Building and Construction Trades Department, AFL-CIO, and their local constituent bodies.

ARTICLE II

STIPULATION PROCEDURE

Sec. 1. The Department of National and International Unions affiliated with the Department shall, in accordance with their constitutional powers, request each of the Building and Construction Trades Department Councils, District Councils and Local Unions, respectively:

(a) To secure written assent or stipulation to the Plan for the Settlement of Jurisdictional Disputes in the construction Industry by all Employers in signed agreement with said National or International Union, Council and/or Local Union except for such Employers who are stipulated to the Plan by the action of the Employer Association of which they are members; or

(b) To proceed at the earliest opportunity to negotiate stipulation to the Plan into all agreements with each employer whose employees are represented by such Building Trades Council, District Council or Local Union.

Sec. 2. All Employer Associations shall seek to have their local chapters stipulate their membership to the Plan for the Settlement of Jurisdictional Disputes in the Construction Industry unless the national Employer Association has made such stipulation on behalf of its membership, in the event a local chapter refuses to stipulate, the national association shall notify the Joint Administrative Committee of the negative action of the specific local chapter and/or the individual member.

Sec. 3. It is understood that only those Employers or Employer Associations who employ members of the organizations affiliated with the Department shall be considered bound by this Agreement when they have signed a stipulation setting forth that they are willing to subscribe to and be bound by the terms and provisions of this Agreement.

ARTICLE III

JOINT ADMINISTRATIVE COMMITTEE

Sec. 1. There shall be established a Joint Administrative Committee (hereinafter referred to as the "JAC"), to oversee the operation of the Plan.

Sec. 2. The JAC representing the Department and the signatory Employer Associations shall consist of eight (8) voting members, four (4) nominees from the Department and four (4) from the Employer Associations. There shall be a Chairman and a Vice Chairman of the JAC. The Chairman shall be the President of the Department. The Vice Chairman shall be designated by the signatory Employer Associations. The Chairman and the Vice Chairman shall be nonvoting members of the Committee.

Sec. 3. The JAC shall appoint two (2) Administrators of the Plan. One Administrator shall handle all matters arising in the United States. The second Administrator shall handle all matters arising in Canada. References to the Administrator in this Agreement and the Procedural Rules shall mean the appropriate U.S. or Canadian Administrator. The Administrator shall be compensated at a rate and under terms to be established by the JAC.

Sec. 4. The Administrator shall be bonded and made responsible for disbursement of the funds, shall keep the books of the Plan and submit to parties to the Agreement a quarterly financial statement; shall provide for an annual audit of the books by a certified public accountant and shall prepare annually proposed budget of the necessary expenses of the Plan for the following, twelve (12) months and submit same to the JAC for approval. The total amount of the budget, when approved, shall be subscribed annually in advance, 50 percent by the Department and 50 percent by the signatory Employer Associations. All expenditures shall be within the approved budget. In order to assure adequate funding of the Plan, the JAC may establish a schedule of

fees to be charged to parties wishing to utilize the services of the Plan but who are not affiliated with any of the organizations signatory to this Agreement.

ARTICLE IV

RULES AND REGULATIONS

Sec. 1. The Administrator shall adapt his operations to assure that all cases submitted shall be disposed of as expeditiously as possible.

Sec. 2. The Administrator, with the prior approval of the JAC, shall establish such procedural regulations and administrative practices as may be required for the effective administration of this Agreement, provided such regulations and practices are consistent with the expressed terms of this Agreement.

Sec. 3. The JAC shall have the power to revise the procedural regulations and administrative practices of the Administrator. The Administrator shall promptly notify all parties to the Plan of any revisions in the procedural or administrative practices.

Sec. 4. The Administrator shall keep records of disputes and decisions and develop such statistical and operational information as may be of value to the JAC. The Administrator shall from time to time, make recommendations to the JAC for changes in the procedural rules or provisions of the Plan which will strengthen and improve the effectiveness of the Plan.

Sec. 5. It shall be the duty of the Administrator to process cases of jurisdictional disputes in the Building and Construction Industry when disputes are referred to him by any of the National and International Unions involved in the dispute, or an Employer directly affected by the dispute on the work in which he is engaged or by the signatory Employer Association representing such Employer. The Administrator shall only process cases in which all parties to the dispute are stipulated to the Plan in accordance with Article II or, upon that filing of a dispute, become stipulated to the Plan in accordance with Article II. In the Administrator's sole discretion, the issue of stipulation may be submitted to an Arbitrator. The Arbitrator shall be bound to apply the same terms of the Plan and the Procedural Rules regarding stipulation as the Administrator.

Sec. 6. If the responsible contractor is not stipulated to the Plan, any of the National and International Unions involved in a dispute with the contractor may file a statement with the Plan Administrator indicating that the contractor had been stipulated to the Plan, the Union would have filed a jurisdictional dispute pursuant to Article V of the Plan. The notice shall include the unions involved, a description of the work in dispute, the name and location of the project, the name of the responsible contractor, the assignment that was made by the contractor and which of the Article V, Section 8, criteria the Union contends supports its claim to the work. The Plan administrator shall compile a list of such statements and distribute it to the parties to the Plan monthly.

Sec. 7. In the interest of expediting resolutions of jurisdictional disputes, the Administrator shall undertake to keep a record of decisions involving the same type of dispute and involving the same trades and report such record quarterly to the JAC.

ARTICLE V

RESOLUTION OF JURISDICTIONAL DISPUTES

Sec. 1. When a dispute over an assignment of work arises, the National or International Union challenging the assignment, or the Employer directly affected by the dispute or the signatory Employer Association representing such Employer shall notify the Administrator in writing, with copies to the other parties to the dispute. The notice shall include a statement whether representatives of the National and International Unions have met or attempted to meet with the local parties to attempt to resolve the matter. For disputes in the United States, if the National and International Unions involved in the dispute voluntarily agree to mediation the notice shall so advise the Administrator. The mediation may be used in lieu of the meeting of the International Representatives.

Sec. 2. Upon receipt of said notice, the Administrator or his designee shall notify within two (2) days by facsimile all directly affected National and International Unions and employers that a dispute exists between the local parties. The Administrator shall also provide notice of the dispute to all other National and International Unions party to this Agreement. At the same time, if the National and International Unions involved in a dispute in the United States have consented to voluntary mediation, the Administrator shall contact the Federal Mediation and Conciliation Service and request the appointment of a mediator to assist the parties in the local area in settling the dispute. The mediator shall have three (3) days from the date the matter is referred by the Administrator to mediate the dispute. The mediator shall submit by facsimile a report to the parties and the Administrator indicating whether the dispute has been resolved no later than the end of the three (3) day period. The report of the mediator shall not be submitted to a Plan Arbitrator.

Sec. 3. If the respective National and International unions of the disputing locals and the directly affected Employer are unable to resolve the dispute, any of the directly affected parties may request arbitration of the dispute, within five (5) days, from the date the matter is referred by the Administrator, by filing a notice to arbitrate with the Administrator, with copies to all directly affected parties. The Administrator will only honor a request to submit the matter to arbitration prior to the expiration of the five (5) day period if the requesting party has demonstrated that the International Representatives have met or attempted to meet with the local parties to resolve the matter or have been through the mediation process set forth in Section 2.

Sec. 4. Upon receipt of said notice, the Administrator shall send to all directly affected parties a list of impartial arbitrators knowledgeable about the construction industry, chosen by the JAC.

Sec. 5. The directly affected National and International Unions and the responsible contractor(s) will each have three (3) days in which to cross off the name of one arbitrator to which it objects, number the remaining names to indicate the order of preference and return the list to the Administrator. If a party does not return the list within the time specified, all persons named therein shall be deemed acceptable. From among the persons who have been approved on each party's list, and in accordance with the designated order of mutual preference, the Administrator shall notify the parties of the arbitrator selected. If the parties are unable to select an arbitrator, the Administrator shall appoint the arbitrator.

Sec. 6. Upon his selection the Arbitrator, with the assistance of the Administrator, shall set and hold a hearing within seven (7) days. The Administrator shall notify the employer, and the

appropriate National and International Unions and Employer Associations by facsimile of the place and time chosen for the hearing. Said hearing shall be held in Washington, D C or, for a dispute arising in Canada, in Eastern, Central or Western Canada as determined by the Administrator. A failure of any party or parties to attend said hearing without good cause, as determined by the Administrator, shall not delay the hearing of evidence or issuance of a decision by the Arbitrator.

Sec. 7. The Arbitrator shall issue his decision within three (3) days after the case has been closed. The decision of the Arbitrator shall be final and binding on all parties to the dispute.

Sec. 8. In rendering his decision, the Arbitrator shall determine:

a) First whether a previous agreement of record or applicable agreement including a disclaimer agreement between the National or International Unions to the dispute governs;

b) Only if the Arbitrator finds that the dispute is not covered by an appropriate or applicable agreement of record or agreement between the crafts to the dispute, he shall then consider whether there is a previous decision of record governing the case;

c) If the Arbitrator finds that a previous decision of record governs the case, the Arbitrator shall apply the decision of record in rendering his decision except under the following circumstances. After notice to the other parties to the dispute prior to the hearing that it intends to challenge the decision of record, if a trade challenging the decision of record is able to demonstrate that the recognized and established prevailing practice in the locality of the work has been contrary to the applicable decision of record, and that historically in that locality the work in dispute has not been perforated by the other craft or crafts, the Arbitrator may rely on such prevailing practice rather than the decision of record. If the craft relying on the decision of record demonstrates that it has performed the work in dispute in the locality of the job, then the Arbitrator shall apply the decision of record in rendering his decision. If the Arbitrators finds that a craft has improperly obtained the prevailing practice in the locality, through raiding the undercutting of wages or by the use of vertical agreements, the Arbitrator shall rely on the decision of record rather than the prevailing practice in the locality;

d) If no decision of record is applicable, the Arbitrator shall then consider the established trade practice in the industry and prevailing practice in the locality; and

e) Only if none of the above criteria is found to exist, the Arbitrator shall then consider that because efficiency, cost or continuity and good management are essential to the well being of the Industry, the interests of the consumer of the past practices of the employer shall not be ignored. The Arbitrator shall set forth the basis for his decision and shall explain his findings regarding the applicability of the above criteria. If lower-ranked criteria are relied upon, the Arbitrator shall explain why the higher-ranked criteria were not deemed applicable. The Arbitrator's decision shall only apply to the job in dispute.

Sec. 9. Agreements of record are applicable only to the parties signatory to such agreements. Decisions of record are applicable to all trades.

Sec. 10. The Arbitrator is not authorized to award back pay or any other damages for a miss assignment of work. Nor may any party to this Plan bring an independent action for back pay or any other damages, based upon a decision of an Arbitrator.

Sec. 11. Each party to the arbitration shall bear its own expense for the arbitration and agrees that the fees and expenses of the Arbitrator shall be borne by the losing party or parties. An administrative fee, in accordance with the fee schedule established by the JAC, shall be paid to the Plan by the affected employer(s) if the employer(s) is not affiliated with any of the organizations signatory to this Agreement

Sec. 12. Any party to a dispute that has been arbitrated that believes the Arbitrator failed to address established criteria of Article V, Section 8, may request the JAC to consider an appeal. No appeal may be processed unless the Arbitrator's decision has been implemented.

Sec. 13. A request to consider an appeal from a final decision of a Plan Arbitrator shall be filed with the Administrator, with copies to the other parties to the dispute, within five (5) days of the date the Administrator transmitted the Arbitrator's decision. The request to consider an appeal shall include a copy of the Arbitrator's decision being appealed and a statement describing the basis of the claim that the Arbitrator failed to address the established criteria of Article V, Section 8. The other parties to the dispute shall have three (3) days to submit to the Administrator, with copies to the other parties, a response to the request for appeal.

Sec. 14. Once the submissions of the parties are complete, the Administrator shall distribute copies of the appeal to the members of the JAC that are not parties to the dispute. Within five days from receipt of the submissions, each member of the JAC shall notify the Administrator whether the appeal should be heard. If a majority of the JAC does not wish to consider the appeal, the decision of the Arbitrator shall be final and binding. If a majority of the JAC members believes the appeal has merit, the Administrator shall arrange for a meeting of the JAC, which may be by telephone conference, to consider the appeal. The sole issue to be considered on appeal is whether the Arbitrator failed to address the established criteria of Article V, Section 8.

Sec. 15. If the JAC determines that the Arbitrator failed to address the established criteria of Article V, Section 8, it shall remand the case to the Administrator to process for a hearing before a new Plan Arbitrator.

ARTICLE VI

CONTINUATION OF WORK

Sec. 1. During the existence of this Agreement, there shall be no strikes, work stoppages or picketing arising out of any jurisdictional dispute. Contractors and subcontractors shall make work assignments in accordance with the Obligations of the Employers as set forth in Article IX, and the Rules and Regulations of the Administrator. Members of organizations affiliated with the Department shall continue to work on the basis of their original assignment.

Sec. 2. Recognizing that it is in the best interests of the parties to this Agreement, the Department, on behalf of itself and the General Presidents of each of the affiliated National and International Unions, reaffirms its desire to eliminate work stoppages, slowdowns and other impediments to job progress and its intent to comply with the provisions of the Plan prohibiting jurisdictional strikes and agrees to enforce these provisions by direction and action of their respective National or International offices. In the event of a work stoppage, slowdown or other impediment to job progress, the employer may take the following course of action:

(a) The employer shall notify the Administrator or his designee of the alleged breach of this Article. Notice to the Administrator shall be by the most expeditious means available, with simultaneous notice by facsimile to the party alleged to be in violation and the involved National or International Union President(s). The National or International President(s) will immediately instruct, order and use the best effort of his office to cause the local union or unions to cease any violation of this article. A National or International Union complying with this obligation shall not be liable for unauthorized acts of its local union.

(b) Upon receipt of said notice, the Administrator or his designee shall select an arbitrator from a panel of arbitrators chosen by the JAC.

(c) Upon his selection, the Arbitrator shall hold a hearing within 24 hours if it is contended that the violation still exists.

(d) The Arbitrator, with the assistance of the Administrator, shall notify the employer, the local union(s), and the appropriate National or International Union(s) and Employer Association(s) by facsimile of the place and time he has chosen for this hearing. Said hearing shall be held in Washington, D.C. or, for a dispute arising in Canada, in Eastern, Central or Western Canada as determined by the Administrator, and shall be completed in one session. A failure of any party or parties to attend said hearing shall not delay the hearing of evidence or issuance of a decision by the Arbitrator.

(e) The sole issue at the hearing shall be whether or not a violation of this Article has in fact occurred, and the Arbitrator shall have no authority to consider any matter in justification, explanation or mitigation of such violation or to award damages. The Arbitrator's decision shall be issued in writing within three (3) hours after the close of the hearing, and may be issued without an opinion. If any party desires an opinion, one shall be issued within fifteen (15) days, but its issuance shall not delay compliance with, or enforcement of, the decision. The Arbitrator may order cessation of the violation of this Article and other appropriate relief, and such decision shall be served on all parties by facsimile upon issuance.

(f) The Arbitrator's decision may be enforced by the United States District Court for the District of Columbia or, for a dispute arising in Canada, the appropriate Canadian court as determined by the Administrator, upon the filing of this Agreement and all other relevant documents in the following manner: Any National or International Union, Employer or Employer Association whose affiliate was a party to the arbitration proceeding may notify the Administrator of the failure of any party to abide by the Arbitrator's decision. A copy of the notice shall be sent simultaneously to all other parties to the arbitration proceeding and appropriate National or International Union(s) Employers and Employer Association(s). If the Administrator determines that the Arbitrator's decision is not being implemented, he shall proceed to obtain a temporary order enforcing the Arbitrator's decision. Facsimile notice of the filing of such enforcement shall be given to all directly affected parties.

(g) All, parties signatory or stipulated to this Agreement, consent to the jurisdiction of the United States District Court for the District of Columbia or, for a dispute arising in Canada, the appropriate Canadian court as determined by the Administrator, for the purposes of enforcement of an arbitration decision rendered under this Article. In addition, in the proceedings to obtain a temporary order enforcing the arbitration decision, all parties to this Agreement waive the right to a hearing and agree that such proceedings to enforce an

arbitrator's decisions may be *ex parte*. Such agreement does not waive any party's right to participate in a hearing for final order of enforcement. The court's order(s) enforcing the Arbitrator's decision shall be served on all interested parties by hand, by facsimile, by delivery to their last known address or by registered mail.

(h) Any rights created by statute or law governing arbitration proceedings inconsistent with the above procedure or which interfere with compliance therewith are hereby waived by the parties to whom they accrue.

(i) Each party to the arbitration shall bear its own expense for the arbitration and agrees that the fees and expenses of the Arbitrator shall be borne by the losing party or parties. A party notifying the Administrator of the failure of another party to abide by an arbitrator's decision shall be responsible for the ongoing attorneys' fees, court costs and expenses incurred by the Administrator in seeking to enforce the arbitrator's decision. The notifying party shall thereafter be reimbursed for any such attorneys' fees, court costs and expenses incurred by the Administrator, by the party failing to abide by the Arbitrator's decision.

ARTICLE VII

ENFORCEMENT

Sec. 1. When the JAC has determined that an Employer or National or International Union is in violation of this Agreement, such Employer or National or International Union shall be denied a representative on any committee established by this Agreement during the period of violation, provided, however, that in accordance with Article IV, Section 5, an Employer who is not stipulated to this Plan shall not be entitled to resolution by an arbitrator of any dispute in which he is involved or to invoke any sanctions against any National or International Union.

Sec. 2. Any decision or interpretation rendered by an arbitrator shall be immediately accepted and complied with by all parties subject to this Agreement. If a party fails to accept and comply with a jurisdictional decision of an arbitrator or a ruling of the Administrator or the JAC, the Administrator may, with the approval of the JAC, proceed in the same manner as the enforcement of an arbitrator's decision set forth in Section 2 (f)-(i) of Article VI.

Sec. 3. It shall be a violation of this Agreement for any Local, National or International Union, Employer or Employer Association signatory or stipulated to this Agreement, to enter into any agreement, resolution or stipulation that (a) attempts to establish any jurisdiction which deviates from the spirit and intent of the Agreement and Rules and Regulations of the Plan; or (b) permits jurisdictional disputes between affiliates of the Department to be resolved by a single craft labor- management committee, provided the dispute involves stipulated contractors and can be processed under this Plan.

ARTICLE VIII

LOCAL BOARDS

Sec. 1. In any community or locality where a plan for the settlement of jurisdictional disputes has been recognized by the Department, it shall be used in the first instance to bring about an agreement, settlement or decision. However, any such local settlement, agreement or decision

may be appealed by any of the involved parties in accordance with Section 2 and 3 of this Article.

Sec. 2. The Administrator is empowered to refer to arbitration, in accordance with Article V, Sections 5-10, any appeal from a decision or ruling of a Local Board recognized under Section 1. The authority of the Administrator to refer a case to arbitration shall be discretionary. The Administrator is authorized, subject to the prior approval of the JAC, to prescribe rules as to the types of cases he will refer to arbitration.

Sec. 3. The Administrator shall have the authority to establish such procedural, regulations and administrative practices as may be required for the effective administration of this appeals procedure, subject to the prior approval of the JAC.

ARTICLE IX

OBLIGATIONS OF THE PARTIES

To the end that proper assignments of work are made by the Employer involved and that jurisdictional dispute between unions are settled under the terms of the Plan without interruptions of Work, it is therefore agreed as follows:

Sec. 1. Obligations of the Employer

(a) Each Employer or Employer Association stipulated to this Plan agrees that all cases, disputes or controversies involving jurisdictional disputes or assignments of work arising under this Agreement shall be resolved as provided herein, and shall comply with decisions and rulings of the Administrator, the JAC, arbitrators or National Arbitration Panels established hereunder. A jurisdictional dispute is defined as a dispute between unions over the assignment of work and in which the Employer has an interest.

(b) Each Employer agrees that he shall continue to make work assignments in accordance with Article V, Section 8 and the Rules and Regulations of the Administrator.

Continued miss assignments by an Employer, as determined by the Administrator, shall be reported to the JAC which shall take such procedural or legal action against such Employer as it deems necessary and proper to effectuate the purposes of this Agreement.

(c) All participating Employer Associations shall inform their stipulated members, in writing, of their responsibility for the assignment of work in accordance with the Rules and Regulations of the Administrator.

(d) All participating Employer Associations shall encourage inclusion of work assignment training in all supervisory training programs.

(e) Each Employer who is bound by this Plan will use his best efforts to assure compliance with its terms by subcontractors engaged by the Employer on any construction job covered by the Plan.

Sec. 2. Obligations of the Department and its Affiliated Unions

(a) The Department and each of its affiliated unions agree that all cases, disputes or controversies involving jurisdictional disputes and assignments of work arising under this Agreement shall be resolved as provided herein, and shall comply with the decisions and rulings of the Administrator, the JAC, arbitrators or National Arbitration Panels established hereunder.

(b) The Department and each of its affiliated National and International Unions agree that the establishment or picket lines and/or the stoppage of work by reason of an Employer's assignment of work are prohibited. No Local Union of an affiliated National or International Union shall institute or post picket lines for jurisdictional purposes.

(c) In the event of a jurisdictional dispute, resulting in a work stoppage, strike, picket line or other interference of the work, a report of that fact shall be made by the Employer and/or the National or International Union immediately to the Administrator, to the Building and Construction Trades Department and to the appropriate Employer Association office for processing in accordance with Article VI of the Plan.

(d) In the event pickets are posted by any local trades council or any local or a National or International Union affiliated with the Department for jurisdictional purposes, the Department will immediately direct all National and International Unions to advise their affiliates to ignore such picketing and to continue to work. If in contravention of this Plan a jurisdictional work stoppage should occur, it is the intent of this Article that the work shall continue with the crafts cooperating to the maximum extent possible to enable job continuity.

(e) The Administrator shall send a monthly report to each General President, the President of the Department and to the executive heads of the signatory Employer Associations setting forth all information on jurisdictional disputes for that month. The report should include the location and job where the dispute occurred, the parties involved, the subject of the dispute and shall indicate whether any stoppage occurred or picket lines were established.

ARTICLE X

NATIONAL ARBITRATION PANEL

Sec. 1. National Arbitration Panels shall be established hereunder and shall be composed of three (3) arbitrators, knowledgeable in the construction Industry, appointed by the JAC.

Sec. 2.

(a) The JAC shall meet quarterly and among its other duties and responsibilities it shall, at each meeting, review the record of disputes filed with the Administrator and in particular shall review the record of decisions involving the same trades as submitted by the Administrator in accordance with Article IV, Section 6 hereof.

(b) A dispute will be declared repetitive by the JAC when in its judgment such dispute is disruptive to the industry or seriously jeopardizes the operational integrity of the Plan. All parties to the Plan may bring a dispute to the JAC for such determination. The JAC will develop such criteria and guidelines to determine what constitutes a repetitive dispute. The JAC will issue a written report to the party or parties who have requested a decision from the JAC involving the dispute referred for such consideration. The written report will be timely and

reflect the circumstances and criteria used by the JAC to determine whether or not said dispute is in fact considered repetitive.

(c) In the event the JAC declares a dispute to be repetitive, the JAC shall refer the matter to the National and International Unions involved for a period of not more than ninety (90) days during which time the Unions shall consult with the Employer Associations who represent Employers who have responsibility for that type of work. The Unions shall endeavor to reach a national agreement governing future jurisdiction. The Administrator shall assist the Unions and may appoint a mediator to facilitate settlement. If an agreement is reached, it shall be attested to by the Administrator and shall serve as a criterion for decisions in future disputes. Should the National and International Unions fail to reach an agreement within ninety (90) days, the Administrator shall refer the dispute to a National Arbitration Panel.

Sec. 3. In any case to go to a National Arbitration Panel, the Administrator shall notify all General Presidents of National and International Unions affiliated with the department and the signatory Employer Associations stating the controversy to be considered. Only directly affected parties as determined by the JAC shall be allowed to intervene. Thirty (30) days notice shall be given of the date set for the hearing. Briefs shall be submitted and exchanged by all parties to the dispute at least ten (10) days prior to the hearing date.

Sec. 4. The National Arbitration Panel shall in every instance consider all pertinent evidence, including the criteria set forth in Article V, Section 8, and shall render a decision, if possible, within ten (10) days after the conclusion of the hearings. Copies of the National Arbitration Panel's decision shall be sent to all parties signatory to this Agreement. Decisions of the National Arbitration Panel shall be immediately recognized under the provisions of the Constitution of the Department and Article IX of this Plan. Decisions of the National Arbitration Panel shall be immediately accepted and compiled with by the disputing unions.

Sec. 5. In the event any party to a dispute fails to present its case within the stated time, the National Arbitration Panel shall, nevertheless, proceed with the case and make its decision on the basis of the evidence presented.

ARTICLE XI

TECHNOLOGICAL CHANGES

Sec. 1. The JAC shall establish a standing Technological Change Committee. The Committee shall concern itself with technological Changes in the building and construction Industry as they affect the jurisdiction of the various affiliated unions of the Building and Construction Trades Department. The Committee shall consist of ten members from the Building and Construction Trades Department and ten members from the signatory Employer Associations, respectively. The Committee shall select a chairman and a secretary.

Sec. 2. The Committee is authorized to establish subcommittees provided that there is equal representation of labor and management on each subcommittee. Each subcommittee shall elect a chairman and a secretary.

Sec. 3. The Committee shall study existing methods of construction and procedures as they relate to technological changes in the Industry and make recommendations to the JAC. The Committee may refer particular items to the crafts concerned who may establish

committees to determine craft jurisdiction and report their decisions to the Department and the signatory Employer Associations.

Sec. 4. The Committee shall submit a report of its activities, including reports from any subcommittees, quarterly to the JAC.

ARTICLE XII

NATIONAL AGREEMENT'S REGARDING JURISDICTION

Sec. 1. When national agreements regarding jurisdiction between National or International Unions have been negotiated; immediate notice of such agreements shall be given to the appropriate management groups. Prior consultation with such groups regarding the making of agreements between National or International Unions is desirable and should be carried on.

Sec. 2. National agreements entered into and properly signed by disputing National or International Unions shall be filed with the Administrator and attested by the Administrator. Such national agreements shall take effect prospectively and shall not apply to jobs in progress at the time of execution. "Jobs in process" means any construction contract upon which the date for submission of bids or proposals has passed.

ARTICLE XIII

EFFECTIVE DATE, TERMINATION, CHANGE AND WITHDRAWAL

Sec. 1. This Agreement shall take effect on June 1, 2011 and shall remain in force and effect and continue until such time as the Project Located at Nassau County, East Meadow New York, known as the Rehabilitation of the Aquatic Center project is issued final completion by the County, such end date is currently anticipated to be August 31, 2012 plus all time extensions duly issued by the County to obtain final completion of the project.

Sec. 2. If either the Department or any signatory Employer Association desires to change or terminate this Agreement it shall notify the other party in writing at least ninety (90) days before the anniversary date of this Agreement. When notice for change is given, the nature of the changes desired must be specified in the notice. This Agreement shall be subject to change at any time by mutual consent of the parties hereto. Any changes agreed upon shall be reduced to writing and signed by the parties hereto, the same as this Agreement.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed and effective as of the day and year above written.

NO TEXT ON THIS PAGE

TECHNICAL SPECIFICATION INDEX

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

TECHNICAL SPECIFICATIONS INDEX

DIVISION 1 – GENERAL REQUIREMENTS

01010	SUMMARY OF WORK
01020	ALLOWANCES
01030	ALTERNATES
01031	ADDITIONS, MODIFICATIONS AND ALTERATIONS TO EXISTING BUILDING AND STRUCTURES
01039	DEMOLITION OF EXISTING STRUCTURES AND EQUIPMENT
01045	CUTTING AND PATCHING
01050	FIELD ENGINEERING
01072	REFERENCE STANDARDS
01150	MEASUREMENT AND PAYMENT
01300	SUBMITTALS
01311	CONSTRUCTION SCHEDULING
01342	SAMPLES
01355	HAZARDOUS MATERIALS AND CONTROL
01356	SAFE AND HEALTHFUL WORKING CONDITIONS
01356A	HOT WORK PERMIT
01370	SCHEDULE OF VALUES
01400	PROTECTION OF UTILITIES
01410	JOB PHOTOGRAPHS
01416	SPECIAL INSPECTIONS
01416A	SPECIAL INSPECTIONS ATTACHMENTS
01495	SPILL PREVENTION AND CONTROL
01500	TEMPORARY FACILITIES AND CONTROLS
01516	TEMPORARY FIRE PROTECTION
01560	ENVIRONMENTAL CONTROLS
01600	MATERIALS AND EQUIPMENT
01610	TRANSPORTATION AND HANDLING OF MATERIALS AND EQUIPMENT
01650	STARTING OF SYSTEMS
01660	QUALITY CONTROL
01700	MAINTENANCE OF PLANT OPERATIONS
01700A	SCHEDULE OF SHUTDOWNS
01710	CLEANING
01720	PROJECT RECORD DOCUMENTS
01730	OPERATIONS AND MAINTENANCE DATA
01733	CONSTRUCTION WASTE MANAGEMENT
01760	PROJECT CLOSEOUT

DIVISION 2 - SITE WORK

02050	DEMOLITION, REMOVALS AND MODIFICATIONS
02214	FLOWABLE FILL
02222	DEMOLITION
02230	SITE CLEARING
02315	EXCAVATION
02316	BACKFILLING
02317	TRENCHING
02419	SELECTIVE DEMOLITION
02480	RESTORATION OF SURFACES
02505	LEAKAGE TESTS

TECHNICAL SPECIFICATION INDEX

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

02513	HIGH PRESSURE WATER CLEANING
02721	RECYCLED CONCRETE AGGREGATE BASE COURSE
02740	ASPHALTIC CONCRETE PAVEMENT

DIVISION 3 - CONCRETE

03210	REINFORCING STEEL
03251	CONCRETE ACCESSORIES
03300	CAST-IN-PLACE CONCRETE
03600	GROUTING
03930	CONCRETE REHABILITATION

DIVISIONS 4 - MASONRY

04060	MASONRY MORTARING AND GROUTING
04090	MASONRY ANCHORAGE AND REINFORCING
04201	UNIT MASONRY CONSTRUCTION
04220	CONCRETE UNIT MASONRY

DIVISION 5 - METALS

05120	STRUCTURAL STEEL FRAMING
05400	COLD FORMED METAL FRAMING
05500	METAL FABRICATIONS
05510	METAL GRATING STAIRS
05514	METAL LADDERS
05520	METAL RAILINGS
05530	METAL GRATINGS
05750	METAL FABRICATIONS - ALUMINUM

DIVISION 6 – WOOD AND PLASTICS

06100	ROUGH CARPENTRY
06600	FIBERGLASS REINFORCED PLASTIC FABRICATIONS

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07132	SELF-ADHERING MEMBRANE WATERPROOFING
07412	INSULATED METAL WALL PANELS
07533	MODIFIED BITUMINOUS ROOFING
07591	PREPARATION FOR RE-ROOFING
07620	SHEET METAL FLASHING AND TRIM
07712	GUTTERS AND DOWNSPOUTS
07721	ROOF HATCHES
07840	FIRESTOPPING
07920	JOINT SEALANTS

DIVISION 8 – DOORS AND WINDOWS

08100	HOLLOW METAL DOORS AND FRAMES
08332	OVERHEAD ROLLING SERVICE DOORS
08710	FINISH HARDWARE
08800	GLASS AND GLAZING

DIVISION 9 - FINISHES

09910	PAINTING
09961	SLIP RESISTANT FLOOR COATING SYSTEM

TECHNICAL SPECIFICATION INDEX

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

DIVISION 10 - SPECIALTIES

10400	IDENTIFICATION DEVICES
10522	PORTABLE FIRE PROTECTION EQUIPMENT

DIVISION 11 - EQUIPMENT

11287	STOP GATES
11295	VALVES AND VALVE ACCESSORIES
11318	BOOSTER PUMP
11320	PROGRESSIVE CAVITY PUMP
11331	TOP OPENING INLINE SLUDGE MACERATORS
11348	CHEMICAL FEED EQUIPMENT
11350	SLUDGE DEWATERING EQUIPMENT
11352	POLYMER BLENDING AND FEED EQUIPMENT

DIVISION 12 - FURNISHINGS

NO ITEMS IN THIS DIVISION

DIVISION 13 - SPECIAL CONSTRUCTION

13401	PROCESS CONTROL SYSTEM GENERAL PROVISIONS
13402	PROCESS CONTROL SYSTEM FACTORY TESTING
13403	PROCESS CONTROL SYSTEM START-UP AND FIELD TESTING
13404	PROCESS CONTROL SYSTEM TRAINING
13420	PRIMARY SENSORS AND FIELD INSTRUMENTS
13425	GAS DETECTION SYSTEM
13430	PROCESS CONTROL PANELS AND ENCLOSURES
13440	PANEL MOUNTED INSTRUMENTS AND DEVICES
13451	PLC HARDWARE AND SOFTWARE
13480	INPUT OUTPUT POINT LIST
13491	PROCESS CONTROL DESCRIPTIONS

DIVISION 14 - CONVEYING SYSTEMS

14250	PORTABLE TRUCK SCALES (ALLOWANCE ITEM NO. 2)
14500	SHAFTLESS SCREW CONVEYOR
14650	PORTABLE HOIST (JIB CRANE)

DIVISION 15 - MECHANICAL

15010	GENERAL MECHANICAL REQUIREMENTS
15015	MECHANICAL DEMOLITION
15060	PIPE HANGERS
15075	MECHANICAL IDENTIFICATION
15080	INSULATION
15140	SMALL PIPING, VALVES AND MISCELLANEOUS EQUIPMENT
15141	FACILITY PIPING
15145	LARGE PIPING AND FITTINGS
15435	PIPE PENETRATION SEALS
15546	ELECTRIC UNIT HEATERS
15832	EXHAUST FANS
15890	SHEET METAL WORK
15992	CLEANING AND TESTING

DIVISION 16 – ELECTRICAL

16010	GENERAL ELECTRICAL REQUIREMENTS
-------	---------------------------------

TECHNICAL SPECIFICATION INDEX

GLEN COVE WASTEWATER TREATMENT PLANT
SLUDGE DEWATERING FACILITY IMPROVEMENTS
H2M CONTRACT NO.: NCDP 15-01

DEPARTMENT OF PUBLIC WORKS
NASSAU COUNTY, NEW YORK
CONTRACT NO.: S35114-06GR

16035	DEMOLITION ELECTRICAL
16036	TESTING
16061	GROUNDING
16071	SUPPORTING DEVICES
16076	LABELING AND IDENTIFICATION
16121	ELECTRIC WIRES AND CABLES
16131	ELECTRIC CONDUIT SYSTEM
16271	DRY TYPE TRANSFORMERS
16441	PANELBOARDS
16442	ELECTRIC CONTROL EQUIPMENT LOW VOLTAGE AC MOTORS AND DEVICES
16482	MOTOR CONTROL CENTERS
16496	AUTOMATIC TRANSFER SWITCHES
16511	LIGHTING FIXTURES AND DEVICES
16521	OUTDOOR LIGHTING
16900	CABLE AND CONDUIT SCHEDULE

LEAD PAINT & ASBESTOS SURVEY

(FOR INFORMATION ONLY - NOT PART OF CONTRACT S35114-06C CONTRACT DOCUMENTS)

PART 1 - GENERAL**1.01 - BRIEF PURPOSE OF PROJECT / GENERAL**

- A. The work to be completed consists of furnishing and installing two (2) new belt filter presses inside of the existing Dissolved Air Flotation (DAF) Building at the Glen Cove WWTP; the installation of new power and control panels for the belt filter presses; replacement of existing sludge feed pumps; installation of a new liquid polymer feed system; miscellaneous improvements to the existing wash water system currently in-place; installation of permanent sludge dewatering canopy to comply with current SWPPP regulations; installation of additional sludge conveyors that will discharge to the existing truck loader, and interior and exterior improvements to the existing DAF Building as shown on the Contract Drawings and in accordance with the Specifications for Contract S35114-06G. The Contractor shall perform all Work as required for such construction in accordance with the Contract Documents and subject to the terms and conditions of the Contract, complete and ready for use.

1.02 - NOMENCLATURE

- A. The CONSTRUCTION CONTRACTOR may be referred to as the "General Contractor", "Prime General Contractor", "Contract G Contractor" or similar wording. The lack of word capitalization shall be incidental. This Construction Contract shall be known as Contract S35114-06G.

1.03 - ABBREVIATED SUMMARY OF WORK

- A. Furnish all labor, equipment, materials, tools, means, methods, and incidentals necessary to complete the Work as required by the Contract Documents for this Construction Contract.
- B. This following abbreviated summary is provided in order to briefly describe the work covered by the Contract Documents for this Construction Contract. It is not all inclusive of the work under the Contract.
- C. Contract S35114-06G - Construction work includes, but is not limited to, the following in accordance with the Contract Plans and Specifications:
1. Remove and dispose of the existing Dissolved Air Flotation (DAF) Thickener Unit No. 1 and No. 2 steel tanks, lower and upper sludge collector drives, recirculation pumps, retention tanks, thickened sludge box, Flotation Thickener Building Metering Panel No. 3, two (2) plunger-type sludge feed pumps, and all associated concrete equipment maintenance pads and curbs.
 2. Remove and dispose of select existing exterior cast-in-place concrete building walls, exterior metal paneling systems, interior and exterior vinyl clad façades, exterior pre-cast

concrete wall panels, exterior corrugated steel wall sections, exterior metal framed window sections, interior steel and aluminum framing, grating and handrail sections, and interior aluminum stairway sections.

3. Remove and dispose of select interior concrete floor slab sections.
4. Remove, abate and dispose of existing DAF building ballasted roofing system.
5. Remove and dispose all existing HVAC ductwork, appurtenances and associated exhaust fans and intake louvers.
6. Remove and dispose of select electrical unit heaters.
7. Reuse select electric unit heaters not identified for demolition.
8. Remove and dispose of existing potable water booster pump.
9. Remove and dispose existing progressive cavity sludge feed pumps and inline sludge grinder equipment and associated controls; must be coordinated with Owner and GC WWTP operations personnel to ensure sludge dewatering operations are maintained throughout the duration of Contract work.
10. Remove and dispose of the existing motor control center (MCC) cabinets; must be coordinated with Owner and GC WWTP operations personnel to ensure sludge dewatering operations are maintained throughout the duration of Contract work.
11. Remove and dispose of existing mechanical pipe sections and associated fittings; must be coordinated with Owner and GC WWTP operations personnel to ensure sludge dewatering operations are maintained throughout the duration of Contract work.
12. Decommission and leave in place the existing polymer mixing and feed system; must be coordinated with Owner and GC WWTP operations personnel to ensure sludge dewatering operations are maintained throughout the duration of Contract work.
13. Remove, dispose and replace the existing potable water booster pump with new pump and controls; must be coordinated with Owner and GC WWTP operations personnel to ensure sludge dewatering operations are maintained throughout the duration of Contract work.
14. Pressure wash, clean and dispose of all sludge residue generated from cleaning all concrete floor and roof surfaces prior to the installation of new work.

15. Construct and install new exterior concrete masonry unit (CMU) building walls, access doors, overhead coiling doors and building façade.
16. Install new modified bitumen roofing system, roof drains and HVAC equipment curbs.
17. Install new fire rated CMU walls along existing corrugate steel wall systems that are located along the property line and common to the existing Belt Filter Press Room to comply with current NYS Building Code.
18. Construct new CMU interior partitioning wall, windows and access doors.
19. Construct new equipment concrete pedestals and maintenance pads.
20. Construction new concrete belt filter press bath containment walls.
21. Furnish and install two (2) new belt filter presses, and two (2) new control panels to control the two (2) new presses.
22. Furnish and install one (1) new main control panel to integrate the control selection of the two (2) new belt filter presses, one (1) existing belt filter press, three (3) new sludge feed pumps and five (5) new sludge cake conveyors, and two (2) existing sludge cake conveyors.
23. Furnish and install three (3) liquid polymer blend and feed equipment skids and three (3) liquid polymer totes.
24. Furnish and install three (3) progressive cavity sludge feed pumps and controls.
25. Furnish and install one (1) top opening inline sludge macerator and controls.
26. Furnish and install three (3) magnetic-type flow meters and transmitters.
27. Furnish and install new potable water booster pump.
28. Furnish and install all mechanical piping, fittings and appurtenances.
29. Furnish and install new motor control cabinet (MCC) sections, power distribution panel(s) and step-down transformer.
30. Furnish and install all electrical conduit, wire, fittings and appurtenances.
31. Furnish and install new electric unit heaters, exhaust fans, ductwork, diffusers and appurtenances.

32. Install new sludge conveyors and controls.
33. Install new steel and aluminum framing, grating, handrails and stairways.
34. Install new overhead canopy above the existing sludge transfer area.
35. Install new sludge conveyor equipment and controls.
36. Construct and install all structural support systems for all equipment and associated appurtenances.
37. Install new concrete masonry unit (CMU) interior partitioning wall within the DAF building.
38. Construct fire rated CMU walls along the exterior DAF building west wall, located on the property line and common wall section between the DAF building and existing press room to comply with current NYS Building Code.
39. Contain, remove and dispose of all water/wastewater/sludge remaining inside of piping and valves when removing the existing piping, valves and mechanical equipment.
40. Paint all surfaces as indicated on the Contract drawings.
41. Startup participation for the Sludge Dewatering Facility to troubleshoot issues pertaining to seating and operation of the plug valves and gear operators.
42. Restore site areas impacted by construction activities to match pre-existing conditions.
43. Project closeout submittals.

1.04 - PARTIAL LISTING OF SPECIFIC CONTRACT REQUIREMENTS

- A. The Contract Documents detail the work included in the Contract. Related requirements and conditions covered by the Contract Documents include, but is not limited to, the following:
 1. Site safety in accordance with all applicable federal, state and local regulations.
 2. Adherence to:
 - a. Guidelines and requirements of the "Owner", Nassau County Department of Public Works (NCDPW)
 - b. Guidelines and requirements of the Nassau County Department of Health (NCDH)

- c. Guidelines and requirements of the New York State Department of Environmental Conservation (NYSDEC)
- d. Guidelines and requirements of the New York State Department of Transportation (NYSDOT)
- e. Guidelines and requirements of Severn Trent Environmental Services (STES) as they pertain to confined space entry and general site access and safety.
- f. Local laws and ordinances of the Town of North Hempstead and City of Glen Cove.

1.05 - PARTIAL LISTING OF OVERALL CONTRACT REQUIREMENTS

- A. The Contract Documents detail the work included in the Contract. Related requirements and conditions covered by the Contract Documents include, but is not limited to, the following:
 - 1. Debris removal and daily and final cleaning up.
 - 2. Coordination with the Owner and other contractors who have been awarded work by the Owner.
 - 3. Site utilization and management so as not to disrupt the Owner's ability to operate the existing facilities in a safe and efficient manner.
 - 4. Maintain the Owner's ability to operate the facility at all times during the construction period.
 - 5. Facilities to be used during the contract period by the Owner or his representatives and others involved with constructing the project.
 - 6. Product and equipment storage and handling requirements.
 - 7. Starting and adjusting of the equipment and systems required under the project.
 - 8. Site safety in accordance with all applicable federal, state, and local regulations.
 - 9. Maintain vehicle and pedestrian traffic in public right-of-way.
 - 10. Project submittals, meetings, photographs, testing services, work plans, schedules, shop drawings, closeout procedures and documents, manuals, as-built drawings, and final commissioning of the work shall be provided as required by the Contract.

11. Site utilization and management so as to allow other contractors to perform work in conjunction with this project and to afford them equal opportunity and space to complete their contractual obligations with the Owner as solely defined by the Engineer.
- B. Coordinate the work between the various construction contracts, through the Owner, as required to complete the contract requirements.

1.06 - OWNER SUPPLIED PRODUCTS AND UTILITIES

- A. The Owner will not be supplying equipment, labor, materials, or tools for the project.

1.07 - EXISTING CONDITIONS

- A. The Drawings show certain information that has been obtained by the Owner regarding various pipelines, utilities, and structures that exist at the location of the project both below and at grade.
- B. The Owner and the Engineer expressly disclaim all responsibility for the accuracy or completeness of the information given on the Drawings with regard to existing facilities.
- C. In the case where the Contractor discovers an obstruction not indicated on the Drawings or not described via specification reference, then the Contractor shall immediately notify the Engineer of the obstructions' existence.
- D. The Engineer will determine if the obstruction is to be relocated or removed.
- E. Compensation for this extra work will be paid for in accordance with the provisions in the Contract for "Extra Work".

1.08 - CONFINED SPACE ENTRY

- A. Comply with all OSHA and STES requirements for entry into a confined space whenever it is necessary for a Contractor's employee to enter a Nassau County and/or STES sanitary sewer manhole, wet well, valve pit and process tank. The minimum requirements the Contractor must comply with are:
 1. Contractor issued "Entry Permit" in accordance with the approved Health and Safety Plan (HASP).
 2. Confined space entry monitoring to test for toxic, explosive and oxygen deficient atmosphere.
 3. Confined space rescue and retrieval equipment.

4. The Contractor will not be permitted to work in a Nassau County and/or STES sanitary sewer manhole, wet well, valve pit and process tank unless he is in compliance with all applicable OSHA and STES requirements.

1.09 - SUGGESTED CONSTRUCTION SEQUENCE

- A. The following is one suggested general, not all-inclusive, sequence of construction that may be used to complete all the work under the Contract within the time specified. Since wastewater conveyance shall be maintained during construction, then certain existing equipment and units cannot be taken offline until new facilities are placed into permanent, fault free operation.
- B. The following suggested sequence is provided for information only; refer to Section 01700 Maintenance of Plant Operations for specific limitations associated with the phasing/sequencing of Contract work activities:
 1. Complete exterior building wall and roof demolition and rehabilitation activities.
 2. Remove existing non-operational DAF system components, and select steel and aluminum framing and grating sections to facilitate the installation of the new belt filter press equipment and sludge conveyors.
 3. Construct new interior and exterior building structural and architectural improvements.
 4. Apply new coatings systems to all structural and architectural components as detailed on the Plans and Specifications.
 5. Furnish and install new belt filter press equipment and controls, polymer feed equipment and controls, and sludge conveyors and controls.
 6. Furnish and install new MCC sections, step down transformer and power distribution panels. Transfer all existing MCC loads to remain in operation to new MCC sections.
 7. Furnish and install two (2) new sludge feed pumps and all associated mechanical piping; maintain one (1) existing pump in operation to maintain existing belt filter press operations.
 8. Start-up and test one (1) new belt filter press, associated sludge conveyors and polymer blend and feed skid; remove and replace the one (1) existing sludge feed pump left in operation with the new sludge feed pump when the new belt filter press start-up is accepted by the Owner and Engineer.
 9. Remove and dispose of existing MCC and associated appurtenances.

10. Perform start-up and testing on remaining belt filter press, associated sludge conveyors and polymer blend and feed skids.
11. Furnish and install new HVAC equipment.
12. Furnish and install remaining steel and aluminum framing, handrails, grating and stairway sections.
13. Restore site.
14. Project closeout submittals.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 – SECTION INCLUDES**

- A. General: The Allowances described below shall be included in the Contractor's total bid. Any amounts not expended prior to completion of the Project shall be deducted from final payment made to the Contractor.

1.02 – SCHEDULE OF ALLOWANCES

- A. General Construction Contractor:
 - 1. Item No. 2: An allowance of twenty thousand dollars (\$20,000.00) for the purchase, delivery and start-up/testing of the portable truck scale system as specified in Section 14250 – Portable Truck Scales. Installation by others.

1.03 – BASIS FOR PAYMENT

- A. General Construction Contractor:
 - 1. Item No. 2: Payment under this allowance item shall be paid on the basis of the itemized invoice costs for the purchase, delivery and start-up testing of the portable truck scale system as specified in Section 14250 – Portable Truck Scales plus overhead and profit, computed in accordance with the requirements of the Agreement, Article XXII, "Extra Work". Any funds remaining at the end will be eliminated by a Credit Change Order.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION**3.01 – EXAMINATION**

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 – PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. General: The Alternates described below shall be included in the Contractor's total bid. Deduction of Alternates shall be in the order that they are listed, and all Alternates deducted from the Contract prior to completion of the Project shall be deducted from final payment made to the Contractor.
- B. Documentation of changes to Contract Sum/Price and Contract Time.

1.02 - RELATED SECTIONS

- A. Proposal Form.
- B. Other sections referencing this section.
- C. All contractual requirements outlined in the documents.

1.03 - SUBMISSION REQUIREMENTS

- A. Bid alternates will be provided on the Proposal Form that will identify the effect on adjacent or related components.
- B. Alternates will be reviewed and deducted from the Contract scope at the Owner's option in the order that they are listed.
- C. For alternates deducted from the Contract scope, the Contractor will coordinate related work and modify surrounding work to deduct the Work of each Alternate Bid Item.

1.04 - SELECTION AND AWARD OF ALTERNATES

- A. On the Proposal Form, the Contractor will indicate the variation of Bid Price for Alternate Bid Items as listed. The Proposal Form requests a "difference" in Bid Price by deducting from the Base Bid Price.
- B. Alternates quoted on the Proposal Form will be reviewed and accepted at the Owner's option in the order they are listed.
- C. Accepted alternates will be identified in the Owner-Contractor Agreement.
- D. Bids will be evaluated on the Base Bid Price, less alternate items.

1.05 - WORK FOR ALTERNATES

- A. Each Alternate shall include all related materials, supplies, labor, equipment and operations necessary to conduct and complete the alternate work and all other affected work or adjacent areas.
- B. There shall be no change in time or completion date for selected alternates, unless specified herein or approved in writing by the Architect/Engineer and Owner.
- C. Alternates and associated work shall meet all standards and specifications delineated in the Contract Documents.
- D. Contractor shall coordinate pertinent related Work and modify surrounding Work as required to complete the project under each alternate selected by the Owner.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

- A. Work for each alternate, related items and collateral work shall be completed in their entirety.
- A. If alternate items are not deducted from the Contract scope, then all work for the Base Bid and collateral work shall be completed in their entirety.

+ + END OF SECTION + +

PART 1 - GENERAL

1.01 – SECTION INCLUDES

- A. Work includes all labor, materials, equipment and appurtenances required for the complete execution of additions, modifications and alterations to existing buildings and structures as shown on the Drawings and specified.
- B. The Contractor shall have examined all Work to be performed to the existing buildings and structures and familiarize themselves with the nature and extent to which the existing buildings and structures will be damaged, items removed or re-arranged due to the Work under this Contract and that of other contracts.
 - 1. Cutting and patching shall conform to the requirements of the General Conditions, Article GC-29, "Cutting and Patching", and Section 01045 Cutting and Patching.
 - 2. Patching Work shall be performed with similar materials and in the same manner as adjoining Work. Joining between old and new Work shall be perfect and practically invisible. All due caution shall be taken to obtain a bond between old and new Work.
- C. Major portions of the Work are indicated on the Drawings for the Contract and the accompanying Specifications thereto. All Work must be complete in all respects and executed with high quality workmanship.
- D. Work to be performed due to damage caused by Contractor or his workers during demolition, removals, additions, modifications, and alterations that is not specifically indicated by details or general notes on the contract drawings may include the following:
 - 1. Removing loose rust, sealing or peeling paint from metal surfaces by scraping, sanding or wire brushing; priming and repainting metal surface (inside and outside) as specified under Section 09900, Painting.
 - 2. Cutting and modifying existing openings as necessary to receive new Work.
 - 3. Cleaning and repainting steel handrails, brackets, sleeves, etc. Replacing existing railing with new aluminum railing, brackets, sleeves, etc.
- E. The Contractor shall submit detailed description of methods and equipment and sequence for additions, modifications and alterations for Engineer's review.

1.02 – SITE AND BUILDINGS

- A. Prior to ordering any materials or doing any Work, the Contractor shall verify and be responsible for the correctness of all measurements, dimensions and other conditions of each building and structure scheduled for Work as necessary and required

1.03 – MATERIALS

- A. All materials to perform and complete the Work for Contract shall be new. Salvaged materials, such as brick, stone copings, granite sills, may be used under certain conditions subject to the approval of Engineer.
- B. All salvaged materials shall be sound and undamaged. Materials to be re-used shall be stored and protected as directed by Engineer. Care shall be taken to prevent damage to materials or equipment to be re-used.

1.04 – SHORING, UNDERPINNING AND BRACING

- A. When necessary and required, the Contractor shall provide underpinning and temporary shoring and bracings, all in accordance with code requirements, the Drawings, and as approved by Engineer.
- B. Shoring and bracing shall be of such form and so installed as to safely support the Work and interfere as little as possible with the progress of the Work. Suitable means shall be provided to adjust any settlement in the shoring supports. Temporary shoring shall consist of sound timbers or rolled shapes of required dimensions which shall be removed after necessity for same ceases to exist. All Work removed or damaged through installation of temporary shoring or through improper shoring shall be replaced or repaired after the shoring is removed, at no additional cost to the County.

1.05 – WORK PREPARATION AND TEMPORARY ACCESS

- A. The Contractor, before commencing Work shall prepare a Progress Schedule in accordance with the requirements of Section 01300, Additional Submittals and Section 01700, Maintenance of Plant Operations, in order to coordinate the Work of all trades and to insure completion on or before the completion date. The County and the Engineer reserve the right to revise or modify such schedules as required to expedite each phase of Work and to coordinate such Work with the partial use of the building for purposes as directed.
- B. No facility such as toilets, corridors, etc., shall be barricaded or access restricted without providing other temporary or interim means of access. It is further required that no Work specified hereinafter shall disturb or interfere with the operation of the existing mechanical

installation until proposed new Work has been completed or satisfactorily installed. Exception may be made to this requirement only by written approval from County and Engineer.

- C. Detailed sequence of availability of areas within the present buildings where Work is to be performed under each Contract shall be in accordance with Section 01700, Maintenance of Plant Operations, but may be modified by the Contractor, upon authorization by the County and Engineer as the Work progresses.
- D. The General Construction Contractor shall furnish and install all temporary fire exits, fire extinguishers, hose and safety devices as may be required by authorities having jurisdiction.
- E. Work within the existing building, once started, shall be completed as quickly as practicable and each trade shall determine before Work is started that all required materials are at hand or readily obtainable to avoid delays.
- F. Shut-downs of existing services within existing buildings which may be occupied during construction will be permitted only upon approval by the County subject to at least thirty (30) day notice in writing to the County in each case. Shut-downs will be limited to times which will result in the least interference with normal operations.

1.06 – CUTTING, PATCHING, REPAIRING AND REFINISHING

- A. The Contractor will be responsible for cutting all openings in walls, floors and ceilings (indicated to remain) to accommodate alteration Work under his Contract in accordance with the requirements of the General Conditions, Article GC-29, "Cutting and Patching" and Article GC-30, "Openings and Chases" and as hereinafter specified.
 - 1. Where new openings are to occur in existing exterior and interior concrete and masonry bearing walls and structural concrete floors, the Contractor will be required to notify the Engineer in writing and shall obtain approval prior to cutting operations. The Engineer will determine whether such openings affect the structural stability or load bearing capacities of the walls and the floors. Where embedded electrical conduits are known to exist, or where embedded conduits are found, the Contractor shall notify the County to determine if the conduit can be abandoned. If the conduit connects to equipment or lighting that must be maintained in service, the County will direct the Contractor to install temporary conduit and cable to maintain service until existing service is no longer required.
 - 2. Core drill for individual openings passing through existing concrete slabs. Obtain authorization from the County prior to core drilling. Prior to core drilling, the Contractor shall drill sufficient number of small exploratory holes to establish that the area to be core drilled is free of existing embedded conduits.

3. All holes and openings to be cut in existing walls, floors and ceilings of any nature shall be geometrically correct and no larger than necessary to accommodate the new Work.
 4. No cutting of finished or structural Work may be done without the approval of the Engineer.
- B. The Contractor shall be responsible for all finish patching operations of holes and openings in existing floors, walls, ceilings and roofs to accommodate the alteration Work under the Contract.
- C. The Contractor and/or his Subcontractors shall provide and set in place all sleeves, forms and inserts required for their Work before new walls, partitions, floors and roofs are built. All cutting and patching of new walls, partitions floors and ceilings necessary for the reception of Work caused by failure to properly locate sleeves, forms and inserts or caused by incorrect location of Work shall be done at the expense of the Contractor involved, and shall require the approval of the Contractor whose Work is being cut, and the approval of the Engineer.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL

1.01 – SECTION INCLUDES

- A. This Section covers the demolition, removal, and disposal of existing structures and equipment as indicated on the Contract Drawings and as specified hereinafter. The Contractor shall furnish all labor, materials and equipment to demolish structures and equipment and to remove fixtures, anchors, supports, piping and accessories designated to be removed on the Contract Drawings.
1. The Contractor's attention is directed to the fact there may be hazardous materials present within existing structures, and equipment to be demolished, removed, and disposed that will require special handling and other safe guard measures in order to minimize chemical exposure hazards to site workers and to prevent environmental impacts to offsite areas.
 2. The removal of all equipment and piping, and all materials from the demolition of structure shall, when released by the Engineer and/or Owners construction representative, be done by the Contractor and shall become the Contractor's property, unless otherwise noted, for disposition in any other manner not contrary to the Contract requirements and shall be removed from the Site to the Contractor's own place of disposal.
- B. Scheduling:
1. Prior to commencement of work, the Contractor shall conduct a hazardous materials survey of all structures, and equipment to be demolished, removed and disposed, as shown on the Contract Drawings, **in addition to the hazardous materials survey report provided in the contract documents**. The survey shall include the identification, quantification, sample collection, and laboratory analytical testing of the following types of hazardous materials:
 - a. Asbestos: An asbestos survey shall be performed by a New York State Department of Labor (NYSDOL)-certified Asbestos Inspector. The survey shall include suspect material sample collection and the subsequent laboratory analysis of these samples by a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory. The asbestos survey will be performed in accordance with current federal and state asbestos regulations.
 - b. Paint: A paint survey shall be performed by an Environmental Protection Agency (EPA)-certified Lead Inspector. The survey shall include paint chip sample

collection and/or the use of an X-Ray Fluorescence (XRF) analyzer to determine the presence of lead and polychlorinated biphenyls (PCBs) in paints. Paint chip sample analysis shall be performed by a NYSDOH ELAP-certified laboratory.

- c. PCB-containing building materials: A survey of potential PCB-containing building materials (e.g., caulking and bitumastic coatings) shall be conducted by the Contractor. The survey shall include suspect material sample collection and the subsequent laboratory analysis of these samples by a NYSDOH ELAP-certified laboratory.
 - d. Mercury/PCB-containing fixtures and equipment: An inventory of potential mercury and PCB-containing fixtures and equipment shall be performed by the Contractor.
 - e. Survey Report: At the completion of the hazardous materials survey, the Contractor shall develop a survey report and submit it to the Engineer for review and approval prior to the commencement of work. The survey report shall include sample collection protocols and descriptions and estimated quantities of all materials that were sampled. In addition, the survey report shall include sample location drawings and laboratory analytical results for all samples collected.
- 2. The Contractor shall submit detailed description of methods and equipment and sequence for demolition and removal for the Engineer's review.
 - 3. The Contractor shall proceed with the removal of the equipment, piping and appurtenances in a sequence designed to maintain the plant in continuous operation as described in Section 01700, Maintenance of Plant Operations, and shall proceed only after approval of the Engineer.
 - 4. Any equipment, piping and appurtenances removed without prior authorization, which are necessary for the operation of the existing plant or of the plant expansion, shall be replaced to the satisfaction of the Engineer at no cost to the County.
 - 5. A hazardous materials investigation was performed in part on the existing Odor Control building that is to be demolished as part of the work of this contract. The investigation included an asbestos and lead paint within the building. The report is included within these contract documents for the Contractor's reference.

C. Related Sections:

1. Section 01355, Hazardous Materials Control.
2. Section 02050, Demolition, Removals and Modifications.

1.02 - PROTECTION

A. General:

1. Demolition and removal Work shall be performed by competent workmen experienced in the various types of demolition and removal work required and shall be carried through to completion with due regard to the safety of County employees, workmen on the Site and the public. The Work shall be performed with as little nuisance as possible.
2. The Work shall comply with the applicable provisions and recommendation of ANSI A10.2, Safety Code for Building Construction, all governing codes and as hereinafter specified.
3. The Contractor shall make such investigations, explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. The Contractor shall give particular attention to shoring and bracing requirements so as to prevent any damage to new or existing construction.

B. Execution:

1. The Contractor shall provide, erect and maintain catch platforms, lights, barriers, weather protection, warning signs and other items as required for proper protection of the public, occupants of the building, workmen engaged in demolition operations, and adjacent construction.
2. The Contractor shall provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.
3. The Contractor shall provide and maintain temporary protection of the existing structure designated to remain where demolition, removal and new Work is being done, connections made, materials handled or equipment moved.
4. The Contractor shall take necessary precautions to prevent dust from rising by wetting demolished masonry, concrete, plaster and similar debris. Unaltered portions of the existing structures affected by the operations under this Section shall be protected by dustproof partitions and other adequate means.

5. The Contractor shall provide adequate fire protection in accordance with local Fire Department requirements.
6. The Contractor shall not close or obstruct walkways, passageways, or stairways and shall not store or place materials in passageways, stairs or other means of egress. The Contractor shall conduct operations with minimum traffic interference.
7. The Contractor shall be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.

1.03 - WORKMANSHIP

- A. The demolition and removal Work shall be performed as described in the Contract Documents. The Work required shall be done with care, and shall include all required shoring, bracing, etc. The Contractor shall be responsible for any damage which may be caused by demolition and removal Work to any part or parts of existing structures or items designated for reuse or to remain. The Contractor shall perform patching, restoration and new Work in accordance with applicable technical sections of the Specifications and in accordance with the details shown on the Contract Drawings. Prior to starting of the Work, the Contractor shall provide a detailed description of methods and equipment to be used for each operation and the sequence thereof for review by the Engineer. All cutting and patching shall be performed in accordance with the requirements of the General Conditions, Article GC-29, "Cutting and Patching".
- B. All supports, pedestals and anchors shall be removed with the equipment and piping unless otherwise specified or required. Concrete bases, anchor bolts and other supports shall be removed to approximately one inch (1-in.) below the surrounding finished area and the recesses shall be patched to match the adjacent areas as shown. Wall and roof openings shall be closed, and damaged surfaces shall be patched to match the adjacent areas, as specified, as shown on the Contract Drawings, or as directed by the Engineer. Wall sleeves and castings shall be plugged or blanked off, all openings in concrete shall be closed in a manner meeting the requirements of the appropriate sections of the Specifications, as shown on the Contract Drawings and as directed and approved by the Engineer.
- C. Wherever piping is to be removed for disposition, the piping shall be drained by the Contractor and adjacent pipe and headers that are to remain in service shall be blanked off or plugged and then anchored in an approved manner.
- D. Materials or items to be demolished and not designated in Section 02050, Demolitions, Removals and Modifications, to become the property of the County or to be reinstalled shall become the property of the Contractor and shall be removed from the property and legally disposed of.

- E. The Contractor shall execute the Work in a careful and orderly manner, with the least possible disturbance to the public and to the occupants of the structures.
- F. Where alterations occur, or new and old Work join in, the Contractor shall cut, remove, patch, repair or refinish the adjacent surfaces to the extent required by the construction conditions, so as to leave the altered Work in as good a condition as existed prior to the start of the Work. The materials and workmanship employed in the alterations, unless otherwise shown on the Contract Drawing or specified, shall comply with that of the various respective trades which normally perform the particular items of work.
- G. The Contractor shall finish adjacent existing surfaces of new Work to match the specified finish for new Work. The Contractor shall clean existing surfaces of dirt, grease, loose paint, etc., before refinishing.
- H. Where existing equipment are indicated to be reused, the Contractor shall repair and refinish such equipment to put them in perfect working order. Refinishing shall be as specified in Section 02050, Demolitions and directed by the Engineer.
- I. The Contractor shall remove temporary work, such as enclosures, signs, guards, and the like when such temporary work is no longer required or when directed at the completion of the Work.

1.04 – CONDITION OF STRUCTURES AND EQUIPMENT

- A. The County does not assume responsibility for the actual condition of structures and equipment to be demolished and removed.
- B. Conditions existing at the time of inspection for bidding purposes will be maintained by the County so far as practicable.
- C. The information regarding the existing structures and equipment shown on the Contract Drawings is based on visual inspection and a walk-through survey only. Neither the Engineer nor the County will be responsible for interpretations or conclusions drawn therefrom by the Contractor.

1.05 – MAINTENANCE

- A. The Contractor shall maintain the structures and public properties free from accumulations of waste, debris and rubbish, caused by the demolition and removal operations.
- B. The Contractor shall provide on-site dump containers for collection of waste materials, debris and rubbish, and he shall wet down dry materials to lay down and prevent blowing dust.

- C. At least once a week during the progress of the demolition and removal Work or as directed by the Engineer, the Contractor shall clean the Site and properties (including sweeping roadways with mechanical street sweeper), and dispose of waste materials, debris and rubbish.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - GENERAL**

- A. This Section is supplementary to the requirements of the General Conditions, Article GC-29, "Cutting and Patching" and includes all cutting and patching of all Work under construction, completed Work and facilities installed by others, in order to accommodate the coordination of Work, install other Work, uncover Work for access, inspection or testing, or similar purposes. Demolition, removals and modifications work" is specified in Section 01039, Demolition and Removal of Existing Structures and Equipment. Execute all cutting and patching, including excavation, backfill and fitting required to:
1. Remove and replace defective Work or Work not conforming to requirements of the Contract Documents.
 2. Remove samples of installed Work as required for testing.
 3. Remove all constructions required to provide for specified alteration or addition to Work by others.
 4. Uncover Work to provide for the Engineer's inspection of covered Work or inspection by regulatory agencies having jurisdiction.
 5. Connect to completed Work that was not accomplished in the proper sequence.
 6. Remove or relocate utilities and pipes installed by others which obstruct the Work to which connections must be made.
 7. Make connections or alterations to new facilities or facilities installed by others.
- B. Restore all Work by others to a state equal to that which it was in prior to cutting and restore new Work to the standards of these Specifications.
- C. Submittals:
1. Prior to cutting, which may affect the integrity and design function of the Project, County's operations, or Work of another Contractor, submit written notice to the Engineer, requesting consent to proceed with cutting, including:
 - a. Identification of the Project.
 - b. Description of affected Work of Contractor and Work of others.

- c. Necessity for cutting.
 - d. Effect on other Work and on structural integrity of the Project.
 - e. Description of proposed Work. Designate:
 - i. Scope of cutting and patching.
 - ii. Contractor, Subcontractor or trade to execute Work.
 - iii. Products proposed to be used.
 - iv. Extent of refinishing.
 - v. Schedule of operations.
 - f. Alternatives to cutting and patching, if any.
 - g. Designation of party responsible for cost of cutting and patching.
 - 2. Should conditions of Work, or schedule, indicate change of materials or methods, submit written recommendation to the Engineer, including:
 - a. Conditions indicating change.
 - b. Recommendations for alternative materials or methods.
 - c. Submittals as required for substitutions.
 - 3. Submit written notice to the Engineer, designating the time Work will be uncovered, to provide for observation. Do not begin cutting or patching operations until authorized by the Engineer.
- D. Provide shoring, bracing and support as required to maintain structural integrity of the Project and protect adjacent Work from damage during cutting and patching.
- E. Conform to all applicable Specifications for application and installation of materials used for patching.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - GENERAL**

- A. The General Construction Contractor shall establish at least two bench marks for use by all Contractors, in accordance with the General Conditions, Article GC 28, "Layout and Levels" and the Agreement, Article XXIX, "Character and Competency" and Article XXX, "Superintendence". The Contractor shall comply with this article.
- B. Contractor shall:
1. Provide civil, structural or other professional engineering services specified, or required to execute Contractor's construction methods.
 2. Develop and make all detail surveys and measurements needed for construction including slope stakes, batter boards, piling and pier layouts and all other working lines, elevations and cut sheets.
 3. Keep a transit and leveling instrument on the Site at all times and a skilled instrument man employed or obtained whenever necessary for layout of the Work.
 4. Provide all material required for benchmarks, control points, batter boards, grade stakes, and other items.
 5. Be solely responsible for all locations, dimensions and levels. No data other than written orders of the Engineer shall justify departure from the dimensions and levels required by the Drawings.
 6. When requested by Engineer, provide such facilities as may be necessary for the Engineer to check line and grade points placed by the Contractor. The Contractor shall do no excavation, backfill or embankment Work until all cross sectioning necessary for determining pay quantities has been completed and checked by the Engineer.

1.02 – CONTRACTOR'S FIELD ENGINEER

- A. The Contractor shall employ and retain at the Site of the Work a field engineer capable of performing all engineering tasks required of the Contractor. Tasks included are:
1. A projection of Work to be completed the following day must be submitted to the Engineer by 4:00 PM of the preceding workday. This projection must include:

- a. Location of all areas in which construction will be done, including the Contractor and his Subcontractors.
 - b. Major construction equipment utilized.
 - c. Equipment and materials to be installed.
2. Provide all surveying equipment required including transit, level, stakes and required surveying accessories.
3. Furnish all required lines and grades for construction of operations. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment.
4. Maintain field office files and drawings, Record Drawings, and coordinate engineering services with Subcontractors. Prepare Layout and Coordination Drawings for construction operations.
5. Check and coordinate Work for conflicts and interference and immediately advise the Engineer of all discrepancies noted.
6. Cooperate with the Engineer in field inspections, as required

1.03 – QUALIFICATIONS OF SURVEYOR OR ENGINEER

- A. A qualified engineer or registered land surveyor, acceptable to the Engineer.

1.04 – RECORDS

- A. Maintain a complete, accurate log of all control and survey Work as it progresses.
- B. On completion of foundation walls and major Site improvements, prepare a certified survey showing all dimensions, locations, angles and elevations of construction.

1.05 – SUBMITTALS

- A. When requested by the Engineer, submit a certificate signed by a registered Engineer or surveyor certifying that elevations and locations of Work are in conformance with the Contract Documents. Explain all deviations.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 – SECTION INCLUDES**

- A. When a reference standard is specified, comply with the requirements and recommendations stated in that standard, except when they are modified by the Contract Documents, or when applicable laws, ordinances, rules, regulations or codes establish stricter standards. The latest provisions of applicable standards shall apply to the Work, unless otherwise specified. Reference standards include, but are not necessarily limited to, the following:

AMCA- Air Moving and Conditioning Association, Inc.

AASHTO - American Association of State Highway and Transportation Officials.

ABMA- American Boiler Manufacturers' Association

ACI - American Concrete Institute.

ACIFS- American Cast Iron Flange Standards.

AFBMA- Anti-Friction Bearing Manufacturers Association.

AGA- American Gas Association.

AGMA- American Gear Manufacturers Association.

AIA- American Institute of Architects.

AISC- American Institute of Steel Construction.

ISI- American Iron and Steel Institute.

ANSI - American National Standards Institute.

APA- American Plywood Association.

API- American Petroleum Institute.

ASCE- American Society of Civil Engineers.

ASME- American Society of Mechanical Engineers.

ASTM- American Society for Testing and Materials.

AWPA- American Wood Preservers Association.

AWS- American Welding Society.

AWWA- American Water Works Association.

CGA- Compressed Gas Association.

CRSI- Concrete Reinforcing Steel Institute.

CMAA- Crane Manufacturers' Association of America.

DIPRA- Ductile Iron Pipe Research Association.

EEl- Edison Electric Institute.

EJMA- Expansion Joint Manufacturers' Association.

Fed Spec - Federal Specifications.

FM- Factory Mutual.

HMI- Hoist Manufacturers' Institute.

IEEE- Institute of Electrical and Electronic Engineers.

IPCEA- Insulated Power Cable Engineers Association.

NACE- National Association of Corrosion Engineers.

NB- National Board of Boiler Pressure Vessels.

NBS- National Bureau of Standards.

NEC- National Electric Code.

NEMA- National Electrical Manufacturers Association.

NFPA- National Fire Protection Association.

NYSDOT - New York State Department of Transportation.

OSHA- Occupational Safety and Health Act.

PCA- Portland Cement Association.

PCI- Pre-stressed Concrete Institute.

RMA- Rubber Manufacturers' Association.

SMACCNA - Sheet Metal and Air Conditioning Contractors National Association.

SPI- Society of Plastics Industry.

SSPC- Steel Structures Painting Council.

STI- Steel Tank Institute

UL- Underwriters' Laboratory.

- B. The Contractor shall, when required, furnish evidence satisfactory to the Engineer that materials and methods are in accordance with such standards where so specified.
- C. In the event any questions arise as to the application of these standards or codes, copies shall be supplied on Site by Contractor.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - GENERAL**

- A. Payment of the Work of the Contract will be made on the basis of the bid prices, as agreed upon and stipulated in the signed Contract Agreement. Payments include the furnishing of all labor, materials equipment and incidentals required to complete the work of the Contract as shown on the Contract Drawings and as specified.
- B. A schedule outlining the procedures for measurement and payment for the contractor is included below. The schedule includes measurement and payment for the lump sum bid item and various unit price items only. For measurement and payment of Allowance items, the Contractor's attention is directed to Section 01020.

1.02 – CONTRACT NUMBER S35114-06G

- A. Lump Sum Bid - Item No.1: Glen Cove Wastewater Treatment Plant Sludge Dewatering Facility Improvements.
 - 1. Measurement for payment of the Lump Sum Bid Item No. 1 shall be made in accordance with the Construction Agreement. The measurement shall be the percentage of work performed and in place as of the date of the payment request and shall be determined for each item included on the schedule of values. The measurement shall be documented by calculation of costs incurred, quantities in place, and invoices of materials and equipment supplied, as well as certification of the Contractor as to the accuracy of the measurement.
 - 2. Payment shall fully compensate the Contractor for furnishing all labor, materials, equipment and incidentals required to complete the work as specified and shown in the Contract Documents, except for the allowance items listed in Section 01020 and unit price items, all as contained in the Bid Proposal and agreed upon in the Construction Contract.
 - 3. Payment of the lump sum shall also compensate the Contractor for insurance, bonds, furnishing and removing the temporary facilities as specified in Sections 01700 and 01500 and as shown on the drawings, and all other services required for the satisfactory completion of the work of this contract.

1.03 – ALLOWANCES

- A. Allowances will be paid in accordance with the provisions of Section 01020.

1.04 – ALTERNATES

- A. Alternate Bid Item No. 4 shall be as listed in the Proposal. Payment shall fully compensate the Contractor for furnishing all labor, materials, equipment and incidentals required to complete the work as specified and shown in the Contract Documents.

1.06 – RELATED PROVISIONS ELSEWHERE

- A. Payments to the Contractor: Refer to the Agreement and the General Conditions.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 – DESCRIPTION OF REQUIREMENTS**

- A. This Section specifies the general methods and requirements of submissions applicable to Shop Drawings, Product Data, Samples, Mock Ups, Construction Photographs, Construction or Submittal Schedules. Detailed submittal requirements are specified in the technical Sections.
- B. All submittals shall be clearly identified by reference to Section Number, Paragraph, Drawing Number or Detail as applicable. Submittals shall be clear and legible and of sufficient size for presentation of data.

1.02 – SHOP DRAWINGS, PRODUCT SAMPLES, DATA

- A. Shop Drawings
 - 1. Shop drawings as specified in individual Sections include, custom-prepared data such as fabrication and erection/installation (working) drawings, scheduled information, setting diagrams, actual shop work manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the work.
 - 2. All shop drawings submitted by subcontractors shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.
 - 3. Check all subcontractor's shop drawings regarding measurements, size of members, materials and details to make sure that they conform to the intent of the Drawings and related Sections. Return shop drawings found to be inaccurate or otherwise in error to the subcontractors for correction before submission thereof.
 - 4. All details on shop drawings shall show clearly the relation of the various parts to the main members and lines of the structure and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted.
 - 5. Submittals for equipment specified under Divisions 13 through 16 shall include a listing of all installations where identical or similar equipment has been installed and been in operation for a period of at least one year.
- B. Product Data

1. Product data as specified in individual Sections include, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing and printed product warranties, as applicable to the work.

C. Samples

1. Samples specified in individual Sections include, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the work.

1.03 – CONTRACTORS RESPONSIBILITIES

- A. Review shop drawings, product data and samples, including those by subcontractors, prior to submission to determine and verify the following:
 1. Field measurements
 2. Field construction criteria
 3. Catalog numbers and similar data
 4. Conformance with related Sections
- B. Each shop drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor: "Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements." The cover sheet shall fully describe the packaged data and include a listing of all items within the package. Provide to the Resident Project Representative a copy of each transmittal sheet for shop drawings, product data and samples at the time of submittal to the Engineer.

- C. The Contractor shall utilize a 9 character submittal identification numbering system in the following manner:
1. The first five digits shall be the applicable Section Number.
 2. The next three digits shall be the numbers 001 to 999 to sequentially number each initial separate item or drawing submitted under each specific Section Number.
 3. The last character shall be a letter, A to Z, indicating the submission, or resubmission of the same Drawing, i.e., "A=1st submission, B=2nd submission, C=3rd submission, etc. A typical submittal number would be as follows:

 03300-008-B
 03300 = Section for Concrete
 008 = The eighth initial submittal under this section
 B. = The second submission (first resubmission) of that particular shop drawing]
- D. Notify the Engineer in writing, at the time of submittal, of any deviations in the submittals from the requirements of the Contract Documents. All cost associated with any deviations shall be borne by the Contractor.
- E. The review and approval of shop drawings, samples or product data by the Engineer shall not relieve the Contractor from the responsibility for the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will have no responsibility therefor.
- F. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved shop drawings and data shall not be permitted. The Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.
- G. Project work, materials, fabrication, and installation shall conform with approved shop drawings, applicable samples, and product data.

1.04 – SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule and in such sequence as to cause no delay in the Work or in the work of any other contractor.
- B. Contractor shall reference the General Conditions for additional submission requirements.
- C. Number of submittals required:

1. Shop Drawings: See Article 1.05 below.
2. Product Data: See Article 1.05 below.
3. Samples: Submit the number stated in the respective Sections.

D. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.
2. The Project title and number.
3. Contractor identification.
4. The names of:
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
5. Identification of the product, with the section number, page and paragraph(s).
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the work or materials.
8. Applicable standards, such as ASTM or Federal Standards numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. A blank space suitably sized for Contractor and Engineer stamps as defined in the General Conditions.
12. Where calculations are required to be submitted by the Contractor, the calculations shall have been checked by a qualified individual other than the preparer. The submitted calculations shall clearly show the names of the preparer and of the checker.

1.05 – ELECTRONIC SUBMITTAL FORMAT

- A. Files shall be electronically searchable based on Owner and Engineer established standard file naming convention.
- B. Quality and Legibility: Electronic submittal files shall be made from the original and shall be clear and legible. Do not provide scans of faxed copies. Electronic file shall be made at the full size of the original paper documents. All pages shall be properly oriented for reading on a computer screen without rotating.
- C. Organization and Content:
 - 1. Each electronic submittal shall be one electronic file. Do not divide and submit individual submittals into multiple electronic files unless directed by Engineer.
 - 2. When submittal is large or contains multiple parts, provide PDF file with bookmark for each section of submittal.
 - 3. Submittal content shall include Contractor's letter of transmittal and Contractor's review and stamp.
- D. Electronic file format: PDF (Portable Document Format): .pdf, Adobe PDF documents; created through electronic conversion rather than optically scanned whenever possible.

1.06 – REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

- A. The review of shop drawings, data and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed:
 - 1. as permitting any departure from the Contract requirements;
 - 2. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
 - 3. as approving departures from details furnished by the Engineer, except as otherwise provided herein.
- B. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- C. If the shop drawings, data or samples as submitted describe variations and show a departure from the Contract requirements which Engineer finds to be in the interest of the Owner and to be

so minor as not to involve a change in Contract Price or Contract Time, the Engineer may return the reviewed drawings without noting an exception.

D. Submittals will be returned to the Contractor under one of the following codes.

Code 1 - "APPROVED" is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.

Code 2 - "APPROVED AS NOTED". This code is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

Code 3 - "APPROVED AS NOTED/CONFIRM". This combination of codes is assigned when a confirmation of the notations and comments IS required by the Contractor. The Contractor may, at his own risk, release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the Engineer within 14 calendar days of the date of the Engineer's transmittal requiring the confirmation.

Code 4 - "APPROVED AS NOTED/RESUBMIT". This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the Engineer within 14 calendar days of the date of the Engineer's transmittal requiring the resubmittal.

Code 5 - "NOT APPROVED" is assigned when the submittal does not meet the intent of the Contract Documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.

Code 6 - "COMMENTS ATTACHED" is assigned where there are comments attached to the returned submittal which provide additional data to aid the Contractor.

Code 7 - "SUBMITTED FOR THE RECORD" is assigned when the contractor has submitted information for record purposes.

Codes 1 through 5 designate the status of the reviewed submittal with Code 6 showing there has been an attachment of additional data.

- E. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall identify all revisions made to the submittals, either in writing on the letter of transmittal or on the shop drawings by use of revision triangles or other similar methods. The resubmittal shall clearly respond to each comment made by the Engineer on the previous submission. Additionally, the Contractor shall direct specific attention to any revisions made other than the corrections requested by the Engineer on previous submissions.
- F. Partial submittals may not be reviewed. The Engineer will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor and will be considered "Not Approved" until resubmitted. The Engineer may at his option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.
- G. Repetitive Review
 - 1. Shop drawings and other submittals will be reviewed no more than three times at the Owner's and Engineer's expense. All subsequent reviews will be performed at times convenient to the Owner and Engineer and at the Contractor's expense, based on the Owner's and Engineer's then prevailing rates. The Contractor shall reimburse the Owner and Engineer for all such fees invoiced to the Owner by the Engineer as defined in Article GC-18 of the General Conditions. Submittals are required until approved.
 - 2. Any need for more than one resubmission, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Time.
- H. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Engineer at least 7 working days prior to release for manufacture. If such notice is not received within 7 day the Contractor will not be eligible for a claim against the County for additional compensation.
- I. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

1.07 – DISTRIBUTION

- A. Distribute reproductions of approved shop drawings and copies of approved product data and samples, where required, to the job site file and elsewhere as directed by the Engineer. Number of copies shall be as directed by the Engineer but shall not exceed six.

1.08 – MOCK UPS

- A. Mock Up units as specified in individual Sections, include but are not necessarily limited to, complete units of the standard of acceptance for that type of work to be used on the project. Remove at the completion of the work or when directed.

1.09 – CONSTRUCTION PHOTOGRAPHS

- A. The General Contractor shall have a total of 500 color photographs made of the work during its progress and color photographs of the completed facilities. The photographs shall be of such views and taken at such times as the Engineer directs.
- B. All photographic work shall be done by a qualified, established commercial photographer acceptable to the Engineer. Three prints of each photograph shall be furnished promptly to the Engineer, and each print shall have a glossy finish and be mounted in plastic sleeving on a substantial backing. The overall dimensions of each mounted print shall be 8-in by 10-in with 1-1/4-in flexible binding margin on the long top side to permit storage in standard 3-ring binders.
- C. The film negatives shall be retained in the files of the photographer until the completion of the project and shall then be turned over to the Owner Engineer.
- D. Each photograph shall have attached to the backing a paper label, approximately 2-1/4-in wide by 1-3/4-in high containing thereon in neat lettering:
 - 1. Contractor's name
 - 2. Short Description of View
 - 3. Photo Number and Date Taken
 - 4. Photographer's Firm Name
- E. Additional requirements for construction photographs are provided in Article GC-37 of the General Conditions.
- F. If photographer takes digital pictures then all such pictures shall be provided, to the County, electronically on a CD. Provide 2 copies on CD.

1.10 – PROFESSIONAL ENGINEER (P.E.) CERTIFICATION FORM

- A. If specifically required in other related Sections, submit a P.E. Certification for each item required, in the form attached to this Section, completely filled in and stamped.

1.11 – ADDITIONAL SUBMITTAL REQUIREMENTS

- A. Additional Contractor submission requirements are included in Article GC-14 of the General Conditions.

1.12 – GENERAL PROCEDURES FOR SUBMITTALS

- A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work of other related Sections, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

++ END OF SECTION ++

NO TEXT THIS PAGE

P.E. CERTIFICATION FORM

The undersigned hereby certifies that he/she is a Professional Engineer registered in the State of New York and that he/she has been employed by

_____ to design
(Name of Contractor)

_____ (Insert P.E. Responsibilities)
in accordance with Section _____ for the

_____ (Name of Project)
The undersigned further certifies that he/she has performed the design of the
_____,
(Name of Project)

that said design is in conformance with all applicable local, state and federal codes, rules, and regulations, and that his/her signature and P.E. stamp have been affixed to all calculations and drawings used in, and resulting from, the design.

The undersigned hereby agrees to make all original design drawings and calculations available to the

Nassau County Department of Public Works
(Insert Name of Owner)

or Owner's representative within seven days following written request therefor by the Owner.

P.E. Name Contractor's Name

Signature Signature

Address Title

Address

NO TEXT THIS PAGE

PART 1 - GENERAL**1.01 – SECTION INCLUDES**

- A. The work shall consist of preparing, submitting, and maintaining a computerized CPM (Critical Path Method) progress schedule using Primavera P6 software.
- B. The purpose of the computerized CPM progress schedule is to ensure timely completion of the contract and to establish a standard methodology for time adjustment analysis based on the principles of the Critical Path Method of Scheduling.
- C. For this specification, 'Engineer' means County authorized Construction Manager.
- D. The Contractor shall ensure that any and all computer files submitted to the Engineer are in a format that can be imported directly using Primavera software, version 16.2 or later.
- E. The Contractor will retain a CPM Consultant, approved by the Engineer, to assist in the development and preparation of the CPM schedule, and in subsequent schedule updating. The CPM Consultant shall have acceptable certifications such as AACE's Planning & Scheduling Professional (PSP), Project Management Institute's PMI-SP, or approved equal. The CPM Consultant is required to attend the Monthly Schedule Update Meetings. The Contractor is deemed to have included in the Bid price sufficient monies to pay all expenses required to develop the CPM Schedule and to guarantee its successful operation, implementation and maintenance.

1.02 - DETAILS

- A. PRE CONSTRUCTION SCHEDULE MEETING
 - 1. The Engineer will schedule and conduct a Pre-construction Scheduling Meeting with the Contractor within ten (10) working days after Notice to Proceed. The requirements of this specification will be reviewed at this meeting. Additionally, the following topics will be discussed:
 - a. Specifics of any contract Time-Related Clauses.
 - b. The representation in the schedule of the Time-Related work.
 - c. The calendar, activity coding, and resource definition requirements unique to and consistent with the contract.
 - d. The Contractor's schedule methodology employed, proposed work sequence and any proposed deviations of sequences from the contract plans.

- e. The factors that the Contractor determines to control the completion of the project and any milestone completions contained therein.
 - f. Narrative content for Initial Baseline and Monthly Updates.
 - g. Schedule submission protocol for Initial Baseline and Monthly Updates.
2. The Contractors attendance at the Pre-construction Scheduling Meeting is mandatory. No field work will be allowed, with the exception of set up of the field office, until this meeting is held.

B. INITIAL BASELINE CPM CONSTRUCTION SCHEDULE

- 1. Within sixty (60) work days following the Notice to Proceed, the Contractor shall prepare and submit to the Engineer the Initial Baseline CPM Construction Schedule for the entire project. This submission shall include the electronic Schedule file and paper reports as required and approved by the Engineer.
- 2. The Initial Baseline Schedule must be Cost and resource loaded and shall represent the Contractor's plan to construct the project. This schedule shall include all work and activities necessary to complete the project including but not limited to activities for the preparation, submittal, review, approval, fabrication, and delivery of all shop drawing and procurement related items. The Initial Baseline CPM Construction Schedule must be set up to conform to the staging/phasing and other requirements defined in or required by the contract.
- 3. The Initial Baseline Schedule shall meet all interim milestone dates and shall not extend beyond the contract completion date.

C. SCHEDULE REQUIREMENTS

- 1. The Contractors Initial Baseline CPM Construction Schedule shall meet the following requirements:
 - a. CPM ACTIVITY NETWORK FORMAT - The schedule network shall use the Precedence Diagramming Method.
 - b. PROJECT DEFINITIONS - The following project specific properties within the schedule shall be defined:
 - i. CALENDAR - All calendars created shall encompass and account for the total duration of the contract time period. The standard calendar shall be

8-hour days, five days per week and shall account for holidays and non-working days. Additional calendars shall be created and included as required for:

- 1) Work week (5 or 6 day). (When or if the contractor elects to utilize a 6-day work week he shall be responsible for the county's overtime costs as applicable by the contract requirements)
- 2) Seasonal restrictions (asphalt, landscape, etc.).
- 3) Concrete curing/calendar days.
- 4) Any project specifics as required by the Engineer.
- 5) Expected and contemplated weather conditions shall be accounted for in the calendars.

2. ACTIVITY CODE- As a minimum following activity codes shall be established:

- a. Responsibility - The party responsible for each activity. Only one party can be responsible for an activity. Include Values for "Nassau County Department of Public Works (NC)", "Prime Contractor" and third parties to the contract as appropriate (utilities, etc).
- b. Phase- Phasing consistent with Contract plans where each activity is performed; Include Values for "None", and "Project Wide".
- c. Location - Location of activity work by Stationing; Include Value for "None", and "Project Wide".
- d. Type- The type of work for each activity; Include a Value for Administrative"
- e. Added Work- Work added to the Contract and incorporated into the schedule with the Engineers Approval.
- f. As Required by Project - Any coding unique to or as required by the Engineer to facilitate the use and analysis of the Schedule. This coding shall be established in consultation with the Engineer at the Pre-construction Scheduling Meeting.

3. RESOURCES - The Resource Dictionary shall be established as required by the Engineer. The Resource Dictionary shall be limited to Labor and Equipment. Labor may

be represented by work crews. The composition of each crew must be detailed and included as an appendix to the Narrative Report. Sub-Contractors shall be represented as a labor crew(s).

4. COST LOADING – Basis of cost loading will be the approved Schedule of Values.
5. ACTIVITY DATA
 - a. ACTIVITY IDENTIFICATION - Each activity shall have a unique identifier. The identifier may be alpha-numeric, but at a minimum must be a unique number.
 - b. ACTIVITY DESCRIPTION - Each activity shall be unambiguously described. Descriptions such as "construct 30% of Y" are unacceptable. Activities shall be discrete to the extent necessary to accurately schedule the work.
 - c. ACTIVITY DURATION - Durations of individual work activities shall not exceed twenty (20) working days. The minimum activity duration increment is one full day. Durations of individual shop drawing review activities may exceed fifteen working days and shall be consistent with Contract Requirements. Exceptions to this will be reviewed by the Engineer on an activity-by-activity basis. If requested by the Engineer, production rates or other supporting information shall be supplied justifying the reasonableness of any given activity time duration. A Method Statement including the labor, equipment, production rates and any additional information, required to achieve a given activity shall be supplied within 5 working days when requested by the Engineer.
 - d. ACTIVITY RELATIONSHIPS – Activity relationships shall be finish-to-start with no lags unless directed otherwise by the Engineer. Contractor requests for exemptions will be made on a case by case basis. Each activity with the exception of the required "Project Notice to Proceed" and "Completion" activities shall have a predecessor and a successor activity relationship.
 - e. ACTIVITY START and FINISH DATES - The earliest start date, earliest finish date, latest start date, and latest finish date shall be calculated for each activity.
 - f. ACTIVITY TOTAL FLOAT - The total float shall be calculated for each activity. Total float is the full amount of time by which the start on an activity may be delayed without causing the project to last longer.
 - g. ACTIVITY CALENDARS - The appropriate calendar assignment shall be made to each activity.

- h. ACTIVITY CODES - Coding shall be assigned to each activity from the defined activity dictionary. Each code shall have a value assigned in a given activity.
 - i. ACTIVITY CONSTRAINTS - The start or completion of any activity shall not be constrained. Exceptions to this must receive prior approval in writing by the Engineer. A "Must-Finish-By" Date for the overall project is a constraint and must be pre-approved by the Engineer.
 - j. ACTIVITY RESOURCES- The schedule shall be "Resource" loaded as required by the Engineer. The resources required to accomplish each activity shall be assigned to that activity from the 'Resource Dictionary'
6. REQUIRED ACTIVITIES - The following activities shall be incorporated into the Schedule:

<u>Activity ID</u>	<u>Activity Description</u>	<u>Activity Type</u>	<u>Logic Relationship</u>
000010	Contract "Notice to Proceed"	Start Milestone	No Predecessors to this First Schedule Activity
999999	Completion	Finish Milestone	No Successors to this Last Schedule Activity

7. DATA DATE - The Data Date and Project Start Date in the Initial Baseline Schedule shall be the NOTICE TO PROCEED DATE. The Data Date for each Monthly Update shall be the last work day of the month.

D. REVIEW AND ACCEPTANCE OF THE INITIAL BASELINE CPM CONSTRUCTION SCHEDULE-

- 1. The Contractor shall submit to the Engineer the following items to facilitate review of the Initial Baseline CPM Construction Schedule:
 - a. Narrative- A statement explaining the general sequence of work in the Contractor's schedule, a detailed definition of the work on the Critical Path, a statement regarding the meeting of any Time Restrictive Clause dates, and the explanation of any other ambiguities in the schedule.
- 2. The following Activity Sorts generated from the software shall be provided or as required and approved by the Engineer:
 - a. Critical Path Activity Sort - The activities that comprise the projects Critical Path. The list shall start with the first activity in the path and then ascend by Early Start date to the final activity in the path.

- b. Time Related Activity Sort - For the activities necessary to complete the work within each specific Time Frame provision in the contract, shall be listed. The list shall start with the first milestone activity and then ascend by Early Start date to the final milestone activity in the network comprising each Time Frame period. Include a Critical Path activity sort for each specific Time Frame in the contract.
 - c. Constraint Activity Sort - Listing of Constrained Activities and type of constraint.
 - d. Listing of Calendars and Activity Coding incorporated in the Schedule
- 3. Electronic copies of the Initial CPM Construction Schedule shall be provided in format approved by the Engineer.
- 4. The Engineer will review the Initial Baseline CPM Construction Schedule and forward any comments, revisions, or requests to the Contractor. Within ten (10) work days of the Engineer's reply, the Contractor shall make adjustment to the Initial Baseline CPM Construction Schedule in accordance with the Engineer's comments and resubmit copies for review consistent with the above directives.
- 5. Upon final revisions, the Contractor shall submit electronic file copies of the Initial Baseline CPM Construction Schedule to the Engineer. A sort of activities scheduled to start (ES) & finish (EF) in the next update period shall be included. The Logic Diagram shall be submitted as directed by the Engineer. The final submission shall be submitted for approval within five (5) work days of the Contractor's receipt of the final comments by the Engineer.
- 6. Approval of the Initial Baseline CPM Construction Schedule by the Engineer shall not be construed to imply approval of any particular method or sequence of construction or to relieve the Contractor of providing sufficient materials, equipment, and labor to guarantee completion of the project in accordance with the contract proposal, plans, and specifications. Approval shall not be construed to modify or amend the completion date. Completion dates can only be modified or amended by standard contractual means.
- 7. Failure to include in the Initial Baseline CPM Construction Schedule any element of work required for the performance of the contract shall not excuse the Contractor from completing all work required within the completion date(s) specified in the contract.

E. SCHEDULE UPDATES

- 1. MONTHLY PROGRESS UPDATES: The Contractor shall update the schedule monthly. The schedule shall be updated to include all work and progress up to and including the

last working day of the month. This will establish the "Data Date". The Monthly update shall detail progress based on actual dates of activities started and completed, the percent of work completed to date on each activity started but not yet completed and the status of procurement of critical materials. The updated schedule data shall be submitted in an electronic file format acceptable to the Engineer.

2. A Narrative Report is required for each update and shall provide the following information:
 - a. Contractors transmittal letter to the Engineer stating the update period and schedule "Data Date".
 - b. Work started, completed and ongoing during the update period by activity with "Actual Dates".
 - c. Description of current Critical Path and any change from previous Critical Path.
 - d. Any activities added or deleted and any proposed changes in Activity Logic (Engineer's approval in writing is required).
 - e. Current Delays or Advancements
 - i. Delayed or Advanced Activities.
 - ii. Proposed corrective action and schedule adjustments to address the Delay.
 - iii. Impact of Delay or Advancement on other activities (duration, ES,EF,LS,LF), milestone and completion dates.
 - iv. Impact of Delay or Advancement on the Critical Path.
 - f. Outstanding Items that effect the schedule and status thereof (including but not limited to):
 - i. Permits.
 - ii. Shop Drawings.
 - iii. Change Orders.
 - iv. Reviews of submittals.

- v. Approvals.
 - vi. Fabrication and Delivery.
 - g. Scheduled Completion Date Status
 - i. Contract Completion.
 - ii. Interim Milestones/Time Frame if any.
- 3. The following Activity Sorts generated from the Software shall be provided:
 - a. Current Critical Path Activity Sort
 - b. Near Critical Activities Sort
 - c. Sort of Activities scheduled to start (ES) & finish (EF) in the next Monthly update period.
 - d. Any other "Report" as directed by the Engineer and/or as discussed in the pre-construction scheduling meeting.
- 4. The Monthly Progress Updates shall be submitted to the Engineer within five (5) work days of the "Data Date". The Engineer shall prepare a written response within five (5) work days of receipt of the Monthly Update approving, approving with comments, or returning for resubmission within five (5) work days.
- 5. If the Contractor fails to comply with the Monthly Progress Update submission requirements the Commissioner reserves the right to withhold any or all contract payments.
- 6. Monthly Schedule Meetings and Reports
 - a. Monthly, on a date established by the Engineer prior to the Data Date, a CPM Progress Meeting will be held, at which the schedule updated will be reviewed. The meeting shall be attended by the Engineer and representative(s) of the Contractor including the scheduling consultant. The Contractor representative(s) at the meeting shall have competence and authority to make any necessary decisions and their statement shall commit the Contractor to the agreed procedures, sequencing of Work, coordination and time schedules.

- b. Prior to the meeting, the CPM scheduling consultant shall obtain, through any required means including Site meetings, the necessary information to update the CPM schedule to reflect progress to date and to update/revise the schedule for the balance of the Project. The updated schedule and draft narrative report shall be furnished to the Engineer at least 48 hours prior to the meeting and be distributed by the Contractor in hard copy at the meeting for review. To update the CPM schedule, the Contractor shall:
 - i. Enter actual start and completion dates for those Activities started and/or completed during the previous reporting period.
 - ii. For Activities in progress, indicate the Remaining Duration correlating to an accurate forecasted completion date and physical percentage complete to date (Percent Complete is to reflect the actual quantity of Work completed, and is separate from any actual or Remaining Duration calculation). Review, and revise as necessary, the network logic for the Remaining Duration of the Work from the update to the estimated completion date.
 - iii. For activities not yet started, review, and revise as required, the necessary Logic, the Durations of Work and the estimated start and completion dates.
 - iv. Enter for each applicable Activity, actual installed quantities information.
- c. The total Duration to be initially added to any schedule update reflecting the Change Order Activities from identification to the approval of any specific change order shall be in approved by the Engineer and shall be incorporated into the monthly schedule update following the identification of the changed Work. The forecasted construction Activities shall be logically tied to the appropriate predecessor and successor base Contract Activities and contain all of the required Logic, Duration, Coding and Resources/Cost Loading specified for the detailed CPM schedule activities.
- d. In the event the Contractor begins performance in the field of Extra Work during the update period, the monthly progress schedule update shall reflect the actual start date of the Work, and any predecessor Logic ties or restraints shall be broken in order to accurately forecast complete of the identified Extra Work

Activity. This will allow for accurate forecasting of the successor Work Activities and completion Milestones.

- e. Default progress data provided from the scheduling system is not allowed. Actual start and finish dates and the Remaining Durations of the Activities shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual start and finish dates on the CPM schedule shall match those dates provided from the Contractor's Daily Quality Control Reports. Failure of the Contractor to document the actual start and finish dates on the Contractor Daily Quality Control Report for every in-progress or completed Activity and ensure that the data contained on the Contractor Daily Quality Control Report is the sole basis for the schedule updating shall result in the disapproval of the Contractor's submittal.
 - f. Activities that have reported progress without predecessor Activities being completed (out-of-sequence progress) will not be allowed except on a case-by-case basis with the approval of the Engineer. A written explanation for each instance shall be included in the monthly submittal.
 - g. The Contractor shall not constrain the schedule with artificial Logic ties and/or constraint dates and/or any other scheduling techniques that may distort the Activity Float and Total Float associated with the critical Path Activities and the schedule in general.
- F. TOTAL FLOAT OWNERSHIP: Total Float belongs to the contract and shall not be considered as available for the exclusive use or benefit of either the County or the Contractor. Total Float is the number of days an activity may be delayed without extending the completion of either the project or an interim milestone. Float is available on a first-come, first-served basis to all identified "Responsible" parties in the schedule.
- G. FLOAT MANIPULATION NOT PERMITTED: The Schedule shall not sequester float through such strategies as calendar manipulation, resource/labor manipulation or the extension of activity durations to fill up available float time. The Initial Baseline CPM Construction Schedule shall not attribute negative float to any activity.
- H. CHANGES TO THE SCHEDULE: The Initial Baseline CPM Construction Schedule shall accurately reflect the manner in which the Contractor intends to proceed with the project. Changes to the schedule (the addition or deletion of activities, logic changes, and duration changes) shall be submitted in writing to the Engineer for approval and inclusion in the next Monthly Progress Update. The process of comparing the Schedule Update to Baseline shall be followed throughout the contract. Revision to any contract milestones, or contractually mandated schedule provisions will not be permitted without written authorization from the Engineer.

- I. **CRITICAL ACTIVITIES AND BASIS FOR TIME ADJUSTMENTS:** The measure for Time Adjustments in the schedule shall be based on the criticality, and responsibility of the delay or advancement. Criticality is defined as the presence of the delayed or advanced activity on the projects Critical Path. The Critical Path is defined to be the longest continuous chain of activities through the schedule network that establishes the minimum overall duration in the absence of constraints in the program software. Time adjustment does not mean an extension of time for this contract.
- J. **CHANGES TO THE CONTRACT:** In the event a notice of a change to the contract is received the Contractor shall notify the Engineer in writing within 10 (ten) calendar days of the effect of such change to the schedule. Change to the contract includes, but is not limited to, extra work, change orders, work suspensions, changed condition, Value Engineering Change Proposal, etc. The effect of the change to the contract on the projects Critical Path shall be stated. Any proposed revisions to the Schedule to incorporate the change to the contract shall be stated. No changes shall be made to the Schedule without prior written approval of the Engineer. The approved changes shall be incorporated in the next Monthly Progress Update.

1.03 – TIME IMPACT ANALYSIS

- A. This analysis will be performed by the Engineer (CM's scheduler) based on schedule updates as accepted in monthly schedule meetings.
- B. Events, actions, and progress that cause delays or gains to the Project Schedule will be analyzed solely by the "Contemporaneous Period Analysis" method. The Contemporaneous Period Analysis evaluates delays or gains in the period in which it occurred. The analysis period for the purpose of this Specification shall be the period covered in each Monthly update to the schedule.
- C. Impact of delay will be evaluated at the completion of the project. However an interim extension of time for payment purposes only may be granted by the Commissioner at his or her sole discretion at the end of contractual completion date.

1.04 – RECOVERY SCHEDULES

- A. General Provisions for Recovery Schedules:
 - 1. When updated Progress Schedule indicates and the Engineer determines that the ability to comply with the Contract Times falls behind schedule due to delay attributed to the CONTRACTOR, the Contractor shall prepare and submit a Progress Schedule demonstrating responsible Contractor's plan to accelerate related work to achieve compliance with the Contract Times ("recovery schedule") for Engineer's acceptance.
 - 2. Submit recovery schedule within 10 work days after submittal of updated Progress Schedule where need for recovery schedule is indicated or include in next update as directed by the Engineer.

B. Implementation of Recovery Schedule:

1. At no additional cost to OWNER, do one or more of the following: furnish additional labor, provide additional construction equipment, provide suitable materials, employ additional work shifts, expedite procurement of materials and equipment to be incorporated into the Work, and other measures necessary to complete the Work within the Contract Times.
2. Item 1 above is also applicable when prime Contractor is required to accelerate their Work to recover lost time
3. Upon acceptance of recovery schedule by Engineer, incorporate recovery schedule into the next Progress Schedule update.

C. Lack of Action:

1. The Contractor's refusal, failure, or neglect to take appropriate recovery action, or General Contractor's refusal to submit a recovery schedule and take appropriate recovery action, shall constitute reasonable evidence that CONTRACTOR is not prosecuting the Work or separable part thereof with the diligence that will ensure completion within the Contract Times. Such lack of action shall constitute sufficient basis for OWNER to exercise remedies available to OWNER under the Contract Documents.

1.05 – METHOD OF MEASUREMENTS

- A. The CPM (Critical Path Method) Progress Schedule will be measured for payment on a Lump Sum Basis.

1.06 – BASIS OF PAYMENT

- A. The lump sum price bid for the Critical Path Method Scheduling system shall include the cost of preparation and submission of the Initial Baseline Schedule and the preparation and submission of the monthly updates.
- B. Payment will be made as follows:
 1. Upon submission of the Initial Baseline CPM Construction Schedule 20%
 2. Upon acceptance of the Baseline CPM Construction Schedule 20%
 3. The balance will be paid in equal monthly payments distributed over the contract. These payments will be contingent on the submission of acceptable monthly updates. 60%
- C. No additional payment over and above the lump sum price bid will be made for addition or deletion of work, delays, or any other reason whatsoever.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL

1.01 - GENERAL

- A. Submittal of Samples shall conform to the requirements of the General Conditions, Article GC 15, "Samples" and to procedures described in this Section.
- B. Samples and Shop Drawings which are related to the same unit of Work or Specification Section shall be submitted at the same time. If related, Shop Drawings and Samples are submitted at different times, they cannot be reviewed until both are furnished to the Engineer.

1.02 - PROCEDURE

- A. Submission of Samples shall conform to all applicable provisions under Shop Drawing Submittal and Correspondence Procedure.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope**

1. This section describes the minimum health, safety, and emergency response requirements for the activities at the site. Site activities may involve worker exposure to potentially hazardous materials.

B. Contractor shall implement health and safety criteria and practices sufficient to protect onsite personnel, the public, and the environment from physical and chemical hazards particular to each site.**C. The Contractor shall furnish all labor, materials, equipment and incidentals to remediate any hazardous materials discovered during the performance of the work in this Contract.****D. References: Where conflicts arise between requirements of the regulatory requirements listed below, the most restrictive of the requirements shall be followed.**

1. 29 CFR 1910 OSHA Standards; General Industry
2. 29 CFR 1910.120 OSHA Standards; Hazardous Waste Operations and Emergency Response
3. 29 CFR 1926 OSHA Standards; Construction Industry
4. DOT Standards and Regulations 49 CFR 171 Hazardous Materials Regulations; General Information, Regulations, and Definitions
5. DOT Standards and Regulations 49 CFR 172 Hazardous Materials Tables and Military Standards
6. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, ACGIH
7. Guide to Occupational Exposure Values, ACGIH

E. Related Specifications

1. Section 01356, Safe and Healthful Working Conditions.

1.02 – REMEDIAL ACTION FOR UNFORESEEN HAZARDOUS MATERIAL

- A. When remedial action is necessary for unforeseen hazardous materials, the Engineer will submit the scope of work in writing to the Contractor. The Contractor shall then obtain proposals for the work, including prices, from three separate County approved certified hazardous material remediation specialists, and submit them in writing to the Engineer within ten (10) consecutive calendar days of receiving the scope of work. The Engineer may select one proposal and direct the Contractor to engage the selected remediation specialist as a Subcontractor. Remediation work shall not commence until the Contractor receives written notice from the Engineer to proceed with the work. All remediation work shall be performed by the certified remediation specialist.
- B. Some of the remediation work may be critical to maintaining construction schedules. When this occurs, a time of completion shall be indicated in the scope of work submitted to the Contractor by the Engineer, and the work shall be subject to liquidated damages as set forth in the Agreement, Article XIV, "Liquidated Damages."
- C. Disposal of wastes generated by remediation work will be based on the results of the testing performed by the Contractor. Disposal of remediated hazardous material must be at a site approved by the County and applicable state agency to accept such waste. The Contractor shall notify the Engineer at least fourteen (14) days prior to removal of the containers of hazardous material to allow for inspection of the containers and the hazardous waste manifest.
- D. The Contractor shall submit written evidence that the receiving waste treatment, storage, or disposal facility to receive such waste by the EPA, DEC and State or local regulatory agencies. The Contractor shall also submit copies of the complete manifest, signed and dated by the initial transporter, in accordance with Federal and State requirements. Completed and signed manifests from treatment or disposal facility shall be provided to the County within seven (7) days of disposal.

PART 2 - PRODUCTS**2.01 – HEALTH AND SAFETY PLAN**

- A. The Contractor shall have a Health and Safety Plan (HASP) prepared, prior to the start of any construction. The HASP shall be available to workers on site and be submitted to the Engineer and County at least two weeks before the beginning of any field work. Copies of the plan shall be provided to the Contractors' insurers and their risk managers, if any, by the Contractor.
 - 1. The Contractor will abide by the work specific Health and Safety requirements as directed by the County.

2. The provisions of the site HASP in no way relieves the Contractor of his primary obligation to provide for the safety of his employees and to ensure that all operations under this Contract are carried out so as to protect persons and property on the site and in the surrounding work area.
- B. These minimum health and safety requirements are based on the potential for physical, biological, and chemical hazards associated with the work activities, including the potential exposure to hazardous materials that may be present. The HASP shall be prepared by a Certified Industrial Hygienist (CIH) who is qualified by training and experienced to perform this work. The HASP shall be submitted to the Engineer and County for review. The purpose of the HASP is to establish site-specific health and safety requirements for protecting the health and safety of the Contractor and subcontractor personnel and visitors during all activities conducted on-site.
1. Construction activities which need to be addressed in the HASP include, but are not limited to:
 - a. Soil excavation and grading.
 - b. Demolition.
 - c. Equipment installation.
 2. The HASP shall include as a minimum the following items tabulated in Paragraph 2.1.E through Paragraph 2.1.S, below.
- C. The Contractor shall identify an individual who shall serve as the Site Safety Officer for this project. The individual shall:
1. Have a working knowledge of pertinent federal, state, and local health and safety regulations, program development and implementation, and air monitoring techniques.
 2. Be knowledgeable in tank cleaning procedures and protocols required by this project.
 3. Be certified as having completed training in first aid and CPR by a recognized, approved organization, such as the American Red Cross.
 4. Be continuously onsite during all operations covered by this Contract.
 5. Be familiar with the Site Health and Safety Plan and its requirements and be responsible for the Plan's implementation.

6. The Site Safety Officer may designate an alternate to assist him, provided his alternate meets all of the above requirements. The Contractor shall submit the name, qualifications (education summary and documentation), and work experience of the Site Safety Officer, and any alternates to the Engineer prior to commencement of work at the site.
- D. Personnel Qualifications (CIH): The Contractor shall identify an individual who shall serve as the CIH for this project. This individual shall:
1. Have a minimum of three (3) years experience in tank removal or hazardous waste field.
 2. Be familiar with all applicable OSHA, USEPA, and NYSDEC standards.
- E. Standards and Regulations: The HASP shall be developed in accordance with the Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29, Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 1926) and all pertinent laws, rules, and regulations existing at the time of the work, including, but not limited to:
1. Hazardous Waste Management System, Title 40 CFR 261-264.
 2. OSHA Standards, Hazardous Waste Operations and Emergency Response, Title 29 CFR 1910.120.
 3. OSHA Standards, Asbestos Regulations, Title 29 1910.1001.
 4. OSHA Standards, Subpart Z, Toxic and Hazardous Substance, Title 29 CFR 1926.58.
 5. OSHA Standards, Title X, Lead in Construction, 1926.62.
 6. EPA National Emission Standard for Hazardous Air Pollutants, National Emission Standard for Asbestos, Title 40 CFR, Part 51, Subpart M.
 7. OSHA Standards, Hazard Communication, Title 29 CFR 1926.59.
 8. OSHA Standards, Access to Employee Exposure and Medical Records, Title 29 CFR 1910.20.
 9. OSHA Standards, Personal Protective Equipment, Title 29 CFR 1910.133.
 10. OSHA Standards, Record Keeping, Title 29 CFR 1910.20.
 11. OSHA Standards, Respiratory Protection, Title 29 CFR 1910.134.

12. The American National Standard Institute (ANSI) Practices for Respiratory Protection, ANSI Z38.2.
13. OSHA Standards, Ventilation, Title 29 CFR 1910.94.
14. ANSI Fundamentals Governing the Design and Operation of Local Exhaust System, ANSI Z9 2.
15. Hazardous Waste Management System, Title 6 NYCRR Parts 370-373.
16. Asbestos Safety Program Requirements, NYCRR Chapter 11, Title 10, Part 73.
17. Industrial Code Rule 56, NYCRR Title 12, Part 56.
18. Transportation Act, Title 49 CFR Parts 106, 107, 171-179.
19. New York State Solid Waste Hauling and Disposal Regulations, NYCRR Title 6, Parts 360 and 364.

F. Identification of Key Health and Safety Personnel and Alternates:

1. List key personnel and alternates for site health and safety on a project responsibility chart, which includes phone numbers.
2. Identify roles and responsibilities of key personnel.

G. Project Task/Operation Health and Safety Risk Analysis:

1. Identify and describe the project tasks.
2. Provide a hazard assessment of each project task, which shall include descriptions of potential chemical, biological, and physical hazards associated with the performance of the activity.
3. Provide a description of health and safety mitigative actions for each project task which shall include, but not be limited to, administrative control, engineering control, safe work practice controls and personal protective equipment.

H. Personnel Training Requirements:

1. Confirm that personnel are adequately trained to conduct their job responsibilities and handle the specific hazardous situations they may encounter during the project.

2. Provide, as required, certification of personnel training and First Aid/Cardio-Pulmonary Resuscitation (CPR).
3. Establish procedures and training for Hazard Communication Program in accordance with 29 CFR 1910.1200.
4. Provide information regarding training and experience of the person who will oversee excavation activities.

I. Personnel Protective Equipment (PPE) and PPE Reassessment Program:

1. Describe the protective clothing and equipment to be worn by personnel during task-specific operations of the project.
2. Describe the PPE reassessment program for the upgrading/downgrading of PPE levels associated with the task-specific operations of the project.
3. Provide a written respiratory protection program and reassessment program, which shall be implemented during task-specific operations. The written program must include the procedure for proper selection and use of respirators, instructions on proper cleaning, storage, and inspection of respirators.

J. Medical Surveillance:

1. Describe the program for medical monitoring for each task-specific activity.
2. Confirm and provide documentation, as applicable, that all project personnel are currently under a medical surveillance program.
3. Provide documentation, as applicable, that all project personnel have respiratory clearance.

K. Site Control Measures:

1. Define site control methods and site communications and include a site map delineating the control areas, if appropriate.
2. Delineate the work area, including an exclusion zone (EZ), contamination reduction zone (CRZ) and the support zone, and describe the activities allowed in each zone.

L. Engineering Control Measures:

1. Identify methods to control the generation of airborne particulates and volatile organic vapors during excavation of potentially contaminated soils.
2. Identify engineering control of generation of lead-containing airborne particulates when impacting materials coated with lead paint.
3. Identify engineering controls (e.g., tent enclosure, wetting of surfaces) to control generation of dusts when conducting dust-generating activities indoors (e.g., demolition of concrete foundations).

M. Decontamination Program:

1. Establish decontamination procedures for personnel and equipment.
2. The decontamination plan shall include provisions for hand wash facilities, and lunch/break areas, and a description of proper housekeeping practices.

N. Air Monitoring Program:

1. Describe the area air monitoring program to be conducted during all intrusive site work, soil handling, and below-grade equipment installation, when works may be exposed to potentially contaminated soils. Minimum air monitoring requirements must include continuous real time measurements for volatile organic vapors, hydrogen sulfide, dust, and LEL (methane).
2. Describe the area air monitoring program to be conducted during equipment removal and demolition affecting materials coated with lead paint when airborne dusts may be generated.
3. The air monitoring programs shall identify the analytical methodology required for each task-specific activity to ensure regulatory compliance.

O. Emergency Response/Contingency Plan:

1. Describe instruction and procedures for evacuation of personnel.
2. Describe instructions and procedures for methods of reporting fires. If the Contractor will be conducting activities such as welding, hot cutting or burning, or working with flammable materials such as paints, glues, and solvents, the Contractor shall provide a minimum of two Class ABC fire extinguishers (minimum 10 pounds) in the work area. The Contractor shall obtain a "Hot Works Permit" from the agency having authority and submit copies to the Engineer.

3. Describe instructions and procedures for medical emergencies, including emergency notification and response procedures and a description of the route to the hospital.
4. The medical emergency contingency plan shall include provisions for a minimum of two first aid kits (minimum 24-unit industrial first aid kit).
5. Describe procedures addressing emergencies and equipment failures and barrier failures during work activities.

P. Surveillance Methods:

1. Describe safety surveillance methods.
2. Provide schedules of both walk-through surveys and in-depth safety audits to be performed on site.

Q. Safety Inspection Sheets:

1. Provide safety inspection check-off sheets to be used on a regular basis in evaluation the site work and methods.

R. Safety Evacuation Drill: A quarterly evacuation drill shall be held in coordination with the existing plan alarm signal under the control of the Plant Chief. Conducting the safety drill shall be coordinated during regular scheduled work hours, but timed to minimize disruption of major contract work. Upon evacuation, the Contractor shall immediately notify the Plant Chief and/or Resident Engineer that all personnel have evacuated.

S. Accident Prevention: An Accident Prevention Plan and description of work-phase safety plan shall be developed and written by a CIH. Each phase of the Accident Prevention Plan shall include a description of the work activity, probable hazards related to the work, and positive precautionary measures to be taken to safeguard against and reduce or eliminate each particular hazard. In the event of an accident/injury, the Contractor shall immediately notify the Engineer. Within two working days of any reportable accident, the Contractor shall complete and submit to the Engineer an Accident Report.

T. The Unforeseen Hazardous Material Remediation allowance provided in Section 01020, Allowances is intended to cover only those extra costs incurred by the Contractor in meeting County directed health and safety or remedial action requirements. It is not intended to fund the Contractor for the hiring of his own consultants nor to fund the costs of the Contractor's meeting obligations under OSHA.

PART 3 - EXECUTION

3.01 – HAZARDOUS MATERIALS

- A. There may be materials present at the project site that may pose chemical hazards to site workers during construction activities.
- B. The Contractor shall be responsible for identifying suspect hazardous materials as they are encountered. Indication of the presence of hazardous materials, including odorous or stained soils and liquids, shall be immediately reported to the Engineer. If it is determined that the presence of hazardous material is not a threat to the health and safety of County to Contractor personnel, the Contractor shall continue planned work activities. Otherwise, the Contractor will be directed to take additional health and safety precautions as appropriate.
- C. All non-disposable equipment that has been in contact with contaminated soils, lead-containing debris, or other hazardous materials, shall be cleaned prior to leaving the site. Equipment decontamination shall be performed in an area to be directed by the Engineer. The Contractor shall be responsible for containing all procedures within the perimeter of the designated decontamination area.
 - 1. The solid materials and rinse water collected as the result of the decontamination procedures shall be stored in appropriate containers on-site prior to disposal. Disposal of the wastes will be based on the results for testing performed by the Contractor, and will be classified as non-hazardous or hazardous waste.
 - 2. Rinse water that does not meet the criteria for discharge to a POTW, shall be disposed of at an appropriate treatment and/or disposal facility.
 - 3. Payment for disposal of the unforeseen decontamination wastes shall be made from the Hazardous Materials Remediation Allowance item as described in Section 01020, Allowances.

3.02 – MEDICAL SURVEILLANCE

- A. Physical examinations for personnel working onsite shall be provided prior to project start-up. The examinations shall address the chemical and physical hazards to which the employees will be exposed. The medical examination results shall be evaluated by a physician practicing occupational medicine to determine that the individual is medically qualified to wear a respirator and is physically fit for the work to be performed. The physician must certify that no physical condition or disease could be aggravated by exposure to the identified hazards. The results of the medical surveillance program shall be provided to the Engineer upon request.

3.03 – PERSONNEL TRAINING

- A. Personnel employed to sample tank residuals, perform hazardous materials remediation, and supervisors shall be trained and thoroughly familiar with the safety precautions, procedures, and equipment required for controlling the potential hazards associated with this project. This training shall be documented in detail and recorded in the project's records.

3.04 – FIRST AID AND EMERGENCY RESPONSE EQUIPMENT AND PROCEDURES

- A. The Contractor shall provide for appropriate emergency first aid equipment (including ANSI-approved eye wash stations, a portable stretcher, and an industrial-type first aid kit) suitable for treatment of exposure to site physical and chemical hazards. Additionally, two ABC-rated fire extinguishers shall be maintained on site as well absorbent material of sufficient quantity to as collect any spill which might occur during this project. A listing of emergency phone numbers and of contact for fire, hospital, police, ambulance, and other necessary contacts shall be points posted the Contractor's site. A route map detailing the directions to the nearest hospital also shall be posted.

3.05 – HEAT AND COLD STRESS

- A. The Contractor shall monitor all personnel for signs of heat or cold stress, as dictated by weather conditions. In addition, all field personnel shall be instructed to observe for symptoms of heat or cold stress in themselves and fellow workers and methods to control them. The Contractor shall adhere to guidelines provided in the Threshold Limit Values and Biological Exposure Indices published by the ACGIH for heat and cold extremes.

3.06 – ILLUMINATION

- A. Work areas shall be illuminated to a minimum of 10 foot-candles. Lighting shall be sufficient to determine whether material spills have occurred.

3.07 – ELECTRICAL SAFETY

- A. All electrical services must be grounded and equipped with and use ground fault circuit interrupter (GFCI) protected outlets. Portable lights used shall be suitable for hazardous locations and shall be connected to extension cords equipped with connectors or switches approved for hazardous locations. Such equipment, when used, shall be inspected to ensure it will not be a source of ignition. All air monitoring instrumentation shall be rated as intrinsically safe for Class I, Division I, Group D atmospheres.

3.08 – SITE CONTROL AND WORK ZONES

- A. Personnel not directly involved with this project shall not be permitted to enter the work zone. For purposes of this Contract, the "Work zone" and Contractor's staging areas shall be the areas as shown on the drawings. The initial minimum level of PPE shall be in accordance with these Specifications. The boundary of the work zone shall be demarcated and posted clearly by the Contractor.

3.09 – COMBUSTIBLE GAS/OXYGEN MONITORING

- A. All tanks shall be monitored for the presence of combustible vapors prior to the start of project operations. Such monitoring shall be conducted both in the tanks and in the areas surrounding the tanks, especially in excavations.
- B. If combustible gas monitoring shows that explosive levels within the tanks are less than 10% Lower Explosive Limit (LEL), those tanks may be removed and purged on the surface. However, if readings are at or above 10% LEL, the tank shall be monitored and purged in the ground, as outlined elsewhere in these Specifications.
- C. Purging shall continue until monitoring shows readings below 10% LEL. Any reading above 10% LEL outside the tanks shall result in the suspension of operations until the situation is resolved and retesting indicates the space is "safe" (explosive levels less than 10% LEL).
- D. Also, oxygen levels shall be monitored in trenches and excavations prior to allowing workers to enter, and continuously during the time the workers are present in these spaces. Any reading less than 19.5% or greater than 23% oxygen shall prevent the workers from entering until the situation is resolved and retesting indicates the space is safe for entry.
- E. Resolution of these hazardous situations may require forced ventilation of the space. Any combustible gas/oxygen monitor, provided it complies with these Specifications, may be selected.
- F. The combustible gas indicator shall be calibrated, checked, and maintained daily as per manufacturer's directions.

3.10 – AIR MONITORING AND SURVEILLANCE

- A. When personnel are working on or near tanks or within trenches/excavations, the Contractor shall implement routine air surveillance and monitoring for LEL and oxygen levels. Air monitoring and surveillance shall be required whenever personnel enter a trench/excavation, every 15 minutes during tank decontamination, or whenever site conditions indicate that fuel vapors are present. Air

monitoring, when conducted, shall be performed in the breathing zone of the personnel. Air monitoring and surveillance equipment shall be described in the Health and Safety Plan.

3.11 – ACTION LEVELS

- A. Based upon published results of air monitoring and surveillance for combustible gas/oxygen monitoring for similar projects, the following action levels are recommended.
 - 1. Combustible Gas Monitoring
 - a. 0 to 10% LEL: Normal operations, continue monitoring
 - b. Greater than 10% LEL: Shut down operations and equipment; ventilate area
 - 2. Oxygen Monitoring
 - a. 19.5% to 23% Oxygen: Normal operations, continue monitoring
 - b. Less than 19.5% oxygen: Shut down operations and ventilate area
 - c. Greater than 23% oxygen: Shutdown operations and ventilate area

3.12 – EXCAVATION SAFETY

- A. All demolition and excavating work shall be conducted in strict conformance with, at a minimum, 29 CFR 1926.650 through 29 CFR 1926.653, including requirements for sloping or shoring found in 29 CFR 1926.652. If the excavation must remain open during periods when the work site is unoccupied (i.e., overnight, over a weekend, and other similar off periods) barricades shall be placed around the excavation in such a manner to alert personnel to the danger and prevent them from falling into the trench (i.e. using road plates and barriers.)

3.13 – CONFINED SPACE ENTRY

- A. If any person is required to enter the tank or an excavation greater than 4 feet, it is considered a confined space entry. The medical surveillance shall ensure that the worker is capable of entering a confined space. Workers required to enter confined space shall have the specialized training required under CFR 1910. 146 (Vol. 58, No. 9, January 14, 1993).

3.14 – EATING, DRINKING, SMOKING

- A. No eating, drinking, smoking, chewing of tobacco or gum, or other hand-to-mouth activities shall be permitted in any of the work areas during the course of this project.

3.15 – IGNITION SOURCES

- A. Ignition sources (e.g., cigarette lighters, matches, or other flame producing items) not required for the completion of the project, shall not be permitted in the work zones. Before any work is done that might release vapors, work areas shall be barricaded and posted, and burning or other work shall be eliminated from the area where flammable vapors may be present or may travel. No work shall be done if the direction of the wind might carry vapors into areas where they might produce a hazardous condition, or when an electrical storm is threatening the site of work. Sparks caused by friction of electrostatic effects also may be a source of ignition in flammable atmospheres, especially at low humidity. Proper grounding of metal objects and/or electrical equipment, together with the use of sparkless tools and localized adjustment of humidity, may reduce this hazard.

3.16 – BREAK AREA AND SUPPORT ACTIVITIES

- A. All eating, drinking, smoking, and break facilities, as well as the Contractor's equipment storage, parking, and office shall be located outside the work zones as determined by the Site Safety Officer and approved by the Engineer.

3.17 – SANITATION

- A. The Contractor shall ensure that all onsite personnel have ready access to soap and clean water for washing and toilet facilities.

3.18 - UNFORSEEN HAZARDS

- A. Should any unforeseen or site-specific safety-related threat, hazard, or condition become evident during the performance of work at this site, it shall be the Contractor's responsibility to bring such conditions to the attention of the Engineer both verbally and in writing as quickly as possible, for resolution. In the interim, the Contractor shall take prudent action to establish and maintain working conditions and to safeguard employees, the public, and the environment.

3.19 - TERMINATION

- A. Any disregard for the provisions of these Specifications shall be deemed just and sufficient cause for termination of the Contractor or any Subcontractor without compromise or prejudice to the rights of the Contractor.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - DESCRIPTION**

- A. This section describes the requirements for safe and healthful working conditions.

1.02 – RELATED SPECIFICATIONS

- A. Section 01355, Hazardous Materials Control

1.03 – PAYMENT

- A. No separate payment for the item "Safe and Healthful Working Conditions" will be made. The costs of same will be included in the Base Bid.

1.04 – DEFINITIONS

- A. Safety staff shall mean the safety professional and his safety representative(s) or the safety person.

1.05 – SPECIAL CONDITIONS

- A. In prosecuting the work of this Contract, the Contractor shall provide working conditions on each operation that shall be as safe and healthful as the nature of that operation permits. The various operations connected with the work shall be so conducted that they will not be unsafe or injurious to health; and the Contractor shall comply with all regulations and published recommendations of the New York State Department of Labor and all provisions, regulations and recommendations issued pursuant to the Federal Occupational Safety and Health Act of 1970 and the Construction Safety Act of 1969, as amended, and with laws, rules, and regulations of other authorities having jurisdiction, with regard to all matters relating to safe and healthful working conditions. Compliance with governmental requirements is mandated by law and considered only a minimum level of safety performance. All work shall also be performed in accordance with safe work practice.
- B. The Contractor shall be responsible for the safety of the Contractor's employees, the public and all other persons at or about the site of the work. The Contractor shall be solely responsible for the adequacy and safety of all construction methods, materials, equipment and the safe prosecution of the work
- C. The Contractor shall employ a properly qualified safety professional familiar with all work under this contract whose duties shall be to initiate, review and cause implementation of measures for the protection of health and prevention of accidents. The Contractor shall also employ full-time safety representative(s) whose sole duties shall be to work under the direct supervision of the safety professional, to implement the safety program for the work under this Contract.

- D. The safety staff shall be provided with an appropriate office on the job site to maintain and keep available safety records, up-to-date copies of all pertinent safety rules, regulations and governing legislation, material safety data sheets, and the site safety plan including information concerning foreseeable emergency conditions, location of emergency and telephone contacts for supportive actions.
- E. The Contractor shall stop work whenever a work procedure or a condition at a work site is deemed unsafe by the safety staff.
- F. The Contractor and subcontractors shall be required to issue Photo Identification badges for each employee required to be on site. Badge shop drawings and updated logs showing employee names and badge numbers shall be issued to the Engineer for approval.

1.06 – SUBMITTALS

- A. The Contractor shall submit a Health and Safety Plan (HASP) as described in Section 01355, Hazardous Materials Control.
- B. Within 30 days of receiving a Notice to Proceed, the Contractor shall submit the name of a safety professional, employed by the Contractor, responsible for project safety management, and of the safety representative(s) who will work under his direction.
- C. A resume, along with other qualifications, of the safety person or the safety professional and the safety representative(s), must be submitted to the Engineer for review and approval. The resume shall include such items as: experience, education, special safety courses completed, safety conferences attended and certification and registrations. Documentation and/or personal references confirming the qualifications may also be required. The persons proposed as safety person, safety professional or safety representative(s) may be rejected by the Engineer for failure to have adequate qualifications or other cause.

1.07 – QUALIFICATIONS

- A. Safety Professional: Recognition as a safety professional shall be based on a minimum of: Certification by the Board of Certified Safety Professionals as a Certified Safety Professional and five years of professional safety management experience in the types of construction and conditions expected to be encountered on the site.
- B. Safety Representative: Qualifications of the safety representative(s) shall include a minimum of: five years of relevant construction experience, three years of which were exclusively in construction safety management, successful completion of a 30 Hour OSHA Construction Safety and Health training course, 40 Hour OSHA Hazardous Materials training course, Confined Space training, and at least one year membership in the American Society of Safety Engineers.

- C. Safety Person: Qualifications of the safety person must include a minimum of five years of relevant construction experience, two of which are related to safety management.
- D. The safety staff shall be completely experienced with and knowledgeable of all applicable health and safety requirements of all governing laws, rules and regulations as well as of good safety practice. The safety staff shall not include the project manager, engineer, or superintendent, or anyone else working on the project. The safety staff shall have no other duties except those directly related to safety.

PART 2 - PRODUCTS

2.01 – HEALTH AND SAFETY PLAN

- A. The Contractor shall commit to writing a specific site health and safety plan before the start of any construction in accordance with Section 01355, Hazardous Materials Control.

2.02 – ACCIDENT REPORTS

- A. The Contractor shall promptly report to the Engineer all accidents involving injury to personnel or damage to equipment and structures, investigate these accidents and prepare required reports and submit a monthly summary of these accidents. The Contractor must submit a preliminary accident report to the Resident Engineer by the following day at the latest.
 - 1. The summary report, due by the 10th day of the following month, shall include descriptions of corrective actions to reduce the probability of similar accidents.
 - 2. In addition, the Contractor shall furnish to the Engineer a copy of all accident and health or safety hazard reports received from OSHA or any other government agency within one day of receipt.
- B. In addition to the reports which the Contractor is required to file under the provision of the Workmen's Compensation Law, he shall submit to the Engineer on or before the tenth day of each month a report giving the total force employed on his Contract in man-days during the previous calendar month, the number and character of all accidents resulting in loss of time or considered recordable by OSHA, and any other information on classification of employees, injuries received on the work, and disabilities arising therefrom that may be required by the Engineer.
 - 1. The submittal shall also contain an audit report for the prior month, including the safety training conducted, the above equipment logs, records of the condition of the work areas, safety and health records, OSHA and ANSI Z16.1 incidence rates for frequency and

severity of recordable accidents, and an evaluation of the effectiveness of the HASP with any changes necessary.

2. The safety professional (G) and the Contractor shall sign this audit report. The Engineer will review these reports for Contractor's compliance with the safety provisions of the Contract.

2.03 – SAFETY AND RESCUE EQUIPMENT

- A. The Contractor shall have proper safety and rescue equipment, adequately maintained and readily available, for any foreseeable contingency. This equipment shall include such applicable items as: proper fire extinguishers, first aid supplies, safety ropes and harnesses, stretchers, water safety devices, oxygen breathing apparatus, resuscitators, gas detectors, oxygen deficiency indicators, combustible gas detectors, etc.
- B. This equipment should be kept in protected areas and checked at scheduled intervals. A log shall be maintained indicating who checked the equipment, when it was checked, and that it was acceptable. This equipment log shall be updated monthly and be submitted with the monthly report. Equipment that requires calibration shall have copies of dated calibration certificates on site.
- C. Substitute safety and rescue equipment must be provided while primary equipment is being serviced or calibrated.

2.04 – PROTECTIVE EQUIPMENT

- A. All personnel employed by the Contractor or his subcontractors or any visitors whenever entering the job site shall be required to wear appropriate personal protection equipment required for that area. The Contractor shall continuously provide all necessary personal protective equipment as requested by the Engineer for his designated representatives.

2.05 – IDENTIFICATION BADGES

- A. The Contractor shall submit shop drawings of Identification Badge to the Engineer for approval.

2.06 – HOT WORK PERMIT

- A. All hot work shall be in accordance with NFPA 51B.
- B. The Contractor shall complete and submit the Nassau County Hot Work Permit included in this Section as Attachment 01356-A, located after the "End of Section" designation.

PART 3 – EXECUTION**3.01 – SAFETY STAFF DUTIES**

- A. The safety professional shall visit and audit all work areas as frequently as necessary (a minimum of once a week) and shall be available for consultation whenever necessary. The safety staff shall have full authority to implement and enforce the health and safety plan to take immediate action to correct unsafe, hazardous or unhealthful conditions.
- B. A member of the safety staff must be at the job site full time (a minimum of 8 hours per working day) whenever work is in progress. When multiple shift work is in progress more than one safety representative may be required.
- C. The safety staff shall as a minimum:
 - 1. Schedule and conduct safety meetings and safety training programs as required by law, the safety plan, and good safety practice. A specific schedule of dates of these meetings and an outline of materials to be covered shall be provided with the safety plan. The Engineer shall be advised in advance of the time and place of such meetings. County personnel shall be invited to attend the meetings. All employees shall be instructed on the recognition of hazards, observance of precautions, of the contents of the safety plan and the use of protective and emergency equipment.
 - 2. Determine that operators of specific equipment are qualified by training and/or experience before they are allowed to operate such equipment.
 - 3. Develop and implement emergency response procedures. Post the name, address and hours of the nearest medical doctor, name and address of nearby clinics and hospitals, and the telephone numbers of the appropriate ambulance service, fire, and the police department.
 - 4. Post all appropriate notices regarding safety and health regulations at locations, which afford maximum exposure to all personnel at the job site.
 - 5. Post appropriate instructions and warning signs in regard to all hazardous areas or conditions, which cannot be eliminated. Identification of these areas shall be based on experience, on site surveillance, and severity of hazard. Such signs shall not be used in place of appropriate workplace controls.
 - 6. Ascertain by personal inspection that all safety rules and regulations are enforced. Make inspections at least once a shift to ensure that all machines, tools and equipment are in a safe operating condition; and that all work areas are free of hazards. Take necessary and

timely corrective actions to eliminate all unsafe acts and/or conditions, and submit to the Engineer each day a copy of his findings on the inspection check list report forms established in the safety plan.

7. Submit to the Engineer, copies of all safety inspection reports and citations from regulating agencies and insurance companies within one working day of receipt of such reports.
8. Provide safety training and orientation to authorized visitors to ensure their safety while occupying the job site.
9. Perform all related tasks necessary to achieve the highest degree of safety that the nature of the work permits.

3.02 – VISITORS

- A. All non-County personnel visitors that visit and tour the site shall sign the Visitors Log at the Plant's Administration Building, and sign waivers as directed by the County. The Resident Engineer must be aware of all tours/visits in conjunction with the Safety Evacuation Plan Protocol notification. All efforts should be made not to schedule site tours/visits at the time of scheduled evacuation drills.

3.03 – ATTACHMENTS

- A. The attachments listed below, following the "End of Section" designation, are a part of this Specification section.
 1. Attachment 01356-A, Hot Work Permit.

+ + END OF SECTION + +

Nassau County Sewage Treatment Plant Hot Work Permit

Hot Work Permit Job Information

Contractor Name: _____ Location of Hot Work: _____

Permit Authorizing Individual: _____ Phone: _____

Permit Issued (Date) _____ (Time) _____ AM/PM

Permit Expires (Date) _____ (Time) _____ AM/PM

Type of hot work to be used (Source of ignition): ☐ Grinding ☐ Cutting ☐ Brazing or Soldering
☐ Welding/Burning ☐ Heating ☐ Other _____

PPE to be Used by Person Performing Hot Work: _____

Describe the Hot Work Job and Materials to be Worked on: _____

Any special hazards and/or special precautions to be taken: _____

Fire Watch Required? ☐ Yes ☐ No Number of Fire Watches Required: _____

Acknowledgement of Permit Review by Person Performing Work or Crew Supervisor

Acknowledgment: I participated in the work site preparation, coordinated with the PAI, reviewed this Hot Work Permit and I fully understand the work to be performed and my responsibilities. The person(s) performing the hot work understand that this permit is valid only so long as work conditions existing at the time of issuance do not change. They will stop the work and notify the PAI of any change in work area conditions which adversely affects safety. I or the person(s) performing the work are adequately trained in the safe handling and use of their equipment and applicable regulatory requirements.

Worker/Supervisor: _____ Signature: _____

Company: _____ Date: _____

Permit Authorizing Individual (PAI) Authorization

I completed the site inspection, notified the person performing the work or their crew supervisor about flammable materials or hazardous conditions which may not be obvious, and verified that the person performing (or directly supervising the crew performing) hot work has reviewed the permit and signed the acknowledgment above. (If no, hot work is not permitted)

Signature: _____ Date: _____

Notice: Post this permit in Hot Work Permit area until permitted operations are complete. Upon Completion return permit to the PAI.

Final Inspection (Fire Watch, or PAI if No Fire Watch Was Required)

I completed final inspection at the required times after completion of Hot Work and observed no signs of smoldering or combustion.

Signature: _____ Date: _____ Time: _____ (Day 1)

Day	PAI Signature	Date/Time	Acceptable		Final Insp./ Initials	Comments
			Yes	No		
2						
3						
4						
5						
6						
7						

- Permit Authorizing Individual (PAI) - The individual designated by management to [authorize hot work](#)
- [Conducts inspection](#) to verify that safeguards are in place based on site-specific conditions of flammable/ combustible materials, hazardous processes, or other potential fire hazards in the work location.
- [Ensure](#) fire protection and extinguishing equipment are available and properly located at the site.
- [Verify](#) a fire watch is at the site, if required.
- [Issues](#) a Hot Work Permit (HWP), when required.

Hot Work Required Precautions Checklist

- 1) Inspect work area and confirm that applicable precautions have been taken in accordance with NFPA 51B (by PAI After Coordination With & Setup By Person Performing Hot Work; initially and when revalidating):
- 2) All sprinkler and/or other fire suppression systems in the Hot Work Permit area operational.
- 3) Cutting/welding equipment in good repair, free of damage or defects.
- 4) Persons conducting hot work have been trained.
- 5) All facility employees or other parties that may be potentially affected by the hot work have been notified.

REQUIREMENTS WITHIN 35 FEET OF WORK (HORIZONTAL & VERTICAL)

- 1) Flammable liquids and combustible dust/lint/oil deposits/trash removed or shielded with fire-retardant material.
- 2) Flammable vapor sources removed or flammable vapor properly tested and found to be well below the LEL.
- 3) Combustible flooring properly wetted, wet sanded or shielded.
- 4) Combustible walls, ceilings, partitions or roofing properly shielded.
- 5) Covers under work to keep sparks from lower levels and shielding/partitions to protect passer-by.

WORK ON WALLS OR CEILINGS

- 1) Combustibles have been moved away from opposite side. (If no, hot work is not permitted)
- 2) No combustible covering, interior (for sandwich-type panel) or other combustible content.
- 3) Danger from conduction of heat to adjacent rooms eliminated.

WORK ON ENCLOSED EQUIPMENT (Tanks, Containers, Ducts, Dust Collectors, etc.)

- 1) All duct and conveyor systems properly protected or shut down.
- 2) Equipment is cleaned of all combustibles, flammable vapors, liquids, or dusts. (If a flammable vapor source - conduct vapor monitoring)

FIRE WATCH

- 1) Required for the following: (a) Torch work (b) Combustibles within 35' (c) Combustibles >35', but easily ignited, (d) Wall/floor openings expose adjacent/concealed combustibles, (e) Conduction through metal can ignite other side (f) Potential for more than a minor fire.
- 2) Charged, inspected, operational fire extinguishers of an appropriate type are present.
- 3) Fire Watch trained in extinguisher and emergency alarms (fire alarm, telephone, or radio).

OTHER PRECAUTIONS

- 1) Work in a confined space requires Confined Space Entry Permit prior to hot work permit approval.
- 2) Is continuous atmospheric monitoring, smoke detection or heat detection warranted?
- 3) Ample ventilation exists or provisions made for continuous ventilation to remove smoke/vapor from work area
- 4) Process equipment/piping purged, disconnected and blanked in accordance with Lockout/Tagout procedures.
- 5) Do conditions require Re-Validation more than every 24 hr?

PART 1 - GENERAL**1.01 – REQUIREMENTS INCLUDED**

- A. Submit a Schedule of Values allocated to the various portions of the work, within 21 days after the effective date of the Agreement.
- B. Upon request of the Engineer, support the values with data which will substantiate their correctness.
- C. The accepted Schedule of Values shall be used only as the basis for the Contractor's Applications for Payment.

1.02 – RELATED REQUIREMENTS

- A. General Conditions of the Construction Contract

1.03 – FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Contractor's standard forms and automated printout will be considered for approval by the Engineer upon Contractor's request. Identify schedule with:
 - 1. Title of Project and location.
 - 2. Engineer and Project number.
 - 3. Name and Address of Contractor.
 - 4. Contract designation.
 - 5. Date of submission.
- B. Schedule shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. Identify each line item with the number and title of the respective Section.
- D. For each major line item list sub-values of major products or operations under the item.
- E. For the various portions of the work:
 - 1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.

2. For items on which progress payments will be requested for County approved stored materials, break down the value into:
 - a. The cost of the materials, delivered and unloaded, with all taxes paid. Paid invoices are required for materials upon request by the Engineer.
 - b. The total installed value.

F. The sum of all values listed in the schedule shall equal the total Contract Sum.

1.04 – FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Submit a sub-schedule of unit costs and quantities for:
 1. Products on which progress payments will be requested for County approved stored products.
- B. The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
- C. The unit quantity for bulk materials shall include an allowance for normal waste.
- D. The unit values for the materials shall be broken down into:
 1. Cost of the material, delivered and unloaded at the site with all taxes paid.
 2. Copies of invoices for component material shall be included with the payment request in which the material first appears.
 3. Paid invoices shall be provided with the second payment request in which the material appears or no payment shall be allowed and/or may be deleted from the request.
- E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 – WORK INCLUDES**

- A. Work includes all labor, materials, equipment and incidentals required to mark out and protect all public or private utilities, including concrete encased piping, within or adjacent to the Contract area.
- B. The Contractor is specifically directed to become familiar with the existence of aerial, surface or subsurface structures of municipal and other public or private service corporations within the construction site.
- C. A careful search has been made, in good faith, and known public or private utilities within or adjacent to the Contract area are shown in their approximate locations on the Contract Plans. However, there is no guarantee that all existing utilities have been found. All utilities may not be shown on the Contract Drawings.
- D. The Contractor's attention is also directed to the fact that during the life of the plant, the County and operators of utilities may make changes in their facilities.
- E. The Contractor shall determine the exact locations and elevations of all pertinent structures, utilities and facilities before construction work and new installations commence.
- F. Conflict between existing structures, utilities and facilities and new work shall be ascertained by the Contractor and called to the attention of the Engineer.
- G. The Contractor shall cooperate with the County and public utility corporations whose structures (aerial, surface or subsurface) are within the limits of or along the outside of the construction areas to make it possible for them to maintain uninterrupted service.
- H. The Contractor shall conduct operations in such a way as to delay or interfere as little as practicable with the work of utility corporations.
- I. The Contractor shall give the County and public utility corporations involved reasonable notice, but not less than 48 hours in advance of operations, which may or will affect their structures.
- J. The Contractor shall protect, in a suitable manner, all utilities encountered, including concrete encased piping, and shall repair any damage to structures, utilities and facilities caused by operations.
 - 1. If the nature of the damage is such as to endanger the satisfactory functioning of the utilities and necessary repairs are not immediately made by the Contractor, the work may

be done by the respective owning companies and the cost thereof charged against the Contractor.

- K. The Contractor shall take these conditions into consideration in making up the bid.
- L. It is understood and agreed that the Contractor has considered in his bid all of the permanent and temporary utility appurtenances and that no additional compensation will be allowed for any delays, inconveniences or damage sustained by him due to any interference from the utility appurtenances.

1.02 – PUBLIC AND PRIVATE UTILITY MARKOUTS

- A. The Contractor shall be required to provide utility markouts for all private and public utilities. The limits for these markouts shall be the project limit shown on the Engineering Drawings. The Contractor shall submit the proposed utility subcontractor for approval.

1.03 – MEASUREMENT AND PAYMENT

- A. No separate payment for the items “Protection of Utilities” will be made. The costs of same shall be included in the Base Bid.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope of Work:**

1. The Contractor shall engage the services of an experienced photographer, approved by the County, to take color job photographs and video as detailed under these specifications.
2. The photographer will be required to take preliminary photographs of the site prior to the commencement of work as directed by the Engineer.
3. Subsequent photographs as determined by the Engineer shall be taken during the construction phase.
4. The photographer shall visit the site prior to the start of construction, then every other week as the work progresses, additional visits may be required.
5. The quantities of job photographs specified herein supersede the quantities specified in the General Conditions, Article GC-37, Photographs.

1.02 – MEASUREMENT AND PAYMENT

- A. No separate payment for the item "Job Photographs" will be made. The costs of same shall be included in the Base Bid.
- B. If less than 500 photographs are required, the Contractor shall credit the County fifteen dollars (\$15.00) for each photograph under 500 photographs; should more than 500 photographs be required, the Contractor will be paid fifteen dollars (\$20.00) for each photograph over 500 photographs.

PART 2 - PRODUCTS**2.01 - PHOTOGRAPHS**

- A. A photograph shall be defined as one exposure.
- B. A total of 500 photographs at the site shall be taken.
- C. The County shall reserve the right to reject any photograph that is not clear or definitive. Any photograph so rejected shall be subtracted from the total exposures before computations for payment or credit under this section.

- D. The prints, slides and negatives shall be suitably mounted and labeled in loose-leaf type binders, which have protective covers for the prints, slides and negatives.
- E. The prints shall have indelibly printed on their reverse side of the following:
1. Project Number
 2. Project Name
 3. Contract Number and Description
 4. Job Number
 5. Photo Number
 6. View and description indicating location of camera, general description of what photograph represents, and whether this is a preliminary or construction photograph. (A plot plan shall be submitted by the Contractor indicating location and photo number of all preliminary of all preliminary photographs.)
 7. Date picture was taken.
 8. Name of photographer.
- F. An electronic copy containing all photos taken at the site shall be supplied on CD and submitted to the Engineer for approval.

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope**

1. Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified and required to cooperate with the Coordinating Special Inspector and individual special inspectors employed by County, and to perform required testing and inspections. County shall engage the services of testing agencies as needed to facilitate Special Inspections.
2. Supplement A, Statement of Special Inspections, included with this Section, lists testing and inspection divisions. The Statement of Special Inspections has been prepared by the Structural Engineer of Record (SER) for the project.

1.02 - DEFINITIONS

- A. Special Inspector: Professional engineer or architect, hired by County, registered in the same state as the Site, responsible for coordinating and verifying the inspection and testing required by the Statement of Special Inspections included in this Section and reporting to the Building Official.
- B. Building Official: Officer or other designated authority having jurisdiction charged with the administration and enforcement of the governing code, or a duly authorized representative.
- C. SER: The Structural Engineer of Record (SER) is the Registered Design Professional in Responsible Charge of the structural system. The SER is responsible for preparing the Statement of Special Inspections (SSI) for the structural elements subject to inspection and testing.
- D. Special Inspections: Testing and inspection required in the Statement of Special Inspections, prepared by the SER.

1.03 – QUALITY ASSURANCE

- A. County will employ and pay for services of the Special Inspector, who will have a minimum of five years of experience in managing, monitoring, and inspecting building construction.
- B. Special Inspections shall be in accordance with applicable building code Laws and Regulations, and the Statement of Special Inspections, prepared by the SER.
- C. Inspectors shall be qualified in their assigned Special Inspection in accordance with the Statement of Special Inspections, prepared by the SER.

1.04 – SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Samples: Representative Samples of materials when required or requested by County / Special Inspector.
- B. Informational Submittals: Submit the following:
 - 1. Completed Supplement D, Fabricator's Certificate of Compliance, as attached to this Section, for fabrication of structural steel.
 - 2. Site Quality Control Submittals: Material test reports.
 - 3. Qualification Statements: Names and qualifications of each testing agency employed, and qualifications of testing agency's personnel that will perform testing as required in the Statement of Special Inspections, prepared by the SER.

1.05 – CONTRACTOR'S RESPONSIBILITIES

- A. Provide safe access to Work to be tested and inspected.
- B. Protect test samples left at designated area on Site.
- C. Facilitate inspections and tests.
- D. Provide access to Suppliers' and Subcontractors' operations as required.
- E. Notify testing agencies, Special Inspector, and County sufficiently in advance of the Work for the testing agencies, Special Inspector, and County to coordinate their personnel at the Site. Do not cover Work to be inspected until Special Inspections have been completed and accepted.
- F. Special Inspections required in this Section do not supersede or make unnecessary inspections and tests required under other Specification Sections or standard inspections required by Laws and Regulations.
- G. Provide the completed Statement of Special Inspections to the local Building Official when obtaining the Building Permit.

1.06 – SPECIAL INSPECTOR'S RESPONSIBILITIES

- A. Special Inspector will:

1. Review testing agencies and testing personnel, relative to conformance to the Statement of Special Inspections, and in accordance with Laws and Regulations.
2. Complete Supplement A, Statement of Special Inspections, of this Section to provide names of each inspector and testing agency for each Special Inspection required. Review completed Statement of Special Inspections, prepared by SER for general conformance with the current State Building Code.
3. Coordinate activities of individual inspectors and testing agencies with Contractor.
4. Provide interim reports of inspections and material testing to Building Official, County.
5. To obtain certificate of use and occupancy from the Building Official, complete and provide to the Building Official, County, Supplement B, Final Report of Special Inspections, of this Section, documenting completion of Special Inspections and correction of discrepancies noted in the Special Inspections.

1.07 – INSPECTOR RESPONSIBILITIES

- A. Perform specified inspections, sampling, and testing of materials and methods of construction; review and ascertain compliance with Laws and Regulations.
- B. Promptly notify Special Inspector, County, and Contractor of irregularities or deficiencies in the Work observed during Special Inspections. Corrective action, if required, will be determined by County.
- C. Promptly submit two copies each of reports of inspections and tests to Special Inspector, County, and Contractor including:
 1. Date issued.
 2. Project title and number.
 3. Name and signature of inspector.
 4. Date of inspection or sampling and test.
 5. Record of temperature and weather.
 6. Identification of product and Specification Section.
 7. Location in Project.

8. Type of inspection or test.
9. Location of inspection or test within project.
10. Results of inspections and tests, and observations regarding compliance with Laws and Regulations, and standards.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION**3.01 – SUPPLEMENTS**

- A. The supplements listed below, following the "End of Section" designation, are part of this Section:
 1. Supplement A – Statement of Special Inspections
 2. Supplement B – Final Report of Special Inspections
 3. Supplement C – (Not Used)
 4. Supplement D – Fabricator's Certificate of Compliance

+ + END OF SECTION + +

Page 492 of 1543

Schedule of Inspection and Testing Agencies

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- | | |
|--|--|
| <input type="checkbox"/> Soils and Foundations | <input type="checkbox"/> Spray Fire Resistant Material |
| <input type="checkbox"/> Cast-in-Place Concrete | <input type="checkbox"/> Wood Construction |
| <input type="checkbox"/> Precast Concrete | <input type="checkbox"/> Exterior Insulation and Finish System |
| <input type="checkbox"/> Masonry | <input type="checkbox"/> Mechanical & Electrical Systems |
| <input type="checkbox"/> Structural Steel | <input type="checkbox"/> Architectural Systems |
| <input type="checkbox"/> Cold-Formed Steel Framing | <input type="checkbox"/> Special Cases |

Special Inspection Agencies	Firm	Address, Telephone, e-mail
1. Special Inspector		
2. Inspector		
3. Inspector		
4. Testing Agency		
5. Testing Agency		
6. Other		

Note: The inspectors and testing agencies shall be engaged by Owner or Owner's Agent, and not by Contractor or Subcontractor whose Work is to be inspected or tested. Conflicts of interest must be disclosed to the Building Official prior to commencing Work.

Qualifications of Inspectors and Testing Technicians

The qualifications of all personnel performing Special Inspections are subject to the approval of the Building Official. The credentials of all inspectors and testing technicians shall be provided if requested.

Key for Minimum Qualifications of Inspection Agents:

When Engineer deems it appropriate that the individual performing a stipulated test or inspection have a specific certification or license as indicated below, such designation shall appear below the *Agency Number* on the Schedule.

PE/SE	Structural Engineer – a licensed SE or PE specializing in the design of building structures
PE/GE	Geotechnical Engineer – a licensed PE specializing in soil mechanics and foundations
EIT	Engineer-In-Training – a graduate engineer who has passed the Fundamentals of Engineering examination

American Concrete Institute (ACI) Certification

ACI-CFTT	Concrete Field Testing Technician – Grade 1
ACI-CCI	Concrete Construction Inspector
ACI-LTT	Laboratory Testing Technician – Grade 1&2
ACI-STT	Strength Testing Technician

American Welding Society (AWS) Certification

AWS-CWI	Certified Welding Inspector
AWS/AISC-SSI	Certified Structural Steel Inspector

American Society of Non-Destructive Testing (ASNT) Certification

ASNT	Non-Destructive Testing Technician – Level II or III.
------	---

International Code Council (ICC) Certification

ICC-SMSI	Structural Masonry Special Inspector
ICC-SWSI	Structural Steel and Welding Special Inspector
ICC-SFSI	Spray-Applied Fireproofing Special Inspector
ICC-PCSI	Prestressed Concrete Special Inspector
ICC-RCSI	Reinforced Concrete Special Inspector

National Institute for Certification in Engineering Technologies (NICET)

NICET-CT	Concrete Technician – Levels I, II, III & IV
NICET-ST	Soils Technician - Levels I, II, III & IV
NICET-GET	Geotechnical Engineering Technician - Levels I, II, III & IV

Exterior Design Institute (EDI) Certification

EDI-EIFS	EIFS Third Party Inspector
----------	----------------------------

Other

Soils and Foundations

Page of

Item	Agency # (Qualif.)	Scope
1. Shallow Foundations		
2. Controlled Structural Fill		
3. Deep Foundations (Auger Cast Piles)		
4. Load Testing		
4. Other:		

Item	Agency # (Qualif.)	Scope
1. Mix Design		
2. Material Certification		
3. Reinforcement Installation		
4. Post-Tensioning Operations		
5. Welding of Reinforcing		
6. Anchor Rods		
7. Concrete Placement		
8. Sampling and Testing of Concrete		
9. Curing and Protection		
10. Other:		

Item	Agency # (Qualif.)	Scope
1. Plant Certification / Quality Control Procedures <input type="checkbox"/> Fabricator Exempt		
2. Mix Design		
3. Material Certification		
4. Reinforcement Installation		
5. Prestress Operations		
6. Connections / Embedded Items		
7. Formwork Geometry		
8. Concrete Placement		
9. Sampling and Testing of Concrete		
10. Curing and Protection		
11. Erected Precast Elements		
12. Other:		

MasonryRequired Inspection Level: ☐ 1

Item	Agency # (Qualif.)	Scope
1. Material Certification		
2. Mixing of Mortar and Grout		
3. Installation of Masonry		
4. Mortar Joints		
5. Reinforcement Installation		
6. Prestressed Masonry		
7. Grouting Operations		
7. Weather Protection		
9. Evaluation of Masonry Strength		
10. Anchors and Ties		
11. Other:		

Item	Agency # (Qualif.)	Scope
1. Fabricator Certification/ Quality Control Procedures <input type="checkbox"/> Fabricator Exempt		
2. Material Certification		
3. Open Web Steel Joists		
4. Bolting		
5. Welding		
6. Shear Connectors		
7. Structural Details		
8. Metal Deck		
9. Other:		

Item	Agency # (Qualif.)	Scope
1. Member Sizes		
2. Material Thickness		
3. Material Properties		
4. Mechanical Connections		
5. Welding		
6. Framing Details		
7. Trusses		
8. Permanent Truss Bracing		
9. Other:		

Item	Agency # (Qualif.)	Scope
1. Smoke Control		
2. Mechanical, HVAC & Piping		
3. Electrical System		
4. Other:		

Item	Agency # (Qualif.)	Scope
1. Wall Panels & Veneers		
2. Suspended Ceilings		
3. Access Floors		
4. Other:		

Item	Agency # (Qualif.)	Scope

Supplement B - Final Report of Special Inspections

Project:

Location:

Owner:

Owner's Address:

Architect of Record:

Structural Engineer of Record:

To the best of my information, knowledge and belief, the Special Inspections required for this project, and itemized in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

(Attach continuation sheets if required to complete the description of corrections.)

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report.

Respectfully submitted,
Special Inspector

(Type or print name)

Signature

Date

Licensed Professional Seal

Agent's Final Report

Project:

Agent:

Special Inspector:

To the best of my information, knowledge and belief, the Special Inspections or testing required for this project, and designated for this Agent in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

(Attach continuation sheets if required to complete the description of corrections.)

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report.

Respectfully submitted,
Agent of the Special Inspector

(Type or print name)

Signature

Date

*Licensed Professional Seal or
Certification*

Supplement D - Fabricator's Certificate of Compliance

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2 of the International Building Code must submit a *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project:

Fabricator's Name:

Address:

Certification or Approval Agency:

Certification Number:

Date of Last Audit or Approval:

Description of structural members and assemblies that have been fabricated:

I hereby certify that items described above were fabricated in strict accordance with the Contract Documents.

Signature

Date

Title

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

++ NO TEXT ON THIS PAGE ++

PART 1 - GENERAL**1.01 - DESCRIPTION**

- A. Scope:
1. This section covers the Contractor's responsibilities with respect to spill prevention and control.
- B. References: Where conflicts arise between requirements of the above-listed regulatory requirements, the most restrictive of the requirements shall be followed.
1. USEPA Remedial Action at Waste Disposal sites EPA/625/6-B5/006
 2. 40 CFR Part 300 national Oil and Hazardous Substances Pollution Contingency Plan
 3. 40 CFR Protection of Environment
 4. ASTM E119 Fire Resistance Directory

1.02 - SUBMITTALS

- A. A Spill Prevention and Control Plan shall be provided to the Engineer.

1.03 – GENERAL REQUIREMENTS

- A. The Contractor shall prepare and implement a Spill Prevention and Control Plan and maintain appropriate containment and/or diversionary structures, materials and equipment to prevent and control the maximum spillage of any specific item within the Scope of Work. All materials and equipment used in connection with this project shall be included. The plan shall include inspection and test procedures performed to ensure compliance.
- B. Laws and Regulations: The Contractor shall not pollute any area with any manmade or natural harmful materials. It is the sole responsibility of the Contractor to investigate and comply with all applicable Federal, State, County and municipal laws and regulations concerning the Spill Prevention and Control Plan.
- C. A Project Telephone Directory shall be incorporated into the plan.
- D. Written Discussions: In addition to the minimal prevention standards listed, the Plan shall include a complete discussion of conformance with the following applicable guidelines, other effective spill prevention and containment procedures, or if more stringent, with the State rules, regulations and guidelines.

1. Facility Drainage
 2. Bulk Storage
 3. Facility Transfer operations, pumping, and conveying materials
 4. Truck loading/unloading rack
- E. Design and Specifications: The Contractor shall provide a Spill Prevention and Control Plan with the following designs and specifications:
1. Appropriate containment and/or diversionary structures or equipment to prevent discharge of materials to the environment
 2. Dikes sufficiently impervious to contain spill materials
 3. Curbing
 4. Culverts, gutters, or other drainage systems
 5. Weirs, booms, or other barriers
 6. Sorbent materials
 7. Curbing drip pans
 8. Sumps and collection systems
- F. Inspections and Records: Inspections required by this Scope of Work shall be in accordance with written procedures developed for the facility of the Contractor. These written procedures and a record of the inspections, signed by the appropriate supervisor or inspector, shall be part of the Spill Control and Prevention Plan, and shall be maintained during the project and submitted to the Engineer for final closeout.
- G. Facility Lighting: Facility lighting shall be commensurate with the type and location of the facility. Consideration shall be given to the following:
1. Discovery of spills, occurring during hours of darkness, both by operating personnel, if present, and by non-operating personnel (security personnel, the general public, local police, etc.)
 2. Prevention of spills occurring through acts of vandalism.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION**3.01 - GENERAL**

- A. If materials are released, the Contractor shall provide a written description of the event, corrective action taken, and plans for preventing a recurrence, as well as a written commitment of manpower, equipment, and materials required to expedite control and removal of any harmful quantity of materials released.
- B. The Contractor shall notify the New York State Department of Environmental Conservation, Nassau County Department of Health, Nassau County Department of Public Works, and the Engineer within two hours of the release or spill.

3.02 - TRAINING

- A. Personnel Training and Spill Prevention Procedures: The Contractor shall be responsible for properly instructing his personnel regarding applicable pollution control laws, rules, and regulations; and in the operation and maintenance of equipment to prevent the discharge of materials.
- B. Briefings: The Contractor shall schedule and conduct Spill Prevention Briefings for its operating personnel at intervals frequent enough to assure adequate understanding of the Spill Prevention and Control Plan for this project. Such briefings shall highlight and describe known spill events or failures, malfunctioning components, and recently developed precautionary measures.
- C. Evacuation Routes shall be marked on the project site.

3.03 - TESTING

- A. Facility communication or alarm systems and spill control equipment must be tested and maintained by the Contractor as necessary to assure proper operation in time of emergency.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - GENERAL**

- A. Temporary facilities and controls shall be provided in the manner designated hereinafter. These temporary facilities shall be provided at the Glen Cove WWTP for this project.
- B. Contractor shall coordinate and install all temporary facilities and controls in accordance with the requirements of the local authorities or utility companies having jurisdiction and in accordance with all state, federal and local codes and regulations.
- C. At the completion of the Work, or when the temporary facilities and controls are no longer required, subject to the approval of the County, the temporary facilities and controls shall be removed and the facilities restored to their original conditions by the Contractor.
- D. Costs in connection with the temporary electric, lighting, heating and ventilation, and other miscellaneous temporary facilities and controls including but not limited to, installation, maintenance, relocation and removal shall be borne by the Contractor.

1.02 - TEMPORARY WATER FACILITIES

- A. The Contractor shall make all arrangements with the County for connection and use of potable water from the station system to supply the work areas. The County will make the potable water available at no cost to General Construction Contractor.
- B. General Construction Contractor shall furnish and install a complete piping system for use of temporary water including a two-inch valve connection in the temporary water system and backflow prevention devices (i.e., double check valves) at all potable water connections to the County's system. The Contractor for other contracts or Subcontractors shall provide their own hoses, valves and containers as required to service their own work force.
- C. In the event that the Contractor requires more potable water than is available through the existing system, then that Contractor shall pay all costs for obtaining and providing the additional water from the local water company.
- D. The Contractor shall protect the temporary water pipe system from freezing by heat-tracing above ground piping and installing buried pipes at a minimum depth of four feet. The system shall be extended and relocated as necessary to meet construction procedures and temporary water requirements.
- E. Potable water for connection to construction trailers is available at the site. The Contractor shall extend and connect potable water supply to each Prime Contractor's field office and the

Engineer's trailer within the Staging Area. The Contractor is responsible for supplying bottled water to his field office.

1.03 – TEMPORARY SANITARY FACILITIES

- A. The Contractor shall provide and pay all costs for temporary toilet facilities in sufficient numbers, for the Contractor's and Subcontractors' personnel on this Project.
- B. Sanitary facilities shall be properly screened from public observation and shall be provided and maintained at suitable locations by the Contractor including Contractor's staging area, all as prescribed by state labor regulations and local ordinances. This system shall not be connected to the local sanitary sewer system and the contents of same shall be removed and disposed of in a satisfactory manner, as the occasion requires.
- C. The Contractor shall rigorously prohibit the nuisances within, on, or about the Work.
- D. County Sanitary Facilities and Locker rooms are prohibited from Contractors' and subcontractors' use.

1.04 – TEMPORARY ELECTRICAL FACILITIES

- A. The Contractor shall furnish and install a temporary electrical facilities system which shall consist of temporary electric service points, a temporary general lighting system, a security lighting system, a safety lighting system, and service to the Contractor's field offices.
- B. The Contractor shall submit a drawing showing the proposed temporary electrical facilities system layout for approval by the Engineer prior to installation.
 - 1. Work Included: Temporary work shall include the following:
 - a. Furnish and pay for all labor, material and equipment for the installation of the temporary electrical facilities system. The installation shall comply with all applicable requirements of the National Electric Code and any other codes or bodies having jurisdiction.
 - b. Furnish and pay for all labor material and equipment for the maintenance of the temporary electrical facilities system.
 - c. Furnish and pay for labor, materials and equipment for removing all temporary facilities.
- C. Requirements:

1. Temporary electrical facilities system shall be as herein specified and required for the contractor's use, and shall be provided no later than thirty days after the date of Notice to Proceed.

D. Temporary Electric Service Points:

1. The Contractor shall furnish, install and maintain a temporary power distribution point local to the work area.
2. At the temporary power distribution point, the Contractor shall furnish and install an overcurrent protection device. The overcurrent protection device shall be rated for 480 volts, three-phase, and shall be sized for Contractor's temporary electric requirements.
3. The Contractor shall utilize an existing temporary service point located at USS-3 for serving the temporary electrical requirements. The Contractor shall modify the identified temporary distribution point as required to provide temporary electric service for the Work shown and specified. The Contractor shall provide a temporary transformer, a 100 Amp circuit breaker and any other equipment necessary and required to provide the temporary electric system with the specified capacity. The Contractor shall provide separate distribution circuit breakers or fused switches for disconnection and overcurrent protection of the temporary electrical facilities fed from the service point which shall include the Contractor's field offices and the security lighting system for the Staging Area.
4. The Contractor shall furnish and install circuit breakers or fused switches, transformers, wiring and conduit as required for the temporary power distribution point.
5. Distribution circuit breakers or fused switches shall be furnished and installed at each location for disconnection and overcurrent protection of the temporary electrical facilities, including the temporary general lighting system, the security lighting system and the safety lighting system.
6. At the completion of the project, the Contractor shall remove the temporary electric service point facilities to the condition they were prior to construction.

E. Temporary General Lighting System:

1. The Contractor shall provide and maintain a temporary lighting system. The system shall conform to the applicable Federal and State codes, shall meet the illumination requirements specified herein, and shall meet the approval of the County.

2. Temporary general lighting system shall provide 120-volt receptacles and lighting for access to and egress from the work and for safe and expeditious construction within designated enclosed areas of the structure or structures.
3. Temporary general lighting system shall consist of wiring, switches, necessary insulated supports, poles, fixtures, receptacles, 100 watt lamps, guards, cutouts and fuses as specified shown or required.
4. The Contractor shall furnish lamps, fuses, receptacles and cords for the temporary general lighting system and shall replace broken and burned out lamps and blown fuses for the system.
5. Temporary general lighting system shall be installed progressively in the structure as the areas are enclosed or as lighting becomes necessary because of partial enclosure.
6. Required Illumination for Work Lighting:
 - a. General: Five foot-candles.
 - b. Stairs: Ten foot-candles.
 - c. Construction Plant and Shops: Ten foot-candles.
 - d. For Detail and Finishing Work: Twenty foot-candles.
 - e. For Testing and Inspection: Thirty foot-candles.
 - f. At First-aid Stations: Thirty foot-candles.
 - g. Areas of OWNER'S Operations: One 300-watt lamp at intervals of 15 feet on centers.
7. The Contractor shall maintain the temporary general lighting system in safe working order.
8. The Contractor shall arrange and install the lamps in a manner so as to provide an even distribution of illumination as necessary and required over the work areas.
9. If necessary and required, the Contractor shall install the receptacles in such a manner as to reach any point in the work areas with an extension cord not to exceed 40 feet in length.

10. In case of overloading of circuits, the County will restrict the use of tools as required for the correct loading.
11. The temporary general lighting system shall be used for small power purposes only.
12. Handtools, such as drills, hammers and grinders, may be connected to the temporary general lighting system provided that they are suitable for 120 volt, single phase, 60 hertz operation and do not have a power requirement exceeding 1,500 volt amperes. Only one unit may be connected to a single receptacle and shall not be connected to lighting outlets. Cords of tools shall not exceed 40 feet in length.
13. No Contractor will be permitted to proceed with any portion of his work which in the opinion of the Engineer, is not adequately illuminated. If any Work by any other Contractor requires special lighting other than what is provided, the Contractor shall arrange for same.
14. The Contractor shall keep the temporary general lighting system in service each working day, from Monday through Friday inclusive, by energizing the system at 7:00 A.M. and de energizing the system at 3:30 P.M.
15. Any Contractor requiring the use of a temporary general lighting system other than during the times set forth in the preceding paragraph from Monday through Friday, or at any time on Saturdays, Sundays or Holidays, shall pay the costs of energizing or de energizing the system and for keeping the system in operation.
16. Temporary general lighting system shall be removed in its entirety at the completion of the project.

F. Security Lighting System:

1. The Contractor shall furnish, install and maintain a security lighting system to illuminate the Staging Area and the construction site outside the building.
2. Security lighting system shall consist of floodlights equal to Crouse Hinds Cat. No. MVD 4HCW O PC DF AF VS AF 400 watt mercury vapor lamp, Cat. No. ML2590 photocell, Cat No. ML5547 vandal shield and Cat. No. 105 N11 bracket for wood pole mounting. Floodlights shall be mounted approximately 30 feet above the ground.
3. Each floodlight shall be complete with a constant wattage, high power factor ballast in a cast aluminum housing, a flat clear lens of heat and impact resistant glass, photo control, lamp and suitable mounting hardware.

4. Photometric performance shall be equal to that of the above specified unit with a beam spread of approximately 150 degrees horizontal to 80 degrees vertical and with a beam efficiency of not less than 55 percent.
5. Poles shall be 35 foot, class F wood and shall be securely set five feet in the ground.
6. Wiring for the security lighting system may be installed overhead. The security lighting system shall be properly maintained and energized at all times with each floodlight controlled by a photocell installed on the floodlight. The photocells shall be adjusted so that all floodlights are energized at approximately the same time. Broken and burned out lamps shall be replaced.
7. Security lighting system shall be installed and made operative within 30 days after the date of the Notice to Proceed.
8. Security lighting system shall be removed in its entirety at the completion of the project.

G. Safety Lighting:

1. The Contractor shall provide, install and maintain sufficient lighting fixtures to provide adequate light to ensure safe access to, egress from, and passage through the construction areas between the hours of 4:30 P.M. and 7:00 A.M. Monday through Friday and 24 hours per day for Saturdays, Sundays, and Holidays. The lighting system shall be operated by a time clock. Fixtures shall be 100 watt and shall be provided, as a minimum at every landing of every stairway and every 50 feet along passageways. The safety lighting system shall be installed progressively in structures as the designated areas are enclosed or as lighting becomes necessary because of partial enclosure. This lighting is not intended for construction purposes.

H. Contractors' Field Offices:

1. The Contractor shall extend the temporary electric service from the tie-in to the service point specified in Paragraph 1.3.D.3 to the Contractor's field office within the Staging Area.
2. The Contractor shall be responsible for providing his own telephone facilities as required.
3. Electric service for connection to construction trailers is available from the Plant. The Contractor shall coordinate with the Plants for the power source (motor control center in local building) and shall install the electrical service as required to each Field Office.

I. Additional Facilities:

1. Should any portion of any Contractor's work require light or power in addition to that supplied by the temporary general lighting system herein described, he shall furnish, install and maintain such additional temporary lighting and power facilities at his own expense. Additional temporary lighting shall be sufficient for safe access to and egress from such work, and for safe expeditious construction.
2. The installation of additional facilities shall comply with all applicable requirements of the National Electric Code and any other codes of enforcing bodies having jurisdiction, and shall be in-stalled so as not to interfere with the work of other Contractors.
3. Upon completion of the work under his contract, the Contractor responsible shall remove all additional facilities installed by him.

1.05 - MAINTENANCE OF ELECTRIC POWER TO EXISTING FACILITIES

- A. The Contractor shall be responsible for maintaining electric power to existing facilities at all times throughout the duration of the contract and as required to maintain continuous operation of equipment during the phased construction. Reference Section 01705, Detailed MOPO description for additional details.

1.06 – TEMPORARY HEATING FACILITIES

- A. Temporary construction heating shall be provided by the Contractor responsible for the Work involved for all cold weather protection of his own equipment, Work, and his employee's comfort at all times.
- B. The Contractor shall provide all temporary building heat for heating the interior of all structures and building areas, which is necessary for the protection of all Work and equipment of the Contract for the comfort of his employees or his Subcontractor's employees, after the building or structure is temporarily enclosed. Hot water or steam from the existing plant system will not be available for use as temporary heating. The following requirements shall apply:
1. All temporary heating methods proposed by Contractor shall be submitted to the County for approval and must comply with all federal, state and county rules and regulations.
 2. Temporary construction heat for "cold weather protection" shall be provided by Contractor responsible for the Work involved. "Cold weather protection" shall be considered to include both temporary heat and protective covers or enclosures required during the construction period prior to the enclosure of new buildings or buildings and structures being remodeled. "Cold weather protection" shall be provided until all

construction requirements under the Contracts are complied with, or until the enclosure of a new building or structure complies with the requirements for temporary building heating as hereinafter specified in Paragraph 1.4.E.

- C. The Contractor is to provide temporary heat for the temporary building heating system. The systems shall be gas or oil fired; steam, hot water or warm air type. Electric heating will not be permitted.
- D. No salamanders or other direct fired equipment will be allowed in areas of existing buildings, or in new construction areas where the use of such equipment will damage or deteriorate the construction or finishes or is harmful to employees working in the area.
- E. Temporary building heating systems shall be complete, including pumps, radiators, unit heaters, water and heating piping, insulation, controls, or any other equipment necessary, all furnished and installed by Contractor. Systems shall include boilers, fuel, and fuel storage facilities or any other equipment necessary, all furnished and installed and paid for by the Contractor, including fuel and electrical costs. All fuel oil tanks shall be provided with adequate secondary containment and the fuel oil systems shall comply with Nassau County Fire Prevention Ordinance-Article III. Special notice is given to the Contractor that the electrical service and cost relative to obtaining temporary heating beyond those provided under the temporary electrical facilities shall be the responsibility of the Contractor and provided for under temporary heating. This includes, but is not limited to, the cost of providing temporary light if it should be required.
- F. A building, structure or gallery shall be considered to be temporarily enclosed when the area is covered by a permanent structural slab or deck and all openings through the permanent slab or deck are covered to prevent the entrance of rain or snow. Intermediate floor structures or multi floor buildings or structures shall be considered to be temporarily enclosed subject to the same requirements. The building shall be considered to be temporarily enclosed when one of the permanent exterior wall elements, concrete, block, or the permanent exterior wall, or facing material, is installed and all openings through that element are covered or temporarily enclosed to prevent the entrance of rain, snow, or direct wind. Openings through structures, intermediate floors or exterior wall elements shall be considered to be enclosed when that opening is covered with minimum ten mil plastic or minimum twelve (12) ounce waterproof duck canvas tarpaulins or with minimum three eighths inch thickness exterior grade plywood. Temporary covers or enclosures for openings shall be the responsibility of the Contractor.
- G. Temporary building heating shall be provided from the first day of October to the last day of the following April. The system shall be capable of maintaining a minimum of fifty five degrees Fahrenheit (55°F) simultaneously in all areas of construction in buildings, structures or galleries. Temporary heating shall be provided on a twenty four hours per day, seven days per week basis.

Where it is determined by the County that higher temperatures are required in a particular area to protect installed equipment or new construction, it shall be so, provided under this Contract.

- H. The Contractor shall provide and pay for all electric wiring and electrical accessories required for the temporary heating system.
- I. Temporary heating equipment shall not be located so as to interfere with the new construction Work. Heating system equipment shall not cause undue noise or fumes and shall be enclosed by wire fencing, or other means to provide protection to personnel.

1.07 – TEMPORARY VENTILATION FACILITIES

- A. Temporary construction ventilation shall be provided by the Contractor for the protection of his equipment, Work and his employees' comfort and safety at all times.
- B. The Contractor shall provide all temporary building ventilation for ventilating all structures and building areas, both above and below ground level, which is necessary for the protection of all Work and equipment of this Contract or for the comfort and safety of his employees, his Subcontractor's employees, or the employees of the other Contractors, after the building or structure is enclosed.
- C. Ventilating systems may be forced or gravity type and shall be complete with fans, motors, inlets, outlets, ductwork, heaters, controls or any other equipment necessary, all furnished and installed by the Contractor responsible for the Work involved. The following additional requirements shall apply:
 - 1. All temporary ventilation methods proposed by the Contractor shall be submitted to the County for approval and must comply with all federal, state and county rules and regulations.
 - 2. Temporary ventilation shall be provided by the Contractor until the building or structure is enclosed.
 - 3. A building or structure shall be considered to be enclosed as hereinbefore specified in Paragraph 1.4, Temporary Heating Facilities.
 - 4. Ventilation air shall be heated to those temperatures specified for space or room temperatures as hereinbefore specified in Paragraph 1.4, Temporary Heating Facilities. Where dehumidification is required to prevent mildew or moisture forming on equipment, Work or structures in areas being ventilated, it shall be provided by the Contractor.

- D. The Contractor shall provide and pay for all equipment and labor to operate the temporary ventilation system after a building or structure is enclosed. Heating required for the ventilation system shall be provided by the temporary heating system specified in Paragraph 1.4.
- E. The Contractor shall provide and pay for all electric wiring and electrical accessories required for the temporary ventilation system.
- F. Temporary ventilation equipment shall not be located so as to interfere with the operation of the new construction Work. Protective devices shall be provided for the protection of the personnel.
- G. Temporary ventilation shall be supplied to all buildings or structures below grade at a minimum of three air changes per hour and the outside air shall be tempered to room temperature levels unless otherwise noted. Temporary ventilation shall be supplied to all new buildings or structures above grade only where required to protect equipment and Work being installed or for safety of employee.

1.08 - TEMPORARY PIPE PLUGS

- A. Temporary pipe plugs shall be the inflatable double acting type meeting the following minimum requirements:
- B. Structural Frame: 6061 aluminum.
- C. Seal Material: SBR rubber.
- D. Pressure Rating: 15 psig minimum.
- E. Double acting plug shall seal through deflection with a total displacement of approximately 2 inches. "Balloon" type plugs which seal through stretching are unacceptable.
- F. Seal shall be capable of withstanding a 200 psig inflation pressure when installed. Seal shall be easily replaceable in the field.
- G. Plug shall be provided with a 4-inch threaded drain plug near the invert on the dry side.
- H. Provide pipe plugs as manufactured by Mechanical Research and Design Corporation "Sealfast LP Series" or equal.
- I. Contractor shall submit pipe plugs for approval. Double plug all installations unless otherwise approved.
- J. Contractor shall maintain a back-up air compressor on site whenever the pipe plugs are in use.

1.09 – PROTECTION OF WORK AND MATERIALS**A. Protection Requirements:**

1. During the progress of the Work and up to the date of Final Payment, the Contractor shall be solely responsible for the care and protection of all Work and materials covered by the Contract. In order to prevent damage, injury or loss, actions shall include, but not be limited to, the following:
 - a. Store apparatus, materials, supplies, and equipment in an orderly, safe manner that will not unduly interfere with the progress of the Work or the work of any other contractor or utility service company.
 - b. Provide suitable storage facilities for all materials, which are subject to injury by exposure to weather, theft, breakage, or otherwise.
 - c. Place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work.
 - d. Clean up frequently all refuse, rubbish, scrap materials, and debris caused by his operations, to the end that at all times the Site of the Work shall present a safe, orderly and workmanlike appearance.
 - e. Provide barricades and guard rails around openings, for scaffolding, for temporary stairs and ramps, around excavations, elevated walkways and other dangerous areas as deemed necessary by Engineer.
2. The Contractor shall protect the existing Work and material from damage by his workmen and shall be responsible for repairing any such damage at no additional cost to the County.
3. The Contractor shall protect trees, shrubbery and other natural features or structures from being cut, trimmed or injured in his areas of Work. Trees adjacent to the Site of Work shall be protected and temporary supports provided for long branches. Stored materials and equipment shall be in cleared spaces, away from all trees and shrubs, and confined to areas as directed by the Engineer.
 - a. Temporary fences or barricades shall be installed to protect trees and plants in areas subject to traffic.
 - b. No fires will be permitted at the Bay Park STP.

- c. Within the limits of the Work, water trees and plants that are to remain, in order to maintain their health during construction operations.
 - d. Cover all exposed roots with burlap that shall be kept continuously wet. Cover all exposed roots with earth as soon as possible. Protect root systems from mechanical damage and damage by erosion, flooding, run off or noxious materials in solution.
 - e. If branches or trunks are damaged, prune branches immediately and protect the cut or damaged areas with emulsified asphalt compounded specifically for horticultural use in a manner approved by Engineer.
 - f. All damaged trees and plants that die or suffer permanent injury shall be removed when ordered by the Engineer and replaced by a specimen of equal or better quality.
 - g. Coordinate Work in this Section with requirements of Sections 02200, Earthwork, and 02485, Grassing and Planting.
4. All Work and materials shall be protected in accordance with the requirements of the Agreement, Article VI, "Protection"; General Conditions, Articles GC 17, "Materials and Equipment, Approvals Substitutions and Deviations", GC 21, "Protection Requirements", and GC 24, "Barricades, Warning Signs and Lights".

B. Maintenance of Egress:

- 1. During the course of demolition and construction Work of this Project, the Contractor shall maintain and keep free of debris, materials or equipment points of required egress in accordance with the requirements of the Nassau County Fire Commissioner and Fire Safety Regulations.
- 2. The Contractor in his particular area of Work shall maintain egress as herein specified.
- 3. In active process areas, the Contractor shall not be permitted to store or stockpile material. Debris or other material shall be removed daily which may obstruct plant personnel from operating or maintaining active equipment and piping.

C. Temporary Construction Fencing:

- 1. The Work areas of the Project Site shall be enclosed at all times by temporary fencing to ensure security.

2. Temporary fencing shall not be less than six feet in height. Fabric shall be ten-gauge minimum, electrically welded wire, forming a rectangular mesh with opening two by four inches and three rows of double barb ten-gage wire on angle brackets measuring two feet vertically. Fabric shall be mounted on heavy duty steel tee spaced at intervals not exceeding ten feet.
3. The Contractor shall furnish, erect, relocate and maintain all temporary fencing. Upon completion of the Project all temporary fencing shall be removed and disposed of.
4. All Work in connection with the temporary fencing shall be done at no additional cost to the County.

D. Protection of Existing Structures:

1. Underground Structures:

- a. Underground structures are defined to include, but not be limited to, all sewer, water, gas, and other piping, and manholes, chambers, electrical and signal conduits, tunnels and other existing subsurface work located within or adjacent to the limits of the Work.
- b. All underground structures known to the Engineer, except water, sewer, electric and telephone service are shown on the Drawings. This information is shown for the assistance of the Contractor in accordance with the best information available, but is not guaranteed to be correct or complete.
- c. The Contractor shall explore ahead of his trenching and excavation Work and shall uncover all obstructing underground structures sufficiently to determine their location, to prevent damage to them and to prevent interruption of the services which such structures provide. If the Contractor damages an underground structure, he shall restore it to original condition at his expense.
- d. Necessary changes in the location of the Work may be made by the Engineer, to avoid unanticipated underground structures.
- e. If permanent relocation of an underground structure or other subsurface facility is required and is not otherwise provided for in the Contract Documents, the Engineer will direct the Contractor in writing to perform the Work, which shall be paid for under the provisions of the Agreement.

2. Surface Structures:

- a. Surface structures are defined as all existing buildings, structures and other facilities above the ground surface. Included with such structures are their foundations or any extension below the surface. Surface structures include, but are not limited to, buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, piles, wires, posts, signs, markers, curbs, walks and all other facilities that are visible above the ground surface.
 3. Protection of Underground and Surface Structures:
 - a. The Contractor shall sustain in their places and protect from direct or indirect injury all underground and surface structures located within or adjacent to the limits of the Work. Such sustaining and supporting shall be done by the Contractor in a careful manner and as required by the County. Before proceeding with the Work of sustaining and supporting such structure, the Contractor shall satisfy the Engineer that the methods and procedures to be used have been approved by the County.
 - b. The Contractor shall assume all risks attending the presence or proximity of all underground and surface structures within or adjacent to the limits to the Work. The Contractor shall be responsible for all damage and expense for direct or indirect injury caused by his Work to any structure. The Contractor shall repair immediately all damage caused by his Work to the satisfaction of the owner of the damaged structure.
 4. All other existing surface facilities, including but not limited to guard rails, posts, guard cables, signs, poles, markers, and curbs, which are temporarily removed to facilitate installation of the Work shall be replaced and restored to their original condition at Contractor's expense.
- E. Protection of Floors and Roofs:
1. The Contractor shall protect floors, roofs and stairs from overloads, dirt and damage during entire construction period. In areas subject to foot traffic, secure heavy paper, sheet goods, or other materials in place. For storage of products, lay tight wood sheathing in place. Cover walls and floors of elevator cars and surfaces of elevator car doors used by construction personnel.
 2. Proper protective covering shall be used when moving heavy equipment, when handling materials or other loads, when painting, when handling mortar and grout and when cleaning walls and ceilings.

3. Use metal pans to collect all oil and cuttings from pipe, conduit, or rod threading machines and under all metal cutting machines.
4. Concrete floors less than 28 days old shall not be loaded without written permission of the Engineer. No floor, roof or slab shall be loaded in excess of the design loading shown on the Drawings.
5. Roof slabs shall not be loaded without written permission of the Engineer. Prohibit use of finished roofing surfaces for traffic of any kind, and for storage of any products. When activity must take place in order to carry out the Work, obtain recommendations of installer for protection of surface. Install recommended protection and remove on completion of that activity. Restrict use of adjacent unprotected areas.
6. The Contractor shall restrict access to roofs and keep clear of existing roofs except as required by the new Work.
7. If access to roofs is required, roofing, parapets, openings and all other construction on or adjacent to roof shall be protected with suitable plywood or other approved means.

F. Protection of Installed Products and Landscaping:

1. Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to completion of Work.
2. Control traffic to prevent damage to equipment, materials and surfaces.
3. Provide covering to protect equipment and materials from damage.
 - a. Cover projections, wall corners, and jambs, sills and soffits of openings, in areas used for traffic and for passage of products in subsequent Work.
4. Prohibit traffic of any kind across planted lawn and landscaped areas.

G. Protection from Flood:

1. The Contractor shall not allow any areas turned over to him for commencement of Work, to flood. The Contractor shall keep all existing and new facilities within his Work area free of any accumulations of water. The Contractor shall provide, install, and operate sufficient pumps for this purpose. Continuous monitoring for floods and protection of structures from damage and flotation shall be provided. The Contractor shall install any combination of suitable dikes, well points, pumps, and the like to protect the Work until it is accepted.

H. Special Protection of Machinery and Equipment:

1. The Contractor shall take all protective measures to the satisfaction of the County necessary to insure that inclement weather or dust and debris from demolition does not enter any of the mechanical or electrical equipment rooms or enclosures. Enclosures shall be provided where necessary to prevent contamination of the air. All protective measures shall be furnished, installed, lighted, ventilated, maintained and removed at the Contractor's own cost.
2. Interior dustproof covers shall be a heavy reinforced polyethylene film curtain, minimum thickness 6 mils, supported by wood framing. All seams and penetration shall be sealed with duct tape on two sides. Junctions with existing walls, floors and ceilings shall be made with a double fold secured with a backing strip anchored to the existing wall, floor and ceiling.
3. The Contractor shall be responsible for all damage to existing structures, equipment, and facilities caused by his construction operations and must repair all such damage when and as ordered at no additional cost to the County. All work shall be done in accordance with the requirements of Section 01039, Demolition and Removal of Existing Structures and Equipment.

I. Emergency Repair Crews

1. In case the Contractor's operations disrupt plant operations, the treatment process or the operating facilities herein before described, at any time, he shall at his own cost immediately make all repairs or replacements and do all work necessary to restore the plant to operation to the satisfaction of the County. Such work shall progress continuously to completion on a 24-hour/day, 7-workday/week basis. The Contractor shall provide the services of emergency repair crews, available on call 24 hours per day.

1.10 – ACCESS ROADS, PARKING, STAGING, STORAGE AND WORK AREAS

A. Contractor's Staging and Storage Area

1. The Contractor shall construct a Contractor's Staging Areas as shown on the Contract Drawings. The Staging Area shall be leveled, graded and seeded after completion of the Contract.
2. The Contractor shall plan on relocating the entire initial staging area to an alternate staging area part way thru the project. The current periods of contract time that the designated staging areas will be available to the contractor are noted in the plan sheets.

Relocation of all contractor and project materials and all staging area services shall be indicated in lump sum bid item #1. All staging area requirements apply to both the initial staging area and the relocated staging area.

3. The Staging Area shall be drained so that no ponding of runoff water shall occur in the Staging Area or adjacent areas.
4. The Contractor shall erect six-foot high galvanized chain link fencing and gates around the Staging Area as specified in Paragraph 1.6.C.
5. The Contractor shall provide pavement and utilities in the Staging Area and shall maintain all sections of the Staging Area in a suitable manner, including the cutting of grass, weeding and preventing the accumulation of debris. The Contractor shall provide electrical utilities in the Staging Area.
6. At the completion of the project, the Contractor shall remove all debris not limited to gravel, grout, wood, etc., from the Staging Area off-site. The Contractor shall also grade the Staging Area level and furnish a minimum of six (6) inches of topsoil, which will be unloaded, graded and hydro-seeded as directed by the Engineer.

B. Access Roads:

1. Access roads will be provided by the Contractor in accordance with the requirements of the General Conditions, Article GC 22, "Access Roads and Parking Areas", the Drawings and the applicable Technical Specifications.
2. The Contractor shall take all necessary precautions to protect traffic, including but not limited to, complying with the requirements of the General Conditions, Articles GC 23, "Traffic Regulations" and GC 24, "Barricades, Warning Signs and Lights".
3. The Contractor shall post speed limit signs to be adhered to at all times in the vicinity of the staging and work areas.

C. Parking, Storage and Work Areas:

1. No on-site parking is permitted.
2. The Contractor shall construct and maintain suitable storage areas for his use within the staging area designated on the Drawings.

3. The Contractor will be required to arrange his Work and dispose of his materials in such manner as to cause the least interference with the Work of other Contractors working within the same area.
4. No Contractor shall claim exclusive occupancy of areas within or adjacent to the limits of his Work under this Contract. The County and its employees and the Contractors for other contracts shall also have access to these areas.
5. The Contractor shall modify any storage areas to cause minimum damage to the landscape and shall comply with the directions of the County. At the completion of the Work the surfaces of the land used for storage areas shall be restored by the Contractor to the satisfaction of the County and the Engineer.

1.11 – CONTRACTOR'S FIELD OFFICE

- A. The Contractor shall furnish, equip and maintain a field office for his use at the Site during the period of construction. The Contractor shall provide his own telephone service and shall have readily accessible, at the field office, copies of the Contract Documents, latest approved Shop Drawings and all Project related correspondence, Change Orders, etc.
- B. Contractor's field office shall be located in the Staging Area.
- C. The Contractor shall provide a Contractor's field office with the minimum facilities specified. Provide all required storage and work sheds.
 1. Field Office and Furnishings:
 - a. Acceptable appearance, weatherproof building or trailer with lockable door.
 - b. Telephone service.
 - c. Six protective helmets for visitor's use.
 - d. Exterior identifying sign.
 - e. Company sign no larger than 4 feet by 8 feet.
 2. Remove office and sheds upon Final Acceptance unless otherwise approved by the Engineer.

1.12 – SECURITY

- A. It shall be the responsibility of the Contractor to make whatever provisions he deems necessary to safely guard all Work, materials, equipment and property from loss, theft, damage and vandalism. The Contractor's duty to safely guard property shall include the County's property and other private property from injury or loss in connection with the performance of the Contract.
- B. The Contractor may make no claim against the County for damage resulting from trespassing.
- C. The Contractor shall repair all damage to the property of the County and others arising from failure to provide adequate security.
- D. If existing fencing or barriers are breached or removed for purposes of obstruction, the Contractor shall provide and maintain temporary security fencing equal to the existing one, in a manner satisfactory to the Engineer and the County.
- E. Security measures taken by the Contractor shall be at least equal to those usually provided by the County to protect his existing facilities during normal operation.
- F. Maintain the security program throughout construction until the date of Substantial Completion and occupancy precludes need for Contractor's security program.
- G. The Contractor's employees shall be issued identification badges, which shall be displayed at all times, as per Section 01356, Safe and Healthful Working Conditions, Paragraph 1.5.F.

1.13 - ENGINEER'S FIELD OFFICE

- A. It shall be the Contractor's Responsibility to furnish the following equipment items and maintenance services for the contract period or for a period not to exceed two months after the work has received final acceptance by the Department.
- B. No Construction shall commence until the trailer is provided, furnished as herein specified and made available to the Engineer. The office shall be erected at a location approved by the Engineer and as shown on the Contract Drawings. The Engineer's field office shall be separate from any office used by the Contractors.
- C. The office shall be 36' long (including hitch), 10' wide, a minimum ceiling height of 8 feet, 2 exterior doors and 7 windows. All windows and the door shall be equipped with adequate locking devices, alarmed and be weatherproof and screened to provide adequate ventilation.
- D. Windows shall be the type that will open and close as required. A flush type toilet shall be provided, and shall be located in an enclosed separate room, in compliance with applicable

sanitary codes. The field office shall be equipped with a lavatory with hot and cold running water and venetian blinds. Adequate electric lighting and heating shall be provided at all times. The sanitary facilities shall be connected by the Contractor to an existing manhole adjacent to the existing Pumping Station. The Contractor shall provide door switch with terminals for intrusion alarm indication.

- E. The Contractor shall provide door switches on all doors with terminals for intrusion alarm indication. Water services, electric and sanitary services shall be provided and shall be maintained in proper order by the Contractor throughout construction.
- F. The Contractor shall provide telephone service to the field office, including all Verizon coordination.
- G. The furnishings shall be as follows:
 - Four (4) Office chairs. (Stackable type)
 - Four (4) Folding chairs and a folding table.
 - One (1) Bracketed wall table (3 feet by 5 feet)
 - Two (2) Desks
 - One (1) Draftsman's stool.
 - One (1) Each hand operated fire extinguisher, Class ABC.
 - One (1) Telephone set with 1 dedicated telephone line for the exclusive use of the Engineer and his authorized representatives.
 - One (1) Two Mbit/s down/1Mbit/s up or greater internet connection (Verizon FIOS, Optimum Online or equal).
 - One (1) First aid kit (#25 kit as manufactured by Acme Cotton Products or equal).
 - One (1) Rechargeable lantern type light (Flashlight).
 - One (1) printer, scanner and fax machine with 11 x 17 capability as manufactured by Canon, ImageClass MF7480 or equal. A dedicated telephone line (separate from telephone set line) with supplies and maintenance service for the machine for the duration of the project shall be provided.

- Two (2) Laptop computer systems as manufactured by Dell or equal. The Contractor shall provide the following items as provided by Dell or equal.

<u>Catalog Number / Description</u>	<u>Product Code</u>	<u>Qty</u>
Processor: 4th gen Intel® Core™ i5-4210U Processor (1.7GHz, 3M cache)	I54210	1
Operating System: Windows 7 Professional English/French 64bit (Includes Windows 8.1 Pro license)	DW17P6M	1
Office Productivity Software: Microsoft® Office Home and Business 2013, English, French and Spanish	13HB	1
Dell Data Protection Encryption Security SW: DDPE Personal Edition License + ProSupport for Software 1 Year	PDPE1Y	1
Adobe Creativity and Productivity Software: Adobe® Acrobat® XI Standard, Digital Delivery	ADBXC	1
Security Software: No Security Software	NOSS	1
Operating System Recovery Options: Windows 8.1 English OS Recovery - DVD	M81D6E	1
Optical Software: No Power DVD	PDVDW7	1
Camera Software: Software for Integrated Camera	SCW7	1
Video Card: Intel® Integrated HD Graphics 4400	UMA	1
Base Options: Intel® Core™ i5-4210U processor, Integrated Graphics, Express Card	4210	1
Hard Drive: 500GB Solid State Hybrid Drive	500SDH	1
Latitude 15 5000 Series: Latitude 15 5000 Series	E5540	1
Memory: 4GB (1x4GB) 1600MHz DDR3L Memory	4G1D6	1

<u>Catalog Number / Description</u>	<u>Product Code</u>	<u>Qty</u>
Keyboard: Internal English Single Pointing Keyboard	ENGSP	1
Optical Drive: 8X DVD+/-RW	DVDR8	1
Wireless Driver: Intel® Dual Band Wireless-AC 7260 + BT 4.0 Driver	DR7260	1
Wireless: Intel® Dual Band Wireless-AC 7260 802.11AC Wi-Fi + BT 4.0LE Half Mini Card	IW7260	1
Power Cord: US Power Cord	USE5	1
Documentation: System Documentation, English	DOCENG	1
Primary Battery: 6-cell (65Wh) Lithium Ion battery with ExpressCharge™	6C	1
E-Star: Energy Star	ESTAR	1
Processor Branding: Intel® Core™ i5 Processor Label	I5INTEL	1
Non-Microsoft Application Software: Additional Software for Window 7 Downgrade	WIN7DG	1
Power Supply: 65W A/C Adapter (3-pin)	65WE5	1
Camera: Light Sensitive Webcam and Noise Cancelling Digital Array Mic	NTCAM	1
LCD: 15.6" HD (1366x768) Wide View Anti-Glare WLED-backlit	HD	1
Palmrest: No Fingerprint Reader (Single Pointing) Palmrest	SPNOFP	1
Systems Management: No Out-of-Band Systems Management	NOVPRO	1
Packaging: Ship Material, Min-Config	MINCFG	1
Regulatory Label:		

<u>Catalog Number / Description</u>	<u>Product Code</u>	<u>Qty</u>
Regulatory Label	NTOUCH	1
System Recovery: No Resource DVD	NRDVD	1
FGA Module: Alpine15_R1_106/US/BTS	FG0052	1
Dell Backup & Recovery: Dell Backup and Recovery Basic	DBRBSC6	1
Transportation from ODM to region: BTS Shipment	BTS	1
Placemat: System Documentation, English	ENGGD	1
UPC/POD Label: POD Label	POD	1
Intel Rapid Start and Smart Connect: No Intel Rapid Start or Smart Connect	NONE	1

Provide for each laptop G-data total protection for duration of project.

- One (1) 10/100 Ethernet router with at least 4 Smith Ports.
- One (1) microwave oven.
- One (1) stove/refrigerator combination unit.
- Bottled drinking water supplied by a service to the site; provide refrigerated drinking fountains with a spigot. Disposable drinking cups shall be furnished and supplied at all times.
- Fire-Resistant File Cabinets:
 1. Description: Four drawer, legal size, UL Class D label.
 2. Number Required: 2.
 3. Product and Manufacturer: Provide one of the following:
 - a. Model 4 CFD by Schwab Safe Company.
 - b. Fireking International, Incorporated.

c. Or equal.

- H. All facilities, equipment and utilities furnished under this section shall be provided and maintained in good working order at all times. In addition, the Contractor shall furnish daily janitorial services and necessary washroom supplies. All utility costs for telephone, DSL, etc. shall be paid for by the Contractor for the duration of the project.
- I. Two months after final acceptance of the work or when ordered by the Engineer, whichever is sooner, the trailer and the field office equipment and facilities furnished by the Contractor limited to the chairs, tables, stool, telephone set, fax machine, copy machine, computer system, microwave oven, stove/refrigerator combination unit, bottled water system and file cabinets shall revert to the Contractor who shall remove them and leave the site in a satisfactory condition, as approved by the Engineer.

1.14 - FIRST AID

- A. Each Contractor shall furnish and keep on the site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when men are employed on the work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. The Contractor shall provide temporary fire protection at the Bay Park STP for all areas where work of this contract is being performed and throughout the Project, until the County takes occupancy. Remove temporary fire protection when the County takes occupancy.
2. The Contractor shall comply with Section 901.7 and 1404.5 of the Fire Code of New York State (2010).
3. The Contractor shall pay all costs associated with temporary fire protection, including installation, maintenance, and removal.
4. The Contractor shall conform to provisions of this Section and Laws and Regulations.

B. Reference Standards and Regulatory Requirements:

1. Comply with applicable provisions of:
 - a. NFPA Standard No. 10, Portable Fire Extinguishers.
 - b. NFPA Standard No. 241, Safeguarding Building Construction and Demolition Operations.
 - c. Fire Code of New York State, Section 901.7.
 - d. Fire Code of New York State, Section 1404.5
2. Temporary fire protection shall conform to Laws and Regulations.

1.02 – REQUIRED TEMPORARY FIREFIGHTING EQUIPMENT

- A. Provide portable fire extinguishers, rated not less than 2A or 5B in accordance with NFPA Standard No. 10 for each temporary building and for every 3,000 square feet of floor area under construction.
- B. Provide portable fire extinguishers 50 feet maximum from all points in protected area.

1.03 – FIRE PREVENTION AND SAFETY MEASURES

- A. Prohibit smoking in hazardous areas and inside of the County's buildings. Provide visible, suitable warning signs in areas that are continuously or intermittently hazardous.
- B. Storage of Flammable and Combustible Products:
 - 1. Use metal safety containers for storing and handling flammable and combustible liquids and materials.
 - 2. Do not store flammable or combustible liquids and materials in or near stairways or exits.
- C. Maintain clear exits from all points at the Site.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - GENERAL**

- A. Provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and adjacent areas. Remove physical evidence of temporary facilities at completion of Work.

1.02 – NOISE CONTROL

- A. Contractor's vehicles and equipment shall be such as to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and in no case will noise levels be permitted which interfere with the Work of the County or others.

1.03 – DUST CONTROL

- A. The Contractor shall be responsible for controlling objectionable dust caused by his operation of vehicles and equipment, clearing or for any reason whatever, in accordance with the General Conditions Article GC-25, "Dust Control and Spillage."

1.04 – PEST AND RODENT CONTROL

- A. Provide rodent and pest control as necessary to prevent infestation of construction or storage area.
 - 1. Employ methods and use materials, which will not adversely affect conditions at the Site or on adjoining properties.
- B. Provide seals in accordance with the General Conditions, Article GC-26, "Vermin Control."

1.05 – WATER CONTROL

- A. Provide methods to control surface water and water from excavations and structures to prevent damage to the Work, the Site, or adjoining properties.
 - 1. Control fill, grading and ditching to direct water away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff courses so as to prevent any erosion, damage or nuisance.
- B. Provide, operate and maintain equipment and facilities of adequate size to control surface water.
- C. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the Site or to adjoining areas and in conformance with all environmental requirements.
- D. All work must conform to the Storm Water Pollution Plan.

1.06 – POLLUTION CONTROL

- A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.
- B. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.
 - 1. Excavate and dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.
- C. Take special measures to prevent harmful substances from entering public waters.
 - 1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.
- D. Provide systems for control of atmospheric pollutants.
 - 1. Prevent toxic concentrations of chemicals.
 - 2. Prevent harmful dispersal of pollutants into the atmosphere.
- E. Contractor's equipment used during construction shall conform to all current federal, state and local laws and regulations.

1.07 – EROSION CONTROL

- A. Plan and execute construction work and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
 - 1. Hold the areas of bare soil exposed at one time to a minimum.
 - 2. Provide temporary control measures such as berms, dikes and drains.
- B. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.
- C. Periodically inspect earthwork to detect any evidence of the start of erosion, apply corrective measures as required to control erosion.

1.08 – HAZARDOUS MATERIAL CONTROL

- A. Refer to Section 01355, Hazardous Materials Control.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 - GENERAL****A. Furnish and Install:**

1. Where the words "furnish", "provide", "supply", "replace" or "install" are used, whether singly or in combination, they shall mean to furnish and install, unless specifically stated otherwise.
2. In the interest of brevity, the explicit direction "to furnish and install" has sometimes been omitted in specifying materials and/or equipment. Unless specifically noted otherwise, it shall be understood that all equipment and/or materials specified or shown on the Drawings shall be furnished and installed under the Contract as designated on the Drawings.

B. Concrete Work

1. Contractor, unless specifically noted otherwise, shall provide all concrete shown, specified or required under this Contract.

C. Concrete Maintenance Pads for Equipment:

1. The Contractor shall provide all concrete maintenance pads shown, specified or required within the building, for all equipment furnished under this Contracts.
2. Anchor bolts and templates for equipment maintenance pads shall be furnished under this Contract and be installed by the Contractor. Expansion, epoxy resin and grouted anchor bolts will be permitted unless shown or specified otherwise. The equipment manufacturer should show a normal equipment installation including the anchoring system in their shop drawing submittal. The anchoring system shall exhibit pertinent design criteria such as bolt diameter, embedment depth, pull out strength, spacing, type of anchor, edge distance, bolt patterns and certifications that the anchoring system will function properly with the equipment selected. The anchor system will be subject to additional requirements and testing called for in Section 05051 on these Contract Documents.
3. All concrete maintenance pads for equipment shall be treated, by the Contractor, with a sealer, approved by the Engineer, to prevent oil from seeping into the concrete.

D. Contractor's Title to Materials:

1. No materials or supplies for the Work shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the Work, free from all liens, claims or encumbrances.

1.02 - TRANSPORTATION AND HANDLING OF MATERIALS AND EQUIPMENT

- A. The Contractor shall make all arrangements for transportation, delivery and handling of equipment and materials required for prosecution and completion of the Work in accordance with Section 01610, Transportation and Handling of Materials and Equipment.

1.03 - STORAGE OF EQUIPMENT AND MATERIALS

- A. The Contractor shall store his equipment and materials at the job Site in accordance with the requirements of the General Conditions, Article GC-17, "Materials and Equipment, Approvals Substitutions and Deviations", and as hereinafter specified. All equipment and materials shall be stored in accordance with manufacturer's recommendations and as directed by the Engineer, and in conformity to applicable statutes, ordinances, regulations and rulings of the public authority having jurisdiction.
- B. The Contractor shall enforce the instructions of the County and the Engineer regarding the posting of regulatory signs for loading on structures, fire safety and smoking areas.
- C. The Contractor shall not store materials or encroach upon private property without the written consent of the owners of such private property.

1.04 - INSTALLATION OF EQUIPMENT

- A. Equipment and materials shall be installed in accordance with the requirements of the General Conditions, Article GC-17, "Materials and Equipment, Approvals, Substitutions and Deviations".
- B. Concrete maintenance pads for equipment shall be of approved design and shall be adequate in size, suitable for the equipment erected thereon, properly reinforced, and tied into floor slabs by means of reinforcing bars or dowels. Maintenance pads bolts of ample size and strength shall be provided and properly positioned by means of suitable templates and secured during placement of concrete. Maintenance pads shall be built and bolts installed in accordance with the manufacturer's certified drawings.
- C. Before mounting equipment on a maintenance pad, the Contractor shall clean the top surface; if necessary, rough it with a star chisel and clean again; and clean out all maintenance pads bolt sleeves. The Contractor shall provide a sufficient number of steel plate shims about 2 inches

wide and 4 inches long, and of a varying thickness from 1/8 to 1/2 inch. A combination of these shims shall be placed next to each maintenance pads bolt to bring the bottom of the bedplate or frame about 1/8 inch above the final setting. The equipment shall be lowered by changing the combination of shims. Using brass shim stock of various thicknesses, continue to level the equipment a little at a time and in rotation until it is at the correct elevation in both directions. When the equipment is level, tighten down on the maintenance pads bolts a little at a time in rotation to make certain the equipment remains level and does not shift on the shims. A preliminary alignment check shall be made before grout is placed.

- D. Equipment shall be set, aligned and assembled in conformance with manufacturer's drawings or instructions. Runout tolerances by dial indicator method of alignment shall be plus or minus 0.002 inches, unless otherwise directed by the Engineer.
- E. Blocking, wedges, shims, filling pieces, or other materials required by the proper support and leveling of equipment during installation shall be furnished by the Contractor. All temporary supports shall be removed, except steel wedges and shims, which may be left in place with the approval of the Engineer. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the Contractor.
- F. Each piece of equipment or supporting base, bearing on concrete maintenance pads, shall be bedded in grout. The Contractor shall provide a minimum of 1-1/2-inch thick grouting under the entire baseplate supporting each pump, motor drive unit and other equipment. Mortar shall be non-shrink grout, as specified under Section 03600, Grouting.
- G. When motors are shipped separately from driven equipment, the motors shall be received, stored, meggered once a month, and the reports submitted to the Engineer. After driven equipment is set, the motors shall be set, mounted, shimmed, millrighted, coupled and connected complete.
 - 1. Space heaters shall be supplied in all enclosures being utilized for storage of motors. All areas shall be heated.
 - 2. Electrical machines being stored shall be turned in accordance with the manufacturer's recommendations to prevent "flat-spotting" of bearings.
- H. Anchor and expansion bolts will be furnished by the Contractor, as specified and required. Expansion bolts shall only be used where permitted by the Engineer. Anchor and expansion bolts shall be of Type 304 stainless steel unless otherwise specified. Anchorage items shall conform to the applicable requirements of Section 05051, Anchor Systems.
- I. Workmanship:

1. The following erection Specifications are not intended to cover all instructions, but only some of the important practices. In all cases, only the best methods known to the trades are to be employed.
2. Only those mechanics skilled in the handling, setting, alignment, leveling and adjustment of the type of equipment materials supplied shall be employed in the Work.
3. An oil bath heater shall always be used to expand couplings, gears, etc. They shall not be forced or driven on equipment shafts, nor shall they be subjected to an open flame or torch.
4. Wedging will not be permitted. Only the least number of flat shims are to be used in leveling equipment (shims are to be clean and free of slag). All shims, filling pieces, keys packing, red or white lead grout, or other materials necessary to properly align, level and secure apparatus in place shall be furnished by the Contractor. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the Contractor.
5. Proper tools shall be used in the assembly of equipment and materials to prevent marring the surface of shafts, nuts or other parts.
6. Connections requiring gaskets shall be tightened evenly all around to ensure uniform stress over the entire gasket area.
7. No equipment and materials shall be altered or repaired, and no burning or welding will be permitted on any parts having machined surfaces, except by written permission of the Engineer.
8. No rigging shall be done from any structure without the permission of the Engineer, and the Contractor shall be completely responsible for any damage to the structure due to his operations.
9. Only such equipment and materials that will not damage the structure, equipment, or materials, shall be used on the Work.
10. The Contractor shall be responsible for the exact alignment of equipment with associated piping and, under no circumstances, will "pipe springing" be allowed.
11. Misaligned holes shall be reamed, as excessive driving of bolts or keys will not be permitted.

12. The Contractor shall furnish and install all necessary plugs in lubrication holes to prevent entry of foreign material.

J. Alignment and Leveling:

1. All couplings shall be aligned while the equipment is free from all external loads.
2. Both angular and parallel alignment shall be checked, and the degree of misalignment shall be recorded and submitted to the Engineer.
3. Dial indicators shall be used for the checking of angular and parallel alignment. During rotation of the half couplings in performance of this test, they shall be maintained in the same relative position, and the dial indicator readings shall be taken at the same place on the circumference of the coupling.
4. Misalignment shall not exceed the manufacturer's tolerances.

K. Threaded Connections:

1. A molybdenum disulfide anti-seize compound shall be applied to all threads in mechanical connections such as bolts, studs, cap screws, tubing, etc. unless otherwise indicated.

L. Lubrication:

1. All lubrication shall be performed by the Contractor before start-up, in accordance with the lubricant specifications and directions furnished by the manufacturer. The Contractor shall furnish the lubricants.

M. Electrical Connections:

1. Electrical connections shall be provided in accordance with the applicable requirements of Division 16, Electrical.

N. Painting:

1. All equipment and materials, unless specified otherwise, shall be field painted in accordance with the requirements of Section 09900, Painting.

O. Testing:

1. The Contractor shall carry out all checking and/or testing of installed equipment in accordance with manufacturer's specifications, and as required by the Engineer.

P. Maintenance of Installed Equipment:

1. During the time period between installation and receipt of the certificate of completion, the Contractor shall maintain all equipment in accordance with the equipment manufacturer's instructions and with the approval of the Engineer.

Q. Services of Manufacturer's Representatives:

1. Equipment furnished under Divisions 2 through 16 shall include the cost of a representative of the manufacturers of all equipment as specified in the General Conditions, Article GC-17, "Materials and Equipment, Approvals, Substitutions and Deviations".
2. Detailed Specifications contain additional requirements for furnishing the services of the manufacturer's representatives.
3. A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested and is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of the unit shall be submitted within thirty days of completion of the performance test.

1.05 - CONNECTIONS TO EQUIPMENT

- A. Connections to equipment shall follow manufacturer's recommendations as to size and arrangement of connections and/or as shown in detail on the Drawings or approved Shop Drawings. Piping connections shall be made to permit ready disconnection of equipment with minimum disturbance of adjoining piping and equipment. The Contractor shall be responsible for the exact alignment of equipment with associated piping and under no circumstances will pipe springing be allowed.
- B. The Contractor shall be responsible for bringing proper electrical service to each item of equipment requiring electrical service as shown on the Drawings or approved Shop Drawings. Electrical connections to equipment requiring electrical service shall be made by the Contractor, unless otherwise indicated on the Drawings or in the Technical Specifications.

1.06 - SUBSTITUTIONS

- A. Requests for substitutions of equipment or materials shall conform to the requirements of the General Conditions, Article GC-17, "Materials and Equipment, Approvals, Substitutions and Deviations", and as hereinafter specified.
1. The Contractor shall submit for each proposed substitution sufficient details, complete descriptive literature and performance data together with Samples of the materials, where feasible, to enable the County to determine if the proposed substitution is equal.
 2. The Contractor shall submit certified tests, where applicable, by an independent laboratory attesting that the proposed substitution is equal.
 3. A list of installations where the proposed substitution is in satisfactory operation.
 4. Requests for substitutions shall include full information concerning differences in cost, and any savings in cost resulting from such substitutions shall be passed on to the County.
- B. Where the approval of a substitution requires revision or redesign of any part of the Work, all such revision and redesign, and all new Drawings and details required therefore, shall be provided by the Contractor at his own cost and expense, and shall be subject to the approval of the County.
- C. In the event that the Engineer or his consultants is required to provide additional services, the charges for such additional services shall be charged to the Contractor by the County in accordance with the requirements of the General Conditions, Article GC-18, "Contractor Costs for Engineering Services".
- D. Any modifications in Work required under other Contracts, to accommodate the changed design, will be incorporated in the appropriate Contracts and any resulting increases in Contract prices will be deducted by the County from payments otherwise due by the Contractor who initiated the changed design.
- E. In all cases the County shall be the judge as to whether a proposed substitution is to be approved. The Contractor shall abide by their decision when proposed substitute items are judged to be unacceptable and shall in such instances furnish the item specified or indicated. No substitute items shall be used in the Work without written approval of the County.
- F. In making request for substitution, the Contractor represents that:

1. The Contractor has investigated proposed substitution, and determined that it is equal to or superior in all respects to the product, manufacturer or method specified.
2. The Contractor has verified that proposed substitution will coordinate with existing design.
3. The Contractor will provide the same or better warranties or bonds for proposed substitution as for product, manufacturer or method specified.
4. The Contractor waives all claims for additional costs or extension of time related to proposed substitution that subsequently may become apparent.

G. Proposed substitutions will not be accepted if:

1. Acceptance will require substantial revision of the Contract Documents.
2. They will change design concepts or Specifications.
3. They will delay completion of the Work, or the work of other contractors.
4. They are indicated or implied on a Shop Drawing and are not accompanied by a formal request for substitution from the Contractor.

H. Approval of a substitution will not relieve the Contractor from the requirement for submission of Shop Drawings as set forth in the Contract Documents.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 - GENERAL**

- A. The Contractor shall make all arrangements for transportation, delivery and handling of equipment and materials required for prosecution and completion of the Work.
- B. Shipments of materials to the Contractor or Subcontractors shall be delivered to the Site only during regular working hours. Shipments shall be addressed and consigned to the proper party-giving name of the Project, street number and city. Shipments shall not be delivered to the County except where otherwise directed.
- C. If necessary to move stored materials and equipment during construction, the Contractor shall move or cause to be moved materials and equipment without any additional compensation.

1.02 - DELIVERY

- A. Arrange deliveries of products in accordance with construction schedules and in ample time to facilitate inspection prior to installation.
- B. Coordinate deliveries to avoid conflict with Work and conditions at site and to accommodate the following:
 - 1. Work of other contractors, or the County.
 - 2. Limitations of storage space.
 - 3. Availability of equipment and personnel for handling products.
 - 4. County's use of premises.
- C. Do not have products delivered to the Project Site until related Shop Drawings have been approved by the Engineer.
- D. Do not have products delivered to the Site until required storage facilities have been provided.
- E. Have products delivered to the Site in manufacturer's original, unopened, labeled containers. Keep the Engineer informed of delivery of all equipment to be incorporated in the Work.
- F. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts and to facilitate assembly.
- G. Immediately on delivery, inspect shipment to assure:

1. Product complies with requirements of the Contract Documents and reviewed submittals.
2. Quantities are correct.
3. Containers and packages are intact, labels are legible.
4. Products are properly protected and undamaged.

1.03 - PRODUCT HANDLING

- A. Provide equipment and personnel necessary to handle products by methods to prevent soiling or damage to products or packaging.
- B. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.
- C. Handle products by methods to prevent bending or overstressing.
- D. Lift heavy components only at designated lifting points.
- E. Materials and equipment shall at all times be handled in a safe manner and as recommended by manufacturer or supplier so that no damage will occur to them. Do not drop, roll or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

1.04 - REMOVING, HAULING, AND INSTALLING EQUIPMENT AND MATERIALS

- A. The Contractor shall inspect all items including all boxes, crates and packages containing equipment and materials for damage that may have occurred during shipment prior to its removal from the truck or other conveyance. Any damage shall immediately be reported to the Engineer. The Contractor shall then carefully remove the equipment and materials from the truck or trucks on which it is shipped. The equipment and materials shall then be transported to the place of installation at the job Site. The Contractor shall be liable for loss or damage that the equipment and materials may receive while being unloaded, transported, stored or installed. The Contractor shall employ competent mechanics experienced in the installation of the types of equipment and materials to be furnished, and shall ensure that all equipment and materials are installed in accordance with the recommendations of the manufacturer. Bolts, nuts and other fastenings shall be furnished by the Contractor, and shall comply with the applicable requirements as specified. Equipment that arrives at the job site during normal working hours shall be unloaded as soon as practicable.

1.05 - COORDINATE STORAGE AND INSTALLATION

- A. The Contractor shall coordinate storage and installation of new equipment with construction schedule for existing and new structures.

1.06 - CONTRACTOR'S USE OF COUNTY LIFTING EQUIPMENT

- A. The Contractor shall not be permitted to use any existing lifting equipment at County facilities unless the following procedure is followed:
1. Contractor shall employ the services of a qualified representative of the lifting equipment manufacturer to inspect all equipment. The manufacturer shall certify that said equipment is in safe operating condition and meets the rated load capacities. The County makes no claim that any existing lifting equipment is in operable condition or meets the requirements of the Contractor. All costs for inspections, certifications and repairs shall be the responsibility of the Contractor.
 2. Upon submittal of the required certifications and receipt of written authorization from the County, the Contractor will assume full responsibility for the operation, maintenance and regular inspection of the lifting equipment for the duration of his work.
 3. Upon completion of his work, the Contractor shall employ the services of a qualified representative of the lifting equipment manufacturer to re-inspect the equipment. The manufacturer shall recertify that said equipment is in safe operating conditions. All costs for inspections, certifications and repairs shall be the responsibility of the Contractor.
 4. Upon submittal of the required certifications and acceptance by the County, the County will resume responsibility for the equipment.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 - GENERAL**

- A. The Contractor shall initially start up and place all equipment installed by him into successful operation according to manufacturers' written instructions and as instructed by manufacturers' field representatives. Provide all material, labor, tools, equipment, and expendables required.
- B. General Activities Include:
 - 1. Cleaning.
 - 2. Removing temporary protective coatings.
 - 3. Flushing and replacing greases and lubricants, where required by manufacturer.
 - 4. Lubrication.
 - 5. Check shaft and coupling alignments and reset where needed.
 - 6. Check and set motor, pump and other equipment rotation, safety interlocks, and belt tensions.
 - 7. Check and correct if necessary leveling plates, grout, bearing plates, anchor bolts, fasteners, and alignment of piping which may put stress on pumping equipment connected to it.
 - 8. All adjustments required.
- C. Provide initial filling of lubricants and all other required operating fluids.
- D. Also provide filters, chemicals, and other expendables required for initial start-up of equipment unless otherwise specified.

1.02 - MINIMUM START UP PROCEDURES

- A. Bearings and Shafting:
 - 1. Inspect for cleanliness, clean and remove foreign materials.
 - 2. Verify alignment.
 - 3. Replace defective bearings, and those which run rough or noisy.

4. Lubricate as necessary, in accordance with manufacturer's recommendations.

B. Drives:

1. Adjust tension in V belt drives, and adjust varipitch sheaves and drives for proper equipment speed.
2. Adjust drives for alignment of sheaves and V belts.
3. Clean and remove foreign materials before starting operation.

C. Motors:

1. Check each motor for comparison to amperage nameplate value.
2. Correct conditions which produce excessive current flow, and which exist due to equipment malfunction.
3. Check each motor for proper rotation.

D. Pumps:

1. Check glands and seals for cleanliness and adjustment before running pump.
2. Inspect shaft sleeves for scoring.
3. Inspect mechanical faces, chambers, and seal rings, and replace if defective.
4. Verify that piping system is free of dirt and scale before circulating liquid through the pump.

E. Valves:

1. Inspect both hand and automatic control valves, clean bonnets and stems.
2. Tighten packing glands to assure no leakage, but permit valve stems to operate without galling.
3. Replace packing in valves to retain maximum adjustment after system is judged complete.
4. Replace packing on any valve which continues to leak.

5. Remove and repair bonnets which leak.
 6. Coat packing gland threads and valve stems with a surface preparation of "Moly Cote" or "Fel Pro", after cleaning.
- F. Verify that control valve seats are free from foreign material, and are properly positioned for intended service.
- G. Tighten all pipe joints after system has been tested.
1. Replace gaskets which show any sign of leakage after tightening.
- H. Inspect all joints for leakage.
1. Promptly remake each joint which appears to be faulty, do not wait for rust to form.
 2. Clean threads on both parts, apply compound and remake joints.
- I. After system has been tested, clean strainers, dirt pockets, orifices, valve seats and headers in fluid system, to assure freedom from foreign materials.
- J. Open steam traps and air vents where used, remove operating elements.
1. Clean thoroughly, replace internal parts and put back into operation.
- K. Remove rust, scale and foreign materials from equipment and renew defaced surfaces.
- L. Set and calibrate equipment.
- M. Inspect fan wheels for clearance and balance. Provide factory authorized personnel for adjustment when needed.
- N. Check each electrical control circuit to assure that operation complies with Specifications and requirements to provide desired performance.
- O. Inspect each pressure gage and thermometer for calibration. Replace items which are defaced, broken, or which read incorrectly.
- P. Repair damaged insulation.
- Q. Vent gasses trapped in any part of systems. Verify that liquids are drained from all parts of gas or air systems.

1.03 - INITIAL PLANT START UP

- A. Prior to start up of the plant facilities, the Contractor shall have prepared and pre tested all equipment to check its ability for sustained operation, including inspections and adjustments by manufacturer's servicemen, as specified in Section 01660 and this Section. Also, all training by vendors shall have begun and all O&M manual submittals shall be completed prior to start-up.
- B. After the facilities are sufficiently complete to permit start up, the Contractor shall furnish competent personnel to start up the plant facilities. The Contractor will be responsible for start up of all facilities constructed under this Contract. During the initial start up period the Contractor shall check and provide for satisfactory mechanical operation of the plant facilities. Prior to start up, the Contractor shall prepare a schedule detailing the proposed start up and his plans for manpower and auxiliary facilities to be provided. The start up schedule is subject to approval of the Engineer. Start up of the plant by the Contractor shall include the operation and maintenance of all mechanical facilities such as pumps, and like equipment, and the ventilating, air conditioning (or heating), and electrical systems. The start-up period shall be a minimum of 10 consecutive 24-hour days of satisfactory operation of the facility or the number of days called for in the Technical Specifications. Start up of either the heating or air conditioning systems is dependent upon the time of year that the plant start up is initiated. The Contractor will be required to return at the beginning of the next heating or air conditioning season (whichever is applicable) to start the appropriate system.
- C. When the start up period is completed, the County will assume responsibility for operation of the new facilities, provided that all major items of the Work are operating satisfactorily and operation and maintenance training has been completed satisfactorily. If any or all of the new facilities are not operating satisfactorily at the end of the start up period, the Contractor shall continue to operate those facilities that are incomplete or not operating satisfactorily until they are complete and acceptable to the County.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 - GENERAL**

- A. All materials and equipment will be tested and inspected to insure full and complete compliance with the Specifications as determined by the County. All testing shall be in accordance with the American Society for Testing Materials and other Specifications as specified herein. Responsibility for performing testing shall be in accordance with the Detailed Specifications.
- B. The County will perform the tests tabulated in the General Conditions, Article GC 19, "Inspection and Testing".
- C. The Contractor shall perform all other testing laboratory services and furnish all test reports in accordance with the requirements of the General Conditions, Article GC 19, "Inspection and Testing".
- D. The Contractor shall perform all leak testing of concrete structures as described herein.

1.02 - FIELD TESTING OF EQUIPMENT

- A. General:
 - 1. Field testing of equipment shall conform to the requirements of the General Conditions, Article GC 19, "Inspection and Testing", the Technical Specifications and as hereinafter specified.
- B. Preliminary Field Tests, Yellow Tag:
 - 1. As soon as conditions permit, after the equipment has been secured in its permanent position, the Contractor shall check the equipment for alignment, direction of rotation and absence of defects.
 - 2. Purpose of tests is to determine if equipment:
 - a. Is properly installed.
 - b. Complies with operating cycles.
 - c. Is operational and free from overheating, overloading, vibration or other operating problems.
 - 3. The Contractor shall flush all bearings, gear housings, etc., in accordance with the manufacturer's recommendations, to remove any foreign matter accumulated during

shipment, storage or erection. Lubricants shall be added as required by the manufacturer's instructions.

4. The Contractor shall furnish all labor, materials, instruments, fuel, incidentals, and expendables required, unless otherwise provided.
5. The Contractor shall make all changes, adjustments and replacements required to place equipment in service and test it.
6. The Engineer and the County shall be given sufficient prior notice to witness tests.
7. When the Contractor has demonstrated to the Engineer that the equipment is ready for operation, a yellow tag will be issued. The tag will be signed by the Engineer or his designated representative, and attached to the equipment. The tag shall not be removed.
8. Preliminary field tests, yellow tag, must be completed before equipment is subjected to final field tests, blue tag.

C. Final Field Tests, Blue Tag:

1. Upon completion of the installation, and at a time approved by the Engineer, equipment will be tested by operating it as a unit with all related piping, ductwork, electrical controls and mechanical operations.
2. To the maximum extent possible, the Contractor shall perform final field tests of equipment prior to initial start up and operation of the Project. Where this is not practicable, final field tests shall be performed during initial start up and operation of the Project.
3. Purpose of the tests is to demonstrate that equipment is:
 - a. Properly installed.
 - b. Completely ready for operation by the County personnel.
 - c. In compliance with design conditions, material specifications and all other requirements of the Contract Documents.
4. The Contractor shall submit the test procedure for approval by the Engineer. The procedure shall specify the duration and the parameters of the test.

5. The Contractor shall notify the Engineer at least 24 hours prior to beginning of tests. The Contractor shall keep notes and data on tests and submit copy to the Engineer. The Engineer and the County's operating personnel shall witness all tests.
6. The equipment will be placed in continuous operation as prescribed or required and witnessed by the Engineer or his designated representative.
7. Each pump shall be tested at maximum rated speed for the number of points specified in the Technical Specifications, but no less than four points, on the pump curve for capacity, head and electric power input. The rated motor nameplate current and power shall not be exceeded at any point within the specified range. Vibrometer readings shall be taken when directed by the Engineer and the results recorded.
8. Pumps with drive motors rated at less than five horsepower shall only be tested for excess current or power when overheating or other malfunction becomes evident in general testing.
9. Until final field tests are acceptable to the Engineer, the Contractor shall make all necessary changes, readjustments and replacements at no additional cost to the County.
10. Defects which cannot be corrected by installation adjustments will be sufficient grounds for rejection of any equipment.
11. Upon acceptance of the field tests a blue tag will be issued. The tag will be signed by the Engineer and attached to the unit. The tag shall not be removed and no further construction Work will be performed on the unit, except as required during start up operations and directed by the Engineer.
12. All costs in connection with such tests including all materials, equipment, instruments, labor, etc. shall be borne by the Contractor.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. General criteria and restrictions.
- B. Specific criteria and restrictions.

1.02 - RELATED SPECIFICATIONS

- A. Summary of Work.
- B. Temporary Facilities and Controls.

1.03 - GENERAL CRITERIA AND RESTRICTIONS

- A. It shall be understood the term contract, as used in the Section, shall be taken to mean the General Contract, which shall include general construction work involving the rehabilitation of the existing DAF building and installation of new sludge dewatering equipment and appurtenances in the rehabilitated DAF building.
- B. The costs for all temporary facilities, maintenance of services, and all other work specified in these specifications shall be borne by the Contractor unless specifically stated otherwise. The costs for all the aforementioned work are deemed included in the lump sum bid price.
- C. For brevity, the Contractor is advised that this Section of the specifications contains several references to equipment, piping, material and appurtenances to be removed or reinstalled. The Contractor shall refer to other Specification Sections and the Contract Drawings for additional details of equipment, piping, material, and appurtenances to be demolished and removed from the site by the Contractors.
- D. If any Bid Alternate is deducted from the Contract scope it shall be subject to timing and constraints under this section.
- E. The existing wastewater treatment plant facilities, both process and non-process related, will be maintained in continuous operation by the County during the entire contract duration. Work under this Contract shall be so scheduled and conducted by the Contractor such that work will not impede any treatment process, create potential hazards to operating equipment, reduce the quality of the plant effluent, cause odors or other nuisances. In performing the work shown and specified, the Contractor shall plan and schedule the work to meet the plant operating requirements and additional constraints outlined in this Section. Treatment plant personnel must have safe access to all areas, which remain in operation throughout the construction period. The existing potable water and fire service supply systems shall be kept in operation at all times.

- F. Except as otherwise permitted, vehicular access to all treatment units and buildings must be maintained at all times. All construction traffic on internal roads shall be as approved by the Engineer and shall in no way prevent the Owner's personnel from gaining access to areas of their work.
- G. If applicable, sanitary facilities in the existing structures shall be kept operational until such time as their temporary or permanent replacements have been installed and are operational. Except as otherwise permitted, all other building plumbing systems such as roof and floor drains, sump pumps, and other systems shall remain in operation.
- H. At the Contractor's request, the Owner shall completely stop existing dewatering operations to facilitate new equipment installation and tie-in work to existing piping and mechanical and electrical equipment by the Contractor. Contractor shall be responsible for maintaining the existing piping, and mechanical and electrical equipment associated with the existing sludge dewatering operations, as well as the disposal of the waste materials generated during these activities. Upon completion of the work which necessitated the shutdown, the Contractor shall advise the Engineer that the facilities are available for the Owner to put each system back into active service.
- I. The Contractor has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done at no additional cost to the County and provided that all requirements of these specifications are fulfilled. Work not specifically covered in the following paragraphs may, in general, be done at any time during the contract period, subject to the general operating requirements outlined hereinafter.
- J. The times noted as days herein are meant to be consecutive calendar days including normal working days, Saturdays, Sundays, and holidays. For times noted in hours, the time is meant to be measured as consecutive hours and not in terms of normal daily working hours. Any and all premium or overtime costs to comply shall be included in the lump sum bid.
- K. Unless otherwise permitted, the Contractor shall not shut off or disconnect any operating system of the Plant. All Plant equipment operations and shutdowns shall be executed by the County. Any required service interruption or shutdowns affecting Plant operation shall be coordinated with and scheduled at times suitable to the County. The Contractor shall not remove any items from service without written permission from the County. Service interruptions and shutdowns shall not begin until all required materials, equipment and personnel are on hand and ready for installation. At a time approved by the County, the Contractor shall proceed with the work and shall proceed continuously, day and night, start to finish, or until the work is completed and the system is tested and ready for operation.

- L. Any Contractor's activities during the period 3:30 PM to 7:00 AM, Monday through Friday, or on Official County Holidays, must have prior approval of the County. A written request should be received by the County 24 hours in advance of beginning the work. The Contractor is responsible for coordination with the County Engineer and/or his duly authorized representative prior to start of the work to determine the dates of observance of the Official County Holidays that may occur during the course of this Contract. Failure of the Contractor to consider Official County Holidays during the preparation of their work plans and schedules shall not be cause for a delay claim against the County.
- M. The OWNER's regular working hours are 7:00 AM to 3:30 PM, or as otherwise established for the project by the OWNER. Should circumstances arise during the course of the Contract, where the CONTRACTOR intends to work outside of the OWNER's regular working hours or on weekends or official County holidays, regardless if this work is performed as a result of the CONTRACTOR's request, or as required by the Contract Documents, or as required per the approved baseline schedule (resource loaded); the CONTRACTOR will reimburse the County for the cost of providing inspection and/or plant assistance, at the rate of \$175 per hour per staff member. Furthermore, failure of the CONTRACTOR to have considered such a contingency cost in his bid price shall not be cause for an additional cost claim to the OWNER.
- N. The Contractor shall keep the County and the Engineer informed of any work which will interfere with the operation of the treatment plant units. This shall be reported to Engineer on a daily basis.
- O. The Contractor and his employees shall observe all safety regulations in force at the Plant and shall not be permitted to enter or use Plant facilities unless specifically authorized to do so by the County.
- P. Existing underground facilities such as electrical duct banks, pipelines, etc., in, under and crossing plant roads have been designed for a maximum wheel load in accordance with AASHTO H-20. Contractor shall not exceed this weight limit. Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressure that will endanger it. For all construction activities that require a crane, heavy machinery etc., the Contractor shall submit a safe structural loading analysis on the existing facilities. Approval of the analysis is required before any work can proceed. The analysis shall require a Professional Engineer's Certification for the given State as part of the submittal to the Engineer. Contractor shall take all provisions necessary to distribute concentrated loads due to cranes and heavy machinery.
- Q. An unobstructed traffic route through all plant gates and roads must be maintained at all times. Vehicular access to all treatment units and buildings must be maintained at all times. Any work

requiring the temporary closing of a road to traffic must be coordinated with the County. All primes are required to coordinate their work to maintain unobstructed vehicular access.

- R. Treatment plant personnel must have safe access to all areas which remain in operation throughout the construction period. Construction site and staging areas shall be maintained in a neat and workmanlike condition. This includes but is not limited to rubbish removal, cutting grass and removing weeds on a regular basis, grading to eliminate potholes, ponding, ruts, etc., as well as temporary lighting, dust control and proper material and equipment storage.
- S. The existing potable water system shall be kept in operation at all times. All connections to the plant potable water system shall be approved by the County prior to installation, and shall contain protective devices as required by the applicable code. Existing fire hydrants within the plant site shall be operational at all times. Temporary fire standpipe shall be provided if work requires hydrant to be removed from service. Storm drainage on the site shall be operational at all times. Electric power, lighting service and communications systems shall be maintained in uninterrupted operation in all areas which remain in operation. Individual units may be disconnected as required for modifications. All existing sumps shall be maintained in an operating condition with either existing pumps or temporary pumps. Service and seal water and the necessary connections to existing equipment shall be maintained during construction.
- T. As a minimum, construction areas, roadways, offices, shops, corridors, process areas, storage areas, etc. shall be lighted in conformance with OSHA (Electrical, Construction Part 1926) to not less than the minimum illumination intensities (foot candles) listed in Table D.3 while any work is in progress. The County reserves the right to request additional lighting at no additional cost to the Owner.
- U. When a construction task requires a suspension of normal operations of an individual treatment unit or an individual equipment system for a period less than twenty-four (24) continuous hours, the suspension shall be considered a service interruption. The frequency of service interruptions for a single or multiple system operations shall be controlled and directed by the County. For each service interruption, the Contractor shall compile an inventory of the labor and materials required to perform the work, an estimate of the time required and a written description of the steps required to complete the task resulting in a service interruption. The inventory, time estimate and written procedure shall be submitted to the County for review thirty (30) days prior to the start date of the task. No service interruption shall be initiated until the list of materials and labor is verified by the Engineer as on site at least one week prior to the proposed start date. After verification of the list of materials and labor, the Contractor shall notify the Engineer of the exact date that he wishes to perform the work in writing two (2) normal working days, excluding Saturdays, Sundays and holidays, prior to the proposed date. When the normal operations of a treatment unit are suspended

longer than twenty-four (24) hours, then the procedures for a shutdown, specified hereinafter, shall be enforced.

- V. Shutdown shall be defined to indicate that a portion of the normal operation of a plant unit or equipment system has to be suspended or taken out of service for more than twenty-four (24) hours in order to perform specified work. For each shutdown the Contractor shall compile an inventory of the labor and materials required to perform the tasks, an estimate of the time required and a written description of steps required to complete the tasks. The inventory, the estimate and written procedure shall be submitted to the County for review thirty (30) calendar days prior to the start date of the shutdown. A date in a schedule shall not constitute proper notification. The Contractor is prohibited from shutting down any plant units or equipment before obtaining written authorization from the County to proceed. No shutdown shall be initiated until the list of materials and labor is verified by the Engineer as on site at least one week prior to the proposed start date. After verification of the list of materials and labor, the Contractor shall notify the Engineer of the exact date that he wishes to perform the work in writing seven (7) normal working days, excluding Saturdays, Sundays and holidays, prior to the proposed date. The Contractor shall have on hand and located in close proximity to the work area, all tools, equipment and materials, both temporary and permanent, necessary to complete each work category, without interruption. Prefabrication of all piping and other assemblies shall be completed to the greatest degree possible, prior to any shutdowns.
- W. The Contractor shall take all protective measures to the satisfaction of the Engineer necessary to insure that inclement weather or dust and debris from demolition does not enter any of the mechanical or electrical equipment enclosures. Enclosures shall be provided where necessary to prevent contamination of the air. All protective measures shall be furnished, installed, lighted, ventilated, maintained and removed at the Contractor's own cost. Exterior weather tight enclosures shall be provided whenever a work area necessitates protection from the weather to facilitate proper rehabilitation activities.
- X. In case the Contractor's operations disrupt the treatment process or the minimum operating facilities hereinbefore described, at any time, he shall at his own cost immediately make all repairs or replacements and do all work necessary to restore the plant to operation to the satisfaction of the County. Such work shall progress continuously to completion on a 24-hour day, seven work-day week basis. The Contractor shall provide the services of emergency repair crews, available on call 24 hours per day.
- Y. Various requirements are listed below that must be complied with during work associated with the modifications to the existing DAF building and installation of new dewatering facility process and electrical equipment, etc.

1. The existing sludge dewatering operations can be taken off-line for a maximum duration equal to one (1) 8-hour shift. When the connection of a new pipeline to an existing structure or pipeline requires a shutdown of the existing structure or pipeline, except for the final connection, the new pipeline shall be tested prior to proceeding with the shutdown. When the final connection is completed, the new pipeline shall be tested again in its entirety. The Contractor shall provide all pumps, piping, valves, etc., as necessary to dewater all conduits, channels, and pipes.
 2. The Contractor shall, clean and remove deleterious materials from all concrete floor surfaces, valves, piping, and appurtenances resulting from Contract work activities. The Contractor is advised that all pre-mentioned piping and valve system components may contain accumulations of putrescible materials, which will remain on the interior surfaces. These materials emit noxious, odorous and hazardous gases such as hydrogen sulfide and methane. The Contractor is advised to ventilate and test the air of all spaces prior to entry in accordance with the confined space entry requirements of the facility.
 3. The Contractor is advised that existing valves, gates and other devices shall be considered as inoperable and subject to leaking. The Contractor shall be responsible for designing, furnishing, installing and removing all temporary devices, plugs or bulkheads necessary to isolate or dewater pipes, channels or conduits to perform his work. The Contractor shall contain and haul all water/wastewater/sludge materials generated from dewatering pipes, channels or conduits to dispose of offsite.
- Z. If applicable, the Contractor shall request in writing the construction schedules for all ongoing contracts at the plant site. The Contractor shall utilize these construction schedules for coordination purposes.
- AA. The Contractor is required to conduct a day meeting (working meeting) with the County and Engineer on the day of the Notice to Proceed. The Contractor will be required to present his means and methods and sequence of work for executing the requirement of this contract. The Contractor shall be prepared with presentation materials and schedules to thoroughly address the project approach. Any problems or complexities that exist with the project approach should be identified and reviewed at this meeting.

1.05 - FUTURE CONSTRUCTION CONTRACTS

- A. Future Contracts. The following future projects may be started after this Contract starts:

PROJECT	DESCRIPTION	ANTICIPATED START
-	Bulkhead Improvements around Existing Outfall	2020

- B. The Contractor shall coordinate his work with the contractors for the above projects/contracts as outlined in Article 7 of the General Conditions.
1. For listed future projects and others (unlisted) that arise, the contract documents, when completed for bidding purposes, will be available for purchase at County offices during the bid period.

1.06 - SPECIFIC CRITERIA AND RESTRICTIONS

- A. The Contractor is advised that during the execution of work, several specific criteria and requirements, as specified herein, shall be adhered to in the scheduling of activities. Schedule 01310-1 provides a general description of the work and constraints required to complete the work. The order in which the principal structures or work areas are presented herein is for convenience of presentation and is not intended as a sequence of work or a listing of priorities. The Contractor is advised that work in multiple areas of the plant must be performed simultaneously in order to complete the entire scope of the Contract within the allotted time. See Schedule 01700-2 Construction Schedule at the end of this Section.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

SCHEDULE 01700-1**CONSTRAINTS, REQUIREMENTS AND SEQUENCE OF WORK ACTIVITIES**LOCATION OF WORK

Principal Work Areas: Interior and Exterior of existing DAF Building (east of Primary Settling Tanks), and sludge transfer area (driveway area located between Primary Settling Tanks and DAF Building)

GENERAL DESCRIPTION OF WORK

1. Modifications to existing DAF building structure and installation of new sludge dewatering process equipment and appurtenances. Removal and replacement of existing sludge feed pumps and inline sludge grinder. Installation of new building egress access ways, roof, equipment doors, man doors and overhead canopy along exterior portions of the DAF building.

CONSTRAINTS, REQUIREMENTS AND SEQUENCE OF WORK ACTIVITIES

1. Working Meeting - A working meeting with the Contractors will be held prior to the start of work at the site to determine the plan of work, schedule, submittal requirements, training, and the order of substation construction and demolition.
2. Shop Drawings - Within 45 days of the NTP, the Contractor shall submit shop drawings for all materials needed and a sequence of work needed to connect the new belt filter press equipment and associated appurtenances to existing facilities and disconnect/demolish existing facilities identified for demolition.
3. Sludge Dewatering Facility Improvements – Contractor shall coordinate with treatment facility operations personnel (i.e. Severn Trent Environmental Services) to stop existing sludge dewatering operations to facilitate the final transfer of controls for the existing belt filter press to the new sludge dewatering control panel as identified on the Contract drawings. The sludge dewatering operations for the existing press will be permitted to be placed back into service when the new controls have been tested and accepted by the Engineer and/or the Owner's construction representative.

The following sequence of work shall be performed to minimize disruption to existing facility operations and reduce the number of times that any motorized equipment will need to be de-energized and locked-out/tagged-out by treatment facility operations personnel:

- a. Contractor shall coordinate the power and control transfer for the existing Aeration Tank No. 2, 4, 6, & 8 mixers and control relays from existing MCC 'F' to the new MCC. GC WWTP operations personnel will isolate one aeration tank at one time to minimize impacts

to the biological treatment process that may result from de-energizing dedicated tank mixers.

- b. Contractor shall coordinate with GC WWTP operations personnel as to when each tank mixers power and control feeds have been transferred to the new MCC and are ready for use.
 - c. The power and control transfer for each Aeration Tank's mixers shall be completed by the Contractor within one (1) 8-hour operator shift.
 - d. Contractor shall coordinate the transfer of the existing belt filter press controls to the new belt filter press control panel after the new belt filter press equipment and appurtenances have been installed, tested and determined ready for service.
4. Training - Training of Plant staff and the submission of O&M manuals shall be completed prior to the start-up of the first reassembled belt filter press dewatering system, including but not limited to the new sludge feed pumps, new liquid polymer feed system, new chemical feed system(s), new sludge cake conveyance system(s) and not before the existing dewatering facilities are taken offline for modification as specified herein this Contract.

**SCHEDULE 01700-2
CONSTRUCTION SCHEDULE**

NO.	ITEM	CALENDAR DAYS	CUMULATIVE CALENDAR DAYS
1	Notice to Proceed and Working Meeting	1	1
2	Contractor mobilization	14	15
3	Shop drawings	45	60
4	Sludge Dewatering Facility Improvements construction period	548	608
5	Start-up, Testing & Training	14	622
6	Project closeout	14	636

Notes:

- The sequence of work activities is for illustrative purposes. The County will determine the order of DAF building rehabilitation work based primarily on process needs and existing equipment condition. The Contractors shall coordinate with the County in order to sequence the fabrication and delivery of equipment, and installation, start-up, and testing accordingly.
- This Schedule is intended for general guidance to and monitoring the progress of the Contractor. The basic requirement of this Contract is to complete all work within the time of completion indicated in the Agreement.

+ + END OF SECTION + +

Section 01700A

Detailed Maintenance of Plant Operations (MOPO) Descriptions

Index to MOPO Items

Item Nos.:	Description:	Page:
1	Replacement of existing mezzanine grating	01700-xx
2	New mezzanine stairs and opening	01700-xx
3	Existing and new MCC sections	01700-xx
4	Replace existing rotary grinder	01700-xx
5	Replace existing sludge pumps	01700-xx
6	Existing Polymer Injection System	01700-xx
7	Sludge Dewatering Process	01700-xx
8	Existing Aeration Tank Mixers	01700-xx

+ + THIS SPACE LEFT BLANK INTENTIONALLY + +

MAINTENANCE OF PLANT OPERATIONS

Item Number:	Item Description:	Time Constraints:	Processes Out of Service:	General definition of Work to be performed:
1	Replacement of existing mezzanine grating		None.	Coordinate replacement to maintain plant operations within sequence of work, see Item 1 for specific requirements
2	New mezzanine stairs and opening		None	Coordinate replacement of existing stairs to maintain plant operations at existing polymer room within sequence of work, see Item 2 for specific requirement
3	Existing and new MCC sections		None.	Contractor shall maintain existing MCC sections and new MCC sections, see Item 3 for specific installation details.
4	Replace existing rotary grinder	eight (8) hours	Rotary grinder, dewatering	Coordinate installation of new rotary grinder to minimize un-grinded sludge from being processed by the existing belt filter press, see Item 4 for specific installation details.
5	Replace existing sludge pumps		None.	Coordinate the installation of the new sludge pumps while maintaining the existing sludge dewatering process, see Item 5 for specific requirements.
6	Existing Polymer Injection System		None.	Coordinate the installation of the new stair opening and re-location of the existing polymer injection pump while maintaining the existing polymer injection process and sludge dewatering process, see Item 6 for specific installation details and requirements.
7	Existing Aeration Tank Mixers		Aeration mixers may be off-line for a duration of one-hour for each individual aeration tank during the mixer power feeder swap over	Sequence of load transfers from existing MCC-FA and MCC-FB to new MCCs for existing aeration tank mixers; see Item 7 for specific installation details and requirements.
8	Existing Belt Filter Press Feeders		None.	Sequence of replacing existing belt filter press feeders; see Item 8 for specific installation details and requirements.

GENERAL NOTE: The existing sludge dewatering process must remain fully operational during construction of the new dewatering process facilities. Any construction/demolition that effects the existing dewatering process must be coordinated, reviewed, and a construction

sequencing plan to maintain the existing operations must be submitted in writing to the Owner/Engineer within ninety (90) days from the Notice to Proceed in accordance with the Coordination Drawings requirement stipulated in Article GC14 – Contractor Submissions section of the General Conditions. The following sequences may not be all encompassing, and the Contractor is required to review the sequences prior to bid, and shall make no claims thereafter in regards to the requirements set forth.

SEQUENCE OF CONSTRUCTION:

Item 1: Replacement of Existing Mezzanine Grating

1. The Contractor shall be required to facilitate a sequenced demolition of the existing mezzanine level grating and MCC cabinets with the installation of the new mezzanine level grating and new MCC cabinets such that the following requirements are met:
 - a. Provide temporary structural support and maintain electrical operation of the existing MCC cabinets during phased demolition and installation of new grating sections such that all loads can be transferred from the existing MCC to the new MCC. Refer to Item Nos. 3,4,5,6, and 7 for equipment shut down limitation that must be considered in the Contractor's construction schedule and submitted phasing plan during the load transfer from the existing to new MCC.
 - b. Provide clear pathway/stairway access (temporary or permanent) and access for operations personnel to transport chemical through the existing DAF building to the DAF building second floor level for the duration of work activities until one of the new belt filter press systems are installed, tested and accepted for normal operational duty. The clear pathway must be identified on the Contractor's Site Utilization Plan and must consider the phrasing/sequencing of work activities such that the pathway is maintained for the duration required. Daily access to the second floor will be required for the duration of the contract.
 - c. Coordinate with Owner such that Zetalyte injection and injection pump to the existing belt filter press operations are undisturbed. The maximum duration of not providing Zetalyte injection shall not exceed eight consecutive hours.

Item 2: New Mezzanine Stairs and Opening

1. Contractor shall be required to facilitate the demolition of the existing stair access to the existing DAF building second floor level such that the following requirements are met:
 - a. Coordinate with Owner such that the existing polymer injection to the existing belt filter press operations are undisturbed. The maximum duration of not providing a secondary back-up polymer injection pump shall not exceed two consecutive weeks.
 - b. Provide clear pathway/stairway access (temporary or permanent) and access for operations personnel to transport chemical through the existing DAF building to the DAF building second floor level for the duration of work activities until one of the new belt filter press systems are installed, tested and accepted for normal operational duty. The clear pathway must be identified on the Contractor's Site Utilization Plan and must consider the phrasing/sequencing of work activities such that the pathway is maintained for the duration required. Daily access to the second floor will be required for the duration of the contract.

Item 3: Existing and New MCC Sections

1. Install new MCC FA and FB on location shown on the new plans and complete system testing.
2. Install a new 6" conduit from new MCC-FA main breaker section, a new 6" conduit from new MCC-FB main breaker section, and a new temporary 2" conduit from MCC-BFP main breaker section in new MCC-FB and terminate all conduits in existing electrical pull box below the new MCC's.
3. Install and pull new feeders (6 – 500 MCM + #2/0 AWG GND) in new 6" conduits for new MCC-FA and new MCC-FB, and a temporary set of 4 - #3/0 AWG + #6 AWG GND in the new 2" conduit for existing MCC-BFP. Terminate one end of the feeders on the line side of the Main Circuit Breakers, and terminate the other end in the existing electrical pull box. Provide 10' of wire slack in the existing electrical pull box.
4. Install new wire trough adjacent to the location of existing panel FU. Install new conduit and wiring from new Panel FU in new MCC-FB for all existing loads in existing Panel FU that are scheduled to remain and re-powered from the new Panel FU. Provide 10' of wire slack.
5. When the new MCC-FA and MCC-FB are ready for energization, close tie breaker in new MCC-FA and MCC-FB.
6. Schedule with owner for the temporary shutdown of existing MCC-BFP. Shut down existing Main Switchboard Breaker A7 in the control building and shut down existing MCC-BFP. Splice new MCC-FA feeder with existing feeder from Circuit Breaker A7 in existing electrical pull box. Splice temporary MCC-BFP feeder from new MCC-FB with existing MCC-BFP feeder in existing pull box. Extend all wiring and conduit of existing loads that are to remain from existing panel FU to new wire trough and splice with feeders from new Panel FU. Check all wiring splices and connection prior to energizing Main Circuit Breaker A7. The shutdown shall not exceed 8 hours.
7. Closed Main Switchboard breaker A7 to energize new MCC-FA and MCC-FB. Energize existing MCC-BFP and confirm all existing functions of MCC-BFP and all existing loads from Panel FU are working properly.

Item 4: Replace Existing Rotary Grinder

1. Install the new rotary grinder, housekeeping pad, associated fittings, control panel, and wiring adjacent to the existing grinder. Test electrical connection(s) to ensure proper operation. The master control panel (CP-01) does *not* have to be operational prior to replacement of the rotary grinder.
2. Follow the procedure outlined below; the duration of when the rotary grinder will be unavailable shall not exceed eight (8) hours:
 - a. Ensure that the existing isolation plug valves are operational and functional.
 - b. Notify the Owner a minimum of five (5) working days in advance of when the rotary grinder will be demolished and rotary grinding will be unavailable.
 - c. Replace existing bolts on existing isolation plug valves with new bolts (i.e., "hot swap").
 - d. Remove and dispose of existing rotary grinder and all associated piping and fittings, while maintaining all existing isolation valves to hold back sludge in the existing feed piping line. Provide new spool pieces and flange adapters to connect to new rotary grinder.
 - e. Contractor shall review procedure prior to submitting bid and notify the engineer of any changes to the procedure prior to submitting the bid for review and approval and shall not make any claims thereafter.

Item 5: Replace Existing Sludge Pumps

1. Follow the procedure and requirements outlined below:

NCDP 15-01

01700A-10

- a. Confirm that all existing isolation plug valves are operational and functional. Isolate Sludge Pump Nos. 1 and 2 such that Sludge Pump No. 3 is feeding the existing belt filter press.
- b. Complete demolition of existing Sludge Pump Nos. 1 and 2 discharge piping as shown on the plans; turn over the existing Sludge Pump Nos. 1 and 2 back to the Owner. Store existing pumps in a location suitable to the Owner. Provide temporary bracing and supports for all existing piping demolition as required.
- c. Install new Sludge Pump Nos. 2 and 3 and all associated piping and valves such that existing Sludge Pump No. 1 can be maintained in operation to feed the existing belt filter press during the completion of the dewatering improvement equipment installations inside the existing DAF building so that new Sludge Pump No. 1 can be installed and isolated from Sludge Pump Nos. 2 and 3, while maintaining new dewatering operations via Belt Filter Press No. 2 and No. 3.
- d. The existing dewatering operations shall not be interrupted until the new dewatering operations are fully operational, therefore, the demolition of the existing Sludge Pump No. 3 shall not commence until the new dewatering operations are in place, have been tested, and has been approved by the Owner. The master control panel (CP-01) does *not* have to be fully operational prior to the replacement of the existing sludge pumps.
- e. The maximum consecutive duration of the facility running with one single existing sludge pump shall be one (1) month, therefore, the Contractor shall take all steps necessary to coordinate demolition and installation of new piping in sections that minimize single pump operation as much as possible.
- f. Once step (d) above is complete, complete demolition of the remaining Sludge Pump No. 1, the remaining existing sludge pumps and the remaining existing piping as shown on the plans.

Item 6: Existing Polymer Injection System

1. Follow the procedures and requirements outlined below:
 - a. Confirm that all existing isolation valves are operational and functional. Isolate the existing polymer pump that is closest to the existing stair opening. The maximum duration in which the facility will operate with one polymer pump shall be two consecutive weeks.
 - b. Cut out the new stair opening as required; coordinate with Item No. 2.
 - c. Re-install the existing polymer pump and pedestal, re-connect the existing piping and all associated accessories as required.

Item 7: Existing Aeration Tank Mixers

1. The following sets of mixers shall be moved in stages/batches. Extend all conduit/cable tray and wiring from existing mixer to new MCC. After each batch of mixers are transferred to the new MCC's, sequentially re-energize the batch of mixers. All mixers shall be tested to confirm proper operation prior to starting the next set of mixers. Coordinate all mixer shutdowns with owner to maintain uninterrupted plant operation. The mixer shut down will only be allowed for one aeration tank at one time. Each aeration tank is not required to be taken offline during the mixer electrical power feeder change over.
 - a. Existing mixers M201, M202, M203, M204, and M205 from existing MCC-F to new MCC-FA.
 - b. Existing mixers M401, M402, M403, M404, and M405 from existing MCC-F to new MCC-FA.
 - c. Existing mixers M601, M602, M603, M604, and M605 from existing MCC-F to new MCC-FB.
 - d. Existing mixers M801, M802, M803, M804, and M805 from existing MCC-F to new MCC-FB.

2. Intercept all existing mixer power feeders and conduit for the existing loads that are to remain from existing MCC-FA and MCC-FB at a new splice box in location shown on plans, and splice new power cable extensions onto each of the existing power feeder cables and extend each power feeder to new MCC-FA and MCC-FB.
3. Once all loads are transferred to the new MCC-FA and FB. Shut-off Main Circuit Breaker B7 in the existing control building and remove and dispose of existing MCC-FA and FB.
4. Splice new MCC-FB feeder with existing feeder from Circuit Breaker B7 in existing electrical pull box. Check all wiring splices and connection prior to energizing Main Circuit Breaker B7.
5. After all of the newly installed wiring and associated splices have been checked and tested, schedule a brief shutdown from the owner to re-energize MCC-FB from Main Circuit Breaker B7. Shutoff all the connected loads to MCC-FB and shutdown MCC-FB by opening the tie breaker. Closed MCC-FB main circuit breaker to energize MCC -FB. Sequentially re-energize all load that are connected to MCC-FB. The shutdown shall not exceed **one hour**.
6. Once re-energization is confirmed, Contractor shall individually remove each of the mixers to check rotation in conjunction with the mixer start-up after the power feeder swap over is complete.

Item 8: Existing Belt Filter Press Feeders

1. When the new belt filter presses, BFP No. 2 and 3, are operational, schedule with owner for the temporary shutdown of existing MCC-BFP and existing belt filter press (BFP-1) from new MCC-FB and remove and dispose of both the existing and temporary power feeders installed as part of Contract work.
2. Remove and dispose of existing MCC-BFP feeders and temporary feeders from new MCC-FB.
3. Install new feeders from new MCC-FB to existing MCC-BFP.
4. Re-energize existing MCC-BFP and existing BFP-1. Confirm proper operations of all existing loads from MCC-BFP and operation of BFP-1.

PART 1 – GENERAL**1.01 - GENERAL**

- A. Execute cleaning, during progress of the Work, at completion of the Work, and as required by the General Conditions, Article GC-33, "Cleaning".
- B. Requirements of Regulatory Agencies:
 - 1. In addition to the requirements herein, maintain the cleanliness of the Work and surrounding premises within the Work limits so as to comply with federal, state, and local fire and safety laws, ordinances, codes and regulations.
 - 2. Comply with all federal, state and local anti-pollution laws, ordinances, codes and regulations when disposing of waste materials, debris and rubbish.
- C. Scheduling of Cleaning and Disposal Operations:
 - 1. So that dust, wash water or other contaminants generated during such operations do not damage or mar painted or finished surfaces.
 - 2. To prevent accumulation of dust, dirt, debris, rubbish and waste materials on or within the Work or on the premises surrounding the Work.
- D. Waste Disposal:
 - 1. Dispose of all waste materials, surplus materials, debris and rubbish off the plant Site.
 - 2. Do not burn or bury rubbish and waste materials on the plant Site.
 - 3. Do not dispose of volatile or hazardous wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 4. Do not discharge wastes into streams or waterways.
- E. Cleaning Materials:
 - 1. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
 - 2. Use each type of cleaning material on only those surfaces recommended by the cleaning material manufacturer.
 - 3. Use only materials which will not create hazards to health or property.

F. During Construction:

1. Keep the Work and surrounding premises within work limits free of accumulations of dirt, dust, waste materials, debris and rubbish, in accordance with the General Conditions, Article GC-33, "Cleaning."
2. Keep dust generating areas wetted down.
3. Provide suitable containers for storage of waste materials, debris and rubbish until time of disposal.
4. Dispose of waste, debris and rubbish off Site at legal disposal areas.

G. When Project is Completed:

1. The Contractor shall clean and maintain the Site in accordance with Division 1, Section 01760, Project Closeout.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 - GENERAL**

- A. The Contractor shall maintain and provide the Engineer with Project record documents as specified below except where otherwise specified or modified in the Specifications or in the General Conditions, Article GC-5, "Drawings and Specifications" and Article GC-36, "Record Drawings."

1.02 - MAINTENANCE OF DOCUMENTS

- A. Maintain the Contractor's field office in clean, dry, legible condition, complete sets of the following: Contract Drawings, Specifications, Addenda, approved Shop Drawings, Samples, photographs, Change Orders, other Modifications of Contract, test records, survey data, Field Orders, and all other documents pertinent to Contractor's Work.
- B. Provide files and racks for proper storage and easy access. File in accordance with the filing format of the Construction Specification Institute (CSI) unless otherwise approved by the Engineer.
 - 1. Make documents available at all times for inspection by the Engineer and the County representative.
 - 2. Record documents shall not be used for any other purpose and shall not be removed from the office without the Engineer's approval.

1.03 - RECORDING UPDATED INFORMATION

- A. General:
 - 1. Label each document "PROJECT RECORD" in 2-inch high printed letters.
 - 2. Keep record documents current, and updated at least monthly.
 - 3. Do not permanently conceal any Work until required information has been recorded.
- B. Contract Drawings: Legibly mark to record actual construction including:
 - 1. Depths of various elements of foundation in relation to datum.
 - 2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.

3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 4. Field changes of dimensions and details.
 5. Changes made by Change Order or Field Order.
 6. Details, not on original Contract Drawings.
- C. Specifications and Addenda: Legibly mark up each Section to record:
1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 2. Changes made by Change Order or Field Order.
 3. Other matters, not originally specified.
- D. Shop Drawings: Maintain as record documents and legibly annotate Drawings to record changes made after review.

1.04 - FINAL SUBMISSION OF RECORD DOCUMENTS

- A. Record Drawings:
1. At the completion of the Work, Contractor shall furnish to the Engineer record drawings one (1) reproducible (Mylar) media set and on CD-R one (1) electronic bound AutoCAD drawing set in Release 2012 or later and one (1) compiled PDF set showing the actual in-place installation of these items installed under this Contract. Drawings shall show the Work in plan and sections as required for clarity with reference dimensions and elevations for complete Record Drawings. Documentation shall be furnished not later than 30 days after completion of the Work and prior to Final Payment.
 2. At the completion of all electrical Work under the Contract, the Contractor shall furnish to the Engineer, reproducible mylar tracings showing a one-line diagram of the distribution system and the actual in-place grounding system, lighting arrangement, motor control centers, equipment and conduit and cable plans. Tracings shall be furnished not later than 30 days after completion of the Work and prior to Final Payment.
 3. The Contract Drawings may be used as a starting point in developing these Drawings. The Subcontractor and manufacturer's drawings may be included in this drawing package. The drawing package must be fully integrated and include the necessary

cross-references between Drawings. The drawing package shall include interconnection and termination details to the equipment furnished under this Contract.

4. All Drawings must be submitted for approval of the Engineer. This shall include the following composite drawings for the system being furnished:
 - a. Schematic (Elementary) Diagrams: This shall include but not be limited to complete schematics including items furnished by others for the following:
 - i. Motor control circuits for starters furnished under this Contract.
 - ii. Substation controls.
 - b. Wiring (connection) diagrams: These shall be included for all pre-wired equipment furnished under this Contract.
 - c. Interconnection diagrams: These shall include all interconnections to be furnished under this Contract.
 - d. Conduit and cable schedules: These shall include all conduit and cable furnished under this Contract.
 - e. Dimension of outline drawings: These shall include all equipment furnished under this Contract.
 - f. Power and lighting layout drawings: These shall include all conduits and wiring furnished under this Contract.

B. Submittal:

1. At completion of Project, deliver 10 record documents to the Engineer.
2. Accompany submittal with transmittal letter containing:
 - a. Date.
 - b. Project title and number.
 - c. Contractor's name and address.
 - d. Title and number of each record document.
 - e. Certification that each document as submitted is complete and accurate.

- f. Signature of the Contractor, or his authorized representative.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 - GENERAL**

- A. Provide operation and maintenance data in the form of instructional manuals for use by the County's personnel for:
 - 1. All equipment and systems.
 - 2. All valves, gates and related accessories.
 - 3. All instruments and control devices.
 - 4. All electrical gear.

1.02 - LUBRICATION SURVEY

- A. Provide a lubrication survey, made by a lubricant supply firm, subject to the approval of the Engineer, and paid for by the Contractor.
- B. Lubrication survey shall list all equipment, the equipment manufacturer's lubrication recommendations, and an interchangeable lubricants tabulation standardizing and consolidating lubricants whenever possible. Include lubricant type, quantities and frequencies for each piece of equipment.
- C. The Contractor shall supply all lubricants, applicators and labor for lubricating the equipment, in accordance with manufacturer's recommendations, for field-testing and prior to final acceptance. A supply of required lubricants sufficient for start-up and one year of operation shall also be supplied by the Contractor.
- D. Twelve copies of the approved lubrication survey shall be furnished prior to final acceptance.

1.03 - SPARE PARTS AND SPECIAL TOOLS

- A. Spare Parts:
 - 1. As soon as practicable after approval of the list of equipment, the Contractor shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies, with current unit prices and source or sources of supply. This information shall also be included in the Operations and Maintenance Manuals.
 - 2. The Contractor shall also furnish a list of parts, and supplies that are either normally furnished at no extra cost with the purchase of the equipment, or specified to be

furnished as part of the Contract and a list of additional items recommended by the manufacturer to assure efficient operation for the particular installation for a period of one year or the guarantee period, whichever is greater.

3. All parts shall be securely boxed and tagged, and clearly marked on the box and individually for identification as to the name of manufacturer or supplier, applicable equipment, part number, description and location in the equipment. All parts shall be protected and packaged for a shelf life of at least ten years.

B. Special Tools:

1. The Contractor shall furnish at no additional cost to the County with each piece of equipment as a minimum, two complete sets, or the number of sets called for in the Technical Specifications, of suitably marked special tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment.
2. The Contractor shall submit, for approval by the Engineer, a complete list of the special tools and appliances to be furnished. Such tools and appliances shall be furnished in approved painted steel cases properly labeled and equipped with good grade cylinder locks and duplicate keys.

1.04 - OPERATION AND MAINTENANCE MANUALS

A. Final Operations and Maintenance Manuals:

1. As a prerequisite to obtaining payments for equipment furnished under this Contract in excess of fifty percent of the Contract amount, the Contractor shall prepare, submit and obtain the Engineer's approval of an operation and maintenance manual for each item of equipment supplied under this Contract. Each item of equipment shall be identified with the equipment identification number given in the Contract Documents or as furnished by the Engineer. Each manual shall be prepared specially for this installation and shall include all approved Shop Drawings, all pertinent and legible instructions, technical bulletins and other printed matter required to provide fully accurate and comprehensive information for the safe and proper operation, maintenance and repair of the equipment item. It shall include, but not be limited to the following:
 - a. Catalogs, diagrams, schematics, drawings, instruction bulletins and manuals marked by underlining, checking, the use of arrows or the obliteration or removal of extraneous data, so as to pertain only to the specific equipment item for which the manual is supplied. Original reprints of manufacturers' catalog information

and maintenance data shall be furnished; photocopies or facsimile (FAX) copies will not be acceptable.

- b. Complete electrical schematics and wiring diagrams. Complete wiring between terminal points must be shown. Computerized diagrams are not acceptable.
- c. Drawings, diagrams and illustrations shall be original quality and clearly legible. Facsimile copies are not acceptable. Reduced drawings shall not be reduced to less than one-half of the original size. All lines, dimensions, lettering and text must be clearly legible.
- d. Reference to features and elements of equipment, such as operational limits of time, speed, pressure, temperature, etc., shall be clear, complete and compatible with authoritative published engineering reference documents. Torque ratings shall be given for all bolted connections. All functional components, electrical systems, equipment, etc., shall be shown on diagrams and discussed in the text so as to identify their proper system relationship. Operation, service, trouble-shooting, checkout and in-line and bench repair procedures, identifying specific system characteristics of the equipment, shall be provided. Detailed start-up and shutdown procedures shall be included as a separate section for each piece of equipment or system.
- e. Recommended procedures and frequencies for preventive maintenance such as inspection, adjustment, lubrication, calibration and cleaning shall be provided including pre-startup checklists for each piece of equipment and long-term shutdown maintenance.
- f. Equipment parts shall be identified by manufacturer's part number and located with relation to other components of the equipment utilizing "exploded" type drawings for clarity. Complete parts lists shall be included, which indicate the part number, the part description, applicable serial and model numbers, current unit prices and the name, address and telephone number of the nearest equipment manufacturer's representative and nearest service and spare parts warehouse. Complete instructions for the ordering of all replaceable parts shall be noted in this section of the Manual. Recommendations as to spare parts and spares inventory levels shall be made. Lead time and shelf life values and preservation, packaging and labeling methods shall be recommended.
- g. All copyrighted material used in the manual or in any operation required in the performance of the Contract will be preceded by the Contractor obtaining the

copyright holder's written permission to use such material. The Contractor shall hold the County and the Engineer free of any legal responsibility for its use.

2. Each operation and maintenance manual shall be bound in a durable, permanent, stiff cover binder of one (more if required) volume with a complete index of the manual's contents arranged by subject matter and in order of presentation in each volume. Applicable equipment item numbers, as shown in the Contract Documents, shall be prominently included at their appropriate location in the index. The title of the manual shall be securely affixed to the binder in two places: the front cover and the binder back edge. The title shall identify the Project by number and name, state the volume is an O&M manual, generally classify the equipment and state the manufacturer's name, equipment model number and equipment identification number.
 - a. Covers shall permit easy removal of pages and shall be of the three-post, metal-hinged, self-expanding type and shall not be overfilled. Covers shall be oil, moisture and wear resistant and approximately 9 by 12 inches in size.
 - b. Page size shall be 8-1/2 by 11 inches; paper shall be 60 pound and holes reinforced with plastic cloth or metal.
 - c. Drawings, diagrams and illustrations shall be attached foldouts up to 11 by 17 inches in size; larger sizes shall be inserted in the attached clear plastic envelopes marked as to contents.
3. Contractor's submittal to the Engineer for approval shall consist of three complete sets of each operation and maintenance manual and two copies of an itemized listing providing cross-reference identification between the Specification Sections of the Contract Documents, the approved Shop Drawings, and the operations and maintenance manual submittal. One copy of the manual and itemized listing will be returned to the Contractor stamped either "Approved" or "Disapproved", the latter when the Manual submittal is considered inadequate, inaccurate or lacking essential information. Discrepancies will be noted on the return itemized listing of a "Disapproved" submittal. The Contractor shall rectify all unapproved submittals by replacing submitted portions or adding additional data, as required, to the manual. The manual's index of contents and the itemized, cross-referenced listing shall be revised to reflect all revisions or additions made. Then two copies of the entire package shall be resubmitted to the Engineer for approval.
4. Upon approval of the operation and maintenance manuals, the Contractor shall submit ten copies of the manual and the itemized listing to the County.

1.05 - MAINTENANCE AND LUBRICATION SCHEDULES

- A. For all items of equipment furnished, Contractor shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained. In addition, a maintenance and lubrication schedule for each piece of equipment shall be submitted with the Shop Drawings. Submission shall be in fifteen copies. The schedules shall be in the form indicated below.

Sample Maintenance Schedule			
Item	Action	Frequency	Remarks

Sample Lubrication Schedule				
Item	Manufacturer's Recommendations	Type Lubricant	Quantity Per Tank	Frequency

1.06 - EQUIPMENT START-UP SERVICES

- A. Equipment start-up period, shall begin after satisfactory completion and acceptance of the field tests described in Section 01660 and shall end before the certified date of substantial completion for the part of the Work for which the equipment is included. If the equipment is not covered by a certificate of substantial completion for a part of the Work, the period shall begin upon substantial completion of the Project.
- B. During the equipment start-up period the Contractor shall furnish, at no additional cost to the County, the services of factory-trained representatives of the equipment manufacturers for the equipment designated in the Specifications to:
1. Assist in the start-up and operations of the equipment.
 2. Conduct training of plant personnel in the proper operation and maintenance of the equipment.
- C. The County shall:
1. Provide the necessary plant personnel for training in the operation and maintenance of the equipment during their regularly assigned work shifts.
- D. The Contractor shall pay for all chemicals consumed up to the date of "certified substantial completion", and in addition shall provide the quantities of fuel and chemicals specified in Section 01660, Quality Control.

- E. The Contractor shall be available to promptly repair all Work during the start-up period so as to cause minimum disruption to the total plant operation.
- F. Upon completion of a minimum of ten consecutive twenty-four hour days of satisfactory operation, or the number of days called for in the Technical Specifications, the County will assume operation and operating cost of the equipment. If the equipment malfunctions during this start-up period, the start-up period will be repeated until satisfactory operation is achieved.
- G. In the event a system, equipment or component proves defective or is unable to meet specified performance criteria, the Contractor shall replace the defective item, and the minimum two years guarantee period, or the guarantee period called for in the Technical Specifications for the item, shall start after satisfactory replacement and testing of the item.

1.07 - TRAINING

A. General:

- 1. Manufacturer shall provide the services of factory trained specialists to instruct the County's operation and maintenance personnel in recommended operation and corrective and preventive maintenance procedures for equipment as specified in the respective equipment Section and outlined in the attached schedule at the end of this Section. Training shall be scheduled prior to start-up of the equipment.
- 2. The qualifications of the specialists shall be subject to approval by the County's representative.
- 3. Manufacturer shall be responsible for coordinating these services at times acceptable to the County, with a minimum of 14 days prior notice, after an approval of the Lesson Plan.
- 4. Manufacturer shall provide a combination of classroom, equipment site, and machine shop training. All training shall be conducted at the Bay Park Sewage Treatment Plant unless otherwise specified.
- 5. Manufacturer shall provide the minimum training for each piece of equipment as specified in the attached schedule.
- 6. The County reserves the right to videotape any and all manufacturer training sessions.

B. Submittals:

- 1. Manufacturer shall submit for approval proposed Lesson Plans for the instruction prior to scheduling training. Lesson plans shall include operations, mechanical maintenance,

and electrical and instrumentation maintenance as outlined in the attached schedule at the end of this section.

2. Manufacturer shall submit for approval credentials of their designated instructors with the Lesson Plan Submittals. Credentials shall include a brief resume and specific details of the instructor's experience with operation and maintenance of and training on the equipment specified.

C. Instruction Lesson Plans:

1. Manufacturer's proposed Lesson Plans shall include the elements presented in the Training Instruction Lesson Plans in Paragraph 1.7,C.4. and any other information necessary for proper operation and maintenance of the equipment. Specific components and procedures shall be identified in the proposed Lesson Plan.
2. Manufacturer's proposed Lesson Plans shall detail specific instruction topics. Training aids to be utilized including handouts, in the instruction shall be referenced and attached to the proposed Lesson Plan. "Hands-On" demonstrations planned for the instruction shall be described in the Lesson Plans.
3. The manufacturer shall indicate the estimated duration of each segment of the training Lesson Plans and the training audience the instruction is to address.
4. Training Instruction Lesson Plans: Guide for Equipment Maintenance:
 - a. Maintenance Training:
 - i. System Overview.
 - 1) Describe the function and performance objectives of the equipment or system.
 - 2) Describe the main features of the equipment or system.
 - 3) Identify all support system and related auxiliary equipment.
 - ii. Preventive Maintenance (PM):
 - 1) Define the recommended PM program and schedules for each system and equipment item.
 - 2) Describe PM procedures.

- 3) Describe inspection and test procedures and use of test equipment, if applicable.
 - 4) Describe routine inspection procedures required to:
 - a) Perform an inspection of equipment while it is operating.
 - b) Identify symptoms of potential problems to anticipate breakdowns.
 - 5) Describe equipment housekeeping procedures.
- b. Equipment Troubleshooting:
- i. Define recommended systematic troubleshooting procedures.
 - ii. Provide component-specific troubleshooting checklists.
 - iii. Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.
- c. Equipment Corrective Maintenance:
- i. Describe recommended equipment preparation requirements.
 - ii. Identify and describe the use of any special tools required for maintenance of the equipment.
 - iii. Describe component removal/installation and disassembly/assembly procedures.
 - iv. Perform at least two "hands-on" demonstrations of common corrective maintenance repairs.
 - v. Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.
 - vi. Define recommended torquing, mounting, calibration and/or alignment procedures and settings, as appropriate.
 - vii. Describe recommended procedures to check/test equipment following a corrective repair.

5. Operations Training:

a. System Overview:

- i. Describe the function and performance objective of the equipment or system.
- ii. Describe the main features of the equipment or system.
- iii. Identify all support systems and related auxiliary equipment.

b. Operation:

- i. Describe operating principles and practices.
- ii. Describe routine operating, start-up and shutdown procedures.
- iii. Describe alarm conditions and response to alarms. Identify safety features and control interlocks.
- iv. Describe routine monitoring and record keeping procedures.

D. Responsibilities:

1. Manufacturer's Instructors shall be fully prepared for the training sessions. Training delivery shall be communicative, clear and proceed according to the approved lesson plan material covered shall be appropriate for the personnel in attendance. If training delivery is found by the County or Engineer to be not to Standards or requirements, the training shall be postponed and rescheduled at a cost to be borne by the Contractor.

E. Training Schedule and Operation & Maintenance Manuals: In order to provide the County with adequate time requirements for manufacturer's training, minimum training times for various pieces of equipment and systems are listed on the attached schedule. Schedule 01730-A also references sections that will require an Operation & Maintenance Manual.

1. Schedule 01730-A: Schedule of specification sections requiring an Operations and Maintenance Manual:

Training Schedule Specification Sec.	Description of Equipment	Minimum Training Time
11318	Booster Pump	1 Trip, 1 Day
11320	Progressive Cavity Pumps	1 Trip, 1 Day
11331	Top Opening Inline Sludge Macerators	1 Trip, 2 Days
11350	Sludge Thickening System	2 Trips, 4 Days
11352	Polymer Blending and Feed Equipment	1 Trip, 3 Days
13420	Primary Sensors and Field Instruments	3 Days
13440	Panel Mounted Instruments and Devices	3 Days
13425	Gas Detection System	3 Days
14250	Portable Truck Scales	1 Day
14500	Shaftless Screw Conveyor	3 Days
16221	Electric Motors	4 hours
16250	Bus Duct	4 hours
16442	Elect. Control Equip. Low Voltage AC Motors and Devices	16 hours
16482	Motor Control Centers	24 hours
16496	Automatic Transfer Switch	16 hours
16511	Light Fixtures and Devices	8 hours

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Requirements for construction waste management.

1.02 - SUBMITTALS

- A. The Contractor shall prepare and submit a Construction Waste Management Plan for review and approval by the Engineer within 15 days after receipt of Notice to Proceed and prior to the removal of any construction waste or demolition materials from the Project site.
- B. The Construction Waste Management Plan shall contain the following:
 - 1. Analysis of the proposed job site waste to be generated during the full construction period, including types and anticipated quantities of each. The list of construction waste materials shall include, at a minimum but not limited to, the following materials:
 - a. Cardboard
 - b. Clean dimensional wood
 - c. Demolition debris
 - d. Concrete
 - e. Bricks
 - f. Concrete masonry units (CMU)
 - g. Asphalt
 - h. Metals from rebar, sheetrock studs, framing, etc.
 - i. Steel sheet piling
 - j. Steel pipe piles
 - k. Structural steel
 - l. Paints, solvents, and other hazardous fluids
 - m. Glass

- n. Roofing
 - o. Wood pallets
 - p. Fencing materials
 - q. Mercury containing light bulbs/batteries
 - r. Recyclable office wastes such as paper and toner and ink cartridges that should be recycled.
- 2. Materials Handling Procedures: A description of the means by which any construction waste materials listed above will be appropriately segregated and not mixed in order to prevent cross-contamination as well as a description of the means to be employed in recycling the above materials consistent with requirements of the County.
 - 3. The Construction Waste Management Plan shall specify a list of waste transporters, transfer stations, disposal facilities and recyclers with addresses, phone numbers, and permits which the Contractor intends to utilize during the construction period for the purpose of complying with the Construction Waste Management Plan. The Plan should list where the non-recyclable materials will be disposed.
 - 4. Transportation: A description of the means of transportation of the recyclable and non-recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste transporter and removed from the site) and destination of such materials.
 - 5. Hazardous wastes: The Construction Waste Management Plan shall specifically note the proper method of disposal for anticipated hazardous wastes or potentially hazardous wastes such as resins, epoxies, waterproofing agents, waste paints, solvents, and other hazardous fluids, expended 55 gallon drums, concrete curing compounds, etc. The Plan shall state that the hazardous waste transporter must hold a current DEC Part 364 Waste Transporter Permit. The permit must authorize the transporter to take the hazardous waste to the Transportation, Storage and Disposal Facility (TSDF) identified in the permit. The Construction Waste Management Plan must state that the hazardous waste will be transported in compliance with USDOT 49 CFR Hazardous Materials Transportation regulations.
 - 6. Universal wastes: The Construction Waste Management Plan shall specifically identify the proper method of handling of universal wastes (e.g., mercury containing bulbs, batteries).

Universal wastes must be managed in compliance with 6NYCRR Part 374-3 and with USDOT 49 CFR Hazardous Materials Transportation regulations.

7. Non hazardous wastes: The Construction Waste Management Plan shall specifically note the proper method of disposal of anticipated non hazardous waste such as oily rags. The Plan shall state the transporter must hold a current Part 364 Waste Transporter Permit to transport the waste to a TSDf that accepts non-hazardous waste.
8. The Construction Waste Management Plan shall include the method of recycling office materials such as clean white paper, mixed paper, toner cartridges for laser printers, copiers and fax machines. Each item shall be recycled in accordance with the manufacturer's instructions.
9. The Construction Waste Management Plan shall include the coordination of product deliveries to designated prepared areas in order to minimize site storage time and potential damage to stored materials and the return of packing materials, such as wood pallets, 55-gallon drums, etc., where economically feasible.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 - CONSTRUCTION WASTE MANAGEMENT

- A. The Contractor shall use construction and demolition methods and processes to ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors. Where economically feasible, as many of the materials from the generated waste shall be salvaged, reused, or recycled.
- B. When encountered as part of his work, the Contractor shall dispose of construction and demolition waste by recycling methods in accordance with all relevant State, County and local codes, laws and regulations.
- C. All hazardous waste, universal waste, and used oil must be separated and stored in their own dedicated storage areas and managed in compliance with NYSDEC Hazardous Waste, Universal Waste and Used Oil Regulations and USDOT 49 CFR Hazardous Material Transportation Regulations.

3.02 - HANDLING AND STORAGE

- A. The Contractor shall designate separate receiving/storage areas for delivered materials and equipment in order to minimize waste due to excessive materials mishandling, misapplication, weather and other damage.
- B. The requirements herein shall supersede any conflicting statements wherever they may appear in the Contract Documents.

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 - FINAL CLEANING**

- A. At the completion of the Work, the Contractor shall remove temporary structures, construction signs, tools, scaffolding, materials, supplies and equipment which he or any of his Subcontractors may have used in the performance of the Work.
- B. The Contractor shall broom clean paved surfaces and rake clean other surfaces of grounds.
- C. The Contractor shall thoroughly clean all materials, equipment and structures; all marred surfaces shall be touched up to match adjacent surfaces; dirty filters and burned-out lights replaced as required. The Contractor shall clean and polish all interior and exterior glass surfaces so as to leave glass surfaces in a clean and new appearing condition.
- D. The Contractor shall remove spatter, grease, stains, fingerprints, dirt, dust, labels, tags, packing materials, rubbish, and other foreign items or substances from interior and exterior surfaces, equipment, signs and lettering.
- E. Remove paint, clean and restore all equipment and material nameplates, labels and other identification markings.
- F. The Contractor shall maintain cleaning until Project, or portion thereof, is occupied by the County.

1.02 - INSPECTIONS

- A. At the time of substantial completion an inspection shall be held in accordance with the requirements of the Agreement, Article XXXVI, "Substantial Completion Payment". At this time the Contractor shall also provide all necessary documentation as required by the above referenced Article.
- B. At the time of completion of all the Work a final inspection shall be held in accordance with the requirements of the Agreement, Article XXXVII, "Final Payment". The Contractor shall also provide all necessary documentation as required by the above referenced Article, and comply with all the requirements of the General Conditions, Article GC-38, "Project Closeout".
- C. Follow-up Inspection:
 - 1. At the time of the completion of the guarantee period as specified in the Agreement, Article XX, "Maintenance and Guarantee," the Engineer will make arrangements with the County and the Contractor for a follow-up inspection and will send a written notice to said parties to inform them of the date and time of the inspection.

2. After the inspection, the Engineer will inform the Contractor of any corrections required.
3. When the corrections have been satisfactorily completed, the Engineer will forward a certificate for the release of Bonds.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified, and required to complete the Work of demolition, removal, and disposal. Included are all modifications to existing facilities as shown and required to complete the Work.
2. Included, but not limited to, are the demolition, removal, and disposal of existing structures, removal and disposal portions of any existing equipment including piping not required for the operation of the plant as indicated on the Drawings and as specified hereinafter.
3. The Contractor shall furnish all labor, materials and equipment to demolish portions of structures and to remove anchors, supports, piping, equipment and accessories designated to be removed on the Drawings.
4. The removal of all equipment, piping, and all other materials from the demolition of structures shall, when released by the Engineer, be done by the Contractor for the materials removed by him and shall become Contractor's property, unless otherwise noted. The debris shall be disposed of offsite in a manner not contrary to the Contract requirements.

1.02 - SUBMITTALS**A. Schedule: Submit for approval the following:**

1. The Contractor shall submit a detailed description of methods and equipment and sequence for demolition and removal for the Engineer's review.

1.03 - PROTECTION**A. General:**

1. Demolition and removal Work shall be performed by competent workmen experienced in the various types of demolition and removal Work required, and shall be carried through to completion with due regard to the safety of the Owner's employees, workmen on the Site and the public. The Work shall be performed with as little nuisance as possible.

2. The Work shall comply with the applicable provisions and recommendation of ANSI A10.2, Safety Code for Building Construction, and all governing codes and as hereinafter specified.
3. The Contractor shall make such investigations, explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal.
4. The Contractor shall provide interior and exterior shoring, bracing and support to prevent movement, settlement, or collapse of existing structures or facilities. The Owner assumes no responsibility for the actual condition of the structures or facilities adjacent to the Work or the structures or facilities designated for removal or modification.
5. Do not bring explosives on site. No explosives will be permitted for this Project.

B. Execution:

1. The Contractor shall provide, erect and maintain catch platforms, lights, barriers, weather protection, warning signs and other items as required for proper protection of the public, occupants of the building, workmen engaged in demolition operations, and adjacent construction.
2. The Contractor shall provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.
3. The Contractor shall provide and maintain temporary protection of the existing structure designated to remain where demolition, removal and new Work is being done, connections made, materials handled or equipment moved.
4. The Contractor shall take necessary precautions to prevent dust from rising by wetting demolished masonry, concrete, plaster and similar debris. Unaltered portions of the existing buildings affected by the operations under this Section shall be protected by dustproof partitions and other adequate means.
5. The Contractor shall provide adequate fire protection in accordance with local Fire Department requirements.
6. The Contractor shall not close or obstruct walkways, passageways, or stairways and shall not store or place materials in passageways, stairs or other means of egress. The Contractor shall conduct operations with minimum traffic interference.

7. The Contractor shall be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.
8. The Contractor shall carry out all operations so as to avoid interference with operations and work in the existing facilities and the work under other contracts.
9. The Contractor shall be solely responsible for making all necessary arrangements and for performing all necessary work involving the discontinuance or interruption of all utilities or services.
10. Any equipment, piping and appurtenances removed without proper authorization, which are necessary for the operation of the existing plant or of the plant expansion, shall immediately be replaced to the satisfaction of the Engineer at no cost to the Owner.

C. Notification:

1. At least 48 hours prior to commencement of demolition or removal, the Contractor shall notify the Engineer in writing of his proposed schedule therefor. The Owner shall inspect the existing equipment and (review with the Contractor) those items that are to remain the property of the Owner. No removals shall be started without the permission of the Engineer.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 - GENERAL

- A. The Work required shall be done with care, and shall include all required shoring, bracing, etc. The Contractor shall be responsible for any damage which may be caused by demolition and removal Work to any part or parts of existing structures or items designated for reuse or to remain. The Contractor shall perform patching, restoration and new Work in accordance with applicable technical sections of the Specifications and in accordance with the details shown on the Drawings.
- B. Surfaces of walls, or other areas which are exposed by any of the removals specified herein, and which will remain as architecturally finished surfaces, which have holes, scars, chipped or other damaged surfaces revealed by the removal shall be repaired by the Contractor with the same or matching materials as the existing surface or as may be otherwise approved by the Engineer.

- C. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
 2. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the Work.
- D. All supports, pedestals and anchors shall be removed with the equipment and piping unless otherwise specified or required. The concrete bases, anchor bolts and other supports shall be removed to approximately one inch below the surrounding finished area and the recesses shall be patched to match the adjacent areas. The superstructure wall and roof openings shall be closed, and damaged surfaces shall be patched to match the adjacent areas, as specified under applicable sections of the Specifications, as shown on the Drawings, or as directed by the Engineer. Wall sleeves and castings shall be plugged or blanked off, all openings in concrete shall be closed in a manner meeting the requirements of the appropriate sections of the Specifications, as shown on the Drawings and as directed and approved by the Engineer.
- E. Deposition of Materials and Equipment:
1. The Contractor shall dispose of all demolition materials, equipment, debris, and all other items not marked by the Owner to remain as property of the Owner, off the site and in conformance with all existing applicable laws and regulations.
 2. The following items are to be salvaged and turned over to the Owner for their own use from the Odor Control Building prior to demolition:
 - a. Roof fan motors and sheaves
 - b. Liebert motor and sheave
 - c. Heat and vent motor and sheave
 - d. Scrubber motors
 - e. Hot water heater

- F. Wherever piping is to be removed for disposition, the piping shall be drained by the Contractor and adjacent pipe and headers that are to remain in service shall be blanked off or plugged and then anchored in an approved manner.
- G. Where alterations occur, or new and old Work join in, the Contractor shall cut, remove, patch, repair or refinish the adjacent surfaces to the extent required by the construction conditions, so as to leave the altered Work in as good a condition as existed prior to the start of the Work. The materials and workmanship employed in the alterations, unless otherwise shown on the Drawings or specified, shall comply with that of the various respective trades, which normally perform the particular items of work.
- H. The Contractor shall remove temporary work, such as enclosures, signs, guards, and the like when such temporary work is no longer required or when directed at the completion of the Work.

3.02 - STRUCTURAL REMOVALS

- A. The Contractor shall remove concrete and structures to the lines and grades shown unless otherwise directed by the Engineer. Where no limits are shown, the limits shall be 4 inches outside the item to be installed.
- B. Determine the thickness of existing concrete to be removed and the extent to which it is reinforced. No additional compensation will be made because of variations from the thickness shown or for variations in the amount of reinforcement.
- C. All concrete, concrete block, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the Engineer. Demolished items shall not be used in backfill.
- D. After removal of parts or all of slabs and like work which tie into new Work or existing work, the point of junction shall be neatly repaired so as to leave only finished edges and finished surfaces exposed.
- E. Where new anchoring materials including bolts, nuts, hangers, welds and reinforcing steel are required to attached new Work to the existing work, they shall be included under this Section, except where specified elsewhere.

3.03 - PAVEMENT, CURB AND SIDEWALK REMOVALS

- A. Remove existing pavement, including bases and surface courses, stabilized sub-bases, curbs, and gutters as required to construct new facilities or as shown. Before removing, saw a straight joint at least 1-1/2-inches deep between sidewalk and pavement designated for removal and that

left in place. Curbs and gutters shall be removed to the nearest construction joint beyond the end of demolition symbol shown on the Drawings.

- B. Determine the thickness of existing pavement, base, sub-base, curb, gutter, driveway pavement, and sidewalk to be removed, and the extent to which they are reinforced. No additional compensation will be made because of variations from the assumed thickness or from the thickness shown or for variations in the amount of reinforcement.
- C. Provide for satisfactory transition between replaced pavement and sidewalks and the portions remaining in place.

3.04 - MECHANICAL REMOVALS

- A. Equipment removals shall consist of dismantling and removing of existing piping, equipment, and other appurtenances as specified, shown, or required for the completion of the Work. It shall include cutting, capping, draining, and plugging as required, except that the cutting of existing piping for the purpose of making connections thereto will be included under Division 15.
- B. When underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping may be left in place unless it interferes with new Work or is shown or specified to be removed.
- C. Any demolition or changes to potable water piping and other plumbing and heating system work shall be made in conformance with all applicable codes. Portions of the potable water system that may have been altered or opened shall be pressure tested and disinfected in accordance with Division 15 and local codes. Other plumbing piping and heating piping shall be pressure tested only.
- D. Provide all caps, plugs, blind flanges, shut-off valves and other work and materials required to remove from service existing piping and necessary to keep existing piping in service where shown or required.

3.05 - MISCELLANEOUS REMOVALS

- A. The Contractor shall remove miscellaneous concrete walls, slabs, pipe supports, and curbs where shown on the Drawings or where necessary for the construction of new structures or modification of existing structures.

3.06 - MODIFICATIONS AND CLOSURES

- A. Modifications shall conform to all applicable Specifications, the Drawings, and the directions and approvals of the Engineer.
- B. Where alterations require cutting or drilling into existing floors and walls the holes shall be repaired in an approved manner. The Contractor shall repair such openings with the same or matching materials as the existing floor, wall, or roof or as otherwise approved by the Engineer. All repairs shall be smoothly finished unless otherwise approved by the Engineer.
- C. Where parts of existing structures are to remain in service, demolish the portions to be removed, repair damage, and leave the structure in proper condition for the intended use. Remove concrete and masonry to the lines designated by drilling, chipping, and other suitable methods. Leave the resulting surfaces true and even, with sharp straight corners that will result in neat joints with new construction or be satisfactory for the purpose intended. Where existing reinforcing rods are to extend into new construction, remove the concrete so that the reinforcing is clean and undamaged. Cut off other reinforcing flush with the surface.
- D. New Work shall be keyed into the existing in an acceptable manner. New reinforcing steel shall be welded to the existing reinforcing. Welding shall conform to AWS D12.1, Reinforcing Steel Welding Code. In general, the same or matching materials as the existing adjacent surface shall be used. The finished closure shall be a smooth, tight, sealed, permanent closure with all exposed surfaces smooth finished and acceptable to the Engineer.

3.07 - TITLE TO EQUIPMENT AND MATERIALS

- A. The Contractor shall have no right or title to any of the equipment, materials or other items to be removed from the existing buildings or structures unless and until said equipment, materials and other items have been removed from the premises. The Contractor shall not sell or assign, or attempt to sell or assign any interest in the said equipment, materials or other items until the said equipment, materials or other items have been removed.
- B. The Contractor shall have no claim against the Owner because of the absence of such fixtures and materials.

3.08 - CONDITION OF BUILDINGS, STRUCTURES AND EQUIPMENT

- A. The Owner does not assume responsibility for the actual condition of buildings, structures and equipment to be demolished and removed.

- B. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner so far as practicable.
- C. The information regarding the existing structures and equipment shown on the Drawings is based on visual inspection and a walk-through survey only. Neither the Engineer nor the Owner will be responsible for interpretations or conclusions drawn therefrom by the Contractor.

3.09 - MAINTENANCE AND CLEAN UP

- A. The Contractor shall maintain the buildings, structures and public properties free from accumulations of waste, debris and rubbish, caused by the demolition and removal operations.
- B. The Contractor shall provide on-site dump containers for collection of waste materials, debris and rubbish, and he shall wet down dry materials to lay down and prevent blowing dust.
- C. At least once a week during the progress of the demolition and removal Work or as directed by the Engineer, the Contractor shall clean the Site and properties (including sweeping roadways with a mechanical sweeper), and dispose of waste materials, debris and rubbish.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - WORK INCLUDED**

- A. The Contractor shall furnish all labor, equipment, materials and services, including pumping equipment and application, necessary for the manufacture, transportation and placement of all cementitious flowable fill as shown on the Contract Drawings or as ordered by the Engineer, except for the work specifically included under other items.

1.02 - RELATED WORK

- A. Division 3 - Concrete

1.03 - SUBMISSIONS

- A. In accordance with the procedures and requirements set forth in the General Conditions and Division 1, the Contractor shall submit the following:
 - 1. Shop Drawings
 - 2. Certifications of specification compliance for all sources of each material
 - 3. Manufacturer's data on all admixtures
 - 4. Mix design and trial mix test results
 - 5. Aggregate gradation

1.04 - QUALITY CONTROL

- A. The Contractor shall engage the services of a testing laboratory, with the qualifications required by Section 03300 - Cast-In-Place Concrete, and experienced in the design and testing of flowable fill materials and mixes, to perform material evaluation tests and to design mixes for flowable fill. A trial mix shall be performed to verify the flowable fill mix design. The trial mix shall also report slump, air content, yield, cement content, and dry unit weight per ASTM C143 and ASTM D6023.

1.05 - PAYMENT

- A. Payment for all work specified under this Section shall be included in the lump sum price bid for this Contract.

PART 2 - PRODUCTS**2.01 - CEMENTITIOUS FLOWABLE FILL**

- A. Flowable fill (controlled low strength material) shall be a uniform mixture of sand, Type II Portland cement, fly ash, admixtures and water. The mix design shall produce a flowable material with little or no bleed water, which produces a minimum compressive strength of 50 psi and maximum compressive strength of 100 psi at 56 days. The cured material shall be excavatable and have a maximum dry weight of 100 pounds per cubic foot. Slump of mix at the point of application shall be 7-inches to 10-inches.
- B. Admixtures specifically designed for flowable fill shall be used to improve flowability, reduce unit weight, control strength development, reduce settlement and reduce bleed water. Admixtures shall be Rheocell-Rheofill by Master Builders, Inc.; Darafill by Grade Construction Products; or approved equal. Cement and all other materials shall be as specified in Section 03300 - Cast-In-Place Concrete.
- C. Fine Aggregate (Sand) shall consist of natural or manufactured siliceous sand, clean and free from deleterious substances, and graded within the following limits:

Sieve Size	Percent Passing by Weight
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100*	2 to 10

*For manufactured sand, the percent passing the No. 100 Sieve may be increased up to 20%.

PART 3 - EXECUTION**3.01 - PLACEMENT OF FLOWABLE FILL**

- A. Flowable fill shall be batched and premixed by an approved producer, dispensed from ready-mix trucks, and placed by approved methods and equipment.
- B. Flowable fill shall be placed so as to completely fill the space to receive it with no trapped air pockets or other voids. Positive means of allowing the air to escape shall be provided where necessary and after approval of the Engineer. Where placed against, around and inside existing structures, lift heights shall be limited so as not to overload the structure. The Engineer shall approve lift heights and procedures. Specific procedures and methods shall be included in the Contractor's shop drawing submittals.

- C. Where flowable fill is placed around piping and other elements subject to floating within the fill space, positive means shall be taken to provide temporary balancing loads to prevent uplift, or fill lift heights shall be limited to prevent uplift.
- D. Application of loads or placement of other fill materials or concrete on top of flowable fill shall not occur until the flowable fill surface is determined to be suitable for loading per ASTM D6024 subject to the approval of the Engineer.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 - DESCRIPTION**

- A. Applicable provisions of the General Conditions, Supplementary and Special Conditions, and Division 1 General Requirements form a part of this Section.
- B. Furnish labor, materials, equipment and appliances necessary or required to perform and complete all work including, but not limited to the following:
 - 1. Remove existing DAF system mechanical and electrical components located inside the existing DAF building.
 - 2. Remove existing progressive cavity sludge feed pumps and inline sludge grinder.
 - 3. Remove existing grating, handrails and stair sections as directed by Engineer in the field.
 - 4. Remove existing MCC.
 - 5. Remove exterior building wall sections at DAF building.
 - 6. Protect and repair affected areas of the building structure adjacent to the demolition activities at the DAF building and sludge transfer area.
 - 7. Special controls for safety, fire, dust and rodent control as required by all local authorities.

1.02 - QUALITY ASSURANCE

- A. Adhere to local building codes, laws and regulations where mandatory; specifications and drawing to the contrary notwithstanding.
- B. Conform to New York State Industrial Code 23 and OSHA standards and regulations.

1.03 - DELIVERY, STORAGE AND HANDLING

- A. Lumber, materials, etc. designated by the Engineer shall remain the property of the Owner and shall be stockpiled as directed by the Engineer.
- B. Unsalvageable materials shall become the property of the Contractor and legally disposed of by him off the site. Obtain and pay for hauling and/or dumping permits as required. Bills of lading and/or dumping receipts shall be submitted to the Engineer.

1.04 - JOB CONDITIONS

- A. Access and egress from the site will be at points on the adjacent public streets or roads as directed and approved by the engineer. The Contractor shall be responsible for and shall settle all claims arising out of his use or abuse of such streets and roads, and shall make good for any damage from traffic on the Owner's property.
- B. Execute the work in an orderly, careful manner with special consideration for occupancy; insure that no damage or injury shall occur to persons, existing curbs, roads and walks and any and all other property. Any damage or injury resulting from work under this section shall be the responsibility of the Contractor's who shall make good for such damage and assume all responsibility for such injury without additional cost to the Owner.
- C. Erect tight dust chutes for removal of material, rubbish, and debris. Demolish masonry in small sections; brace, and shore where necessary to insure safety of building walls, floors, and structure. Do not drop or throw material from any extreme height. Carefully lower, remove framing materials; prevent dust, dirt from rising; thoroughly wet down work affected by demolition operations.
- D. Provide necessary temporary bracing, shoring supports, barricades, and the like. Take precautionary measures to prevent any collapse of walls, floors or unnecessary damage to existing structure during execution of the work.
- E. Do this work at a time and in accordance with a schedule as directed by the Owner and the Engineer.
- F. Take protective measures for safety and provide means of protection to prevent injury to workmen.
- G. The Contractor will be held responsible for any damage, which may be caused to any part of existing structures to remain or to items designated to re-use. Determine the need for bracing, shoring and other protective measures prior to proceeding with demolition work.
- H. In all situations where connections must be made with the existing facility, methods of connection/construction must be submitted to the Engineer well in advance of the construction. Plant personnel must be informed 48-hours in advance of any of the work being undertaken after appropriate approvals have been given to the procedure.

PART 2 – PRODUCTS**2.01 - MATERIALS**

- A. Supply all material required for:
 - 1. Shoring
 - 2. Protection from construction traffic
- B. All other material as herein specified.

PART 3 – EXECUTION**3.01 - INSPECTION**

- A. The Contractor shall thoroughly review the drawings and familiarize themselves with every aspect of the work. They shall thoroughly inspect the site and verify all information and data indicated and described in the Contract Documents. The Contractor shall notify the Engineer immediately in writing if, during their inspection of the site, they find any discrepancy or condition not described or included in the Contract Documents or have any question at all regarding the intent of the work. All demolition work on this site or related demolition work in the streets adjacent to the site shall be executed in strict accordance with the New York State Codes governing such work and all applicable regulations governing safety during demolition work as published and administered by OSHA. The Contractors shall notify the Engineer's office forty-eight (48) hours prior to commencing demolition work on this project.

3.02 - PERFORMANCE

- A. General: The existing work required to be removed shall be in general, as indicated on the drawings, but shall also include any and all other existing materials, structures, and their appurtenances and/or work necessary to install the new work as shown and specified. All demolition and removal work shall be executed in an approved manner that conforms to the requirements of all authorities having jurisdiction over same. No methods using burning or explosives shall be permitted.
- B. The Contractor will be required to repair or replace in kind at his own expense and as directed by the engineer, sidewalks, curbs, and roadway damaged by his operations and which will be required for public traffic during the life of and at the completion of the contract.

- C. Dust Control: All materials shall be wet down with water to the extent necessary to minimize dust. When local inconvenience is caused by dust, the general contractor, when directed by the engineer, shall sprinkle water on the sidewalks, pavements and foundations.
- D. Rodent Control: In the event the local Board of Health requires rodent control, the contractor shall exterminate rodents in each area so infested, as determined by the County and/or District Office of the State Department of Health, the contractor performing the exterminating work shall, upon request, show at least five years' experience in extermination.
- E. The work shall be performed in a manner approved by and satisfactory to the Engineer and in accordance with the requirements of the County and/or District Office of the State Department of Health.
- F. Fire Control: It shall be the General Contractor's responsibility to provide and maintain a fire safety program and to consult with and conform to all fire safety requirements of the local fire district and department while performing the work of this contract.
- G. Maintenance and protection of pedestrian traffic: The General Contractor shall, for the duration of the contract, maintain and keep passable, free from debris, snow and ice all public walkways adjacent to the properties on which building to be demolished are located.
- H. Sequence of operation: The General Contractor shall progress the demolition work as one of the first operations of his Contract work unless directed otherwise by the Engineer.
- I. Removal of buildings by others: The Owner will reserve the right to clear the project of any building or building parts by removal from the site by the Owner thereof or delete any part of the demolition from the Contract.
- J. Salvage value: The Owner does not guarantee the number of fixtures, amount of equivalent or any other material of value existing in the building to be present, after its release to the General Contractor. The General Contractor shall have no claim against the owner because the salvage value of any building has decreased at the time of disposal.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. The Contractor shall complete the following work of this Section:
 - 1. Remove and dispose of trees, shrubs, and native vegetation to the limits shown on the Contract Drawings including stumps and root systems.
 - 2. Remove and dispose of surface debris.
 - 3. Remove and dispose of concrete slabs, foundations, paving, curbs, and other existing items requiring removal to excavate to the limits shown, whether specified to be removed or deemed necessary by the Engineer.
- B. Do not remove trees designated to remain.
- C. Work of this Section also includes the removal and storage of topsoil.
- D. The Contractor shall clear and grub, as it is necessary, to construct the work. Clearing and grubbing consists of cutting and disposing of all trees, down timber, stubs, brush, bushes, snags, vegetation, rubbish, debris, and other objectionable matter and materials.
- E. It is the intent of this Section to limit the area of clearing and grubbing to the minimum area possible to allow for the installation of the work and to preserve all plantings and natural vegetation to the maximum possible extent.

1.02 - RELATED SECTIONS

- A. Section 02312 – Rough grading
- B. Section 02315 - Excavation
- C. Section 02915 – Landscape grading and Topsoil

1.03 - REGULATORY REQUIREMENTS

- A. Conform to applicable local code(s) for disposal of debris.
- B. Burning of materials on the site is prohibited. Burial of materials on the site is prohibited.
- C. Coordinate clearing work with utility companies, Town of Smithtown and conform to local codes.
- D. Conform to applicable local code(s) for all pest/rodent control measures.

1.04 - COORDINATION WITH OTHER CONTRACTORS

- A. The Contractor shall comply with the requirements contained in Section 01310 - Project Management and Coordination.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION**3.01 - PREPARATION**

- A. Verify that existing trees and plant life designated to remain are identified and tagged with orange surveyor's tape.
- B. The Contractor shall employ the services of a licensed land surveyor to locate the limits of clearing, as it is required to construct the work or as it may be shown on the drawings. The Contractor shall verify the limits of clearing before beginning work of this Section.

3.02 - PROTECTION

- A. Locate, identify and protect utilities that are to remain.
- B. Protect trees, plant growth and physical features designated to remain as final landscaping.
- C. Protect benchmarks and existing structures from damage or displacement. Temporarily relocate all property corners beyond the contract work limits. Contractor shall have a professional land surveyor licensed in the State of New York reset property corner monuments after final grading work is completed.
- D. In open areas of the site, do not remove or trim plantings without prior permission of the Engineer.
- E. In wooded areas of the site, trees may be removed and or professionally trimmed, for the proper installation of the work. Gross and unnecessary removal of trees is not permitted.

3.03 - APPLICATION

- A. Clear areas required for access to site and execution of work.
- B. Remove concrete slabs, foundations, paving, curbs, debris and sidewalks as required.
- C. Remove trees and shrubs except as indicated to remain. Remove stumps, main root ball, surface rock and debris.

- D. Clear undergrowth and deadwood without disturbing subsoil.
- E. Remove paving, debris, rock, and extracted plant life from site and dispose of in accordance with state and local ordinances.
- F. Excavate topsoil from areas to be further excavated or regraded. Do not excavate wet topsoil.
- G. Stockpile topsoil, in area designated on site or selected by the Engineer, to a height not exceeding 8 feet (2.4 m). Protect stockpile from erosion by placing hay bales at double height around the full perimeter of the stockpile. Remove excess topsoil not being reused from site. Do not remove any topsoil from the site prior to obtaining the approval of the Engineer.

+ + END OF SECTION + +

++ NO TEXT ON THIS PAGE ++

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Excavation for building and tank foundations.
- B. Excavation for slabs-on-grade, paving and landscaping.
- C. Excavation for site structures.
- D. Refer to Section 02317 for pipe trenching requirements including underground utility mapping.

1.02 - RELATED SECTIONS

- A. Section 02260 – Excavation Support and Protection
- B. Section 02316 - Backfilling
- C. Section 02317 - Trenching

1.03 - QUALITY ASSURANCE

- A. Do not excavate wet or frozen materials without written approval from the Engineer.
- B. If excavation exceeds a depth of four feet (1.2 m), place temporary sheeting. Refer to Section 02260.
- C. Provide safety barricades around all open excavations as specified in Division 1 specifications.

1.04 - FIELD MEASUREMENTS

- A. Verify that survey benchmark and intended elevations for the work are as indicated.

1.05 - COORDINATION

- A. Coordinate excavation with installation of sheeting and pile work (if required).

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION**3.01 - PREPARATION**

- A. Comply with the requirements contained in Section 02317 – Trenching regarding the location, verification, and mapping of underground utilities (pipelines, water, gas, electrical conduit, electricity, etc.) prior to starting any excavation required under this project.
- B. Identify required lines, levels, contours, and datum.
- C. Identify known underground, above ground and aerial utilities. Stake and flag locations.
- D. Notify utility company to remove or relocate utilities, if required.
- E. Protect above and below grade utilities that are to remain.
- F. Protect plant life, lawns and other features remaining as a portion of final landscaping.
- G. Protect benchmarks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic.
- H. Notify the Engineer prior to commencement of excavation.

3.02 - EXCAVATION

- A. Underpin adjacent structures that may be damaged by excavation work, including utilities and pipe chases.
- B. Excavate for structures, building foundations, slabs-on-grade, paving, drainage or sanitary structures, sidewalks, landscaping to the limits as indicated on the plans and extend a sufficient distance from walls, piers, footings and curbs to provide adequate clearances for construction operations, including sheeting and bracing, if required, and for inspection purposes.
- C. Trim approximately the last four (4) inches of excavation subgrade in earth with a smooth edged bucket or by hand just prior to placement of concrete or concrete reinforcement.
- D. Machine slope banks to angle of repose or less, until shored.
- E. Excavation cut not to interfere with normal 45 degree bearing splay of foundations.
- F. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- G. Hand trim excavation. Remove loose matter.

- H. Remove lumped subsoil, boulders, and rock.
- I. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- J. Stockpile excavated material in area designated on site.

3.03 - FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01450.
- B. Provide for visual inspection of bearing surfaces.

3.04 - PROTECTION

- A. Protect work under provisions of Section 01500.
- B. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- C. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

3.05 - DISPOSAL OF MATERIALS

- A. All suitable excavated material shall be utilized for backfill and embankment or for Owner selected stockpiling (Bid Item #34). Stockpile on-site or transport suitable material off site and bring back when conditions allow the stockpiling or filling operations to begin.
- B. All excess suitable excavated material shall become the property of the Contractor and be disposed of by the Contractor in accordance with governing regulations and laws. The cost for hauling and disposal of excess suitable excavated material shall be included in the price as bid.
- C. All unsuitable excavated material that cannot be used for backfill shall become the property of the Contractor and be hauled and disposed of off-site in accordance with governing regulations and laws. The cost for hauling and disposal of unsuitable material shall be included in the price as bid.

3.06 - MATERIALS

- A. The Contractor shall remove unsuitable materials in excavations, which are incapable of supporting structures, as determined by an independent soil-testing laboratory, to the extent and depth directed by the Engineer. Refill and compact the excavation with Type C - Sand fill as defined in Section 02316. If required and directed by the Engineer, import Type C - Sand. The trucking and material costs associated with the import of Type C material will be paid for as "Extra

Work” in accordance with the provisions contained in the Contract. The equipment cost used to offload and place imported material shall be included in the price as bid. The cost for filling and compacting the imported material shall also be included in the price as bid.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Building perimeter and site structure backfilling to sub-grade elevations.
- B. Site filling and backfilling.
- C. Fill under slabs-on-grade and paving.
- D. Consolidation and compaction.
- E. Fill for over-excavation.
- F. Flowable Fill material for abandoned in place pipelines and structural backfill alternative.

1.02 - RELATED SECTIONS

- A. Section 02260 - Excavation Support and Protection
- B. Section 02312 - Rough Grading
- C. Section 02315 - Excavation
- D. Section 02915 - Landscape Grading and Topsoil
- E. Section 03300 - Concrete

1.03 - REFERENCES

- A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18-inch (457-mm) Drop.
- C. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.04 - SUBMITTALS

- A. Submit under provisions of Section 01330. Submit the following:
 - 1. Sieve analysis for each type fill to be used.
 - 2. Compaction reports

3. Flowable Fill Mix Design

1.05 - QUALITY ASSURANCE

- A. Do not backfill over or with wet or frozen materials.
- B. Field quality control laboratory tests will be paid for out of the cash allowance for testing services. Coordination with the testing lab shall be the Contractor's responsibility and be included in the price as bid.

1.06 - COORDINATION

- A. Coordinate work under provisions of Section 01310.
- B. Coordinate and make all arrangements to have the testing laboratory present so that tests can be made. The Engineer may stop backfilling operations until such time as the testing laboratory is on-site to make tests or take required samples.

PART 2 - PRODUCTS

2.01 - MATERIALS

- A. Type A - Coarse Stone: Angular, washed natural stone; free of shale, clay, friable material, sand, debris; graded in accordance with ANSI/ASTM C136 within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
2-inch (50 mm)	100%
1-inch (25 mm)	95%
3/4-inch (19 mm)	75 - 90%
5/8-inch (16 mm)	35 - 60%
3/8-inch (9.5 mm)	15 - 35%
No. 4 (4.75 mm)	< 5%

- B. Type B - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded in accordance with ANSI/ASTM C136, to the following:
 - 1. Minimum Size: 1/4-inch (6.4 mm).
 - 2. Maximum Size: 5/8-inch (16 mm).

- C. Type C - Sand: (Structural Fill) Natural river or bank sand; washed, free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ANSI/ASTM C136, within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
No. 4 (4.75 mm)	100%
No. 14 (1.18 mm)	10 – 100%
No. 50 (0.30 mm)	5 – 90 %
No. 100 (0.15 mm)	4 - 30%
No. 200 (0.075 mm)	0 - 1%

- D. Type D - Subsoil: Reused excavated material, graded, free of lumps, rocks and gravel larger than 3 inches (75 mm) in size, debris and contaminants.
- E. Type E - $\frac{3}{4}$ inch Crushed Blue Stone Surfacing: Angular, washed blue stone; free of shale, clay, friable material, sand, and debris.
- F. Flowable Fill:
1. Ready-mix Controlled Low Strength Material used as an alternative to compacted soil, and is also known as controlled density fill, and several other names, some of which are trademark names of material suppliers. Flowable fill (Controlled Low Strength Material) differs from portland cement concrete as it contains a low cementitious content to reduce strength development for possible future removal.
 2. Unless specifically approved otherwise, by the Engineer, flowable fill used as structural fill shall be designed as a permanent material, not designed for future removal. Design strength for this permanent type flowable fill shall be a compressive strength of 2.1 MPa (300 psi) minimum at 28 days. Chemical admixtures may also be used in flowable fill to modify performance properties of strength, flow, set and permeability.
 3. Excavatable Flowable fill – flowable fill used as pipe filing and alternative trench backfill shall be designed with a compressive strength that will allow excavation as either machine tool excavatable at compressive strength of 1.5 MPa (200 psi) maximum at 1 year, or hand tool excavatable at compressive strength of 0.7 MPa (100 psi) maximum at 1 year.

4. Mix design shall produce a consistency that will result in a flowable product at the time of placement which does not require manual means to move it into place.
5. Flowable fill Mix Design: Provide flowable fill mix design containing cement and water. At the contractor's option, it may also contain fly ash, aggregate, or chemical admixtures in any proportions such that the final product meets the strength and flow consistency, and shrinkage requirements included in this specification.
6. Test and Performance - Submit the following data:
 - a. Flowable fill shall have a minimum strength as noted above.
 - b. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per ft.) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Verify existing conditions and substrate.
- B. Verify fill materials to be reused are acceptable.
- C. Verify items to be buried during backfilling process have been inspected prior to backfilling.

3.02 - PREPARATION

- A. Compact subgrade to 95 percent maximum dry density in accordance with ANSI/ASTM D1557 or ASTM D2922.
- B. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with Type C fill and compact to density equal to or greater than requirements for subsequent backfill material.

3.03 - BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy materials.

- C. Place and compact materials in continuous layers not exceeding 6 inches (150 mm) compacted density.
- D. All backfilled materials shall be compacted to 95 percent maximum dry density in accordance with ANSI/ASTM D1557 or ASTM D2922. Maintain optimum moisture content to attain required density.
- E. Employ a placement method that does not disturb or damage structures or other items against which material is backfilled.
- F. Backfill only against supported structures. Do not backfill against unsupported structures.
- G. Backfill simultaneously on each side of structure.
- H. Make grade changes gradual. Blend slope into level areas.
- I. Immediately remove surplus materials from the site.
- J. Immediately remove suitable backfill material from the site if stockpiling the material is not possible due to site restraints such as: insufficient area to store the material in a safe and secure manner, stockpiling the material would present interference with the operations of the facility, stockpiling the material hinders the operations of other contractors, stockpiling the material does not comply with the adopted Site Utilization Plan specified to be provided in Section 01140 – Work Restrictions. Truck suitable backfill material back to the site as soon as conditions are amenable to continuing the backfilling operations.
- K. Leave fill material stockpile areas completely free of excess fill materials.
- L. Remove temporary sheeting, as backfilling progresses, under provisions of Section 02260.

3.04 - TOLERANCES

- A. Maximum Variation From Top Surface of Backfilling: 1 inch (25 mm).
- B. Maximum Variation From Top Surface of Backfilling Under Paved Areas: $\frac{1}{4}$ inch (6 mm) from required elevations.

3.05 - FIELD QUALITY CONTROL

- A. Perform testing under provisions of Section 01450.
- B. Perform tests and analysis of fill material in accordance with ANSI/ASTM D1557 or ASTM D2922.

- C. If tests indicate work does not meet specified requirements, remove work, replace and re-test at no cost to Owner.
- D. Compaction tests shall be taken at the following rates unless otherwise directed by the Engineer:
 - 1. Concrete Structures: One test per 5 vertical feet (1.5 m) of structure.
 - 2. Pavement Subgrade: One test per 500 square feet (50-sq. m) of subgrade immediately prior to placing subbase.
 - 3. Concrete Flatwork: One test per 400 square feet (40-sq. m) of flatwork.
 - 4. Curbing: one test per 100 linear feet (30 m).
 - 5. Piping Installations: Compaction testing at horizontal intervals of 100 feet at the spring-line of the pipe and after each two (2) vertical feet of backfilling thereafter.
 - 6. Precast Concrete Structures: One (1) compaction test per 500 square feet of structure.
- E. It is the Contractor's responsibility to coordinate the efforts of the testing laboratory and to have a technician present from the laboratory so those tests can be made.

3.06 - PROTECTION

- A. Protect finished work under provisions of Section 01500.
- B. Re-compact fills subjected to vehicular traffic.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. All below grade process piping shall be installed in accordance with work of this Section and Section 15145 for mechanical joint pipe.
- B. *The Contractor shall dig test holes to locate or verify locations of existing pipelines that are shown on the Drawings or that may otherwise be present. Refer to paragraph 1.05 herein.*
- C. *The Contractor shall also employ an underground utility mapping company as specified in paragraph 1.05 herein.*
- D. The work of this Section also includes backfilling and compaction requirements, excavation for trenches for below grade piping and utilities.

1.02 - RELATED SECTIONS

- A. Section 02260 - Excavation Support and Protection
- B. Section 02312 - Rough Grading for topsoil removal from site surface.
- C. Section 02315 - Excavation for disposal requirements for excess material and unsuitable material.
- D. Section 15145 - Large Piping and Fittings

1.03 - REFERENCES

- A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18-inch (457 mm) Drop.
- C. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.04 - SUBMITTALS

- A. Sieve analysis for imported bedding material.
- B. Utility mapping drawings as specified in paragraph 1.05.

1.05 - QUALITY ASSURANCE

- A. Do not excavate wet or frozen materials without written approval from the Engineer.
- B. Do not backfill over or with wet or frozen materials.
- C. When an excavation exceeds a depth of 4 feet (1.2 m), the Contractor shall place temporary sheeting. Comply with the requirements contained in Section 02260 and all OSHA standards.
- D. The Contractor shall include in the as-bid price the costs for providing a backhoe, equivalent to a Ford 755, with operator and laborer to dig test holes at locations selected by the Engineer. Test holes may be dug to a depth of eight (8) feet or less. Hand digging shall be provided when in the opinion of the Engineer the use of machinery may cause damage to existing lines. *The Contractor shall provide seven (7) non-consecutive days (eight hours per day) in the bid.* Test holes shall remain open until tie distances are obtained. Tie distances to exposed piping, located via test holes, shall be obtained by the Contractor and recorded on record drawings prepared by the Contractor as work of Section 01785. Do not backfill test holes until directed by the Engineer. Photographs of exposed piping shall be taken by the Contractor and kept on file for the duration of the project. Duplicate prints shall be provided to the Engineer. Annotate on the back of each print the location of the photograph, the name of the exposed line, and the date it was taken. All photographs shall be taken using a digital camera. The digital file shall be provided to the Engineer. All prints shall be 4 inches by 6 inches. Trenching for new buried pipelines shall not be started until the locations of existing pipes and utilities are verified.
- E. The Contractor shall also employ the services of a company regularly engaged in locating underground utilities and also include the costs for it in the bid price. The services shall be provided by a company specializing in locating underground facilities such as pipelines, electrical conduit, water lines, and utilities such as gas and electricity and have at least three years of experience. *The Contractor shall include six (6) non-consecutive days (at 8 hours each day) in the bid price.* The work shall be conducted during early morning hours if deemed so by the company, which would result in more accurate findings. The company shall be equipped with the latest state-of-the-art equipment. The company shall place ground markers where utilities are mapped, and develop a sketch showing tie distances to all mapped utilities. Use different colored markers for each separate utility run. Immediately take digital photographs to document the mapped utilities and provide same to the Engineer.
- F. *Each unused day for exploration digging shall be credited to the Owner at \$1,500 per day (machine, operator, and laborer). Each unused hour for the utility mapping company shall be credited to the Owner at the amount usually billed by the utility mapping company.* The Contractor shall perform as much underground exploration and underground mapping as is necessary to accurately satisfy these specifications. The Owner will not pay for additional days of

exploration and / or mapping services. The Owner/Engineer makes no claim that the labor, equipment, material and services specified above is sufficient to properly satisfy the requirements contained herein these specifications. Include separate line items in the Schedule of Values for all items subject to Owner's credit.

- G. Field quality control laboratory tests will be paid for out of the cash allowance for testing services. Coordination with the testing lab shall be the Contractor's responsibility and be included in the price as bid.

1.06 - FIELD MEASUREMENTS

- A. Verify that survey benchmark and elevations for the work are as shown on plans.

1.07 - COORDINATION

- A. Coordinate all the work under the provisions of Section 01310.
- B. Coordinate and make all arrangements to have the testing laboratory present so that tests can be made. The Engineer may stop trenching operations until such time as the testing laboratory is on-site to make tests or take required samples.

PART 2 - PRODUCTS

2.01 - MATERIALS

- A. Bedding: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ANSI/ASTM C136; within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
No. 4 (4.75 mm)	100
No. 16 (1.18 mm)	10-100
No. 50 (0.30 mm)	5-90
No. 100 (0.15 mm)	4-30
No. 200 (0.075 mm)	0-1

- B. Type A – Gravel Fill: Refer to Section 02316 for gradation requirements.
- C. Subsoil: Reused, excavated material, graded, free of lumps, rocks and gravel larger than 3 inches (75 mm) in size, debris and contaminants.

PART 3 - EXECUTION**3.01 - EXAMINATION**

- A. Verify that existing site conditions are suitable for trenching operations to take place in that existing structures, piping, and utilities have been located as not being in conflict with the new work. Refer to paragraph 1.05 herein.
- B. Verify, with the Engineer, that excavated material is acceptable for fill. If directed by the Engineer, send soil samples to the testing laboratory to determine its ability to support intended loads.
- C. Test piping prior to backfilling in accordance with the requirements contained in Section 01755.
- D. Do not backfill any item until the Engineer has fully inspected the work. Expose the work that was not inspected by the Engineer, when so directed by the Engineer.

3.02 - PREPARATION

- A. Identify and confirm the location of all underground piping shown on the Contract Drawings prior to excavating for pipe or structures. Dig test holes and employ the underground utility mapping company to determine the existence and location of underground utilities prior to starting any underground work.
- B. Identify required lines, levels, contours, and datum.
- C. Maintain and protect existing utilities remaining which pass through the work area.
- D. Protect plant life, lawns, rock outcropping, and other features remaining as a portion of final landscaping.
- E. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic. Any item damaged by the Contractor shall be promptly repaired at the Contractor's expense.
- F. Protect above and below grade utilities that are to remain.
- G. Excavate unsuitable material in accordance with the requirements contained in Section 02315, paragraph 3.05. Import suitable material in accordance with the requirements contained in Section 02315, paragraph 3.06.

3.03 - EXCAVATION

- A. Excavate subsoil required for piping.

- B. Excavate trenches to the dimensions shown on the plans, or if not shown, to the dimensions required to properly install the work.
- C. Excavation shall not interfere with normal 45 degree bearing splay of foundations.
- D. Hand trim excavation. Hand trim for bell and spigot pipe joints, if necessary. Remove loose matter.
- E. Remove lumped subsoil, boulders, and rock.
- F. For trenches made in solid rock, excavate to a depth of 1 foot (300 mm) below the proposed pipe invert.
- G. Stockpile excavated material in area designated on site and remove excess as specified in Section 02315.
- H. Install sheeting if trench depth exceeds 4 feet (1.2 m). Refer to Section 02260.

3.04 - INSTALLATION - BEDDING

- A. Support pipe and conduit during placement and compaction of bedding fill.
- B. For trenches made in solid rock, place an additional 1-foot (300 mm) of bedding under pipe or conduit.
- C. Place bedding to the dimensions and limits as shown on the plans.
- D. Place bedding material against and to 1 foot (300 mm) over the top of the pipe or conduit in 6 inch (150 mm) compacted layers.
- E. All bedding material shall be compacted to 95 percent maximum dry density in accordance with ANSI/ASTM D1557 or ASTM D2922. Maintain optimum moisture content to attain required density.
- F. Place bedding simultaneously on both sides of the pipe or conduit.

3.05- BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen materials.
- B. Backfill to the dimensions and limits shown on the plans.
- C. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

- D. Place and compact material in continuous layers not exceeding 6 inches (150 mm) compacted depth.
- E. Employ a placement method that does not disturb or damage conduit or pipe.
- F. All backfilled materials shall be compacted to 95 percent of maximum dry density in accordance with ANSI/ASTM D1557 or ASTM D2922. Maintain optimum moisture content to attain required density.
- G. Import suitable material as specified in Section 02315 if directed by the Engineer.

3.06 - TOLERANCES

- A. Maximum variation from top surface of backfilling under paved areas: 1/4 inch (13 mm).
- B. Maximum variation from top surface of general backfilling: 1 inch (25 mm).

3.07- FIELD QUALITY CONTROL

- A. Perform testing under provisions of Section 01450.
- B. Perform tests and analysis of fill material will be performed in accordance with ANSI/ASTM D1557 or ASTM D2922.
- C. If tests indicate work does not meet specified requirements, remove work, replace and re- test at no cost to Owner.
- D. Unless additional testing is required by the Engineer, compaction tests shall be taken every 100 feet (30 m), at the springline of the pipe and every 2 vertical feet (610 mm) of backfill.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - RELATED DOCUMENTS**

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

1.02 - SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.

1.03 - DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 - MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition shall remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.05 - PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.
6. Review procedures for turning over salvaged materials to the Owner and protected off-site storage of materials to be reused in the work of the project.

1.06 - INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting the public, pedestrian access and circulation areas and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs.
 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- D. Inventory: Submit a list of items to be removed, salvaged and delivered to Owner prior to start of demolition.
- E. Pre-demolition Photographs or Video: Submit before Work begins.

- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.07 - CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.08 - QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.09 - FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use and is included in this Division of the specifications. Examine report and / or the appropriate specification section to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
- E. Storage or sale of removed items or materials on-site is not permitted.

- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
 - 2. Provide a Fire Watch or other method acceptable to the authority having jurisdiction should the existing fire protection facilities have to be shut down during the work.
 - 3. Do not disable or disrupt building fire or life safety systems without five (5) days prior written notice to Architect.

1.10 - WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned

collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
1. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.02 - UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
1. Comply with requirements for existing services/systems interruptions specified in Section 011200 "Summary."
- B. Existing Services/Systems to be removed, relocated, or abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Arrange to shut off indicated utilities with utility companies. Provide 5 days' notice to the Architect prior to any utility shut-downs.
 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap, plug or reconnect remaining piping with same or compatible piping material.

- b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - c. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug or reconnect remaining ducts with same or compatible ductwork material.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.03 - PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building. Maintain existing required widths of egress pathways throughout.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.04 - SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner or as indicated on Drawings.
5. Protect items from damage during transport and storage.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.05 - SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 1 inch ()at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.06 - DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.07 - CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.08 - SELECTIVE DEMOLITION SCHEDULE

- A. Remove, store, relocate, salvage and protect the following materials and equipment:
1. Existing Items to Be Removed: .Items indicated on contract drawings and items listed in technical specifications sections.
 2. Existing Items to Be Removed, relocated and / or Salvaged: .Items required to be removed, relocated salvaged and / or stored to complete the work as indicated or called for in these construction documents.
- B. Existing Items to Remain: to complete and conform to the work of the project shall be as indicated on the contract drawings and items listed in the technical specification sections.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - DESCRIPTION**

- A. Work covered by this Section includes the restoration of surfaces damaged or disturbed because of the Contractor's operations and installation of the work.
- B. The Contractor's cost associated with work of this Section shall be included in the lump sum price (Base Bid) as bid.

1.02 - RELATED SECTIONS

- A. Related Sections shall include all applicable technical specification sections.

1.03 - QUALITY ASSURANCE

- A. Provide at least one person who shall be present at all times during this portion of Work and who is thoroughly familiar with the types of materials being installed, the best methods for their installation and who shall direct all work performed under this Section.
- B. Grades and surfaces shall be restored so as to be equal to or better than the original conditions which existed at the time they were damaged or disturbed, except as otherwise specified or shown on the Drawings.
- C. Restoration of surfaces under the jurisdiction of public authorities or public utilities shall be in accordance with the requirements of such authorities. Ascertain these requirements, procure necessary permits, arrange for required inspections, and pay all fees, deposits, and other charges that may be required by the authorities.
- D. Existing pavements, curbs, and walks to be restored shall be replaced with new pavement equivalent to or superior to the existing in quality, thickness, bearing capacity and surface finish, except where otherwise specified.
- E. Replaced pavement shall be free from all noticeable sags, settlements, bumps, humps, cracks or other defects. Other than possibly color, the replaced pavement shall be unnoticeable from the existing pavement.

1.04 - SUBMITTALS

- A. See Section 01330.
- B. Submittals required are identical to those required under other Sections. If submittals have been made and approved under the other Sections, and is applicable to this Section, then a notification to this effect will be sufficient.

- C. At the completion of the Work under this Section, submit copies of letters of approval from all authorities having jurisdiction over the areas that were restored.

1.05 - SCHEDULING

- A. It is the intent of this Section to restore all surfaces as soon as possible to cause the least amount of inconvenience to the existing plant operation.
- B. Replace all pavements as specified elsewhere in these specifications.
- C. Replace all items as soon as possible after the installation of the work, with special attention directed at those that control traffic, protect property and lives, create hazards when not in place or are otherwise deemed essential.
- D. The phrase "after installation of the work" means after the installation of the work that necessitated the removal of an item or items.

1.06 - MAINTENANCE AND GUARANTEE

- A. The maintenance and guarantee requirements of other applicable Sections are required under this Section.
- B. Maintain and care for all restoration work.
- C. Continually maintain all areas where pavement has been removed to provide a smooth, dust-free surface by adding fill and dust control materials and grading daily, or more frequently when required.

PART 2 - PRODUCTS

2.01 - REUSE OF EXISTING MATERIALS

- A. Curbs, walks, roads, fences, walls, signs and other items which have been removed, knocked down, or displaced shall be replaced with existing materials when, in the opinion of Engineer, such materials are in acceptable condition. Where such materials have been damaged, marred, broken, or are otherwise in an unacceptable condition, provide replacements of equal or better quality, appearance, size and type, at the Contractor's expense.

PART 3 - EXECUTION

3.01 - INSPECTION

- A. Carefully inspect the work installed under other Sections and verify that all such work is complete to the point where restoration of surfaces may properly commence and to insure the unnecessary disturbance of restored surfaces at a later date.

- B. Verify schedule of work for conformance to allowable planting times.
- C. Do not begin restoration work until conditions are satisfactory.

3.02 – ASPHALTIC CONCRETE PAVEMENT

- A. All work and materials shall conform to Section 02740.
- B. Cut back undisturbed pavement surfaces and binder course at least 12 inches beyond the walls of the backfilled excavations and trenches, with straight and vertical edges to form an undisturbed ledge of base course under the new pavement.
- C. Thoroughly roll finished surfaces and match existing adjacent surfaces as nearly as practicable.
- D. Replace all pavement markings, as they originally existed.

3.03 - SIDEWALKS

- A. Portland Cement Concrete - Replace walks after backfill has been brought up to proper subgrade elevation and compacted.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 - DESCRIPTION**

- A. This Section includes requirements for leakage testing for all pipelines and structures required to be watertight or airtight.

1.02 - PAYMENT

- A. Payment for work furnished and installed under this Section shall be included in the lump sum price bid for the Contract, as described in Section 01150 – Measurement and Payment.

1.03 - REFERENCES

- A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced Specifications, codes, and standards refer to the most current issue available at the time of Bid.
 - 1. ACI 350.1R – Testing Reinforced Concrete Structures for Watertightness.
 - 2. ASTM C361 – Reinforced Concrete Low-Head Pressure Pipe.
 - 3. AWWA C600 – Installation of Ductile Iron Water Mains and Their Appurtenances.
 - 4. New York State Building Code.

1.04 - SUBMITTALS

- A. All submittals, including the following, shall be provided as specified in the General Conditions.
- B. Submit testing procedures for approval at least thirty (30) days prior to the test.
- C. Testing Report: Prior to placing the piping system or structure in service, submit for review and approval a detailed bound report summarizing the leakage test data, describing the test procedure and showing the calculations on which the leakage test data is based.

1.05 - QUALITY ASSURANCE

- A. Written Notification of Testing: Provide written notice at least two weeks prior to date of testing.
- B. Do not conduct tests without an approved written procedure.
- C. Conduct leakage tests in the presence of the Engineer. Repeat tests in the presence of local authorities having jurisdiction if required by them.

- D. Furnish all labor, equipment, air, water and materials, including meters, gauges, blower, pumps, compressors, fuel, water, bulkheads, temporary weirs, valves, plugs and accessory equipment.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 - GENERAL

- A. Test all pipelines and structures required to be watertight or airtight for leakage. Repair or replace piping and structures which fail the leakage test to the satisfaction of the Engineer and retest until leakage test results are acceptable.
- B. Operation of Existing Facilities: Conduct all tests in a manner to minimize as much as possible any interference with the day-to-day operations of existing facilities or other contractors working on the site.
- C. Test drain lines by an Infiltration Test as specified.
- D. Test all other pipelines with water under the specified pressures.
- E. Test vents and drains in plumbing systems and all cast iron soil pipe lines in accordance with the New York State Building Code unless otherwise specified. Unless specified otherwise, test all vents and drains on process piping as for plumbing systems.
- F. Leakage in pipelines of other-than-circular section shall not exceed an amount based on a circular section having an equivalent inner perimeter.

3.02 - PRESSURE TESTS OF EXPOSED PIPING

- A. Testing: Pressure test exposed pipelines for leakage by maintaining the fluid in the pipe at the specified pressure for a period of one (1) hour. Examine all accessible joints during the test. Stop all visible leakage.
- B. Test Pressures: Test the various pipelines at the test pressures shall be verified in the field for the existing pipes.

3.03 - PRESSURE TESTS OF BURIED OR CONCEALED DUCTILE IRON PIPELINES

- A. Testing:
 - 1. Completely backfill all harnessed sections of buried piping before such sections are tested. Non-harnessed sections of buried piping shall be tested before backfilling.

2. Pressure test buried or concealed pipelines for leakage by maintaining the fluid in the pipe at the specified pressure for a minimum period of 4 hours.
 3. Pressure test the piping for leakage as a whole or in sections, valved or bulkheaded at the ends. Apply the specified pressure to the piping through a tap in the pipe by means of a hand pump or other approved method. Do not use air for testing.
 4. Test the piping at the test pressures specified in the Specifications.
- B. Allowable Leakage: Stop all visible leakage. Do not allow leakage for any piping, as determined by the above test, to exceed the allowable leakage for ductile iron water mains as given by the following formula in Section 4 of AWWA C600 in which L is the allowable leakage in gallons per hour, S is the length of water main tested in feet, D is the nominal diameter of the pipe in inches and P is the average test pressure in psi gauge:

$$L = \frac{S \times D \times (P)^2}{133,200}$$

3.04 - VALVE TESTING

- A. Testing: Operate valves in the section under test through several complete cycles of closing and opening. In addition, have the test pressure for each valve, when in the closed position, applied to one side of the valve only. Test each end of the valve in this manner.
- B. Test Pressure: Test each valve at the same test pressure as that specified for the pipe in which the valve is installed.
- C. Leakage: Stop all external and internal leakage through the valves.
- D. Movement: Stop all valve movement or structural distress.

3.05 - LEAKAGE TESTS FOR GRAVITY SEWERS

- A. Submerged Testing Procedure: When the groundwater level is above the sewer, test sewers for infiltration as follows:
 1. Measure the infiltrated flow of water by means of a weir set up in the invert of the sewer at a known distance from a temporary bulkhead or other limiting point of infiltration.
 2. Test after the sewer or sewers have been pumped out, if necessary.
 3. Do not start testing until normal infiltration conditions are established in the work to be tested.

- a. Inspect gravity sewer visually for infiltration.
 - b. Pump the sewers dry and make sure the groundwater level is above the crown of the sewer.
 - c. Inspect the sewer on the inside, and seal all visible leaks completely.
- B. Non-submerged Testing Procedure: If the groundwater level is below the top of the sewer, test for leakage as follows:
1. Construct a bulkhead in the sewer at the manhole at the lower end of the section under test.
 2. Fill the section being tested with water until the level of water is 4-feet above the crown of the sewer in the manhole at the upper end of the test section. For concrete sewers, allow the water to remain in the piping for at least twelve (12) hours before conducting the tests.
 3. Leakage will be the measured amount of water added to maintain the water at that level.
- C. Carry on tests for a minimum of eight (8) hours with readings at one (1) hour intervals.
- D. In computing the length of sewer contributing infiltration or leakage, include the length of house connections tested, if any, in the total length.
- E. The quantity of infiltration or leakage for sewers shall not exceed 200 gallons per inch of diameter per mile per 24 hours for sewers up to and including 24 inches in diameter, and shall not exceed 5,000 gallons per mile per 24 hours for all sizes larger than 24 inches in diameter.
- F. Repair: When the measured infiltration or leakage exceeds the specified amount, locate and repair defective manholes, pipe or pipe joints. If the defective portions cannot be located, remove and reconstruct as much of the original work as necessary to obtain a sewer within the allowable infiltration limits upon such retesting as necessary.
- G. Regardless of the amount of infiltration or leakage measured, repair and seal in an approved manner all visible or detectable leaks in the sewers, manholes, structures, and other appurtenances.

3.06 - REPAIR OF PIPING LEAKS

- A. Procedures: Repair leaks as follows:
1. Replace broken pipe or joint assemblies found to leak.

2. When leakage occurs in excess of the specified amount, locate and repair defective valves, pipe, cleanouts, and/or joints.
3. If defective portions cannot be located, remove and reconstruct as much of the original work as necessary to obtain piping that meets the leakage requirements specified herein and retest, all at no additional cost to the County.

3.07 - LEAKAGE TESTS FOR CONCRETE STRUCTURES

- A. Leakage tests of wet wells, tanks, channels, containment areas, and other water retaining structures shall be performed following the requirements of ACI 350.1R and as specified herein. Supply all materials and labor needed to conduct the test as directed by the Engineer.
- B. Prior to start of leakage testing, the following requirements shall be met:
 1. All elements of the structure which resist any portion of the retained liquid pressure shall be in place and at specified strength levels. All concrete shall be fully cured.
 2. Structure walls shall not be backfilled prior to leakage testing.
 3. All valves, gates, blind flanges, and other non-concrete items which control the flow or otherwise retain the liquid contents of the structure, shall be checked for watertightness. If not watertight, means shall be taken to assure watertightness during the period of the leakage test.
 4. The portions of the structure to be tested shall be cleaned of all construction debris, standing water, soil, foreign materials and any other material which interferes with the exposed concrete surfaces of the structure.
 5. Defective concrete shall be repaired.
 6. Notify the Engineer a minimum of twenty-four (24) hours prior to start of filling of structure for leakage testing. Leakage testing shall not start until the structure is inspected by the Engineer.
- C. Filling the Structure with Water:
 1. The portion of the structure to be tested shall be filled at a rate not to exceed 2-feet-per-hour.
 2. The structure shall be filled to the normal operating depth of the structure as indicated on the Contract Drawings. Where no operating depth is indicated or where operating depth

is controlled by flowing over a weir, the structure shall be filled to a depth 6-inches below the weir or top of wall elevation, whichever is lower.

3. Water in the structure shall be maintained at the specified test elevation for a minimum of three days prior to the start of the leakage test.
- D. After water has been brought to the test elevation, the exposed elements of the structure shall be inspected for leakage. All locations which exhibit any amount of leakage flow shall be repaired prior to the start of leakage testing.
- E. The leakage test duration shall be determined by the Engineer based on ACI 350.1R but shall not be less than three (3) days.
- F. Leakage Allowance:
1. For unlined concrete structures, the maximum allowable leakage rate shall be 0.075-percent of the volume per twenty-four (24) hour period.
 2. For concrete structures with walls lined by a waterproof material, the maximum allowable leakage rate shall be 0.050-percent of the volume per twenty-four (24) hour period.
- G. Test Locations:
1. Structure cells which are less than 1,000-square-feet in area shall have measurements of water level taken at two (2) locations which are located approximately 180-degrees apart.
 2. Structure cells which are greater than 1,000-square-feet in area shall have measurements of water level taken at four (4) locations which are located approximately 90-degrees apart.
 3. Each test location shall be marked and given a reference number. A reference point shall be marked on the face of the wall above the test water surface in a manner which will prevent its movement or deterioration during the period of the test.
 4. Test locations must be approved by the Engineer.
- H. Evaporation and Precipitation Measuring:
1. In open structures, a clear plastic calibrated open-top container not less than 18-inches in diameter and depth shall be partially filled, floated in the tank, and held in position near each measurement location.

2. The container shall be located so as not to be shaded by tank walls and away from any items passing over it, such as beams or pipes.

I. Test Measurements:

1. Leakage tests shall not be started when periods of severe weather conditions or major changes in average daily temperature are predicted.
2. The following measurements shall be recorded at each test location at the start of the test period and at twenty-four (24) hour intervals thereafter:
 - a. Distance from reference point to test water surface.
 - b. Depth of water in the floating container.
 - c. Temperature of the test water at 18-inches below water surface.
 - d. Temperature of the water in the evaporation-precipitation container at mid-depth.

J. Leakage Determination:

1. The change in water surface elevation at each test location shall be averaged and adjusted as follows.
2. The total change in test water surface elevation shall be adjusted by the average change in water surface elevation in the evaporation-precipitation containers.
3. Where averaged water temperature measurements vary by more than 3-degrees from start to completion of the test period, adjustment in tank volume shall be determined by change of water density resulting from the change in the average water temperature.

K. Retesting:

1. The leakage test shall be considered as failed if the specified leakage allowance is exceeded or if any leakage is observed.
2. If the test becomes unreliable due to excessive precipitation or other external factors, it shall be restarted.
3. If a leakage test fails, it may be retested immediately without repairs if approved by the Engineer. If subsequent leakage tests fail, repair all probably areas of leakage, and the leakage test shall be repeated. The structure shall be retested until it meets the specified

leakage criteria. Repairs shall be made to the probably leakage areas before each retest.

++ END OF SECTION ++

PART 1 – GENERAL**1.01 - SECTION INCLUDES**

- A. Site preparation for pressure washing of Primary and Final Settling Tanks.
- B. Pressure washing requirements.

1.02 – RELATED SECTIONS

- A. Section 011400 – Work Restrictions
- B. Section 017423 – Cleaning

1.03 – REFERENCES

- A. NACE No. 5/SSPC-SP12 (HP-WC) – Surface Preparation and Cleaning by Water jetting Prior to Recoating

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION**3.01 - EXAMINATION**

- A. Verify site conditions and tank details.

3.02 - PREPARATION

- A. Provide rigging/access to allow working of all areas of the tank.
- B. All tank openings (vents) shall be adequately protected during power washing to prevent any spray, dirt or debris from entering tank openings or piping.
- C. All debris generated during pressure washing activities shall be collected and retained on site. All debris shall be disposed of in accordance with all State, Federal and Local Laws.

3.03 - APPLICATION

- A. All interior/exterior surfaces of the tank are to be pressure washed.
- B. All sediment and debris shall be removed from tank interior after high pressure water cleaning is performed.

- C. Water pressure shall be a 4,000 – 5,000 psi as measured at the tip of the nozzle at the area of surface being cleaned. Contractor shall use the means necessary to accomplish the level of cleanliness less than 70µs/cm or as directed by engineer.
- D. Water shall be of a minimum temperature of 120-150°F and shall be capable of removing loosely adhered coatings, mill scale, corrosion, accumulated dirt, mildew, algae, loose/flaking /poorly adhered concrete, efflorescence and calcium deposits. Water temperature shall be maintained with hot water or steam generator.
- E. Stubborn staining shall be removed by soft bristle scrub brush. All exterior tank surfaces shall be cleaned with a mildewcide cleaning solution to remove all mildew, algae, biological growth, etc.
- F. Work shall progress such that completed sections are not soiled by subsequent activities
- G. Any damage to the site due to cleaning activities shall be restored by the contractor at his own expense.

3.04 - TOLERANCES

- A. Minimum water temperature: 120°F.

3.05 - FIELD QUALITY CONTROL

- A. Perform cleaning under provisions of Section 017423.
- B. Do not perform pressure washing when temperatures may create ice formation or when wind conditions will create a nuisance to adjacent properties and buildings.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Recycled concrete aggregate base course.

1.02 - RELATED SECTIONS

- A. Section 02312 - Rough Grading: Preparation of site for base course.
- B. Section 02316 - Backfilling: Compacted fill under base course.
- C. Section 02317 - Trenching: Compacted fill under base course.
- D. Section 02740 - Asphaltic Concrete Paving: Placing asphalt over aggregate base course.

1.03 - REFERENCES

- A. ANSI/ASTM C88 - Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- B. ANSI/ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates.
- C. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10 lb. Rammer and 18-inch Drop.
- D. ASTM D2922 - Test Methods for Density of Soil and Soil Aggregate Mixtures in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 - SUBMITTALS

- A. Submit under provisions of Section 01330 - Submittals.
- B. Submit a sieve analysis for the aggregate base course used.

1.05 - DELIVERY, STORAGE AND HANDLING

- A. Do not handle aggregate in any manner that will cause segregation of large or fine particles.

PART 2 - PRODUCTS**2.01 - MATERIALS**

- A. Aggregate Base Course: Angular, crushed, recycled concrete; free of shale, clay, friable materials and debris; graded in accordance with ANSI/ASTM C136 within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
1-1/2 inches	100
1 inch	90-100
1/2 inch	65-85
3/8 inch	55-75
No. 4	40-55
No. 8	30-45
No. 16	22-36
No. 30	16-27
No. 40	12-19
No. 100	7-13
No. 200	3-7

- B. Material retained on the $\frac{1}{2}$ -inch sieve is coarse aggregate.
- C. Coarse aggregate shall not have more than 10 percent by weight of flat or elongated pieces. A flat or elongated piece is defined as being three times greater in the largest dimension as compared to its least dimension.
- D. The portion of the aggregate base course which passes the No. 40 screen shall have a plasticity index of one as tested in accordance with ASTM D4318.

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Verify elevations of subgrade are as indicated on the plans.
- B. Verify that subgrade is properly compacted and ready to receive work of this section.

3.02 - PREPARATION

- A. Fine grade and compact subgrade to 95 percent maximum dry density in accordance with ANSI/ASTM D1557 or ASTM D2922.

3.03 - AGGREGATE PLACEMENT

- A. Spread course aggregate over prepared subgrade to a total compacted thickness as indicated on the plans.
- B. Place aggregate in 3-inch layers and compact by roller.
- C. Level and contour surfaces to elevations and gradients indicated on Drawings.

- D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- E. Compact placed aggregate materials to achieve 145 lbs/cu ft dry density when compacted in accordance with ANSI/ASTM D1557 or ASTM D2922.
- F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- G. Use mechanical vibrating tamping in areas inaccessible to compaction equipment.
- H. New pavement must be placed on the properly compacted aggregate base course within 24 hours of final compaction. If aggregate base course is left open for more than 24 hours, re-compact and re-test in accordance with ANSI/ASTM D1557 or ASTM D2922.

3.04 - TOLERANCES

- A. Maximum Variation From Flatness: $\frac{1}{4}$ inch measured with 10-foot straight edge.
- B. Maximum Variation From Scheduled Compacted Thickness: $\frac{1}{4}$ inch.
- C. Maximum Variation from True Elevation: $\frac{1}{4}$ inch.

3.05 - FIELD QUALITY CONTROL

- A. Field quality control laboratory tests will be paid for out of the cash allowance for testing services. Coordination with the testing lab shall be the Contractor's responsibility and be included in the price as bid.
- B. Perform field-testing under provisions of Section 01450.
- C. Perform compaction testing in accordance with ANSI/ASTM D1557 or ASTM D2922.
- D. If tests indicate work does not meet specified requirements, remove work, replace, and re-test at no cost to the Owner.
- E. Frequency of Tests: One test per 500 sq. ft (50 sq. m.) immediately prior to paving.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Asphaltic concrete paving, including the wearing and binder courses.

1.02 - RELATED SECTIONS

- A. Section 02312 - Rough Grading: Preparation of site for paving and base.
- B. Section 02721 - Recycled Concrete Aggregate Base Course.

1.03 - REFERENCES

- A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.
- B. AI MS-8 - Asphalt Paving Manual.
- C. ASTM D242 - Mineral Filler for Bituminous Paving Mixtures.
- D. ASTM D546 - Test Method for Sieve Analysis of Mineral Filler for Road and Paving Materials.

1.04 - SUBMITTALS

- A. Submit under provisions of Section 01330.
- B. Supplier: Submit name of asphalt supplier to be used on the project prior to placement of any asphalt on the project.
- C. Design Data: Submit asphalt mix design for each asphalt type to be used.

1.05 - QUALITY ASSURANCE

- A. Field quality control laboratory tests will be paid for out of the cash allowance for testing services. Coordination with the testing lab shall be the Contractor's responsibility and be included in the price as bid.
- B. Obtain materials from the same supplier throughout the duration of the project.
- C. Do not alter from mix design requirements.

1.06 - DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle products to the site under provisions of Section 01650.

- B. Deliver asphalt in sealed metal containers covered with suitable material to protect the asphalt from the elements.
- C. Lightly lubricate the inside surface of the container with a thin oil or soap solution before loading asphalt.
- D. All containers must be cleaned of all foreign materials prior to loading.

1.07 - ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when base surface temperature is less than 40 degrees F (4 degrees C), or if surface is wet or frozen.
- B. Do not place asphalt when precipitation is occurring.

PART 2 - PRODUCTS

2.01 - MATERIALS

- A. Asphalt Cement: AC-20; homogeneous, and shall not foam when heated to 347° F.
- B. Fine Aggregate: Material passing the 1/8 inch sieve; natural sand of hard, strong, durable particles which are free from coatings or injurious amounts of clay, loam or other deleterious substances.
- C. Coarse Aggregate: Material retained on the 1/8-inch sieve; crushed stone or gravel; clean, durable, sharp angled fragments of rock of uniform quality.
- D. Mineral Filler: ASTM D242, finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter; 100 percent shall pass the No. 30 sieve; a minimum of 85 percent shall pass the No. 80 sieve; and a minimum of 65 percent shall pass the No. 200 sieve as measured in accordance with ASTM D546.

2.02 - EQUIPMENT

- A. Pavers: Equipped with a vibratory device.
- B. Rollers: Minimum weight of 10 tons (89 kN) equipped with lubricating devices for the roller wheels.

2.03 - ACCESSORIES

- A. Tack Coat: Homogeneous, medium curing, liquid asphalt.
- B. Wheel Lubricant: Oil-water mixture containing maximum 10 percent lubricating oil.

2.04 - MIXES

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Binder Course: NYSDOT Type 3; 4.5 to 6.5 percent of asphalt cement by weight in mixture in accordance with the following gradation:

<u>Sieve Size</u>	<u>Percent Passing</u>
1-1/2 inches	100
1 inch	95-100
1/2 inch	70-90
1/4 inch	48-74
1/8 inch	32-62
No. 20	15-39
No. 40	8-27
No. 80	4-16
No. 200	2-8

- C. Wearing Course: NYSDOT Type 6; 5.8 to 7.0 percent of asphalt cement by weight in mixture in accordance with the following gradation:

<u>Sieve Size</u>	<u>Percent Passing</u>
1 inch	100
1/2 inch	90-100
1/4 inch	65-85
1/8 inch	36-65
No. 20	15-39
No. 40	8-27
No. 80	4-16
No. 200	3-6

2.05 - SOURCE QUALITY CONTROL

- A. Obtain asphalt materials from same source throughout the project.
- B. Provide asphalt in accordance with the approved mix design for each type of asphalt.
- C. Test samples in accordance with AI MS-2.

PART 3 - EXECUTION**3.01 - EXAMINATION**

- A. Verify existing substrate and conditions.
- B. Verify that compacted subbase is dry and ready to receive work of this Section.
- C. Verify gradients and elevations of base are correct.
- D. Verify that all castings are properly installed and are at the correct elevations.

- E. Beginning of installation means installer accepts existing conditions.

3.02 - PREPARATION

- A. Apply tack coat at uniform rate of 0.03 to 0.07 gal/sq yd to contact surfaces of curbs, gutters and any asphalt or concrete material.
- B. Do not apply tack coat to wet or frozen surfaces.
- C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.03 - INSTALLATION

- A. Install work in accordance with AI MS-8.
- B. Maintain asphalt temperature between 250 and 325 degrees F during placement.
- C. Place asphalt within 24 hours of applying tack coat.
- D. Place asphalt to compacted thickness as identified on plans. If a multiple course pavement is to be used, place top course within 24 hours of placing bottom course. If more than 24 hours elapse, a tack coat will be required to be placed over the entire surface of the bottom course prior to any additional paving.
- E. Utilize the vibratory device on the paver at all times.
- F. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- G. Compact pavement to a minimum of 94 percent maximum density.
- H. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.04 - TOLERANCES

- A. Maximum Variation From Flatness: $\frac{1}{8}$ inch measured with 10-foot straight edge.
- B. Maximum Variation From Scheduled Compacted Thickness: $\frac{1}{8}$ inch.
- C. Maximum Variation from True Elevation: $\frac{1}{4}$ inch.

3.05 - FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01450.

- B. Take samples and perform tests in accordance with AI MS-2.
- C. Testing to include percent compaction, graduation and asphalt content.
- D. Field quality control laboratory tests will be paid for out of the cash allowance for testing services. Coordination with the testing lab shall be the Contractor's responsibility and be included in the price as bid.
- E. Perform field-testing under provisions of Section 01450.

3.06 - PROTECTION

- A. Protect finished work under provisions of Section 01650.
- B. Immediately after placement, protect pavement from mechanical injury until date of substantial completion.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 - SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment and incidentals as shown, specified and required to furnish and place steel reinforcement for concrete including all cutting, bending, fastening and any special work necessary to hold the reinforcement in place and protect it from injury and corrosion.
- B. The work shall also include furnishing deformed reinforcing bars to be grouted into reinforced concrete masonry walls.

1.02 - RELATED SECTIONS

- A. Section 03300, Cast-in-Place Concrete.

1.03 - SUBMITTALS

- A. The Contractor shall submit submittals in accordance with Section 01305.
- B. Submit for approval the following shop drawings:
 - 1. Detailed placing and shop fabricating drawings, prepared in accordance with ACI 315 shall be furnished for all concrete reinforcement. These drawings shall be made to such a scale as to clearly show construction joint locations, openings, the arrangement, spacing and splicing of the bars. No materials shall be cut or fabricated until related drawings have been approved by the Engineer.
 - 2. Mill test certificates

PART 2 – PRODUCTS**2.01 - GENERAL**

- A. Materials:
 - 1. Reinforcing bars shall be deformed new billet steel bars conforming to ASTM A 615, Grade 60.
- B. Bars noted on the plans to be epoxy-coated, shall be coated with Scotch-kote Brand Fusion Bonded Epoxy Coating 213 or 214 as manufactured by St. Paul, Minnesota, or equal. Coating shall be applied to cleaned steel reinforcing bars by the electrostatic spray method and fully cured

in accordance with the recommendations of the manufacturer of the coating material. Before coating, the bars shall be cleaned by abrasive blast cleaning to meet the requirements of near white metal in accordance with SSPC-SP10. The coating shall be applied to the cleaned surface as soon as possible after cleaning, and before oxidation of the surface discernible to the unaided eye occurs. However, in no case shall application of the coating be delayed more than 8 hours after cleaning. The film thickness of the coating after curing shall be 5 to 20 mils, inclusive, as measured using ASTM G 12 on the body of the reinforcing bar between the deformations and/or ribs on a straight length of bar. The coating shall be free from holes, voids, cracks, and damaged areas discernible to the unaided eye. Damaged or other unsatisfactory areas shall be patched with a coating material and by a method recommended by the coating manufacturer. Epoxy coated reinforcing bars shall conform to ASTM A 775.

- C. Wire mesh reinforced shall conform to ASTM A 185 "Welded Steel Wire Fabric for Concrete Reinforcement."
- D. Steel wire shall conform to ASTM A 82 plain, cold-drawn steel.
- E. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting, fastening reinforcing bars and welded wire fabric in placed. Use wire bar type supports complying with CRSI recommendations, unless otherwise acceptable.
 - 1. For slabs-on-grade, use supports with stand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces, where legs supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 10 or stainless steel (CRSI, Class 11).
- F. Tie wires for reinforcing steel shall be 16 gauge or heavier, black annealed wire.
- G. Satisfactory test certificates shall be furnished Engineer on any shipments as required.
- H. All reinforcing steel must be made in the USA

PART 3 - EXECUTION

3.01 - FABRICATION AND STORAGE

- A. All reinforcement shall be cut and bent cold accurately to the dimensions approved. Bends shall be made in conformance with the Manual of Standard Practice of the Concrete Reinforcing Steel

Institute. If shipped to the job fabricated, it shall be properly bundled and tagged so that it can be handled without damage and readily identified with the approved placing diagrams.

- B. Reinforcing steel shall be stored above ground on platforms or other supports and shall be protected from the weather at all times by suitable covering. It shall be stored in an orderly manner and plainly marked to facilitate identification.

3.02 - CLEANING AND PLACING

- A. Before being placed in position, the reinforcement shall be thoroughly cleaned of all loose mill scale and rust, and of any dirt, coatings, or other material that might reduce the bond.
- B. All reinforcement shall be placed in the exact positions and with the spacing shown on the drawings, or as otherwise directed. It shall be so securely fastened in position by saddle tying at intersections with annealed wire of not less than No. 16 gauge or by suitable clips that no displacement will occur. Precast concrete blocks or metal chairs as approved by the Engineer shall be used for supporting horizontal reinforcement in slabs on grade, and footings. For all concrete surfaces, where legs of supports are in contact with forms, provide supports complying with CRSI "Manual of Standard Practices" as follows: Provide either, plastic coated or stainless steel legs, No reinforcement shall be placed so that there is less concrete between it and the finished concrete surface than the minimum shown on the drawings, or specified in the ACI –318 and 350R Building Code.
- C. Wire mesh reinforcement shall be securely fastened at the ends and edges. Wire mesh shall be supported at elevations indicated prior to concrete placement. Edge laps shall not be less than one mesh in width and end laps not less than two meshes in length.
- D. Substitutions of different size bars or mesh will be permitted only with the written authorization of the Engineer.
- E. Concrete shall not be placed until the reinforcing steel is inspected and permission for placing concrete is granted by Engineer. All concrete placed in violation of this provision will be rejected.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 – DESCRIPTION****A. Scope:**

1. Contractor shall provide labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete accessories.

B. Related Sections:

1. Section 03300, Cast-in-Place Concrete.
2. Section 03600, Grouting.
3. Section 07920, Joint Sealants.

1.02 – REFERENCES**A. Standards referenced in this Section are:**

1. ACI 301, Specifications for Structural Concrete.
2. ACI 350.5, Specifications for Environmental Concrete Structures.
3. ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
4. CRD-C572, U.S. Army Corps of Engineers Specifications for Polyvinyl- Chloride Waterstop.

1.03 – SUBMITTALS**A. Action Submittals: Submit the following:**

1. Shop Drawings:
 - a. Layout of construction and expansion joint locations. Submit and obtain approval prior to submitting concrete reinforcement Shop Drawings.
 - b. For construction and expansion joints that require waterstops, submit layout of locations showing waterstop details. Indicate waterstop type, waterstop joint conditions, and details on how joint conditions will be handled.

- c. Detail for joining PVC to steel waterstops.
 - d. Layout of all control joint locations.
- 2. Samples:
 - a. Submit Sample, at least six inches long each, of each type of waterstop proposed for use.
 - b. Submit Sample of foam rubber and cork expansion joint fillers.
 - c. Submit Sample of each type of prefabricated PVC waterstop joint.
- B. Informational Submittals: Submit the following:
 - 1. Manufacturer's Instructions: Manufacturer's specifications and installation instructions for materials required.

1.04 – DELIVERY, STORAGE AND HANDLING

- A. Transportation and Handling of Products:
 - 1. Deliver materials to Site to ensure uninterrupted progress of the Work.
 - 2. Comply with Section 01600, Delivery, Storage and Handling.
- B. Storage and Protection:
 - 1. Store concrete joint materials on platforms or in enclosures or covered to prevent contact with ground and exposure to weather and direct sunlight. Comply with manufacturer's storage and protection requirements.
 - 2. Comply with Section 01600, Delivery, Storage and Handling.

PART 2 – PRODUCTS

2.01 – WATERSTOPS

- A. Polyvinyl Chloride (PVC):
 - 1. Material Requirements:

- a. Waterstops shall be extruded from elastomeric PVC compound containing plasticizers, resins, stabilizers, and other materials necessary to meet requirements of the Contract Documents and requirements of CRD-C572. Do not use reclaimed or scrap material.
 - b. Tensile strength of finished waterstop: 1,400 psi, minimum.
 - c. Ultimate elongation of finished waterstop: 280 percent, minimum.
 - d. Minimum thickness shall be 3/8-inch over entire width of waterstop.
 - e. Provide waterstops with minimum of seven ribs equally spaced at each end on each side. First rib shall be at the edge. Ribs shall be a minimum of 1/8-inch in height.
 - f. Provide waterstops with hog rings or factory-installed grommets anchored to exterior ribs to facilitate tying waterstop in position.
2. Split waterstops are not allowed.
3. Construction Joints: Waterstops shall be flatstrip ribbed type, six-inch minimum width, unless otherwise shown or indicated in the Contract Documents.
4. Expansion Joints: Waterstops shall be centerbulb ribbed type, nine-inch minimum width, unless otherwise shown or indicated in the Contract Documents. Centerbulb shall have minimum outside diameter of 7/8-inch.
5. The waterstops shall be manufactured from virgin polyvinyl chloride plastic compound and shall not contain any scrap or reclaimed material or pigment whatsoever. The properties of the polyvinyl chloride compound used, as well as the physical properties of the waterstops, shall exceed the requirements of the U.S. Army Corps. of Engineers' Specification CRD-C572. The waterstop material shall have an off-white, milky color.
6. Product and Manufacturer: Provide one of the following:
 - a. W.R. Meadows, Inc.
 - b. Durajoint Concrete Accessories.
 - c. Greenstreak Plastic Products Company.
 - d. Paul Murphy Plastics Company.

e. Vinylex Corporation.

f. Or equal.

B. Hydrophilic Waterstop Materials:

1. General Material Properties:

- a. Bentonite-free, and expandable by minimum of 80 percent of dry volume in presence of water to form watertight joint seal without damaging concrete in which material is cast. Provide only where shown or indicated in the Contract Documents.
- b. Material shall be composed of resins and polymers that absorb water and cause an increase in volume in completely reversible and repeatable process. Waterstop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
- c. Select materials that are recommended by manufacturer for type of liquid to be contained.

2. Hydrophilic Rubber Waterstop:

- a. Minimum cross sectional dimensions shall be 3/16-inch by 3/4-inch.
- b. Product and Manufacturer: Provide one of the following:
 - 1) Duroseal Gasket, by BBZ USA, Inc.
 - 2) Adeka Ultraseal MC-2010M, by Asahi Denka Kogyo K.K.
 - 3) Hydrotite, by Greenstreak Plastic Products Company.
 - 4) Or equal.

3. Hydrophilic Sealant:

- a. Hydrophilic sealant shall adhere firmly to concrete, metal, and PVC in dry or damp condition. When cured sealant shall be elastic indefinitely.
- b. Product and Manufacturer: Provide one of the following:
 - 1) Duroseal Paste, by BBZ USA, Inc.

- 2) Adeka Ultraseal P-201, by Asahi Denka Kogyo K.K.
- 3) Hydrotite, by Greenstreak Plastic Products Company.
- 4) SikaSwell S, by Sika Corporation.
- 5) Or equal.

C Injection Hose Waterstop System:

1. Injection Hose Waterstop:

- a. Injection hose shall consist of PVC or neoprene central core of sufficient strength to resist weight of minimum of 25 vertical feet of fresh concrete placed upon it. Provide injection openings closely spaced in minimum of three locations equally spaced around perimeter of hose. Seal openings with strips of closed cell foam of consistency to act as one-way valves preventing entrance of cement paste while allowing free flow of injection material, pumped through hose, into the concrete joint surface.
- b. Injection hose system shall be appropriate for injection of hydrophilic injection resin. Hose shall allow for vacuuming operations and repeated use. Construction of hose shall permit free discharge of specified injected grout into concrete without backwash, for entire length of hose.
- c. Injection hose system shall be complete with hold-down clips, connection tubes, fittings, and injection connections designed to be mounted flush with concrete surface and sealed to allow future injections. All system components shall be provided by same manufacturer.
- d. Product and Manufacturer: Provide one of the following:
 - 1) Fuko Injection System, by BBZ USA, Inc.
 - 2) SikaSwell Hose, by Sika Corporation.
 - 3) Or equal.

2. Hydrophilic Injection Resin:

- a. Hydrophilic injection resin shall be acrylate-ester based. Viscosity shall be less than 50 centipoises (cps). Resin shall be water soluble in its uncured state,

solvent-free, and non-water reactive. In cured state, resin shall form solid, hydrophilic, flexible material resistant to permanent water pressure, and shall not attack bitumen, joint sealants, and concrete.

b. Product and Manufacturer: Provide one of the following:

- 1) Duroseal Inject 1K/2K, by BBZ USA, Inc.
- 2) Sika Injection 29, by Sika Corporation.
- 3) Or equal.

2.02 – PREFORMED EXPANSION JOINT FILLER

A. Provide preformed expansion joint filler complying with ASTM D1752, Type I (sponge rubber) or Type II (cork).

2.03 – CONCRETE CONSTRUCTION JOINT ROUGHENER

A. Provide water-soluble non-flammable, surface-retardant roughener.

B. Product and Manufacturer: Provide one of the following for the types of joints specified:

1. Rugasol-S, by Sika Corporation for horizontal joints only.
2. Concrete Surface Retarder-Formula S, by Euclid Chemical Company, for horizontal joints only.
3. Concrete Surface Retarder-Formula F, by Euclid Chemical Company, for vertical joints only.
4. TK-6100 Concrete Form Surface Retarder, by TK Products.
5. Or equal.

2.04 – EPOXY BONDING AGENT

A. Provide a two-component epoxy-resin bonding agent.

B. Product and Manufacturer: Provide one of the following:

1. Sikadur 32 Hi-Mod LPL, by Sika Corporation.

2. Eucopoxy LPL, by the Euclid Chemical Company.
3. Resi-Bond J-58, by Dayton Superior.
4. Or equal.

2.05 – EPOXY-CEMENT BONDING AGENT

- A. Provide three component epoxy resin-cement blended formulated as bonding agent.
- B. Product and Manufacturer: Provide one of the following:
 1. Sika Armatec 110 EpoCem, as manufactured by Sika Corporation.
 2. Duralprep A.C., as manufactured by the Euclid Chemical Company.
 3. Emaco P24, as manufactured by MBT/ChemRex.
 4. Or equal.

2.06 – JOINT SEALANT AND ACCESSORIES

- A. For joint sealants and accessories used on isolation joints, control joints, and expansion joints, refer to Section 07920, Joint Sealants.

2.07 – CONCRETE BOND BREAKERS

- A. Provide asphalt-saturated rag felt building paper, not less in weight than commercially known as 15 pound felt building paper, which weighs 15 pounds per 100 square feet.

PART 3 – EXECUTION

3.01 – INSPECTION

- A. Contractor and installing Subcontractor, if any, shall examine substrate and conditions under which the Work is to be performed and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 – CONSTRUCTION JOINTS

- A. Comply with requirements of ACI 301, ACI 350.5 and the Contract Documents.

- B. Locate and install construction joints as shown or indicated on the Drawings. Where not shown or indicated, locate joints to not impair strength of the structure; position joints at points of minimum shear. Location of joints shall be approved by Engineer. In addition to joints shown or indicated on the Drawings, locate construction joints as follows:
1. In walls, locate joints at a maximum spacing of 40 feet. Locate joints away from wall intersections a minimum of one-quarter of the clear span distance between wall intersections measured horizontally.
 2. In structural slabs and beams, joints shall be located within middle third of element span and shall be located in compliance with ACI 301 and ACI 350.5, unless otherwise shown or indicated on the Drawings.
- C. Horizontal Joints:
1. Roughen concrete at interface of construction joints by abrasive blasting, hydroblasting, or using surface retardants and water jets to expose aggregate and remove accumulated concrete on projecting rebar immediately subsequent to form stripping, unless otherwise approved by Engineer. Do not allow surface retardants to contact waterstop. Protect waterstop from blasting. Immediately before placing fresh concrete, thoroughly clean existing contact surface using stiff brush or other tools and stream of pressurized water. Surface shall be clean and wet, and free from pools of water at time of placing fresh concrete.
 2. Remove laitance, waste mortar, and other substances that may prevent complete adhesion. Where joint roughening was performed more than seven days prior to concrete placing or where dirt or other bond reducing contaminants are on surface, perform additional light abrasive blasting or hydroblasting to remove laitance and bond-reducing materials just prior to concrete placement.
 3. Provide over contact surface of concrete a six-inch layer of Construction Joint Grout as specified in Section 03600, Grouting. Place fresh concrete before grout has attained its initial set. Placement of grout may be omitted if concrete mix has slump increased to at least six inches by addition of high range water reducer.
- D. Vertical Joints:
1. Apply roughener to the form in thin, even film by brush, spray, or roller in accordance with manufacturer's instructions. Do not allow roughener onto waterstop. Clean off any roughener that contacts the waterstop. After roughener is dry, concrete may be placed.

2. When concrete has been placed, remove joint surface forms as early as necessary to allow for removal of surface retarded concrete. Forms covering member surfaces shall remain in place as required under Section 03100, Concrete Forming. Wash loosened material off with high-pressure water spray to obtain roughened surface subject to approval by Engineer. Alternately, surface shall be roughened by abrasive blasting or hydroblasting to expose aggregate. Outer one-inch of each side of joint face shall be masked and protected from blasting to avoid damaging member surface. Protect waterstop from blasting.

3.03 – EXPANSION JOINTS

- A. Comply with requirements of ACI 301, ACI 350.5, and this Section.
- B. Locate and install expansion joints as shown and indicated in the Contract Documents. Install joint filler in accordance with manufacturer's instructions. Install sealants as specified in this Section.

3.04 – CONTROL JOINTS

- A. Provide control joints in non-water bearing slabs on grade as shown or indicated on the Drawings. Where control joints are not shown or indicated on the Drawings, space control joints at 24 to 36 times thickness of slab in both directions. Locate control joints only at places approved by Engineer.
- B. A groove, with depth of at least 25 percent of the member thickness, shall be tooled, formed, or saw-cut in concrete. Groove shall be filled with joint sealant material in accordance with Section 07920, Joint Sealants.
- C. Where control joint is formed by sawcutting, make sawcut in presence of Engineer immediately after concrete has set sufficiently to support the saw and be cut without damage to concrete. Keep concrete continually moist during cutting. Joints shall be 1/8-inch (+/- 1/32-inch) wide.
- D. Control joints may be formed with tool or by inserting joint forming strip. After concrete has achieved design strength, remove upper portion of joint forming strip and fill void with sealant.

3.05 – ISOLATION JOINTS

- A. Provide isolation joint where sidewalk or other slab on grade abuts a concrete structure and slab on grade is not shown doveled into that structure. Form isolation joint by 1/2-inch joint filler with upper 1/2-inch of joint filled with sealant.

3.06 – WATERSTOPS**A. General:**

1. Comply with ACI 301, ACI 350.5, and this Section. Make joints in accordance with manufacturer's instructions.
2. Provide PVC waterstops, except where otherwise shown or indicated on the Drawings.
3. Provide waterstops in all joints where concrete construction is below grade or intended to retain liquid. Install waterstop to the higher of: at least 12 inches above grade, or 12 inches above overflow liquid level in tanks.
4. Waterstops shall be fully continuous for extent of joint and with waterstops in intersecting joints. Maintain waterstop continuity at transitions between waterstops in joints at different levels and orientations.
5. In vertical joints in walls that are free at the top, waterstops shall extend no closer than six inches from top of wall.
6. In placing concrete around horizontal waterstops, with waterstop flat face in horizontal plane, work the concrete under waterstops by hand to avoid forming air and rock pockets.

B. Polyvinyl Chloride Waterstop:

1. Waterstops shall be positively held from displacement during concrete placing. Tie waterstops to reinforcement or other rigid supports at maximum spacing of 18 inches so that waterstop is securely and rigidly supported in proper position during concrete placing. Continuously inspect waterstops during concrete placing to ensure proper positioning.
2. Perform splicing in waterstops by heat sealing adjacent waterstop sections in accordance with manufacturer's printed recommendations. The following is required:
 - a. Material shall not be damaged by heat sealing.
 - b. Splices shall have tensile strength of not less than 60 percent of unspliced material's tensile strength.
 - c. Maintain the continuity of waterstop ribs and of its tubular center axis.

3. Only butt-type joints of ends of two identical waterstop sections shall be made while material is in forms.
 4. Prefabricated PVC Waterstop Joint:
 - a. Joints with waterstops involving more than two ends to be jointed together, and joints that involve an angle cut, alignment change, or joining of two dissimilar waterstop sections, shall be prefabricated by Contractor or manufacturer prior to placing in the forms.
 - b. Prefabricated joints shall have minimum of 2.0 feet of waterstop material beyond joint in each direction.
 - c. Install prefabricated joint assembly in the forms and butt-weld each two-foot end to a straight-run portion of waterstop in place in the forms.
 5. Where centerbulb waterstop intersects and is jointed with non-centerbulb waterstop, seal end of centerbulb using additional PVC material as required.
 6. Symmetrical halves of waterstops shall be equally divided between concrete placements at joints and centered within joint width, unless shown or indicated otherwise in the Contract Documents. Place centerbulb waterstops in expansion joints so that centerbulb is centered on joint filler material.
 7. When waterstop is installed in the forms or embedded in first concrete placement and waterstop remains exposed to atmosphere for more than four days, implement suitable precautions to shade and protect exposed waterstop from direct rays of sun during entire exposure, until exposed portion of waterstop is embedded in concrete.
 8. Protect waterstop placed in joints intended for future concrete placement from direct rays of the sun by temporary means until permanent cover is installed, so that waterstop is not exposed to direct rays of the sun for more than four days total.
- C. Hydrophilic Rubber Waterstop and Sealant:
1. Where a hydrophilic rubber waterstop or sealant is required in accordance with the Contract Documents, or where approved by Engineer, install waterstop or sealant in accordance with manufacturer's instructions and recommendations; except, as modified in the Contract Documents.
 2. When requested by Engineer, provide manufacturer's technical assistance at the Site.

3. Locate waterstop or sealant as near as possible to center of joint. Waterstop or sealant shall be continuous around entire joint. Minimum distance from edge of waterstop to face of the member shall be three inches.
4. Where hydrophilic rubber waterstop is used in combination with PVC waterstop, hydrophilic rubber waterstop shall overlap PVC waterstop for minimum of six inches. Fill contact surface between hydrophilic rubber waterstop and PVC waterstop with hydrophilic sealant.
5. Where wet curing methods are used, apply hydrophilic rubber waterstop and sealant after curing water is removed and just prior to closing up of the forms for concrete placement. Protect hydrophilic rubber waterstop and sealant from direct rays of sun and from becoming wet prior to concrete placement. If material becomes wet and expands, allow material to dry until material has returned to original cross sectional dimensions before placing concrete.
6. Install hydrophilic rubber waterstop in bed of hydrophilic sealant, before skinning and curing begins, so that irregularities in concrete surface are completely filled and waterstop is bonded to sealant. After sealant has cured, install concrete nails, with washers of a diameter equal to waterstop width, to secure waterstop to concrete at maximum spacing of 1.5 feet.
7. Prior to installing hydrophilic sealant, wire brush or sandblast the concrete surface to remove laitance and other materials that may interfere with bonding. Metal and PVC surfaces to receive sealant shall be cleaned of paint and materials that may interfere with bond. When sealant alone is shown or indicated in the Contract Documents, place sealant placed in built-up bead which has a triangular cross section with each side of triangle at least 3/4-inch long, unless otherwise indicated in the Contract Documents. Do not place concrete until sealant has cured as recommended by sealant manufacturer.

D. Injection Hose Waterstop:

1. Provide injection hose waterstop where shown or indicated on the Drawings.
2. Install injection hose in maximum lengths recommended by manufacturer, but not greater than 40 feet.
3. Clean concrete surface of debris prior to installing injection hose. Install injection hose on two-inch wide strip of unroughened concrete at center of member width in direct contact with concrete. Clamp hose into position with anchor clips set into concrete spaced no more than 10 inches on centers.

4. Where injection hose is used in combination with PVC waterstop, hose shall overlap PVC waterstop for minimum of six inches and shall be less than two inches away from PVC waterstop.
5. Provide each end of injection hose with solid injector hoses mounted to formwork using a fitting. Provide fitting with cover that seals hose from cement paste and serves as a removable and reinstallable cover for future reinjections. Mount fittings on dry side of member, unless shown otherwise on the Drawings.
6. Hose system shall not be injected until authorization is given by Engineer. When authorized, hose system shall be injected with hydrophilic resin in conformance with manufacturer's recommendations. Injection shall be by an applicator authorized by injection system manufacturer.
7. Injection system Supplier shall provide necessary supervision to satisfy Engineer that application conforms strictly to manufacturer's recommendations.
8. Prior to resin injection, flush hose system with water. At end of injection operation, clean the hose system in accordance with manufacturer's recommendations to facilitate future injections. Plug and cover injection and vent ends of system, leaving system ready for future reinjections.

3.07 – BONDING AGENT

- A. Use epoxy bonding agent for bonding of fresh concrete to concrete that has been in place for at least 60 days, and for bonding to existing concrete.
- B. Use epoxy-cement bonding agent for the following:
 1. Bonding toppings and concrete fill to concrete that has been in place for at least 60 days, and for bonding to existing concrete.
 2. For locations where bonding agent is required and concrete cannot be placed within open time period of epoxy bonding agent.
 3. Bonding of horizontal construction joints where joints are required in accordance with the Drawings or approved by Engineer for foundation mats that are five feet thick or greater.
- C. Use cement-water slurry as bonding agent for toppings and concrete fill to concrete that has been in place for less than 60 days. Cement water slurry shall be worked into surface with stiff bristle broom and place the concrete before cement-water slurry dries.

- D. Handle and store bonding agent in accordance with manufacturer's printed instructions and safety precautions.
- E. Mix bonding agent in accordance with manufacturer's instructions.
- F. Before placing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with bonding agent not less than 1/16-inch thick. Place fresh concrete while bonding agent is still tacky (within its open time), without removing in-place bonding agent coat, and as directed by manufacturer.

3.08 – BEARING PAD INSTALLATION

- A. Neoprene Bearing Pad: Install with water insensitive adhesive in accordance with manufacturer's instructions.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - REINFORCED CONCRETE**

- A. ACI 301 – Specification for Structural Concrete.
- B. ACI 304 – Guide For Measuring, Mixing, Transporting, and Placing Concrete.
- C. ACI 305 – Hot Weather Concreting.
- D. ACI 306 – Cold Weather Concreting.
- E. ACI 308 – Guide To Curing Concrete.
- F. ACI 318 – Building Code Requirements for Structural Concrete.
- G. ACI 350 - Concrete Sanitary Engineering Structures.
- H. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- I. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- J. ASTM C33 - Concrete Aggregates.
- K. ASTM C94 - Ready-Mixed Concrete.
- L. ASTM C150 - Portland Cement.
- M. ASTM C260 - Air Entraining Admixtures for concrete.
- N. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- O. ASTM C494 - Chemical Admixtures for Concrete.
- P. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- Q. ASTM D2103 - Polyethylene Film and Sheeting.
- R. CRSI 63 – Recommended Practice for Placing Reinforcing Bars.

1.02 - SUBMITTALS

- A. The Contractor shall comply with the requirements contained in Section 013300 - Submittals.

- B. Product data shall be submitted for all products specified herein.
- C. Shop drawings shall be prepared and submitted in accordance with the requirements specified in paragraph 1.07 below.
- D. Provide proposed concrete mix design for each type of concrete, as specified in paragraph 1.11, below to be used on the project at least 30 calendar days prior to the first scheduled concrete pour. The Contractor's testing laboratory shall develop concrete mix designs and test all materials and mixes for conformance with these specifications. The costs associated with development of the design mix and testing of samples shall not be paid for out of the stipulated cash allowance and shall be included in the bid price.
- E. Furnish the Engineer's field representative with the transit-mix delivery slips.

1.03 - QUALITY CONTROL

- A. Comply with the referenced standards specified in paragraph 1.02 above.
- B. Perform testing under the provisions of Section 014500 - Quality Control.
- C. Laboratory testing costs associated with the work of this Section will be paid for under the contract bid. The Contractor shall arrange to have a qualified technician present at the prescribed time.
- D. Perform all work in accordance with ACI 301.
- E. Fabricate concrete reinforcing in accordance with CRSI 63
- F. Provide field quality control as specified herein this Section.
- G. Procure concrete from a single approved central commercial batching plant. To further insure consistency, coloring, finish and quality, all aggregates, cement, water and other ingredients shall each be secured from the same source for the duration of the project.
- H. The batching plant and raw materials may be subject to inspections and tests performed by the Engineer.
- I. Contractor shall provide an adequately sized, insulated curing box to house concrete test cylinders, at the discretion of the Engineer, for the 24-hour period between concrete pour and sample pick-up by the testing lab. As directed by the Engineer, the Contractor shall cure additional cylinders in the same fashion as the in-place concrete.

- J. Curing box shall be located away from the main construction area and shall be blocked up off the ground.
- K. A log sheet shall be provided in a waterproof sheet protector to log in the placement and removal of the concrete test samples by the testing lab.
- L. Minimum information to be logged for each pour date shall include: date of pour, date of pick-up, weather conditions at time of pour, number of cylinders added, number of cylinders removed, location of pour, testing lab field technician name.

1.04 - REGULATORY REQUIREMENTS

- A. Conform to ACI 304 and all applicable codes for placement of concrete and related work.

1.05 - TESTS

- A. Testing and analysis of concrete shall be performed under the requirements contained in Section 014500 – Quality Control.
- B. The testing laboratory shall take cylinders, perform slump, and air entrainment tests in accordance with ACI 301.

1.06 - SHOP DRAWINGS

- A. Submit shop drawings of reinforcing steel and formwork under the provisions of Section 013300 - Submittals.
- B. Indicate reinforcement sizes, spacing, locations and quantities of reinforcing steel and wire fabric, bending and cutting schedules, splicing and supporting and spacing devices.
- C. Indicate formwork dimensioning, materials, arrangement of joints and ties.

1.07 - COORDINATION

- A. Coordinate work under provisions of Section 013100 - Project Management and Coordination.
- B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Notify Engineer a minimum of three (3) working days prior to commencement of concrete pours.

1.08 - DELIVERY, STORAGE AND HANDLING

- A. Store cement off the ground in a dry, weatherproof, adequately ventilated structure with provisions to prevent absorption of water.
- B. Transport dry concrete batches from the central plant to the site in approved truck mixers conforming to the requirements of the Truck Mixer Manufacturer's Agitating Standards. Each truck shall contain a plate stating the capacity, drum speeds and be provided with a revolution counter.

1.09 - ENVIRONMENTAL REQUIREMENTS

- A. Do not place concrete when the ambient temperature is below 40 deg. F. or when the concrete temperature exceeds 85 deg. F. Under certain circumstances, the Engineer may approve the placement of concrete under the above conditions, provided that the procedures of ACI 305 and ACI 306 are strictly adhered to.
- B. Do not place concrete when the conditions may adversely affect the placing, curing or finishing of concrete, or its strength.
- C. Comply with the requirements contained in Section 016500 - Product Delivery, Storage and Handling.

1.10 - DESIGN MIXES

- A. Submit the following related to design mixes:
 - 1. Name, address, and telephone number of Contractor's laboratory.
 - 2. Mix proportions.
 - 3. Source of cement, type, brand, and certified copies of mill reports, including physical and chemical analysis.
 - 4. Source of fine aggregates and results of tests made in accordance with ASTM C33 and ASTM C40.
 - 5. Source of coarse aggregates and results of tests made in accordance with ASTM C33.
 - 6. Catalogue cuts of all admixtures.
 - 7. Furnish test results of slump, air entrainment and water-cement ratio for each mix design.

8. For each mix proposed, make and cure four (4) standard 6 in. concrete test specimens in the lab in accordance with ASTM C192. Furnish compression test results made in accordance with ASTM C39. Break two (2) cylinders at seven (7) days and two (2) at 28 days.
 9. If the concrete is intended to be pumped, design mix accordingly and submit certification that it has been tested for pumping.
- B. If the adopted mix fails to produce concrete meeting the requirements for strength and placeability, the Engineer may order additional cement or adjustments to mix proportions at no extra cost to the Owner.

PART 2 - PRODUCTS

2.01 - MATERIALS

- A. Plywood forms: Douglas Fir species, solid one side grade and sound undamaged sheets. Thickness of wood shall be as required to support weight of concrete with minimal deflection.
- B. Steel forms: Minimum 16 gage thick, stiffened to support weight of concrete with minimum deflection.
- C. Tubular column type forms: Round, spirally wound laminated fiber material; inside surface treated with release agent.
- D. Form ties: Snap-off metal, of fixed length, cone type.
- E. Reinforcing: ASTM A615, 60 ksi yield grade billet steel deformed bars; uncoated finish, size and dimensions as indicated on plans.
- F. Welded steel wire fabric: Plain type, ANSI/ASTM A185; in flat sheets; uncoated finish; size and dimensions as indicated on plans.
- G. Cement: ASTM C150, Type II, Portland type, gray color.
- H. Fine and coarse aggregates: ASTM C33. (No. 57 or No. 67).
- I. Water: Clean and not detrimental to concrete.

2.02 - ACCESSORIES

- A. Air entraining admixture: ASTM C260.

- B. Chemical admixture: ASTM C494, Type as required.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A.
 - 2. Retarding Admixture: ASTM C 494, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
- C. Bonding agent: Three (3) component, solvent free, moisture tolerant, epoxy-modified cementitious product. Product Armatex 110 EpoCem as manufactured by Sika Corp. or specifically approved equal.
- D. Vapor barrier: ASTM D2103, 15 mil thick clear polyethylene film.
- E. Non shrink grout: Premixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum compressive strength of 2400 psi (16.5 Mpa) at 48 hours and 7000 psi at 28 days. Grout shall be suitable for contact with potable water. For equipment bases and pipe supports use non-shrink grout by Master Builders, Embeco 636, Unisorb V-1, or equal.
- F. Flashing reglets: Galvanized steel; 26 gage longest possible lengths; alignment splines for joints; securable to formwork; Type CO, manufactured by FRY REGLET or equal.
- G. Expansion joints: ASTM D1751; 1/2-inch (13 mm) or 3/4-inch thick, as indicated on drawings, asphalt impregnated fiberboard or felt.
- H. Form release agent: Bio-Release EF or equal; colorless, water based, non-toxic, V.O.C. compliant, environmentally safe material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete; manufactured by Dayton Superior or equal. Agent shall not be detrimental to the environment.
- I. Sealant: ASTM D1190; hot applied rubber compound manufactured by BURKE COMPANY or equal.
- J. Absorptive mat: Burlap-polyethylene, 8-oz/sq. yd. bonded to prevent separation during use.

- K. Membrane curing compound: Moisture Retention complying with ASTM C309. Products: Eucocure VOX as manufactured by Euclid or equal.

2.03 - MIXES

A. Cast in place concrete:

1. Mix concrete in accordance with ASTM C94, Alternative No. 2, to achieve the following:
 - a. Compressive strength (28 day): 4000 psi
 - b. Maximum water (cement ratio by weight): 0.50
 - c. Slump: Beams, Slabs, Footings, and Walls –
 - 1) Conventional Mix (Slump): 3 +/- 1 inch.
 - 2) Pump Mix
 - a) (Initial Slump): 3 +/- 1 inch.
 - b) (Final Slump): 6 1/2 +/- 1 Inch.
 - d. Air entrainment:
 - 1) Piers, Mats, Spread Footings and Foundation Walls: 5½ +/- 1 percent
 - 2) Slabs: 3 +/- 1 percent
 - e. Large aggregate: ¾" crushed stone, ASTM C33, No. 67

- B. Use admixtures only when approved by the Engineer.

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Verify lines, levels, and measurement before proceeding with formwork. Ensure that dimensions agree with the plans.
- B. Inspect the formwork and reinforcing that it has been properly set and secured and that all items to be embedded, built-in or pass through concrete are at their proper locations and elevations.

- C. The General Contractor shall verify that all other prime contractors have installed concrete inserts, sleeves and embedded elements of the project, such as conduit, and that their work has been totally completed and inspected by the Engineer.

3.02 - FORMWORK ERECTION

- A. Hand trim sides and bottom of earth forms and remove loose soil to the satisfaction of the Engineer.
- B. Remove water from forms and excavations and divert flows of water to avoid washing over, under or through freshly placed concrete.
- C. Align form joints.
- D. Do not apply form release agent where concrete surfaces are to receive special finishes or applied coatings that may be affected by the agent.
- E. Where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-metallic/non-shrink grout.
- F. Prepare previously placed concrete by cleaning with steel brush and apply bonding agent in accordance with manufacturer's instructions.
- G. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

3.03 - INSTALLATION

- A. Place, support, and secure reinforcement against displacement at the locations and to the dimensions as indicated on the plans.
- B. Use reinforcing splices at a minimum of locations and only at locations of minimum stress. Review locations of splices with Engineer.
- C. Rebar splice overlap shall be the minimum length as per ACI 318.
- D. Ensure reinforcement, inserts, embedded parts, formed joint fillers, and joint devices are not disturbed during concrete placement.
- E. Install joint fillers in accordance with manufacturer's instructions.
- F. Install joint devices in accordance with manufacturer's instructions.

- G. Install joint device anchors. Maintain correct position to allow joint cover flush with floor and wall finish.
- H. Install joint covers in one-piece length when adjacent construction activity is complete.
- I. Apply sealants in joint devices in accordance with manufacturer's instructions.
- J. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.
- K. Place concrete continuously between predetermined expansion, control and construction joints as rapidly as possible by methods that shall prevent the separation of ingredients.
- L. Place concrete with the aid of mechanical vibrators and shall be capable of transmitting to the concrete not less than 3,000 impulses per minute. Maintain at least three (3) vibrators, in good working condition, ready for use when concrete placement starts in any one area.
- M. Do not interrupt successive placement. Do not permit cold joints to occur.

3.04 - INSTALLATION – FOUNDATION SLAB

- A. Saw cut control joints at an optimum time after finishing. Cut slabs with $\frac{3}{16}$ -inch (4.8 mm) thick blade, $\frac{1}{4}$ depth of slab thickness.
- B. Separate slabs on grade from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within $\frac{1}{4}$ inch (6 mm) of finished slab surface.
- C. Steel trowel all other surfaces except as noted.
- D. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains maintaining a minimum 1 percent slope.
- E. Cure floor surfaces in accordance with ACI 308.
- F. Apply curing compound in accordance with manufacturer's instructions in two (2) coats with second coat at right angles to the first.

3.05 - TOLERANCES

- A. Provide Class A tolerance to floor slabs according to ACI 301.

3.06 - FIELD QUALITY CONTROL

- A. Inspection and testing of concrete performed by the independent testing laboratory shall be performed under provisions of Section 014500 - Quality Control.

3.07 - FINISHES

- A. The Contractor shall finish all concrete by:
1. Filling all localized surface voids ("bugholes"), honeycombing, and pockets exceeding $\frac{1}{8}$ inch diameter and $\frac{1}{8}$ inch depth, in the concrete with an application of cement mortar as follows: White cement shall be added to the mortar in an amount sufficient to tint the mortar a shade lighter than the concrete to be repaired. Mortar shall be mixed approximately 45 minutes in advance of use. Care shall be exercised to obtain a good bond with the concrete. After the mortar has thoroughly hardened, the surface shall be rubbed with a carborundum stone in order to obtain the same color in the mortar as in the surrounding concrete. The final appearance shall be acceptable to the Engineer.
 2. All fins caused by form joints, and other projections shall be completely removed to the satisfaction of the Engineer.
 3. Filling all snap tie voids with mortar as specified above.
- B. First floor interior walking surfaces of all buildings shall be left with a flat rubbed, float or steel trowel finish and be readied for painting as work of another Section.
- C. Interior basement areas not receiving coatings shall be left with a hard steel trowel finish.
- D. Housekeeping pads shall be left with a broom finish with a steel trowel rounded edge.
- E. All exterior-walking surfaces shall be left with a fine broom finish with a steel trowel border and rounded edges.
- F. All exposed horizontal and vertical wall and slab corners shall have a $\frac{3}{4}$ " wide chamfered edge.

3.08 - PROTECTION AND REPAIR

- A. Protect concrete from damage and rust staining to the date that the Final Completion Certificate has been issued by the Engineer. Immediately remove all rust spots that have developed during the construction period as soon as directed by the Engineer.

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 – DESCRIPTION****A. Scope:**

- Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install grout and perform grouting Work.

B. Coordination:

- Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before grouting Work.

C. Related Sections:

- Section 03251, Concrete Accessories.
- Section 03300, Cast-In-Place Concrete.

D. Application and Grout Material:

- The following is a listing of grouting applications and the corresponding type of grout material to be provided for the associated application. Unless shown or indicated otherwise in the Contract Documents, provide grout in accordance with the following:

Table 03600-A: Grout Applications and Material Types

Application	Required Grout Material Type
Beam and column (one- or two-story height) base plates and precast concrete bearing less than 16 inches in the least dimension	Class II Non-Shrink (Non-Metallic)
Column base plates and precast concrete bearing (greater than two-story height or larger than 16 inches in the least dimension)	Class I Non-Shrink (Non-Metallic)
Base plates for storage tanks and other non-motorized equipment, and motorized equipment or machinery less than 50 horsepower	Class I Non-Shrink (unless otherwise recommended by equipment manufacturer) (Non-Metallic)
Motorized equipment or machinery equal to and greater than 50 horsepower, and motorized equipment or machinery less than 50 horsepower subject to severe shock loads or high vibration	Class III Non-Shrink Epoxy (unless otherwise recommended by equipment manufacturer) (Non-Metallic)
Filling blockout spaces for embedded items such as railing posts, guide frames for hydraulic gates, and similar applications	Class II Non-Shrink (Class I where placement time exceeds 15 minutes) (Non-Metallic)
Grout fill or grout toppings less than four inches thick	Grout Fill (Non-Metallic)
Grout fill greater than four inches thick	Class "B" Concrete in accordance with

Application	Required Grout Material Type
	Section 03300, Cast-In-Place Concrete (Non-Metallic)
Applications not listed above, where grout is indicated on the Drawings	Class I Non-Shrink, unless shown or indicated otherwise (Non-Metallic)

1.02 – REFERENCES

A. Standards referenced in this Section are:

1. ACI 211.1, Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
2. ACI 301, Structural Concrete for Buildings.
3. ASTM C33/C33M, Specification for Concrete Aggregates.
4. ASTM C109/C109M, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
5. ASTM C230/C230M, Specification for Flow Table for Use in Tests of Hydraulic Cement.
6. ASTM C531, Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
7. ASTM C579, Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
8. ASTM C827, Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
9. ASTM C882/C882M, Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
10. ASTM C939, Text Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
11. ASTM C1107/C1107M, Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
12. ASTM C1181, Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.

13. NSF/ANSI 61, Drinking Water System Components - Health Effects.

1.03 – QUALITY ASSURANCE

A. Qualifications:

1. Grout Testing Laboratory:
 - a. Independent testing laboratory employed for design and testing of grout materials and mixes shall comply with testing laboratory requirements in Section 03300, Cast-in-Place Concrete and other applicable requirements in the Contract Documents.
2. Manufacturer: Shall have a minimum of five years experience of producing products substantially similar to that required and shall be able to submit documentation of at least five satisfactory installations that have been in successful operation for at least five years each.
3. Manufacturer's Field Service Technician: When required, provide services of manufacturer's full-time employee, factory-trained in handling, use, and installing the products required, with at least five years of experience in field applications of the products required.

B. Trial Batch:

1. Each grout fill and construction joint grout mix proportion and design shall be verified by laboratory trial batch or field experience methods. Comply with ACI 211.1 and submit to Engineer a report with the following data:
 - a. Complete identification of aggregate source of supply.
 - b. Tests of aggregates for compliance with specified requirements.
 - c. Scale weight of each aggregate.
 - d. Absorbed water in each aggregate.
 - e. Brand, type, and composition of cement.
 - f. Brand, type, and amount of each admixture.
 - g. Amounts of water used in trial mixes.

- h. Proportions of each material per cubic yard.
 - i. Unit weight and yield per cubic yard of trial mixtures.
 - j. Measured slump.
 - k. Measured air content.
 - l. Compressive strength developed at seven days and 28 days, from not less than three test specimens cast for each seven-day and 28-day test, and for each design mix as specified in ASTM C 109.
 - m. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time period as appropriate.
- 2. Laboratory Trial Batches: When laboratory trial batches are used to select grout proportions, prepare test specimens and conduct strength tests as specified in ACI 301.
 - 3. Field Experience Method: When field experience methods are used to select grout proportions, establish proportions as specified in ACI 301.
 - 4. The cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Engineer in obtaining specimens for testing. The Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens, at no additional cost to the Owner.
 - 5. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

1.04 – SUBMITTALS

A. Action Submittals: Submit the following:

- 1. Shop Drawings:
 - a. Schedule of Project-specific grout applications, installation locations, and the grout type proposed for each.
 - b. List of grout materials and proportions for the proposed mix designs. Include data sheets, test results, certifications, and mill reports to qualify the materials

proposed for use in the mix designs. Do not start laboratory trial batch testing until submittal is approved by Engineer.

- c. Trial Batch Reports: Submit laboratory test reports for grout materials and mix design tests.

2. Product Data:

- a. Data sheets, certifications, and manufacturer's specifications for all materials proposed for use.

B. Informational Submittals: Submit the following:

1. Manufacturer's Instructions:

- a. Special instructions for shipping, storing, protecting, and handling.
- b. Installation instructions for the materials.

2. Supplier Reports:

- a. Submit written report of results of each visit to Site by Supplier's field service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.

3. Qualifications Statements:

- a. Testing laboratory, when not submitted under other Sections.
- b. Manufacturer, when submittal of qualifications is required by Engineer.
- c. Manufacturer's field service technician, when submittal of qualifications is required by Engineer.

1.05 – PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Storage of Materials: Store grout materials in a dry location, protected from weather and protected from moisture.

PART 2 – PRODUCTS**2.01 – GENERAL**

- A. All grout materials, admixtures, cementitious materials, and other materials used in grout that contact potable water or water that will be treated to become potable shall be listed in NSF/ANSI 61.

2.02 – NON-SHRINK GROUT MATERIALS

- A. General: Non-shrink grout shall be a prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or container in which the materials are packaged. Specific formulation for each type or class of non-shrink grout specified in this Section shall be that recommended by the grout manufacturer for the particular application.
- B. Class I Non-Shrink Grout:
1. Class I non-shrink grouts shall have a minimum 28-day compressive strength of 7,000 psi. Use grout for precision grouting and where water-tightness and non-shrink reliability in both plastic and hardened states is critical, in accordance with Table 03600-A in this Section.
 2. Products and Manufacturer: Provide one of the following:
 - a. Masterflow 928, by Master Builders, Inc.
 - b. Five Star Grout, by Five Star Products, Inc.
 - c. Euro N-S, by Euclid Chemical Company.
 - d. Sikagrout 212, by Sika Corporation.
 - e. Conspec 100 Non-Shrink Non-Metallic Grout by Conspec, Masterflow.
 - f. 555 Grout by BASF Construction Chemicals
 - d. Or equal.
 3. Comply with ASTM C1107/C1107M, Grade C and B (as modified below) when tested using amount of water required to achieve the following properties:
 - a. Fluid consistency (20 to 30 seconds) shall be in accordance with ASTM C939/CDC 611.

- b. At temperatures of 45, 73.4, and 95 degrees F.
 - 4. Length change from placing to time of final set shall not have shrinkage greater than the expansion measured at three or fourteen days. Expansion at three or fourteen days shall not exceed the 28-day expansion.
 - 5. Non-shrink property shall not be based on chemically-generated gas or gypsum expansion.
 - 6. Fluid grout shall pass through the flow cone, with continuous flow, one hour after mixing.
- C. Class II Non-Shrink Grout:
- 1. Class II non-shrink grouts shall have minimum 28-day compressive strength of 7,000 psi. Use grout for general-purpose grouting applications in accordance with Table 03600-A in this Section.
 - 2. Products and Manufacturer: Provide one of the following:
 - a. Construction Grout, by Master Builders, Inc.
 - b. FSP Construction Grout, by Five Star Products, Inc.
 - c. NS Grout, by Euclid Chemical Company.
 - d. Or equal.
 - 3. Comply with ASTM C1107/C1107M and the following when tested using the quantity of water required to achieve the following properties:
 - a. Flowable consistency (140 percent flow in accordance with ASTM C230/C230M, five drops in 30 seconds).
 - b. Fluid working time of at least 15 minutes.
 - c. Flowable for at least 30 minutes.
 - 4. When tested, grout shall not bleed at maximum allowed water.
 - 5. Non-shrink property shall not be based on chemically-generated gas or gypsum expansion.
- D. Class III Non-Shrink Epoxy Grout:

1. Epoxy grout shall be a pourable, non-shrink, 100-percent solids system.
2. Products and Manufacturer: Provide one of the following:
 - a. E3G, by Euclid Chemical Company.
 - b. Sikadur 42 Grout Pak, by Sika Corporation.
 - c. HP Epoxy Grout, by Five Star Products, Inc.
 - d. Masterflow MP by BASF Construction Chemicals.
 - e. Or equal.
3. Epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all pre-measured and prepackaged. Resin component shall not contain non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are unacceptable. Variation of component ratios is not allowed without specific recommendation by manufacturer. Manufacturer's instructions shall be printed on each container in which products are packaged.
4. The following properties shall be attained with the minimum quantity of aggregate allowed by epoxy grout manufacturer.
 - a. Vertical volume change at all times before hardening shall be between zero percent shrinkage and 4.0 percent expansion when measured in accordance with ASTM C827 (modified for epoxy grouts by using an indicator ball with specific gravity between 0.9 and 1.1).
 - b. Length change after hardening shall be less than 0.0006-inch per inch and coefficient of thermal expansion shall be less than 0.00003-inch per inch per degree F when tested in accordance with ASTM C531.
 - c. Compressive creep at one year shall be less than 0.001-inch per inch when tested under a 400-psi constant load at 140 degrees F in accordance with ASTM C1181.
 - d. Minimum seven-day compressive strength shall be 14,000 psi when tested in accordance with ASTM C579
 - e. Grout shall be capable of maintaining at least a flowable consistency for minimum of 30 minutes at 70 degrees F.

- f. Shear bond strength to portland cement concrete shall be greater than shear strength of concrete when tested in accordance with ASTM C882/C882M.
 - g. Minimum effective bearing area shall be 95 percent.
- 5. Epoxy Base Plate Grout
 - a. EPoxy base plate grout shall be Sikadur 42, Grout-Pak by Sika Corporation, or Masterflow MP by BASF Construction Chemicals.

2.03 – GROUT MATERIALS OTHER THAN NON-SHRINK GROUT

- A. General: Materials for grouts (other than non-shrink grouts) shall be in accordance with Section 03300, Cast-In-Place Concrete, except as otherwise specified in this Section.
- B. Grout Fill:
 - 1. Cement grout shall be composed of Portland Cement and sand in the proportion specified in the Contract Documents and the minimum amount of water necessary to obtain the desired consistency. If no proportion is indicated, cement grout shall consist of one part Portland Cement to three parts sand. Water amount shall be as required to achieve desired consistency without compromising strength requirements. White portland cement shall be mixed with the Portland Cement as required to match color of adjacent concrete. Components shall be proportioned and mixed in accordance with this Section.
 - a. Minimum Compressive Strength: 4,000 psi at 28 days.
 - b. Maximum Water-Cement Ratio: 0.45 by weight.
 - c. Coarse Aggregate: ASTM C33/C33M, No. 8 size.
 - d. Fine Aggregate: ASTM C33/C33M, approximately 60 percent by weight of total aggregate.
 - e. Air Content: Seven percent (plus or minus one percent).
 - f. Minimum Cement Content: 564 pounds per cubic yard.
 - g. Slump for grout fill shall be adjusted to match placing and finishing conditions, and shall not exceed four inches.
 - h. For beds thicker than 1-1/2 inch and/or where free passage of grout will not be obstructed by coarse aggregate, 1-1/2 parts of coarse aggregate having a top

size of 3/8 inch should be added. This stipulation does not apply for grout being swept in by a mechanism. These applications shall use a plain cement grout without coarse aggregate regardless of bed thickness.

- i. Sand shall conform to the requirements of ASTM C144.

C. Construction Joint Grout:

- 1. Construction joint grout shall be comprised of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned with similar cementitious characteristics as Class "A" concrete specified in Section 03300, Cast-In-Place Concrete. Mix design shall result in grout that is flowable with high mortar content. Mix requirements are:
 - a. Minimum Compressive Strength: 4,500 psi at 28 days.
 - b. Maximum Water-Cement Ratio: 0.42 by weight.
 - c. Coarse Aggregate: ASTM C33/C33M, No. 8 size.
 - d. Fine Aggregate: ASTM C33/C33M, approximately 60 percent by weight of total aggregate.
 - e. Air Content: Seven percent (plus or minus one percent).
 - f. Minimum Cement Content: 752 pounds per cubic yard.
 - g. Slump for Construction Joint Grout: Seven inches (plus or minus one inch).

D. Filter Underdrain Blocks Grout:

- 1. Grout shall comply with Article 2.1 of this Section. Grout shall consist of one part cement to two parts sand with shrinkage-reducing admixture. Class I or Class II non-shrink grout may be used in lieu of filter underdrain blocks grout.
 - a. Minimum Compressive Strength: 4,000 psi at 28 days.
 - b. Maximum Water-Cement Ratio: 0.45 by weight.

2.04 – CURING MATERIALS

- A. Curing materials shall comply with Section 03300, Cast-in-Place Concrete, and shall be as recommended by the manufacturer of prepackaged grouts.

PART 3 – EXECUTION**3.01 – INSPECTION**

- A. Examine substrate and conditions under which grouting will be performed and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 – INSTALLATION

- A. General:

- 1. Place grout as shown and indicated, and in accordance with Laws and Regulations and grout manufacturer's instructions. If manufacturer's instructions conflict with the Contract Documents, obtain clarification or interpretation from Engineer before proceeding.
- 2. Consistency of non-shrink grouts shall be as required to completely fill the space to be grouted for the particular application. Do not install grout for dry-packing without approval of Engineer. When dry-packing is approved by Engineer, dry-pack consistency shall be such that grout has sufficient water to ensure hydration and grout strength development, and remains plastic, moldable, and that does not flow.
- 3. Grouting shall comply with temperature and weather limitations in Section 03300, Cast-In-Place Concrete.
- 4. Cure grout in accordance with grout manufacturer's instructions for prepackaged grout and Section 03300, Cast-In-Place Concrete, for grout fill.

- B. Columns and Beams:

- 1. After shimming columns and beams to proper elevation, securely tighten anchors. Properly form around base plates allowing sufficient room around edges for placing grout. Provide adequate depth between bottom of base plate and top of concrete base to assure that void is completely filled with non-shrink grout.

- C. Equipment Bases:

- 1. Install equipment in accordance to manufacturer's recommendations, Laws, and Regulations, and the Contract Documents. After shimming equipment to proper elevation, securely tighten anchors. Properly form around base plates, allowing sufficient room around edges for placing grout. Provide adequate depth between bottom of equipment base and top of concrete base to ensure that voids are completely filled with non-shrink grout.

D. Handrail Posts:

1. After posts have been properly inserted into holes or sleeves, fill annular space between posts and sleeve with non-shrink grout. Bevel grout at juncture with post so that water will flow away from post.

E. Construction Joints:

1. Place a six-inch minimum thick layer of construction joint grout over contact surface of concrete at interface of horizontal construction joints in accordance with Section 03251, Concrete Accessories, and Section 03300, Cast-In-Place Concrete.

F. Grout Fill:

1. All mechanical, electrical, and finish work shall be completed prior to placing grout fill. Base slab shall be provided with a scratched finish in accordance with Section 03300, Cast-In-Place Concrete. Roughen existing slabs shall by abrasive blasting or hydroblasting exposing aggregates to ensure bonding to base slab.
2. Minimum thickness of grout fill shall be one-inch. Where finished surface of grout fill is to form an intersecting angle of less than 45 degrees with concrete surface against which grout will be placed, form a key in the concrete surface at the intersection point. Key shall be minimum of 3.5 inches wide by 1.5 inches deep.
3. Thoroughly clean and wet base slab prior to placing grout fill. Do not place grout fill until slab is completely free of standing water. A thin coat of neat Type II cement slurry shall be broomed into surface of slab. Place grout fill while slurry is wet. Grout fill shall be compacted by rolling or tamping, brought to elevation, and floated. In tanks and basins where scraping-type equipment will be installed, grout fill shall be screeded by blades attached to revolving mechanism of equipment in accordance with procedures recommended by equipment manufacturer after grout is brought to elevation.
4. Grout fill placed on sloping slabs shall be installed uniformly from bottom of slab to top, for full width of placement.
5. Test grout fill surface with a straight edge to detect high and low spots; immediately correct high and low spots in grout fill. When grout fill has hardened sufficiently, grout fill shall be steel troweled to provide a smooth surface free of bug holes and other imperfections. While an acceptable type of mechanical trowel may be used in this operation, the last pass over the grout fill surface shall be by hand-troweling. During

finishing, do not apply the following to the grout fill surface: water, dry cement, or mixture of dry cement and sand.

6. Cure and protect grout fill in accordance with Section 03300, Cast-In-Place Concrete.
7. Epoxy grout shall be used for bonding new concrete to hardened concrete.
8. Epoxy base plate grout shall be used for precision seating of base plates including base plates for all equipment such as engines, mixers, pumps, vibratory and heavy impact machinery, etc.

3.03 – FIELD QUALITY CONTROL

A. Field Testing Services:

1. Owner will employ testing laboratory to perform field quality control testing for grout. Engineer will direct the testing requirements.

B. Field Testing Services:

1. Contractor shall employ an independent testing laboratory to perform field quality control testing for grout. Engineer will direct where samples are to be obtained.
2. Contractor shall provide all curing and necessary cube storage facilities in accordance with ASTM C31.
3. Comply with testing laboratory requirements in Section 03300, Cast-In-Place Concrete for required testing laboratory qualifications.

C. Quality Control Testing During Construction:

1. Grout Fill: Perform sampling and testing for field quality control during grout fill placing as follows:
 - a. Sampling Fresh Grout Fill: ASTM C172.
 - b. Slump: ASTM C143; one test for each load of grout at point of discharge.
 - c. Air Content: ASTM C231; one sample for every two grout loads at point of discharge, and when a change in the grout is observed.
 - e. Compression Test Specimens:

- 1) In accordance with ASTM C109/C109M; make one set of compression cubes for each 50 cubic yards of grout, or fraction thereof, of each mix design placed each day. Each set shall be four standard cubes, unless otherwise directed by Engineer.
 2. Non-shrink Grout: Perform sampling and testing for field quality control during non-shrink grout placing as follows:
 - a. Perform compression testing of non-shrink grout in accordance to ASTM C109/C109M at intervals during construction as selected by Engineer. Make a set of four specimens for testing compressive strength at a period of time selected by the Engineer.
 - b. Perform compression tests on epoxy grout and fabricate specimens for epoxy grout testing in accordance with ASTM C579, Method B, at intervals during construction as selected by the Engineer. Make a set of four specimens for testing compressive strength at a period of time selected by Engineer.
- D. Evaluation of Field Quality Control Tests:
1. Do not use grout, delivered to final point of placement, having slump or total air content that does not comply with the Contract Documents.
 2. Compressive strength tests for laboratory-cured cubes will be acceptable if averages of all sets of three consecutive compressive strength test results equal or exceed the required 28-day design compressive strength of the associated type of grout.
 3. If the compressive strength tests do not comply with the requirements in the Contract Documents, the grout represented by such tests will be considered defective and shall be removed and replaced, or subject to other action required by Engineer, at Contractor's expense.
- E. Manufacturer's Services:
1. Manufacturers of proprietary materials shall make available upon 72 hours notification the services of qualified, full time employee, experienced in serving as a field service technician for the products required, to aid in assuring proper use of products under the actual conditions at the Site.

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 – SECTION INCLUDES**

- A. Repair of cracked, spalled, calcinated and hollow areas on concrete tank slab.
- B. Repair of cracked, spalled, calcinated areas of building foundation walls.

1.02 - SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Submit manufacturers' product data and application requirements for proposed materials used to repair spalls and cracks.
- C. Submit documentation on characteristics of proposed media for abrasive blasting.
- D. Submit documentation indicating product applicators are trained and approved by product manufacturer.

1.03 - REGULATORY REQUIREMENTS

- A. Coatings shall comply with NYCRR, Part 205, of the New York State Department of Environmental Conservation (NYSDEC).
- B. Transport debris and rubbish in accordance with New York State Department of Environmental Conservation Law, Article 27, Treatment and Disposal of Refuse and Other Solid Waste.

1.04 - EXISTING CONDITIONS

- A. Allow Owner to conduct an inspection after tank cleaning to identify areas for repair.

PART 2 - PRODUCTS**2.01 – MATERIALS**

- A. Two Component Polymer Modified Cement: Cement shall comply with ANSI/NSF Standard 61 for potable water. All repair mortar shall fully bond to existing surfaces and be free of chlorides. Repair mortar shall be SIKATOP 123 PLUS Repair Mortar.
- B. Bonding Agent and Reinforcement Protection: The bonding agent and reinforcement protection shall be a 3-component, solvent free, moisture tolerant, epoxy-modified, cementitious product specifically formulated as a bonding agent and an anti-corrosion coating. This product shall be Armatec 110 EpoCem as manufactured by SIKA CORP.

- C. Water: Potable, clean and free from oils, acids, alkali organic matter and other deleterious material.
- D. Filler: TNEMEC 63-1500.

PART 3 - EXECUTION

3.01 –PROTECTION

- A. Protect pipe openings so that no materials enter into the lines during preparation and repair.

3.02 – SURFACE PREPARATION

- A. Interior Abrasive blasting: Utilize abrasive blasting to remove all existing coatings and deposits at area to be repaired. Remove loose material to sound substrate. Equipment shall have ample capacity to furnish the required volume of compressed air to operate the blast effectively. The air shall be free of oil or moisture. Media shall be composed principally of silica grains. Do not utilize previously used media for abrasive blasting. Conduct abrasive blasting to prevent spread of media to adjoining property.
- B. Surfaces to be repaired and coated shall be clean.
- C. Mechanical chipping: Where necessary, and as directed by the Engineer, use chipping hammers to remove unsound concrete.

3.03 – REPAIR/RESTORATION

- A. Interior Wall and Floor Crack Repair
 - 1. Rout with dovetail profile to a depth of ½-inch.
 - 2. Remove mortar at the ends of exposed wire and steel until corrosion free steel is exposed. Remove rust deposits and loose material from steel by blasting to a near white finish (SSPC-10). Coat bare steel with 20 mils (2 coats of 10 mils each) of Sika ARMATEC 110 EPOCEM.
 - 3. Saturate surface with clean water.
 - 4. When repair area is saturated surface dry, coat entire concrete surface of repair area with 20 mils of Sika ARMATEC 110 EPOCEM.
 - 5. Prepare two-component, polymer-modified, cementitious, non-sag mortar in accordance with manufacturer's standards.

6. Apply in accordance with manufacturer's recommendations.
7. Cure in accordance with ACI recommendations for Portland Cement Concrete.

B. Interior Wall and Floor Repairs

1. Remove all loose material to sound substrate.
2. Abrasive blast to SSPC-SP13/NACE 6 Surface Preparation of Concrete.
3. When surface preparation of area to be repaired is completed, coat entire concrete surface of repair area with 1/16-inch of TNEMEC 63-1500.

3.04 - CLEANUP

- A. Maintain work area in a neat, orderly fashion. Debris such as used sand, muck, rust, scale, shall be frequently cleaned up and removed from the site. Thinners used to clean spray guns and other tools and equipment shall be held in containers and removed from the site to an approved disposal area by the Contractor. Do not clean equipment in tank.
- B. After completion of repair, thoroughly clean tank interior. Sweep broom clean.
- C. Upon completion of the work, remove all excess material, rigging, empty containers, and supplies, from the site. Buildings and grounds shall be left in as good condition as when work was started.
- D. Transport debris and rubbish in accordance with New York State Department of Environmental Conservation Law, Article 27, Treatment and Disposal of Refuse and Other Solid Waste.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 – SUMMARY OF THE WORK****A. Scope:**

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install masonry mortaring and grouting for unit masonry construction.
2. This Section includes masonry mortaring and grouting for masonry products specified in:
 - a. Section 04220, Concrete Unit Masonry.
3. Types of materials required under this Section include:
 - a. Portland cement-lime mortars.
 - b. Ready-mixed mortar
 - c. Fine grout.
 - d. Coarse grout.
 - e. Grout fill around reinforcement in masonry lintels and bond beams.

B. Related Sections:

1. Section 04090, Masonry Anchorage and Reinforcing.
2. Section 04201, Unit Masonry Construction.
3. Section 04220, Concrete Unit Masonry.

1.02 – REFERENCED STANDARDS**A. Standards referenced in this Section are:**

1. ASTM C144, Specification for Aggregate for Masonry Mortar.
2. ASTM C150/C150M, Specification for Portland Cement.
3. ASTM C207, Specification for Hydrated Lime for Masonry Purposes.
4. ASTM C270, Specification for Mortar for Unit Masonry.

5. ASTM C404, Specification for Aggregates for Masonry Grout.
6. ASTM C91/91M, Standard Specification for Masonry Cement.
7. ASTM C1019, Test Method for Sampling and Testing Grout.

1.03 – QUALITY ASSURANCE

A. Component Supply and Compatibility:

1. Do not change source or brands of mortar materials during the Project.

B. Pre-submittal Meeting:

1. Before submitting Samples of colored mortar for approval, Contractor and Supplier shall meet at the Site with Engineer to review existing mortar to be matched and to preview proposed materials and colors.
2. Refer to Section 04201, Unit Masonry Construction.

1.04 – SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Schedule of locations where each mortar type will be used in the Work.
 - b. Grout mix design and material certification.
2. Product Data:
 - a. Manufacturer's specifications and instructions for each manufactured material or product.
 - b. Compression test results of grout mix, for identical mix previously prepared and tested, in accordance with ASTM C1019, at maximum aggregate allowed. If no previously-prepared mix is identical, perform tests on the job mix design in accordance with ASTM C1019 and submit to Engineer.
 - c. Product data and specifications for integral waterproofing admixture.
3. Samples:

- a. Each type of colored mortar, showing range of color expected in the Work.
- b. Label samples to indicate type and quantity of colorant used.
- c. Engineer's review will be for color only. Compliance with other requirements is Contractor's responsibility.

PART 2 – PRODUCTS

2.01 – MATERIALS

- A. Portland Cement: Provide the following for portland cement-lime mortars:
 - 1. ASTM C150/C150M:
 - a. Use Type I when installation temperature is 50 degrees F or higher.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. Type I Portland Cement, by Essroc Italcementi Group.
 - b. Type I Portland Cement, by Lehigh Portland Cement Company.
 - c. Or equal.
 - 3. Provide non-staining portland cement of natural color or of color required to be compatible with required mortar pigment color selected by Architect.
- B. Hydrated Lime: ASTM C207, Type S, or lime putty ASTM C5.
- C. Sand Aggregates:
 - 1. Mortar Aggregates: ASTM C144, except for joints less than 1/4-inch use aggregate graded with 100 percent passing the No. 16 sieve.
 - 2. Colored Mortar Aggregates: Provide ground marble, granite or other sound stone, as required to match the Sample approved by Engineer for portland cement-lime mortars.
 - 3. Fine Aggregate for Grout: ASTM C404, Size No. 1.
 - 4. Coarse Aggregate for Grout: ASTM C404, Size No. 8 or Size No. 89.
- D. Colored Mortar Pigments: Provide the following for portland cement-lime mortars:

1. Commercial iron oxide, manganese dioxide, ultramarine blue, chromium oxide, or carbon black, compounded for use in mortar mixes.
 2. Products and Manufacturers: Provide one of the following:
 - a. True-Tone Mortar Colors, by Davis Colors, a Subsidiary of Rockwood Pigments, Inc.
 - b. SGS Concentrated Mortar Colors, by Solomon Colors.
 - c. Or equal.
 3. Do not exceed pigment to cement ratios, by weight, of one-to-35 for carbon black, and one-to-seven for other pigments.
 4. Submit complete selection of manufacturer's standard and custom colors for final selection by Engineer.
- E. Ready-mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in Article 2.1 of this Section, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C270.
- F. Water: Free of injurious amounts of oils, acids, alkalis, and organic matter, and clean, fresh, and potable.

2.02 – MORTAR MIXES

- A. General:
1. Material Performance:
 - a. Masonry Strength: Refer to Section 04201, Unit Masonry Construction.
 - b. If questions of compliance with the Contract Documents arise, Specifications for mortar properties shall take precedence over Specification for mortar proportions.
 2. Do not change proportions established for mortar approved, and do not use materials with different physical characteristics in mortar used in the Work, unless compliance with the Contract Documents for mortar properties is re-established via submittals approved by Engineer.
 3. Do not combine in mortar different air-entraining materials.

4. Anti-freeze Admixture or Agents: Not allowed.
5. Calcium Chloride: Not allowed.
- B. Mortar for All Other Unit Masonry: Comply with ASTM C270, Table 2, except limit materials to those specified in this Section. Limit cement-to-lime ratio by volume as follows:
 1. Type S:
 - a. Locations:
 - i. All exterior masonry walls at or below grade.
 - ii. All interior and exterior walls in submerged locations or in contact with ponding water.
 - b. Provide the following proportions by volume:
 - i. Portland Cement: One part.
 - ii. Hydrated Lime or Lime Putty: Over 1/4 to 1/2, maximum.
 - iii. Aggregate Ratio (measured in damp loose condition): Not less than 2-1/4 and not more than three times sum of volumes of cementitious materials.
 - c. Properties:
 - i. Average Compressive Strength, ASTM C270: 1,800 psi.
 - ii. Minimum Water Retention, ASTM C270: 75 percent.
 - iii. Maximum Air Content, ASTM C270: 12 percent.
 2. Type N:
 - a. Locations: All interior and exterior masonry walls above grade.
 - b. Provide the following proportions by volume:
 - i. Portland Cement: One part.
 - ii. Hydrated Lime or Lime Putty: Over 1/2 to 1-1/4, maximum.

- iii. Aggregate Ratio (measured in damp loose condition): Not less than 2-1/4 and not more than three times sum of volumes of cementitious materials.
 - c. Properties:
 - i. Average Compressive Strength, ASTM C270: 750 psi.
 - ii. Minimum Water Retention, ASTM C270: 75 percent.
 - iii. Maximum Air Content, ASTM C270: 12 percent.
- C. Grout:
 - 1. Fine Grout:
 - a. Provide the following proportions by volume:
 - i. Portland Cement: One part.
 - ii. Hydrated Lime or Lime Putty: Zero to 1/10 part.
 - iii. Aggregate Ratio (measured in a damp loose condition): Sand; not less than 2-1/4 and not more than three times sum of volumes of cementitious materials.
 - b. Mix grout to have slump of ten inches plus or minus one inch at time of placement.
 - 2. Coarse Grout:
 - a. Provide the following proportions by volume:
 - i. Portland Cement: One part.
 - ii. Hydrated Lime or Lime Putty: Zero to 1/10 part.
 - iii. Fine Aggregate Ratio (measured in a damp loose condition): Sand; not less than 2-1/4 and not more than three times sum of volumes of cementitious materials.
 - iv. Coarse Aggregate Ratio: Not less than one and not more than two times the sum of volumes of cementitious materials.

- b. Mix grout to have slump of ten inches plus or minus one inch at time of placement.
- D. Grout Fill Around Reinforcement in Masonry Lintels: Portland cement, sand, gravel and water, to be proportioned as required to provide 28-day minimum compressive strength of 2,000 psi.

PART 3 – EXECUTION

3.01 – INSPECTION

- A. Examine conditions under which the Work will be performed and notify Architect in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 – PREPARATION

- A. Measurement of Materials:
 - 1. Cement and Hydrated Lime: Batched by the bag.
 - 2. Sand: Batched by volume in suitably calibrated containers. Make allowance for bulking and consolidation, and for weight per cubic foot of contained moisture.
 - 3. Proportion of Volumetric Mixtures: One 94-pound sack of portland cement and one 50-pound sack of hydrated lime constitute nominal one cubic foot.
 - 4. Shovel measurement: Unacceptable.
- B. Mortar Mixing:
 - 1. Type of Mixer: Machine mix in appropriate mixer in which quantity of water is accurately and uniformly controlled.
 - 2. While mixer is operating, add approximately three-quarters of required water, half the sand, all the cement, and then add remainder of sand.
 - 3. Allow batch to mix briefly and then add balance of water in small quantities until satisfactory workability is obtained.
 - 4. Mix for not less than five minutes after all materials have been added.
 - 5. Hydrated Lime for Mortar Requiring Lime Content: Use dry-mix method. Turn materials over together for each batch until even color of mixed, dry materials indicates that

cementitious material has been thoroughly distributed throughout the mass, and then add water to obtain required plasticity.

6. Prepare lime putty, if approved for use, in accordance with ASTM C5.
7. Waterproofing Admixture: Add to mortar mix for all exterior masonry in accordance with manufacturer's instructions.
8. Mixer drum shall be completely emptied before recharging the next batch.
9. Limit batch size to avoid re-tempering. Re-tempering of mortar is not allowed.

3.03 – INSTALLATION AND MORTAR AND GROUT TYPE LOCATION

A. For mortar and grout type, location, and installation requirements, refer to:

1. Section 04201, Unit Masonry Construction.

3.04 – FIELD QUALITY CONTROL

A. Site Tests:

1. Refer to Section 04201, Unit Masonry Construction, for load-bearing masonry wall strength tests.

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 – DESCRIPTION****A. Scope:**

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install masonry anchorages and reinforcing.
2. Section specifies masonry anchorages and reinforcing for Work specified in:
 - a. Section 04201, Unit Masonry Construction.
3. Types of products required include:
 - a. Continuous horizontal wire reinforcing and ties.
 - b. Individual wire ties.
 - c. Anchoring and positioning devices.
 - d. Miscellaneous masonry accessories, reinforcing bars, compressible filler, and premolded control joint strips.

B. Coordination:

1. Provide masonry anchorages and reinforcing of sizes, dimensions and configurations coordinated with unit masonry construction system component sizes, dimensions and configurations.

C. Related Sections:

1. Section 04201, Unit Masonry Construction.
2. Section 05120, Structural Steel Framing.
3. Section 07620, Sheet Metal Flashing and Trim.
4. Section 07920, Joint Sealants.
5. Section 09900, Painting.

1.02 – REFERENCES**A. Reference Standards:** Standards referenced in this Section are:

1. ACI 315, Details and Detailing of Concrete Reinforcement.
2. ASTM A36/A36M, Specification for Carbon Structural Steel.
3. ASTM A82/A82M, Specification for Steel Wire, Plain, for Concrete Reinforcement.
4. ASTM A153/A153M, Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
5. ASTM A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
6. ASTM A663/A663M, Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
7. ASTM A1008/A1008M, Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
8. ASTM A1011/A1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
9. ASTM D2240, Test Method for Rubber Property – Durometer Hardness.

1.03 – QUALITY ASSURANCE**A. Component Supply and Compatibility:**

1. Provide all metal sheet, wire, plate and bar stock masonry anchorages and reinforcing from same manufacturer.
2. Miscellaneous masonry accessory items other than metal sheet, wire, plate and bar stock shall each be obtained from a single, manufacturer, which may be different from the manufacturer of other products specified in this Section.

B. Regulatory Requirements:

1. Where fire-resistance classification (four-hour, three-hour, and similar designations) is shown or indicated for unit masonry construction, provide masonry anchorages and

reinforcing complying with requirements established by UL tests referenced in this Section (UL U901 through UL U914, as applicable), Laws and Regulations, and requirements of authorities having jurisdiction.

1.04 – SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Submit drawings and material schedules showing all dimensions and sizes of masonry anchorages and reinforcing coordinated with unit masonry Work and other Work in which masonry anchorages and reinforcing will be embedded, be supported from, or restrained.
 - b. Submit schedule indicating type, location, and spacing of each masonry accessory in unit masonry construction and that type, location, and spacing are in compliance with code requirements.
2. Product Data:
 - a. Manufacturer's product literature and specifications for each masonry accessory required. Include data substantiating that materials comply with the Contract Documents.
3. Samples:
 - a. One unit or one modular length of each item specified.

B. Informational Submittals: Submit the following:

1. Manufacturer's Instructions:
 - a. Manufacturer's instructions for handling, storing, and installing for each masonry accessory required.

1.05 – DELIVERY, STORAGE AND HANDLING

A. Comply with:

1. Applicable requirements of standards referenced in this Section.
2. Section 01610, Transportation and Handling of Materials and Equipment.

PART 2 – PRODUCTS**2.01 – MATERIALS**

A. Continuous Horizontal Wire Reinforcing and Ties: Provide the following for all masonry walls unless otherwise shown or indicated:

1. General: Provide the following:

- a. Reinforcement, wire and ties of cold-drawn steel wire complying with ASTM A82 and hot-dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A153.
- b. Welded wire units, prefabricated in straight lengths, at least ten feet long, with matching corner “L” and intersection “T” units, all with deformed continuous nine-gage side rods and plain nine-gage truss-type diagonal cross-rods, butt-welded to side rods, not more than 16 inches on centers, with unit width of 1.5 to two inches less than thickness of wall or partition.
- c. Rectangular boxes, pintles and ties fabricated of 3/16-inch diameter wire, unless otherwise specified.

2. Single-wythe Masonry Walls:

- a. Wall reinforcement system with one horizontal rod beneath each unit masonry face shell wall.
- b. Products and Manufacturers: Provide products of one of the following:
 - 1) Truss Mesh Reinforcement with #120 Truss-Mesh by Hohmann & Barnard, Inc.
 - 2) #DA 3100 Truss by Dur-O-Wal, Division of Dayton Superior.
 - 3) Or equal.

3. Provide special, custom-fabricated shapes to accommodate curved cavity, multi-wythe and single-wythe wall construction.

B. Individual Wire Ties for Masonry: Provide the following where shown:

1. General: Provide the following:

- a. Reinforcing, wire, and ties of cold-drawn steel wire complying with ASTM A82 and hot-dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A153.
 - b. Crimped with vee-drip for use in cavity wall construction and of length required for proper embedment in outer-most face shell walls of wythes of masonry shown or indicated.
 - c. Rectangular box ties and adjustable box ties fabricated of 3/16-inch diameter wire.
2. Single-piece Ties (where facing and back-up joints align):
- a. For use with hollow masonry units laid with cells vertical and with solid masonry units or hollow units laid with cells horizontal, provide four-inch wide rectangular shaped box-ties.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Rectangular Box Ties, by Hohmann & Barnard, Inc.
 - 2) No. 253 Rectangular Wire Ties, by Heckmann Building Products.
 - 3) Or equal.
- C. Anchoring Devices for Masonry: Provide the following, unless otherwise shown or indicated:
1. General: Provide the following:
- a. Cold-rolled steel sheet complying with ASTM A1008; hot-rolled steel sheet and strip complying with ASTM A1011; plates and bars complying with ASTM A36; and cold-drawn steel wire complying with ASTM A82 all hot-dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A153.
 - b. Rectangular, corrugated, one-inch wide ties, fabricated of 12-gage sheet metal, unless otherwise specified.
 - c. Size tie lengths to extend to within one-inch of outside face of outer wythe face shell of opposite face of masonry or to a maximum depth of 12 inches and between 1.5 to two inches less than width of masonry abutting webs and to

maximum depth of 12 inches abutting flanges of structural supports. Provide wire crimped with a vee-drip for use in cavity wall construction.

- d. Flexible Anchors: Where masonry abuts structural walls or framework, provide flexible anchors that allow horizontal and vertical movement of masonry, but provides lateral restraint.
2. Anchorage to Cast-in-Place Concrete Walls, Columns and Spandrels: Provide the following for lateral restraint of unit masonry walls abutting cast-in-place concrete members:
- a. Two-piece anchors with 14-gage dovetail head and 3/16 inch diameter by 7 inch long flexible dovetail brick tie, as shown.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) #315 - Flexible Dovetail Brick Tie and #305 - Dovetail Slot, by Hohmann & Barnard, Inc.
 - 2) No. 103 - Dovetail Triangular Tie and No. 100 - Standard Anchor Slot, by Heckmann Building Products.
 - 3) Or equal.
3. Anchorage to Steel Columns and Steel Beam Webs: Provide the following for lateral restraint of unit masonry walls at structural steel framework:
- a. U-shaped, 7.5-inch long channels welded to steel structure, with 5.5 inches of vertical adjustment, fabricated from 11-gage steel with slotted ties.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) #360 - Gripstay Channels and #364 - Corrugated Gripstay Anchor, by Hohmann & Barnard, Inc.
 - 2) No. 130 Channel Anchor Slots and No. 134 Corrugated Anchor, by Heckmann Building Products.
 - 3) Or equal.

4. Anchorage to Bottom of Concrete Beams and Slabs and Bottom of Steel Beam Flanges: Provide the following for lateral restraint of unit masonry walls at bottom of beam flanges and concrete slabs:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) #PTA - 420 - Partition Top Anchors with PTA Tube, by Hohmann & Barnard, Inc.
 - 2) #419 Pin Type with #421 Plastic Tube, by Heckmann Building Products.
 - 3) Or equal.
 - b. Factory-fabricated partition anchor assembly consisting of 1/4-inch thick plate welded to 3/8-inch diameter, eight-inch long rod at center of plate face. Provide plate with two holes to accept fasteners.
 - c. Clear acrylic tube with compressible polyethylene filler, one for each rod.
5. Lateral Supporting Masonry Wall Anchors: Provide the following for bracing freestanding walls exceeding allowable unbraced span:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) #344 Rigid Partition Anchor, by Hohmann & Barnard, Inc.
 - 2) #140 Masonry Anchor, by Heckmann Building Products.
 - 3) Or equal.
 - b. Plate, 1/4-inch thick by two inches wide fabricated with two-inch long bent legs at 90 degrees to flat face of anchor and of length to extend to center of each wythe of wall, but not less than 2.33 feet long. Cut to length as required.
6. Rebar Positioners: Provide the following:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) #RB Series and #RB-Twin Series Rebar Positioners, by Hohmann & Barnard, Inc.
 - 2) Rebar Positioners, by Heckmann Building Products.

- 3) Or equal.
 - b. Nine-gage reinforcing bar positioners that accommodate both horizontal and vertical reinforcing steel.
 - c. Fabricate units as required for the Work.
- D. Miscellaneous Masonry Accessories: Provide the following where shown:
 - 1. Reinforcing Bars:
 - a. Deformed carbon steel, ASTM A615, Grade 60 for bars No. 3 to No. 18, except as otherwise shown.
 - b. Plain carbon steel, ASTM A663, Grade 80 where No. 2 bars are shown or required.
 - c. Provide galvanized steel reinforcing bars complying with ASTM A153, Class B-1, where shown.
 - 2. Compressible Filler: Provide watertight joint filler where unit masonry construction abuts structural framework members, or as shown. Provide the following:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Polytite Standard, by Polytite Manufacturing Corp.
 - 2) Polyseal, by Sandell Manufacturing Company, Inc.
 - 3) Or equal.
 - b. Polyurethane foam strip saturated with polybutylene waterproofing material that, when installed at a compression ratio of two-to-one, is impermeable to water.
 - c. Resilient to -40 degrees F with 100 percent movement recovery.
 - d. Elongation of 140 percent with a tensile strength of not less than 53 pounds per square inch.
 - 3. Masonry Control Joint Components: Provide the following:
 - a. Premolded Control Joint Strips: Provide complete selection of solid extruded rubber and PVC strips with a Shore A durometer hardness of 80 to 90 complying

with ASTM D2240 and ASTM D2287, designed to fit standard sash block and maintain lateral stability in masonry wall. Size and configuration shall be as shown.

- 1) Products and Manufacturers: Provide one of the following:
 - a) #RS-12 - Control Joints, by Hohmann & Barnard, Inc.
 - b) 352-12 Control Joints, by Heckmann Building Products.
 - c) Or equal.
- b. Sealants: Refer to Section 07920, Joint Sealants.
4. Weep Holes: Provide the following:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) #342 - Plastic Weep Holes, by Hohmann & Barnard, Inc.
 - 2) No. 330 Plastic Weepholes, by Heckmann Building Products.
 - 3) Or equal.
 - b. Rectangular 3/8-inch wide by 1.5 inches high, 3.5 inches long clear butyrate tubes.
4. Weep Vents: Provide the following:
 - a. Products and Manufacturers: Provide one the following:
 - 1) Goodco Brick Vents, by Williams Products, Inc.
 - 2) No. 602 Louvered Weep Holes and Vents, by WIRE-BOND.
 - 3) Or equal.
 - b. Provide injection molded flexible polyvinylchloride brick vents of custom color to match face brick mortar color with top flap, flexible side wings, vertical louvers and water ridges.
5. Cavity Fill Mesh: Provide the following:

- a. Products and Manufacturers: Provide one of the following:
 - 1) #MGS - Mortar/Grout Screen, by Hohmann & Barnard, Inc.
 - 2) No. 267 Plastic Mesh Wall Ties, by Heckmann Building Products.
 - 3) Or equal.
 - b. Monofilament screen of polypropylene polymers 1/4-inch mesh hardware cloth. Provide below all block courses that are to be filled with mortar.
6. Cavity Drainage Material:
- a. Manufactured of high density polyethelene or nylon strands woven into a 90 percent open mesh
 - 1) Product and Manufacturer: Provide one of the following:
 - a) Mortar Net, by Hohmann and Barnard, Inc.
 - b) Mortar Net, by Heckmann Building Products.
 - c) Or equal.
7. Imbedded Flashing Materials:
- a. Metal Flashing: Refer to Section 07620, Sheet Metal Flashing and Trim.

2.02 – FABRICATION

- A. Weld-in-place all channel slots and other specified weld-on anchors at the shop. Field welding is unacceptable.
- B. Coordinate location of weld-on anchors and show on structural steel Shop Drawings required under Section 05120, Structural Steel Framing.
- C. Weld anchor slots and other required accessories in place before shop priming of structural steel.
- D. Prime coat weld-on anchors and other accessories and passivate anchor coating in accordance with Section 09900, Painting.
- E. Shop-fabricate reinforcing bars that are shown or required to be bent or hooked. Comply with ACI 315 for fabricating reinforcing steel for unit masonry Work.

PART 3 – EXECUTION

3.01 – INSTALLATION

A. Refer to the following:

1. Section 04201, Unit Masonry Construction.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 – SUMMARY OF THE WORK****A. Scope:**

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all unit masonry construction. The Work also includes:
 - a. Providing openings in unit masonry construction to accommodate the Work under this and other Sections and building into unit masonry construction all items such as sleeves, anchorage devices, inserts, and other items to be embedded in unit masonry construction for which placement is not specifically included under other Sections.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items to be installed with or before unit masonry construction Work.
2. Remove and rebuild unit masonry construction advanced without built-in flashings and other built-in items at no additional cost to Owner, even after unit masonry construction has been completed.

C. Related Sections:

1. Section 04060, Masonry Mortaring and Grouting.
2. Section 04090, Masonry Anchorage and Reinforcing.
3. Section 05500, Metal Fabrications.
4. Section 06100, Rough Carpentry.
5. Section 07620, Sheet Metal Flashing and Trim.
6. Section 07920, Joint Sealants.
7. Section 09900, Painting.

1.02 – REFERENCED STANDARDS**A. Standards referenced in this Section are:**

1. ACI 530, Building Code Requirements for Masonry Structures.
2. ACI 530.1, Specification for Masonry Structures.
3. ASTM C140, Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
4. ASTM C780, Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unity Masonry.
5. ASTM C1093, Practice for Accreditation of Testing Agencies for Unit Masonry.

1.03 – TERMINOLOGY

- A. The following words or terms are not defined but, when used in this Section, have the following meaning:
1. “Masonry control joint” is a joint in interior and exterior masonry walls that allows expansion and contraction to occur independently without damage to the masonry.
 2. “Masonry expansion joint” is a control joint in interior and exterior masonry walls, located at the separation between adjoining parts of a concrete or steel structure that is provided to allow movements transferred to the masonry to occur independently without damage to the masonry.

1.04 – QUALITY ASSURANCE

- A. Qualifications:
1. Installer:
 - a. Engage a single installer regularly engaged in preformed unit masonry installation and with successful and documented experience in erecting unit masonry of the scope and type of Work required; and who employs only tradesmen with specific skill and successful experience in the type of Work required. Submit name and qualifications with the following information for a minimum of three successful projects:
 - 1) Names and telephone numbers of owners, architects, or engineers responsible for projects.
 - 2) Approximate contract cost of unit masonry.

- 3) Quantity (area) of unit masonry installed.
2. Testing Laboratory:
 - a. In accordance with ASTM C1093.
- B. Component Supply and Compatibility:
 1. Obtain each type of concrete masonry units from one manufacturer, cured by one process and of uniform texture and color or in an established uniform blend thereof.
 2. Use a single source and brand of mortar materials throughout the Work.
- C. Pre-Construction Masonry Conference:
 1. Prior to installing unit masonry construction, Contractor and Contractor's installer shall attend pre-construction masonry conference at the Site. Review foreseeable methods and procedures related to unit masonry construction including, but not limited to, the following:
 - a. Requirements of the Contract Documents.
 - b. Structural concept.
 - c. Sequence of masonry construction.
 - d. Special masonry details.
 - e. Standard of workmanship.
 - f. Prism and grout sampling, and unit masonry test results.
 - g. Quality control requirements.
 - h. Project organization and availability of materials, tradesmen, equipment, and facilities required to avoid delays.
 - i. Masonry control and expansion joint locations and materials.
 - j. Modular planning requirements.
 - k. Weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

- I. Required inspection, testing, and certifying procedures.
 - m. Requirements for complying with building codes.
- 2. Attendance at the conference is mandatory for the following:
 - a. Masonry Subcontractor's superintendent and foreman.
 - b. Authorized representative of face brick and concrete unit masonry Suppliers.
 - c. Engineer
 - d. Resident Project Representative.
 - e. Coordinating Special Inspector.
- 3. If additional information is required to adequately cover items on agenda, reconvene conference as soon as possible.
- 4. Contractor shall record discussions of conference and decisions and agreements (or disagreements) and furnish a copy of the record to each person and entity attending.

1.05 – SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Complete layout of all masonry walls showing modular planning and all special shapes to be used in the Work. Show all details for each condition encountered in the Work. Submit plan and elevation views drawn at scale of 1/4-inch equal to one foot, and details drawn at scale of 1.5-inch equal to one foot. Show all items included in the unit masonry construction.
 - b. Masonry control joint locations and details.
 - c. Drawings showing location, extent, and accurate configuration and profile of all items required by the Contract Documents, in this and other Sections, for unit masonry construction. Provide elevations drawn at scale of 1/4-inch equal to one foot, and details drawn at scale of 1.5-inch equal to one foot.
 - d. Drawings for fabricating, bending, and placing of reinforcing bars. Submit bar schedules, diagrams of bent bars, stirrup spacing, lateral ties, and other

arrangements and assemblies required for fabricating and placing of reinforcing for unit masonry construction.

B. Informational Submittals: Submit the following:

1. Field Quality Control Submittals:

- a. Pre-installation test results in accordance with ASTM C140 and ASTM C1314, and the field quality control Article of this Section.
- b. Post-installation quality control submittals in accordance with the field quality control Article of this Section.

2. Qualifications Statements:

- a. Installer.
- b. Testing laboratory.

C. Closeout Submittals: Submit the following:

1. Record Documentation:

- a. Comply with Section 01720, Record Documents.
- b. Indication location of all masonry control joints and expansion joints.

1.06 – DELIVERY, STORAGE AND HANDLING

A. General:

- 1. Comply with Section 01600, Delivery, Storage and Handling.
- 2. Storage: Maintain temperatures in shelter so that masonry materials are above 20 degrees F when installed.

1.07 – SITE CONDITIONS

A. Environmental Requirements:

1. General:

- a. Temporary Facilities and Temporary Utilities: Provide supplemental heat sources and energy as required for unit masonry construction in cold weather.

- b. Do not perform unit masonry construction when air temperature is below 28 degrees F for rising temperature, or below 36 degrees F for falling temperatures, without providing temporary enclosures and heat, or without heating materials or other measures necessary to prevent freezing as specified.
- c. Do not use frozen materials and do not build on frozen unit masonry construction.
- d. Remove and replace all unit masonry construction damaged by cold temperatures and freezing.

2. Protection:

- a. Cold Weather Protection: Protect unit masonry construction against freezing for at least 48 hours after placement, as follows:
 - 1) When anticipated minimum temperature will be between 40 degrees F and 25 degrees F, cover newly constructed masonry with weather-resistive membrane for 48 hours after installation.
 - 2) When anticipated minimum temperature will be between 25 degrees F and 20 degrees F, completely cover newly constructed masonry with weather-resistive insulating blankets, or equal protection, for 48 hours after installation.
 - 3) When anticipated minimum temperature will be below 20 degrees F, maintain newly constructed masonry at temperature above 32 degrees F for at least 48 hours after installation by using heated enclosures, electric heating blankets, infrared lamps, or other acceptable methods of supplementary heating.
- b. Hot Weather Protection: When mean daily temperature exceeds 100 degrees F, or exceeds 90 degrees F with wind velocity greater than eight miles per hour, fog-spray newly constructed masonry until damp at least three times per day until masonry is 72 hours old.
- c. When Work is not in progress, protect partially-completed unit masonry construction against rapid heat loss and from water entering the masonry by covering top of walls with strong, waterproof, non-staining membrane. Extend membrane at least two feet down both sides of wall and secure in place using

wall cover clamps spaced at intervals of four feet and at each end, and at joints in the membrane.

- d. Do not apply floor or roof loading for at least 72 hours after completing masonry columns or walls.
- e. Do not apply concentrated loads for at least 168 hours after completing masonry columns or walls.

3. Cold Weather Unit Masonry Construction:

- a. When mean daily temperature is below 40 degrees F, mortar used in unit masonry construction shall be portland cement-lime-sand mortar using high-early strength portland cement. Use mortar within 1.5 hours of initial mixing. Use grout within 1.5 hours of initial mixing.
- b. Clay or shale unit masonry with suctions in excess of 20 grams of water per 30 square inches per minute shall be sprinkled with heated water just prior to installation. Provide water temperature above 70 degrees F when temperature of masonry units is above 32 degrees F. Water temperature shall be above 120 degrees F when temperature of masonry units is below 32 degrees F.
- c. For Air Temperatures of 40 degrees F to 32 degrees F: Water and aggregates used in mortar and grout shall not be heated above 140 degrees F. Heat mortar sand or mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F at time of mixing. Heat water and aggregates for grout when water or aggregate temperature is below 32 degrees F.
- d. For Air Temperatures of 32 degrees F to 25 degrees F: Comply with Paragraph 1.7.A.3.c of this Section and the following: Maintain mortar temperature above freezing until used in masonry. Heat aggregates and mixing water for grout to produce grout temperature between 70 degrees F and 120 degrees F at time of mixing. Maintain grout temperature above 70 degrees F at time of grout placement.
- e. For Air Temperatures of 25 degrees F to 20 degrees F: Comply with Paragraphs 1.7.A.3.c and 1.7.A.3.d of this Section and the following: Heat masonry surfaces under construction to 40 degrees F. Provide temporary wind breaks or enclosures when wind velocity exceeds 15 miles per hour. Prior to grouting, heat the masonry to minimum of 40 degrees F.

- f. For Air Temperatures of 20 degrees F and Below: Comply with Paragraphs 1.7.A.3.c, 1.7.A.3.d, and 1.7.A.3.e of this Section and the following: Provide temporary enclosures and auxiliary heat to maintain air temperature within temporary enclosure above 32 degrees F. Temperature of masonry units when laid shall not be less than 20 degrees F.
- 4. Hot Weather Unit Masonry Construction: Using methods acceptable to Engineer, protect unit masonry construction from direct exposure to wind and sun when ambient air temperature is 99 degrees F in shade with relative humidity less than 50 percent.
 - a. When ambient temperature exceeds 100 degrees F, or exceeds 90 degrees F with wind velocity greater than eight miles per hour, maintain temperature of mortar and grout below 120 degrees F. Flush mixers, mortar transport containers, and mortarboards with cool water before they come into contact with mortar ingredients or mortar. Maintain mortar consistency by re-tempering with cool water. Use mortar within two hours of initial mixing. Use grout within 1.5 hours of initial mixing. Maintain sand piles in damp, loose condition.
 - b. When ambient temperature exceeds 115 degrees F, or exceeds 105 degrees F with wind velocity greater than eight miles per hour, comply with Paragraph 1.7.A.4.a of this Section and the following: Use cool mixing water for mortar and grout. Use of ice will be allowed in mixing water prior to use; ice is not allowed in the mixing water when added to other mortar or grout materials. Shade materials and mixing equipment from exposure to direct sunlight.

PART 2 – PRODUCTS

2.01 – MATERIALS

- A. Material requirements for masonry materials are in the following:
 - 1. Section 04060, Masonry Mortaring and Grouting.
 - 2. Section 04090, Masonry Anchorage and Reinforcing.
 - 3. Section 04220, Concrete Unit Masonry.
- B. Mortar, General:
 - 1. Where question of compliance with or interpretation of requirements of this Section arises, mortar properties Specification will take precedence over mortar proportion Specifications.

2. Make no change in proportions established for mortar approved under property Specifications, and do not use materials with different physical characteristics in mortar unless compliance with requirements of property Specifications is re-established by Shop Drawing or submittal data.
3. Do not combine two air-entraining materials in mortar.

PART 3 – EXECUTION

3.01 – INSPECTION

- A. Examine areas and conditions under which unit masonry construction will be installed, and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 – PREPARATION

- A. Concrete Masonry Units: Lay masonry units dry. Do not wet concrete masonry units.
- B. Cleaning of Reinforcing: Before placing, remove loose rust, mill scale, earth, ice, and other contamination from reinforcing materials. Do not use reinforcing bars with kinks or bends not shown or approved Shop Drawings, or bars with reduced cross-section due to rusting or other causes.

3.03 – INSTALLATION, GENERAL

- A. Thickness: Build walls, floors, and other unit masonry construction to thickness shown or indicated. Build single wythe walls to actual thickness of masonry units using units of nominal thickness shown or indicated.
- B. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting unit masonry construction. After installation of said items, complete unit masonry construction to match the Work immediately adjacent to openings.
- C. Cut masonry units using motor-driven wet cutting saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining Work neatly. Use full-size units without cutting where possible. Provide special unit masonry shapes for transitions and intersections. Do not attempt to field-cut special shapes from regular unit masonry shapes, and do not use other options for special unit masonry shapes.
- D. Build interior masonry walls visible from both sides in the finished Work using two wythes of masonry. Masonry shall be continuous over entire plane of wall, including walls that continue behind fixtures, equipment, furniture, lockers, and similar items

- E. Matching Existing Masonry: Match with existing masonry the coursing, pattern bond, color, and texture of new unit masonry construction

3.04 – LAYING MASONRY WALLS

A. General:

1. Mortar Types: Unless otherwise shown or indicated, use mortar specified in Section 04060, Mortar and Masonry Grout, as follows:
 - a. Use Type S mortar for other exterior walls and interior load-bearing walls.
 - b. Use Type N mortar for interior, non-load-bearing walls.
 - c. Use grout fill for structural requirements and for grouting reinforcing steel in unit masonry construction.
 - d. Do not use mortar that has begun to set or if more than thirty minutes have elapsed since initial mixing. Re-temper mortar during the thirty-minute period only as required to restore workability.
2. Lay out walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, masonry control joints, returns, and offsets. Avoid using less than half-size units at corners, jambs, and where possible at other locations.
3. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced, and coordinated with other work.
4. Pattern Bond:
 - a. Lay exterior, and interior concrete unit masonry in running bond pattern with vertical joints in each course centered on units in courses above and below. Avoid using less than full-size units.
 - b. Lay concrete unit masonry scheduled or shown to be concealed by finish materials, except paint, with units in wythe bonded by lapping not less than two inches.
 - c. Do not use units with less than four-inch horizontal face dimensions at corners or jambs.
5. Color and Texture:

- a. Lay concrete unit masonry using mortar of natural color.

B. Construction Tolerances:

1. Variation from Plumb: For lines and surfaces of columns, walls and arises, do not exceed 1/4-inch in ten feet, or 3/8-inch in a story height (20 feet), maximum, nor 1/2-inch in 40 feet or more. Except for external corners, expansion joints and other conspicuous lines, do not exceed 1/4-inch in any story or 20 feet maximum, nor 1/2-inch in 40 feet or more.
2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4-inch in any bay or 20 feet maximum, nor 3/4-inch in 40 feet or more.
3. Variation of Linear Building Line: For position shown and related portion of columns, walls and partitions, do not exceed 1/2-inch in any bay or 20 feet maximum, nor 3/4-inch in 40 feet or more.
4. Variation in Cross Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4-inch nor plus 1/2-inch.

C. Mortar Bedding and Jointing:

1. Lay solid masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
2. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course of piers, columns, and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
3. Maintain 3/8-inch joint widths, except for minor variations required to maintain pattern bond alignment.
4. Cut joints flush for masonry walls to be concealed or to be covered by other materials, except paint, unless otherwise shown.
5. Tool exposed joints slightly concave, when mortar is "thumbprint hard", unless otherwise required to match existing joint treatment. Rake out mortar 1/2-inch deep in preparation for application of caulking or sealants.
6. Concave-tool exterior joints below grade.

7. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units that have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

D. Collar Joints:

1. Fill vertical space between wythes solidly with mortar by parging the in-place wythe and shoving units into the parging.

E. Stopping and Resuming Work: Rake back one unit masonry length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly, if required, and remove loose masonry units and mortar prior to laying new masonry.

F. Built-in Work:

1. As the Work progresses, build-in the items shown, specified or required in the Contract Documents. Fill cores in one-block width solidly with mortar around built-in items.
2. Do not fill space between hollow metal frames and masonry solidly with mortar.
3. Where built-in items are to be embedded in cores of hollow masonry units, place layer of cavity fill mesh in the joint below and rod mortar or grout into core.
4. Where required by Laws or Regulations, or to comply with thickness-to-height ratio, or to provide required fire resistance, fill all cells of unit masonry construction solid with grout.

G. Non-Load-Bearing Interior Partitions

1. Build full height of story to underside of structure above, unless otherwise shown or indicated.
2. Tie non-load-bearing partitions at top and sides with masonry anchors at terminations. Build in end blocks as shown and specified to facilitate placing compressible filler. Insert compressible filler, specified in Section 04090, Masonry Anchorage and Reinforcing, in all horizontal and vertical joints where non-load-bearing masonry and non-load-bearing interior wythe of cavity walls terminate. Insert filler 3/4-inch from both faces of masonry. Use filler four times as thick as widest part of joint. Thickness of filler shall be a minimum of 1.5 times the compressed thickness. Compress filler to less than thickness of joint and insert. At splices, overlap strips by three inches and compress ends to form tight joint. Finish with backer rod and sealant.

H. Horizontal Joint Reinforcing:

1. Provide continuous horizontal joint reinforcing as shown and specified. Refer to Section 04090, Masonry Anchorage and Reinforcing, for reinforcing units required. Fully embed longitudinal side rods in mortar for entire length of rods with minimum cover of 5/8-inch on exterior side of walls and 1/2-inch at other locations. Lap reinforcing minimum of six inches at ends of units. Do not bridge masonry control joints and building expansion joints with reinforcing.
2. Reinforce walls with continuous horizontal joint reinforcing unless specifically indicated as being omitted.
3. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend units in accordance with manufacturer's written instructions for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
4. Space continuous horizontal reinforcing as follows:
 - a. For multi-wythe walls, solid or cavity, that are structurally bonded by masonry headers or individual wire ties, space horizontal reinforcing two feet on centers vertically.
 - b. For multi-wythe walls, solid or cavity, where continuous horizontal reinforcing also acts as structural bond or tie between wythes, space reinforcing as required by Laws and Regulations, but not more than 16 inches on centers vertically.
 - c. For single-wythe walls, space reinforcing at 16 inches on centers vertically, unless otherwise shown.
 - d. For parapets, space reinforcing at eight inches on centers vertically, unless otherwise shown.
5. Reinforce masonry openings greater than 12 inches wide, with horizontal joint reinforcing placed in two horizontal joints approximately eight inches apart, immediately above lintel and immediately below sill. Extend reinforcing a minimum of two feet beyond jambs of opening.
6. In addition to wall reinforcing, provide additional reinforcing at openings as required to comply with the above.

I. Structural Reinforced Unit Masonry Construction:

1. Comply with ACI 530, ACI 530.1 and Laws and Regulations for structural reinforced unit masonry construction.
2. Shape and dimension reinforcement as shown and required by applicable ACI standards and Laws and Regulations.
3. Position reinforcing accurately at spacing shown on approved Shop Drawings. Support and secure vertical bars against displacement using rebar positioners.
4. Where vertical bars are shown in close proximity, provide clear distance between bars of not less than the greater of the nominal bar diameter or one-inch.
5. Provide lapped splices with reinforcing steel placed in contact and wire tied. Provide minimum lap required by Laws and Regulations, unless requirements that are more stringent are shown or indicated. Do not splice reinforcing at points other than shown or as approved on Shop Drawings.
6. Provide substantial and tight formwork and shores as required for temporary support of reinforced masonry elements. Design, erect, support, brace, and maintain formwork.
7. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar grout. Brace, tie, and support as required for maintaining position and shape during construction and curing of reinforced masonry.
8. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other temporary loads that may be placed on them during construction.
9. Allow not less than the following duration to elapse after completing a member before removing shores or forms, provided suitable curing conditions have been obtained during the curing period:
 - a. Girders and Beams: Ten days.
 - b. Slabs: Seven days.
 - c. Reinforced Masonry Soffits: Seven days.

J. Grouting Structural Reinforced Unit Masonry Construction:

1. Limit extent of masonry construction to sections that do not exceed the maximum pour requirements specified. Provide temporary dams or barriers to control horizontal flow of

grout at ends of wall sections. Build dams to full height of grout pour. If masonry units are used, do not bond into permanent masonry wythes. Remove temporary dams after completing grout pour.

2. Use fine grout for filling spaces less than four inches in both horizontal directions. Use coarse grout for filling spaces four inches or larger in both horizontal directions.
3. For spaces 10 inches and larger, use concrete fill.
4. Low-Lift Grouting:
 - a. Use low-lift grouting techniques using fine grout mix for the following:
 - 1) Two-wythe walls with grout space of two inches or less in width.
 - 2) Multi-wythe walls.
 - 3) Grout spaces less than 2-inches in width at intervals not to exceed two feet in lifts of six to eight inches.
 - 4) At Contractor's option, low-lift-grouting technique may be used for structural reinforced unit masonry construction with grout spaces wider than two inches, except use coarse grout mix and place in lifts not to exceed eight inches in height.
 - b. Construct low-lift structural reinforced unit masonry construction by placing reinforcing, laying masonry units and pouring grout as the Work progresses.
 - c. Place vertical reinforcing bars and supports prior to laying of masonry units. Extend above elevation of maximum pour height as required to allow for splicing. Horizontal reinforcing bars may be placed progressively with laying of masonry units.
 - d. Limit grout pours as required to prevent displacing masonry by grout pressure (blowout), but do not exceed 12-inch pour height.
 - e. Lay masonry units prior to each grout pour, but do not construct more than 12 inches above maximum grout pour height in one exterior wythe and four inches above in other exterior wythe. Provide metal wall ties, if required, to prevent blowouts.

- f. Pour grout using container with spout and consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. If poured in lifts, place from center-to-center of masonry courses. Terminate pour 1.5 inches below top of highest course in pour.
- 5. High-Lift Grouting:
 - a. High-lift grouting technique may be used for the following structural reinforced unit masonry construction:
 - 1) Two-wythe walls with grout spaces of 2.5 inches or greater width.
 - b. Place reinforcing and support in proper position, prior to laying of masonry units, except if shown to be placed in mortar joints, place as masonry units are laid. Place horizontal bars in grout spaces on same side of vertical bars.
 - c. Construct high-lift structural reinforced unit masonry construction by laying masonry to full height and width prior to placing of grout. Provide cleanout holes in first course of masonry, and use high-pressure water jet stream to remove excess mortar from grout spaces, reinforcing bars and top surface of structural members, which support wall. Clean grout spaces daily during construction of masonry.
 - d. Walls: Omit every other masonry unit in first course of one wythe to provide cleanout holes. Tie wythes together with metal ties as shown or required by Laws and Regulations, but provide not less than nine-gage wire ties spaced not less than two feet on centers horizontally and 16 inches on centers vertically for running pattern bond or 12 inches on centers vertically for stack bond.
 - e. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dirt, dust, mortar droppings, loose pieces of masonry, and other foreign materials from grout spaces. Clean reinforcing and adjust to proper positioning. Clean top surface of structural members supporting masonry to ensure bond. After cleaning and inspection, close cleanout holes with matching masonry units and brace closures to resist grout pressures.
 - f. Place grout after entire height of masonry to be grouted has attained sufficient strength to resist grout pressure, but not less than three days curing time. Install shores and bracing, if required, before starting grouting operations.

- g. Place grout by pumping into grout spaces, unless alternate methods are acceptable to Engineer.
- h. Use coarse grout mix. Rod or vibrate each grout lift during placing and again after excess moisture has been absorbed, but before plasticity is lost. Do not penetrate or damage grout placed in previous lifts or pours.
- i. Limit grout pours to sections that can be completed in one working day with not more than one-hour interruption of pouring operation. Limit pours to not exceed capacity of masonry to resist displacement or loss of mortar bond due to grout pressures.
 - 1) Do not exceed 12 feet pour height.
 - 2) Do not exceed 25 feet horizontal pour dimension.
- j. Where pour height exceeds four feet place grout in series of lifts not exceeding four feet in height. Place each lift as continuous pouring operation. Allow at least 30 minutes and not more than 60 minutes between lifts of each pour.
- k. When more than one pour is required to complete a section of masonry, extend reinforcing beyond masonry as required for splicing. Pour grout to within 1.5 inches of top course of first pour. After grouted masonry is cured, remove temporary dams, lay masonry units, and place reinforcing for second pour section before grouting.

K. Anchoring Masonry Work:

- 1. Provide anchoring devices as specified under Section 04090, Anchorage and Reinforcing. If not shown or indicated, provide standard type for facing and back-up involved in compliance with Laws and Regulations.
- 2. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:
 - a. Provide an open space not less than a 1/2-inch or more than one-inch in width between masonry and structural members, unless otherwise shown. Keep open space free of mortar and other rigid materials.

- b. Anchor masonry to cast-in-place concrete and structural steel members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections.
 - c. Space anchors as shown, but not more than two feet on center vertically and three feet on centers horizontally.
 - d. Provide end blocks where masonry abuts structural support to facilitate installation of compressible filler, fire-safing insulation, backer rod, and sealant.
 - 3. Anchor single-wythe masonry veneer to backing with metal ties as follows:
 - a. Anchor veneer to structural members with metal anchors embedded in masonry joints and attached to structure. Provide anchors with flexible tie section, unless otherwise shown.
 - b. Anchor veneer to concrete back-up with dovetail anchors and to structural steel back-up with slotted anchors.
 - c. Space anchors as shown, but not more than two feet on centers vertically and three feet on centers horizontally.
- L. Masonry Control and Expansion Joints:
 - 1. Provide vertical expansion and control joints in masonry where shown. Build in related items as unit masonry construction progresses. Rake out mortar in preparation for application of calking and sealants, in accordance with Section 07920, Joint Sealants.
 - 2. Provide masonry control and expansion joints items specified under Section 04090, Masonry Anchorage and Reinforcing where masonry control and expansion joints are shown.
 - a. Build-in compressible fillers as specified. Install in accordance with manufacturer's written instructions.
 - b. Build-in factory-premolded control joint strips into masonry. Build-in sash block and premolded control joint strips as the Work progresses.
 - c. Provide end blocks where masonry partitions abut structure to facilitate installation of compressible filler, fire-safing insulation, backer rod, and sealant.
- M. Lintels and Bond Beams:

1. Provide steel lintels where shown and as specified in Section 05500, Metal Fabrications.
2. Provide masonry lintels and bond beams where shown and where openings of 16-inches or greater are shown without structural steel lintels. Provide formed-in-place masonry lintels and bond beams. Temporarily support formed-in-place lintels and bond beams.
 - a. Unless otherwise shown or indicated, provide one horizontal No. 4 deformed reinforcing bar for each four inches of wall thickness.
 - b. For hollow masonry unit walls, use specially formed U-shaped lintel and bond beam units with reinforcing bars placed as shown, filled with grout as specified in Section 04060, Masonry Mortaring and Grouting.
3. Provide minimum bearing at each jamb, of four inches for openings less than six feet wide, and eight inches for wider openings.
4. On concrete and clay unit masonry walls where pattern bond remains visually exposed, increase minimum bearing of masonry lintels to maintain joint pattern of wall and install to be indistinguishable from surrounding masonry.

N. Flashing of Masonry Work:

1. Provide concealed flashings in masonry Work as shown or indicated. Refer to Section 07620, Sheet Metal Flashing and Trim, for flashing requirements. Prepare masonry surfaces smooth and free from projections that might puncture flashing. Place through-wall flashing on bed of mortar and cover with mortar. Seal flashing penetrations with mastic before covering with mortar. Terminate flashing 1/2-inch from face of wall, unless otherwise shown or indicated.
 - a. Extend flashings beyond edge of lintels and sills at least four inches and turn up edge on sides to form pan to direct moisture to exterior.
 - b. Interlock end joints of deformed metal flashings by overlapping deformations not less than 1.5 inches and seal lap with elastic sealant.
 - c. Install flashings in accordance with manufacturer's instructions and approved Shop Drawings and other submittals.
 - d. Provide flexible flashings in accordance with manufacturer's instructions and approved Shop Drawings and other submittals.

2. Provide weep holes in head joints of first course of masonry immediately above concealed flashings. Spacing is specified elsewhere in this Section.
3. Install reglets and nailers for flashing and other related Work where shown to be built into unit masonry construction.
4. Install flexible masonry flashing into cast-in-place elastic masonry flashing reglets with lead wedges and fill reglet with elastic flashing manufacturers recommended bonding rubber-based adhesive cement.

3.05 – REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or defective, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings, and adjacent Work to provide a neat, uniform appearance, properly prepared for application of sealant compounds.
- C. Cleaning Exposed, Unglazed Masonry Surfaces:
 1. Wipe off excess mortar as the Work progresses. Dry-brush at end of each day's work.
 2. Final Cleaning: After mortar is thoroughly set and cured, clean sample wall area of approximately 20 square feet as described below. Obtain Engineer's acceptance of sample cleaning before proceeding to clean remainder of masonry Work.
 - a. Dry clean to remove large particles of mortar using wood paddles and scrappers. Use chisel or wire brush if required.
 - b. Presoak wall by saturating with water and flush off loose mortar and dirt.
 - c. Scrub down wall with stiff fiber brush and solution of half-cup of sodium hexameta phosphate and half-cup of household detergent dissolved in one gallon of water.
 - d. Rinse walls, using clean, pressurized water, to neutralize cleaning solution and remove loose material.
 - e. Acid cleaning of masonry is unacceptable.

D. Protection:

1. Protect the unit masonry construction from deterioration, discoloration, and damage during subsequent construction operations. At areas where items are installed that project from the finish plane of masonry walls, such as concrete curbs, precast concrete sills, and the like, immediately upon completion of the projecting portion of the Work, provide a minimum 3/4-inch thick plywood cover, cut to fit, to prevent damage from operations continuing above the work. Refer to Section 06100, Miscellaneous Rough Carpentry.

3.06 – FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Pre-construction Testing:
 - a. Engage independent testing laboratory to obtain samples and conduct the following tests prior to the start of installation of unit masonry construction:
 - 1) Mortar Test: For each mix required: ASTM C780.
 - 2) Grout Test: For each mix required: ASTM C1019 and ACI 530.1.
 - 3) Compressive strength of completed concrete unit masonry walls shall be at least 1,500 psi as determined by methods in ACI 530.1.
 - b. Obtain Engineer's acceptance of tests results prior to commencing installation of materials.
 - c. After initial test, Engineer will require performance of up to five additional tests at Engineer's discretion.
2. During and After Installation:
 - a. Comply with Section 01416, Special Inspections:
 - b. Test and inspect unit masonry during construction in accordance with quality assurance program defined in ACI 530, ACI 530.1 and Laws and Regulations in effect at the Site, including building code. Level of special inspections shall comply with requirements of International Building Code classification and occupancy.

3. Repair masonry walls that do not comply with requirements of the special inspections in a manner acceptable to Architect.

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 – DESCRIPTION****A. Scope:**

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete unit masonry.
2. Extent of each type of concrete unit masonry is shown and indicated.
3. Types of materials and features required include:
 - a. Hollow load-bearing units.
 - b. Unit masonry complying with Section 01416, Special Inspections.
 - c. Lightweight aggregates, high recycle content, special and custom shapes required to complete the Work, complete selection of manufacturer's standard and custom colors and other special, and custom features.

B. Related Sections:

1. Section 04201, Unit Masonry Construction.
2. Section 09900, Painting.

1.02 – REFERENCES**A. Standards referenced in this Section are:**

1. ASTM C90, Specification for Load bearing Concrete Masonry Units.
2. ASTM C129, Specification for Non-load-bearing Concrete Masonry Units.
3. ASTM C140, Test Methods for Sampling and Testing Concrete Masonry Units.
4. ASTM C331, Specification for Lightweight Aggregates for Concrete Masonry Units.
5. ASTM C426, Test Method for Drying Shrinkage of Concrete Masonry Units.
6. ASTM C744, Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
7. ASTM C1093, Practice for Accreditation of Testing Agencies for Unit Masonry.

8. ASTM E84, Test Method for Surface Burning Characteristics of Building Materials.
9. ASTM E119, Test Methods for Fire Tests of Building Construction and Materials.

1.03 – QUALITY ASSURANCE

A. Qualifications:

1. Testing Laboratory: In accordance with ASTM C1093.

B. Component Supply and Compatibility:

1. Obtain each type of concrete masonry units from one manufacturer, cured by one process and of uniform texture and color or an established uniform blend texture and color.

1.04 – SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

- a. Complete layout of masonry walls showing modular planning, colors, patterns and all special shapes to be provided. Show details for each condition encountered in the Work. Provide plans and elevation at scale of 1/4-inch equals one foot, and details at scale of 1.5-inch equals one foot.

2. Product Data:

- a. Manufacturer's specifications, manufacturing procedures, and test data for each material specified. Include instructions for handling, storage, installation, and protection of each type of concrete masonry unit.
- b. Laboratory test reports in accordance with ASTM C140.

3. Samples:

- a. Submit Sample of each type of concrete masonry unit required. Select each type of concrete masonry unit to show range of color and texture that will be provided in finished Work.
- b. Complete selection of manufacturer's standard and custom colors.

- c. Engineer's review will be for color and texture only. Compliance with other requirements is responsibility of Contractor.
- B. Informational Submittals: Submit the following:
 - 1. Certifications: Submit certification that concrete unit masonry has been manufactured using only licensing manufacturer's approved materials, manufacturing methods, product standards, and is in accordance with ASTM C744.
 - 2. Source Quality Control Submittals:
 - a. Submit test results as specified in this Section.
 - 3. Qualifications Statements:
 - a. Testing laboratory, if not explicitly included in submittals furnished under other Sections.

1.05 – DELIVERY, STORAGE AND HANDLING

- A. At time of unloading at Site, concrete masonry units shall comply with ASTM C90, Table 2.

1.06 – PROJECT CONDITIONS

- A. Environmental Requirements: Maintain temperature in area of storage and installation so that masonry products are above 20 degrees F when installed.

PART 2 – PRODUCTS

2.01 – GENERAL, CONCRETE UNIT MASONRY

- A. General:
 - 1. Unless specifically modified by other requirements of the Contract Documents, provide concrete unit masonry in compliance with classifications, weights, grades, colors, textures, scores, thermal resistance values, and other features specified in this Section.
 - 2. Cure units by autoclave treatment at minimum temperature of 350 degrees F, and minimum pressure of 125 pounds per square inch.
- B. Hollow and Solid Load-bearing Concrete Masonry Units: ASTM C90, with minimum of 15 percent coal fly ash and 50 percent recycle aggregate as part of concrete mix.
 - 1. Minimum compressive strength: 1,900-psi average of three units.

- C. Hollow Non-load-bearing Concrete Masonry Units: ASTM C129, with minimum of 15 percent coal fly ash and 50 percent recycle aggregate as part of concrete mix.
- D. Size: Manufacturer's standard units with nominal face dimensions of 16 inches long by eight inches high (15-5/8 inches by 7-5/8 inches actual).
- E. Moisture Control:
 - 1. Limit total moisture absorption until time of installation to maximum percentage specified for the weight classification in ASTM C90, Table 2.
 - 2. Total linear dry shrinkage at time of installation shall be less than 0.065 percent.
- F. Special Shapes: Provide the following:
 - 1. Lintels, bond beams, reinforcing units, and flush-end reinforcing units, interior and exterior corner shapes, solid jambs, sash block, coves, pre-molded control joint blocks, headers, and other special conditions.
 - 2. Bullnose units for outside vertical corners including doors, windows, louvers and other openings, unless specifically shown on the Drawings indicating that such feature is not required.
 - 3. End blocks at locations where masonry walls abut concrete, or steel columns, to facilitate installation of compressible filler, backer rod, and sealant or fire-rated fire stop sealant systems, if required.
- G. Weight: Provide lightweight units using aggregate complying with ASTM C331 producing dry net weight of not more than 105 pounds per cubic foot.
- H. Exposed Faces: Provide manufacturer's standard colors and textures as specified for type of concrete masonry unit.
- I. Provide two-core concrete masonry units.

2.02 – SOURCE QUALITY CONTROL

- A. Tests:
 - 1. Provide test data verifying total linear drying shrinkage based on tests of concrete masonry units made with same materials, concrete mix proportions, manufacturing process, and curing method, conducted in accordance with ASTM C426. Tests shall have been conducted within 24 months prior to delivery to Site.

PART 3 – EXECUTION

3.01 – INSTALLATION

- A. Refer to Section 04201, Unit Masonry Construction.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - RELATED DOCUMENTS**

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

1.02 - SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Grout.
 - 3. Baseplates

1.03 - DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A6 with flanges thicker than 1-1/2 inches.
 - 2. Welded built-up members with plates thicker than 2 inches.
 - 3. Column base plates thicker than 2 inches.

1.04 - PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated. Where beam end reactions are not shown on drawings, designer shall design shear connection to resist the reaction resulting from the maximum allowable uniform load of the beam found in AISC specification being applied along its full length.

1. Select and complete connections using AISC 360.
 2. Use ASD; data are given at service-load level.
- B. Moment Connections: Type FR, fully restrained. Provide design and details of moment connections to resist forces shown in the contract drawings.
- C. Construction: Moment frame.

1.05 - SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
1. Shop drawings and required calculations shall bear the seal and signature of a registered professional engineer licensed in the state in which the project is located. Structural steel shop drawings will not be reviewed without said seal and signature.
 - a. A full set of Engineering Calculations for all beam-to-column moment connections shall be submitted to the engineer of record for approval. The steel fabricators drawings shall not be reviewed without said engineering calculations affixed with a seal and signature of licensed New York state professional engineer.
 2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 3. Include embedment drawings.
 4. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments, fasteners, connections, cambers, holes and other pertinent data. Include locations of structural members, openings, attachments and loads.
 5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
 7. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their

preparation.

- C. Qualification Data: For qualified Installer / fabricator.
- D. Welding certificates. Submit certificates certifying that welders employed on the work have met AWS qualifications within the previous 12 months.
- E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- F. Mill test reports for structural steel, including chemical and physical properties. Indicate structural strength, destructive and non-destructive test analysis.
- G. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
 - 6. Non-shrink grout.
 - 7. Insert product.

1.06 - QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD. Fabricator shall have a minimum of 5 (five) years documented experience with performing the work of this section.
- B. Installer Qualifications: A qualified installer specializing in performing the work of this section with a minimum of 3 (three) years documented experience.
- C. Delegated Connection Designer: Connection not fully detailed on the contract drawings shall be designed under direct supervision of a professional structural engineer experienced in design of this work and licensed in the state in which the project is located. The shop drawings shall bear the seal and signature of said professional structural engineer.

- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."
- E. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC Code of Standard Practice for Steel Buildings and Bridges. .
 - 2. AISC Specification for the design, fabrication, and erection of Structural Steel for Buildings.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

1.07 - DELIVERY, STORAGE, AND HANDLING

- A. Deliver, Store and Handle products to the site under provision of division 01 specification of this project manual.
- B. Schedule deliveries of materials to the site at intervals which will ensure uninterrupted progress of the work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- D. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F1852 fasteners and for retesting fasteners after lubrication.

1.08 - COORDINATION

- A. Coordinate the work under Division 01 specification of this project manual.

- B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- C. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
- D. Coordinate the work of this section with utilities installation and all other adjacent work.
- E. Coordinate the work of this section such that general progress of the work is not interrupted.

PART 2 - PRODUCTS

2.01 - STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 50 percent.
- B. W-Shapes: ASTM A992.
- C. Channels, Angles, S-Shapes: ASTM A36.
- D. Plate and Bar: ASTM A36.
- E. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A53, Type E or S, Grade B.
 - 1. Weight Class: As shown in contract documents..
- G. Welding Electrodes: Comply with AWS requirements.

2.02 - BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers with plain

finish.

1. Direct-Tension Indicators: ASTM F959, Type 490, compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
1. Finish: Hot-dip zinc coating.
 2. Direct-Tension Indicators: ASTM F959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: Plain.
- E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- F. Unheaded Anchor Rods: ASTM F 1554, Grade 36. Weldable as indicated in the contract drawings.
1. Configuration: Straight or Hooked.
 2. Nuts: ASTM A563 heavy-hex carbon steel.
 3. Plate Washers: ASTM A36 carbon steel.
 4. Washers: ASTM F436, Type 1, hardened carbon steel.
 5. Finish: Hot-dip zinc coating, ASTM A153, Class C.
- G. Headed Anchor Rods: ASTM F1554, Grade 55, weldable, straight. As indicated in contract drawings.
1. Nuts: ASTM A 563 heavy-hex carbon steel.
 2. Plate Washers: ASTM A 36 carbon steel.

3. Washers: ASTM F 436, Type 1, hardened carbon steel.
 4. Finish: Plain.
- H. Threaded Rods: ASTM A 36.
1. Nuts: ASTM A 563 heavy-hex carbon steel.
 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
- I. Clevises: Made from cold-finished carbon steel bars, ASTM A108, Grade 1035.
- J. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A108, Grade 1030.
- K. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A108, Grade 1018.

2.03 - PRIMER

- A. Primer: Comply with Division 09 painting Sections.
- B. Galvanizing Repair Paint: ASTM A780.

2.04 - GROUT

- A. Non-metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time. Grout shall consist of a premixed compound with cement, water reducing and plasticizing additives capable of developing a minimum compressive strength of 7000 psi at 28 days.

2.05 - FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.

5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
 6. Bearing surfaces shall be planned true to give full bearing over entire surface.
 7. Continuously seal joined members by intermittent welds and plastic filler. Grind welds smooth where exposed or where interference with other building materials is encountered.
 8. Splicing is not permitted unless indicated on the plans or accepted on the final shop drawings.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces. Mechanically thermal cut bolt holder shall not be permitted unless prior approval by Architect is given in writing.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning SSPC-SP 2, "Hand Tool Cleaning or SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Shop prime non-exposed steel members after fabrication in accordance with SSPC-PA. Do not prime surfaces that will be fireproofed, field welded or are in contact with concrete or high strength bolts.
- H. Paint exposed structural steel members in accordance with applicable Division 09 specifications.
- I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning. Unless approved by Architect in writing.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to

steel surfaces.

3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.06 - SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened. Unless otherwise shown in contract drawings or required by connection designer.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.07 - 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.
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5

mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.08 - GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123.
 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 2. Galvanize lintels attached to structural-steel frame and located in exterior walls.

2.09 - SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents. Inspections and test will not relieve the contractor of responsibility for providing materials and fabrication and erection procedures in compliance with specified requirements. The contractor is to verify that all materials meet or exceed the requirements specified in these specifications. Contract documents and related references materials not in compliance with specified requirements will be rejected.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 1. Liquid Penetrant Inspection: ASTM E 165.

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Beginning of installation means erector accepts existing conditions.

3.02 - 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.
1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.
 2. Clean bearing surfaces and other surfaces which will be in permanent contact.

3.03 - ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Proceed with installation only after unsatisfactory conditions have been corrected beginning of installation means erector accepts existing conditions.
- C. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
 - 5. Coordinate placement of anchors in concrete or masonry construction for securing plates.
- D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- E. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- F. Splice members only where indicated.
- G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- J. Erect all components in accordance with approved shop drawings after erection, prime welds, abrasions, and surfaces not shop primed or galvanized, as required, except surfaces to be in contact with concrete.
- K. Field weld components and shear studs as indicated on approved shop drawings and in accordance with AWS D1.1.

3.04 - FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened unless specifically identified as pre-tensioned or slip critical in contract drawings or calculations by delegated connection designer.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 - 4. Connections and abrasions shall be cleaned, prepared and finished in the same manner and with the same materials used in shop finishing.

3.05 - FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to

inspect field welds and high-strength bolted connections.

- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 - TOLERANCES

- A. All members shall be installed within AISC tolerances and the following:
 - 1. Maximum variation from Plumb: 1/4" (6mm) per story, non-cumulative.
 - 2. Maximum offset from true alignment: 1/4"

3.07 - REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair

galvanizing to comply with ASTM A780.

- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

3.08 - ADJUSTING

- A. All misfits due to errors in locations or fabrication or inaccuracies in the setting of anchor bolts or other items of attachment or support shall be immediately reported to the Engineer and corrected in a manner subject to approval by the Engineer.
- B. Submit method of correction to the Architect under Division 01 Specification provisions,
- C. Proceed with corrective work only after receiving written approval from the Architect.
- D. All corrections shall be made at no additional cost to the owner.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - RELATED DOCUMENTS**

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

1.02 - SUMMARY

- A. Section Includes:
 - 1. Exterior and interior stud wall framing.
 - 2. Furring channels.
 - 3. Parapet framing and Bracing.

1.03 - ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
 - 1. Include layout, spacing, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Fabrication Drawings: Prior to fabrication submit fabrication and erection drawings for review and approval by the architect/ engineer. Indicate component details, framing for openings, bearing anchorage, temporary bracing, welds or type and location of mechanical fasteners and accessories or items required of other work for complete installations. Included manufacturer's instructions for securing studs to tracks and for other framing connections.
 - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 - INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

- B. Welding certificates.
- C. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.05 - QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - AWS D1.1, "Structural Welding Code - Steel."
 - AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1.06 - DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, 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

2.01 - MANUFACTURERS

- 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. MarinoWARE.

2. Dietrich Metal Framing; a Worthington Industries Company
3. Or approved equal.

2.02 - PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft..

2.03 - COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: ST33H.
 2. Coating: G90 or equivalent.
- B. Steel Sheet for Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: 50, Class 1.
 2. Coating: G90.
- C. All studs and/or joists and accessories shall be the type, size, gage, and spacing shown on the plans. Studs, runners (track) bracing, and bridging shall be manufactured per ASTM specification C-955.
- D. All galvanized studs, joists, and accessories shall be formed from steel that conforms to the requirements of ASTM A-653, as set forth in Section 1.02 of the AISI specification for design of cold-formed steel structural members.
- E. All galvanized studs joists and accessories shall have a minimum G-60 coating.
- F. All section properties shall be calculated in accordance with the AISI specification for the design of cold-formed steel structural members (latest edition).

- G. Facing materials may not be substituted for bridging. Horizontal bridging must be installed prior to loading the wall and/or floor/roof joists.
- H. The physical and structural properties published by approved supplier will be accepted; otherwise these properties must be substantiated by calculations for loading stresses and deflections of the designed framing sealed by a professional engineer licensed in the state of New York.

2.04 - EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 14 gauge.
 - 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, un-punched, with un-stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 14 gauge.
 - 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MarinoWARE.
 - b. Dietrich Metal Framing; a Worthington Industries company.
 - c. Steel Network, Inc. (The).
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; un-punched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 16 gauge.

2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Steel Thickness: 18 gauge.
 2. Depth: 7/8 inch.

2.05 - SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 18 gauge or as indicated on the construction documents..
 2. Flange Width: 2 inches minimum.

2.06 - FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- 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. Anchor clips.
 5. End clips.
 6. Stud kickers and knee braces.
 7. Hole reinforcing plates.
 8. Backer plates.

2.07 - 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/A 123M.
- 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 allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.08 - MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Nonmetallic, Non-shrink 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/C 1107M, with fluid consistency and 30-minute working time.
- C. Shims: Load bearing, high-density multimonomer plastic, and non-leaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch ()thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.09 - FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, 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 steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M 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 no fewer than three exposed screw threads.
 - 1. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, 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 ()and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch ()from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 - PREPARATION

- A. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.03 - INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. 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. Welds may be butt, fillet, spot or groove type. The appropriateness of which shall be determined by and within the design calculations. All welds shall be touched-up using zinc -rich paint to galvanized members and paint similar to that used by the manufacturer for painted members.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- 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. Include details on Drawings showing expansion-joint construction and locations.

- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal 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.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
- K. Wire tying in structural applications is not permitted.

3.04 - EXTERIOR NON-LOAD-BEARING 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 unless indicated otherwise.
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb 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. Connect vertical deflection clips to infill studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 2. 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, and fasteners, to provide a complete and stable wall-framing system.

3.05 - FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and special inspections and prepare test reports, as required by New York State Building Code.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Inspect all work in order to assure strict conformance to the shop drawings at all phases of the construction.
- D. All members shall be checked for proper alignment, bearing, completeness of attachments, proper placement and reinforcing.
- E. All attachments shall be checked for conformance with the shop drawings. All welds shall be touched-up in accordance with Section 3.06B. ML/SFA Manual.
- F. Testing agency will report test results promptly and in writing to Contractor and Architect.
- G. Remove and replace work where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 - REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and

installer that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

3.07 - TOLERANCES

- A. Vertical alignment (plumbness) of studs shall be within 1/8 inch in 10.0 inches of the span.
- B. Horizontal alignment (levelness) of walls shall be within 1/8 inch in 10.0 inches of their respective lengths.
- C. Spacing of studs shall not be more than +1/8 inch from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - RELATED DOCUMENTS**

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

1.02 - SUMMARY

- A. Section Includes:
1. Steel framing and supports for applications where framing and supports are not specified in other sections.
 2. Steel framing and supports for overhead doors and grilles.
 3. Steel framing and supports for mechanical and electrical equipment.
 4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 5. Shelf angles.
 6. Metal ladders.
 7. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section:
1. Loose steel lintels.
 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.03 - PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.04 - SUBMITTALS

- A. Product Data: For the following:

1. Paint products.
2. Grout.

- B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other sections.
3. For installed products indicated to comply with design loads, including structural analysis data signed and sealed by a qualified professional engineer responsible for their preparation.

- C. Qualification Data: For qualified professional engineer.

- D. Welding certificates.

1.05 - QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.06 - PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on shop drawings

1. Established dimensions: Where field measurements cannot be made without delaying the work. Establish dimensions and proceed with fabricating metal fabrications without field

measurements. Coordinate wall and other contiguous construction to ensure that actual correspond to established dimensions.

2. Provide allowance for trimming and fitting at site.

1.07 - COORDINATION

- A. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 - METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.02 - FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A36.
- C. Steel Tubing: ASTM A500, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53, standard weight (Schedule 40) unless otherwise indicated.
- E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 2. Material: Cold-rolled steel, ASTM A 1008; 0.0966-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- F. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.

2.03 - FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Plain Washers: Round, ASME B18.22.1.
- E. Lock Washers: Helical, spring type, ASME B18.21.1.
- F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- H. Post-Installed Anchors: Torque-controlled expansion anchors and/or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts,

complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.04 - MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 4000 psi.

2.05 - FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.06 - MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer specified in Division 09 Section "High-Performance Coatings" where indicated.

2.07 - METAL LADDERS

A. General:

1. Comply with ANSI A14.3 unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

B. Steel Ladders:

1. Space siderails 24 inches apart unless otherwise indicated.
2. Space siderails of elevator pit ladders 12 inches apart.
3. Siderails: Continuous, 3/8 inch by 2-1/2-inch steel flat bars, with eased edges.
4. Rungs: 1 inch diameter steel bars.
5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
6. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
7. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
8. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
9. Galvanize exterior ladders, including brackets and fasteners.
10. Prime ladders, including brackets and fasteners, with zinc-rich primer.

- C. Extruded Units: with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

2.08 - LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.
- C. **Hot-Dip galvanize loose steel lintels located in exterior walls.**

2.09 - FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 - STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is primers specified in Division 09 Section "High-Performance Coatings" are indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 - INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.

3.02 - INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.03 - INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 1. Use non-shrink grout, either metallic or non-metallic, in concealed locations where not exposed to moisture; use non-shrink, non-metallic grout in exposed locations unless otherwise indicated.
 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 - ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Aluminum stair frame of structural sections, with open risers.
- B. Integral balusters and handrails.

1.02 - REFERENCES

- A. Aluminum Association – ASD-1 Aluminum Standards and Data.
- B. ANSI A117.1 – Buildings and Facilities Providing Accessibility and Usability for Physically Handicapped People.
- C. AWA A2.0 – Standard Welding Symbols.
- D. AWS D1.2 – Structural Welding Code – Aluminum.
- E. ASTM B26 – Specification for Aluminum-Alloy Sand Castings.
- F. ASTM B221 – Specification for Aluminum-Alloy Bars, Rods, Wires, Shapes and Tubes.
- G. ASTM B429 – Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
- H. ASTM B483 – Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purposes Applications.
- I. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials.
- J. ASTM E894 – Standard Test Methods for Anchorage at Permanent Metal Railing Systems and Rails for Building.
- K. ASTM E935 – Standard Test Methods for Anchorage at Permanent Metal Railing Systems and Rails for Buildings.
- L. NFPA 101 – Life Safety Code.

1.03 - DESIGN REQUIREMENTS

- A. Fabricate stair and railing assembly to meet all applicable codes.
- B. Conform to the following codes, regulations and requirements

- C. New York State Building Code.
- D. Occupational Safety & Health Act of 1970 (OSHA) regulations.
- E. Stair assembly shall support 300 lb. concentrated load at any point and a uniform live load of 100 lb/sq. ft., non- simultaneously with deflection not to exceed 1/240 of span.

1.04 - SUBMITTALS

- A. Submit under provisions of Section 01330.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Shop drawings shall bear the seal and signature of a registered professional engineer licensed in the State of New York.
- C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.05 - QUALIFICATIONS

- A. Submit shop drawings prepared under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of New York. Shop drawings shall be affixed with signature and seal of NYS Professional Engineer.
- B. Welders' Certificates: Submit under provisions of Section 01330, certifying welders employed on the work, verifying AWS qualification within the previous 12 months.

1.06 - FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on submitted shop drawings.

PART 2 - PRODUCTS

2.01 - MATERIALS

- A. Structure Sections and Plates: Aluminum 6061-T6 Alloy, tempered.
- B. Bolts, Nuts and Washers: Stainless steel, Type 304.
- C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.
- D. Welding Materials: AWS D1.2; type required for materials being welded.

- E. Tread: Aluminum grating tread with Type A- Standard corrugated angle nosing as manufactured by McNichols Co. or approved equal. Treads shall be 1 1/2 inch by 3/16 inch grating by McNichols Co. or approved equal.
- F. Welds, Welding Metal: Aluminum.
- G. Electrodes shall be suitable for the material, positions and other conditions of use as recommended by AWS or the manufacturer.

2.02 - FABRICATION - GENERAL

- A. Fabricate stair assembly to be self supporting and independent of adjacent wall construction.
- B. Fit and shop assemble in largest practical sections, for delivery to site.
- C. Fabricate components with joints tightly fitted and secured.
- D. Continuously seal jointed pieces by continuous welds.
- E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush and hairline. Ease exposed edges to small uniform radius.
- F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- H. Accurately form components required for anchorage of stairs, landings and railings to each other and to building structure.

2.03 - FABRICATION

- A. Fabricate stair to meet design and OSHA requirements.
- B. Form stringers with channels minimum 10 inches deep. Reinforce tread underside with angles.

2.04 - FINISHES

- A. Clean surfaces of rust, scale, grease and foreign matter prior to finishing.
- B. Clear anodize finish. Finish stair after fabrication.

- C. Coat areas of aluminum to be in contact with dissimilar metals and concrete with (2) coats of bitumastic paint.

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work. Verify dimensions and clearances of piping adjacent to stair.
- B. Beginning of installation means erector accepts existing conditions.
- C. Supply items required to be embedded in masonry and concrete with setting templates, to appropriate sections.

3.02 - INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects to meet design requirements.
- B. Provide anchors, plates, angles, hangers and struts as required for connecting stairs to structure.
- C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Field weld components indicated on approved shop drawings. Perform field welding in accordance with AWS D1.1.
- E. Mechanically fasten joints butted tight, flush and hairline. Grind welds smooth and flush.
- F. Obtain Engineer approval prior to site cutting or making adjustments not scheduled.
- G. After erection, prime welds, abrasions and surfaces not shop primed, except surfaces to be in contact with concrete.

3.03 - TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story.
- B. Maximum Offset From True Alignment: 1/8 inch.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SUMMARY**

- A. Section Includes: Aluminum wall ladders, including parapets, cages, and handrails.
- B. Types: Types of aluminum wall ladders include:
 - 1. Fixed wall ladders with cage and return platform..

1.02 - REFERENCED STANDARDS

- A. AA – Aluminum Association.
- B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- D. OSHA 1910.27 – Fixed Ladders.

1.03 - SYSTEM DESCRIPTION

- A. Performance Requirements: Provide aluminum wall ladders which have been manufactured, fabricated and installed to withstand loads from [Specify code/standard reference.] and to maintain performance criteria stated by manufacturer without defects, damage or failure.
- B. Ladder Performance Requirements:
 - 1. Aluminum Fixed Wall Ladders: Certified to meet ANSI A14.3 as an OSHA Type I industrial metal ladder.
 - 2. Solid Rivets: 4 per rung with combined shear strength in excess of 3600 lb.

1.04 - SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Section 013300.
- B. Product Data: Submit product data, including manufacturer's product sheet, for specified products.
- C. Shop Drawings: Submit shop drawings showing layout, profiles, product components,

accessories and finishes.

1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
 2. Provide templates for anchors and bolts specified for installation under other Sections.
 3. Provide reaction loads for each hanger and bracket.
- D. Samples: Submit selection and verification samples for finishes.
1. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors.
 2. Verification Samples: For each finish specified, two samples, minimum size 6 inches, represent actual product color.
- E. Quality Assurance Submittals: Submit the following:
1. Manufacturer's Instructions: Manufacturer's installation instructions.
- F. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
 2. Warranty: Warranty documents specified herein.

1.05 - QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.
1. Record of successful in-service performance.
 2. Sufficient production capacity to produce required units.
 3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.
- B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and

installing ladders to attain designed operational and structural performance.

- C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

1.06 - DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 1 Product Requirements Sections.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.07 - PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurement before fabrication.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.08 - WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
 - 1. Warranty Period: Five (5) years commencing on the shipment date for an extended Corrective Period for work of this Section against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
 - a. Defects in materials and workmanship.
 - b. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.

- c. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.
- b. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor.

1.09 - EXTRA MATERIALS

- A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Basis of Design: O'Keefe's Inc., Brisbane CA 94005. Telephone: (415) 824-4900.
- B. Approved equal by ALACO Ladder Company, Chino, CA 91710-5143; Telephone: (909) 591-7561.

2.02 - ALUMINUM FIXED WALL LADDERS

- A. O'Keefe's Series 533 Aluminum Fixed Wall Ladder with handrails, safety cage, high parapet access, platform and return.
 - 1 Climb Height: As indicated on drawing.
 - 2 Aluminum: 6061-T6 alloy.
 - a. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
 - b. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.
 - 3 Finish: Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.
 - 4. Rungs: Not less than 1-1/4 inches in section and 18-3/8 inches long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.

Rungs shall withstand a 1,500 pound load without deformation or failure.
 - 5. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch wall thickness by 3 inches wide. Construction shall be self-locking

stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

6. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches above the landing and shall be fitted with deeply serrated, square, tubular grab rails.
7. Landing Platform: 1-1/2 inches or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.
8. Safety cages: Provide cages consisting of 3/16" x 2" aluminum flat vertical bars every 4' or less, with solid riveted connections rated at 934 lb. shear strength each.

2.03 - FABRICATION

A. Aluminum Ladder Fabrications:

1. General: Fabricate tread aluminum stairs to conform with performance and construction requirements, and in accordance with approved shop drawings and/or dimensional prints. Fabricate and shop-assemble to greatest extent possible.

B. Handrail, Safety Cage, and Rest Platform Fabrications:

1. General: Fabricate handrails, cages, rest platforms and security doors to conform with dimensions, performance, and construction requirements, and in accordance with approved shop drawings or dimensional prints.
 - a. Fabricate ladder safety cages to comply with NYS Building Code. Assemble by welding. Spacing of primary hoops, secondary hoops and vertical bars shall not exceed that required by code.
2. Aluminum: Cut, formed, and punched parapets, handrails, cages, rest platforms and security doors with mounting brackets and kickplates possibly gas tungsten arc welded or gas metal arc welded with bolt-on handrails.

2.04 - SOURCE QUALITY

- #### A. Source Quality: Obtain aluminum wall ladders from a single manufacturer.

PART 3 - EXECUTION**3.01 - MANUFACTURER'S INSTRUCTIONS**

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.02 - EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
 - 1. Verification: Verify that dimensions and angle are correct and that substrate is in proper condition for ladder installation. Do not proceed to install until all necessary corrections have been made.

3.03 - PREPARATION

- A. Coordination: Coordinate start and installation of tread stairs with other related and adjacent work. Installation shall not start until construction has progressed to point that weather conditions and remaining construction operations will not damage ladder installation.
- B. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

3.04 - INSTALLATION

- A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.
- B. Aluminum Ladders Installation:
 - 1. Detail top rung at or slightly above stepping-off surface and space rungs 12" o.c. to bottom rung, which is installed 12" from the floor.
 - 2. Space wall mounting brackets 4'-0" o.c., with floor brackets recommended at bottom ends.
 - 3. Install parapet railing 42" above top rung, then extend 24" horizontally and return to roof or the rear of parapet. Rungs can be shown returning to the roof if the parapet is high enough to require them.

4. Touch up with matching paint any chipped or abraded damage to factory finish or coating.

C. Handrails, Safety Cages, and Rest Platforms:

1. Install flared cage between 7' - 8' above the floor.
2. Touch up with matching paint any chipped or abraded damage to factory finish or coating.

3.05 - CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.06 - PROTECTION

- A. Protect installed product and finish surfaces from damage during construction.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 – SECTION INCLUDES**

- A. All labor, materials, equipment and services necessary to furnish and install aluminum handrails and guardrails, posts, toe plates, balusters, anchors, and fittings.
- B. Furnishing and installation of all adhesive anchors.

1.02 - REFERENCES

- A. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- B. ASTM B241 - Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
- C. ASTM B483 - Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
- D. ASTM E935 - Test Methods for Performance of Permanent Metal Handrailing Systems and Rails for Buildings.
- E. ASTM E985 - Permanent Metal Handrailing Systems and Rails for Buildings.
- F. ASTM F593 – Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
- G. ASTM F594 – Specification for Stainless Steel Nuts.

1.03 - SUBMITTALS

- A. Comply with the requirements contained in Section 013300 - Submittals. Provide the following:
 - 1. Design calculations showing all handrailing, balusters, mounting brackets and fittings shall resist lateral force of two hundred (200) lbs at any point without any damage or misalignment.
 - 2. Profiles, sizes, connection attachments, and accessories for handrailing.
 - 3. Catalog cuts of the handrailing.
 - 4. Detail of toe plate anchorage.
 - 5. Catalog cuts for anchorage hardware. Indicate size and type of anchorage hardware.
 - 6. Samples of all components, bases, toe plate and pipe.

- 7. Storage, handling and installation instructions.
- B. Warranty Certificate prepared in accordance with the requirements contained herein.

1.04 - QUALITY ASSURANCE

- A. The handrailing shall be furnished by one single Supplier (Manufacturer). This requires the Supplier to be responsible for the development, design, fabrication, delivery and assembly of the handrailing.
- B. The handrailing shall not be shop fabricated by the Contractor.
- C. Consideration will only be given to Suppliers who can demonstrate that their handrailing complies with these Specifications having had successful and documented experience of the size, quality, performance and reliability to that specified, and who can successfully demonstrate this criteria to the Engineer.
- D. The Supplier shall have at least ten (10) years of experience in the design and manufacturing of the specified handrailing and shall provide five (5) references for projects completed within the last five (5) years.
- E. The handrailing shall be manufactured by Julius Blum & Company, Inc., Connectorail System or equal.

1.05 - PERFORMANCE AND DESIGN REQUIREMENTS

- A. All handrailing, balusters, mounting brackets, and fittings shall resist a force of two hundred-(200) lbs. applied in any direction at any point along the top. This point load shall not be assumed to act currently with the uniform loads described below. The handrail assemblies shall be designed to resist a load of 50 pounds per linear foot applied in any direction at the top.
- B. Identical sections of handrailing shall be interchangeable.
- C. All handrailing, balusters, mounting brackets, and fittings shall conform to the requirements in ASTM E985.
- D. The handrailing shall be made of pipes joined together with component fittings. Components that are pop-riveted or glued at the joints shall not be acceptable.
- E. The toe plate shall conform to OSHA standards. The toe plate shall be a minimum four (4) inches high and shall be an extrusion that attaches to the posts with clamps that allow for expansion and contraction between the posts.

- F. The dimensions and sizes for the handrailing system shall be as shown on the drawings.

1.06 - DELIVERY, STORAGE AND HANDLING

- A. Comply with the requirements of Section 016500 - Product Delivery, Storage and Handling.
- B. The manufacturer shall coordinate the loading of the railing with the Contractor such that the railing to be installed first is located at the bottom of the shipment.
- C. All railing shall be shipped with plastic sleeves that shall be removed by the Contractor after the installation is completed.
- D. All handrailing components shall be blocked off above grade or walking surface, and shall remain covered until such time as the installation begins.

1.07 - WARRANTY

- A. The Supplier shall provide a Warranty Certificate typed on company letterhead and signed by an authorized officer of the Supplier. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located. The Warranty Certificate shall be for all components of the handrailing. The handrailing shall be free from defects in design, materials, and workmanship for a period of one (1) year commencing on the date of the Certificate of Substantial Completion.

PART 2 – PRODUCTS

2.01 – MANUFACTURERS

- A. Post spacing shall be a maximum of four (4) feet on-center.
- B. Posts and handrailings shall be a minimum of 1-1/2 inch Schedule 40 aluminum pipe alloy 6063-832, ASTM-B-429 or ASTM-B-221.
- C. The handrail shall be made of pipes joined together with component fittings. Samples of all components, bases, toe plate, mounting brackets, and pipe shall be submitted for approval. Components that are pop-riveted or glued at the joints shall not be acceptable. All components shall be mechanically fastened with stainless steel hardware.
- D. Posts shall not interrupt the continuation of the top rail at any point along the handrailing, including corners and end terminations. The top surface of the top handrailing shall be smooth and shall not be interrupted by projected fittings.

- E. Railing shall be installed using stainless steel bolts, size as required by the manufacturer. All bolts shall be stainless steel type in conformance with ASTM F593 and F594 and shall be furnished by the Contractor.
- F. The toe plate shall be shipped loose in stock lengths with pre-manufactured corners for field installation.
- G. Openings in the handrailing shall be guarded by 304 stainless steel safety chains with s.s. hardware for easy removal.
- H. The finish shall be Aluminum Association M10-C22-A41 (215-R1). The pipe shall be plastic wrapped. The plastic wrap shall be removed after installation.
- I. Aluminum surfaces in contact with concrete, grout, or dissimilar metals shall be protected with a coat of bituminous paint, mylar isolators, or other approved materials.

2.02 – FABRICATION

- A. Fit and shop assemble components in largest practical sizes for delivery to the site.
- B. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation
- C. Provide anchors and mounting brackets required for connecting railings to the basin or tank.
- D. Exposed mechanical fasteners shall be flush countersunk; unobtrusively located; consistent with design of handrailing, except where specifically noted otherwise.
- E. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
- F. Grind exposed joints flush and smooth with adjacent finish surface. Exposed joints shall be butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- G. Accurately form components to each other and to stair or grating structure.
- H. Accommodate for expansion and contraction of members and stair movement without damage to connections or members.
- I. Finish to be clear anodized.

PART 3 - EXECUTION**3.01 – GENERAL**

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. All equipment of this Section shall be installed by the Contractor unless noted on the Drawings.

3.02 – INSTALLATION

- A. Install handrail in accordance with the written instructions provided by the manufacturer.
- B. Handrail shall be installed plumb and level, accurately fitted, free from distortion and defects.
- C. Clean and strip aluminum where site welding is required.
- D. Supply items required to be embedded in concrete or placed in partitions with setting templates, for each appropriate section.
- E. Anchor railings to stair or grating with mounting brackets that shall be supplied by the manufacturer.
- F. Assemble with spigots and sleeves to accommodate tight joints as shown on the drawings.
- G. Paint aluminum surfaces in contact with steel with two (2) coats of bitumastic paint.
- H. Remove plastic wrap from pipe after installation.
- I. Polish handrailing in accordance with the requirements contained in Section 017423.

3.03 - INSTALLATION TOLERANCES

- A. The maximum variation from plumb shall be one quarter (1/4) inch, non-cumulative.
- B. The maximum offset from true alignment shall be one quarter (1/4) inch.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Aluminum floor gratings. All grating on the project shall be aluminum except as specified in Section 06600, or as noted on the Contract Drawings.

1.02 - REFERENCES

- A. ANSI/ASTM B221 – Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- B. ANSI/NAAMM MBG 531 - Metal Bar Grating Manual.
- C. AWS A2.0 - Standard Welding Symbols.

1.03 - SUBMITTALS

- A. Submit under provisions of Section 013300 - Submittals.
- B. Product Data: Provide span and deflection tables.
- C. Layout Drawing: Prepare a floor grating plan to a minimum scale of 1/4 inch = 1 foot showing the layout and sizes of all grating sections, holes in grating, overall dimensions and locations of openings, structural support members, and embedments.
- D. Shop Drawings: Indicate details of component supports, openings, perimeter construction details and tolerances.
- E. Samples: Submit one sample, 12 inches x 12 inches (300 mm x 300 mm) in size illustrating surface finish, color, and texture.
- F. Manufacturer's Instructions: Indicate special procedures and conditions required for proper installation.

1.04 - PERFORMANCE REQUIREMENTS

- A. Design Live Load: Uniform load of 100 lbs. / sq. ft. minimum; concentrated load of 900 lbs.
- B. Maximum Allowable Deflection under Uniform Live Load: 3/8 inch or span/180 whichever is less.

- C. No removable grating section shall exceed 100 pounds in weight, or be larger than eighteen (18) square feet in plan area. Grating sections shall be easily removable by a maximum of two (2) plant operators.

1.05 - COORDINATION

- A. Field Verify depth of existing grating. Depth of new grating to match existing.
- B. Do not submit layout plan specified above until all process piping has been installed.
- C. Coordinate the work with placement of frames in concrete work and tolerances for openings.
- D. Shop drawings shall demonstrate field verification of the physical sizes and actual locations of equipment and other components as installed.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Aluminum floor gratings shall be manufactured by McNICHOLS CO., or approved equal.

2.02 - MATERIALS

- A. Aluminum grating:
 - 1. Plank sections, bearing bars and grating frames: ANSI/ASTM B221 extruded alloy 6063-T6.
 - 2. Cross bars and connecting bars: ANSI/ASTM B221 aluminum. Gratings shall be Type GAL-200 with 2" x 3/16" bearing bars, typical, except at Headworks Channel, which shall receive new grating whose depth shall match existing.
 - 3. Grating frames: ANSI/ASTM B221 aluminum angle shape, 1/4 inch (6 mm) thick min.
 - 4. Embedment angle per Section 066000 – Plastic Fabrications.

2.03 - ACCESSORIES

- A. Fasteners and saddle clips: Stainless steel.

2.04 - FABRICATION

- A. Aluminum floor grating: 2" high, model No.GAL-200 by McNichols, typical unless otherwise indicated.
 - 1. Swage Locked Rectangular Design:
 - a. Pattern: Main and cross bars shall be arranged in a rectangular pattern, with positive mechanical interlocking joints.
 - b. All grating shall be banded.

2.05 - FINISHES

- A. Aluminum: Mill Finish.
- B. Where aluminum surfaces come into contact with dissimilar materials or concrete the aluminum shall be neatly painted with two (2) coats of bituminous paint as specified in Section 099100.

PART 3 - EXECUTION**3.01 - EXAMINATION**

- A. Verify that opening sizes and dimensional tolerances are acceptable.
- B. Verify that support anchors are correctly positioned.

3.02 - INSTALLATION

- A. Install components in accordance with manufacturer's instructions.
- B. Place frames in correct position, plumb, and level. Attach to substrate in accordance with manufacturer's instructions.
- C. Anchor by bolting through saddle clips.
- D. Set perimeter closure flush with top of grating and surrounding construction. Secure to prevent movement. Installed gratings which rock will be rejected.

3.03 – TOLERANCES

- A. Conform to ANSI/NAAMM MBG 531 - Metal Bar Grating Manual
- B. Maximum space between adjacent grating sections: 1/4 inch.

C. Maximum variation from top surface plane of adjacent sections and floors: 0 inches.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - RELATED DOCUMENTS**

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

1.02 - SUMMARY

- A. Section Includes:
 - 1. Steel framing and supports for applications where framing and supports are not specified on other sections.
 - 2. Aluminum framing and supports for applications where framing and supports are not specified in other Sections.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.03 - COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
 - 1. Provide templates for anchors and bolts specified for installation under other sections.
 - 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by a Qualified Professional Engineer responsible for their preparation.

1.04 - INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.

- B. Welding certificates.
- C. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.05 - QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.06 - FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on the shop drawings.
 - 1. Established dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond with established dimensions.
 - 2. Provide allowance for trimming and fitting at the site.

PART 2 - PRODUCTS

2.01 - PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum fabrications.

2.02 - METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.03 - FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners.

- B. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- D. Post-Installed Anchors: Torque-controlled expansion anchors and/or chemical anchors.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.04 - MISCELLANEOUS MATERIALS

- A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.05 - FABRICATION, GENERAL

- A. Shop Assembly: Pre-assemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form exposed work with accurate angles and surfaces and straight edges.
- D. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- F. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- H. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.06 - SHELF ANGLES

- A. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.07 - FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.
- C. Coat areas of aluminum to be in contact with dissimilar metals and concrete with (2) coats of bitumastic paint.

2.08 - ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.01 - INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART I - GENERAL**1.01 - SECTION INCLUDES**

- A. Rough carpentry and associated rough carpentry accessories including, but not be limited to the following:
 - 1. Framing.
 - 2. Wood Sheathing.
 - 3. Miscellaneous framing, blocking, furring and sheathing.
 - 4. Sill gaskets and flashings.
 - 5. Treated wood members.
 - 6. Framing accessories.

1.02 - QUALITY ASSURANCE

- A. The inclusion of wood framing, blocking and sheathing materials in these specifications does not permit the contractor to assume that wood framing, blocking and sheathing is permitted for all locations. Construction materials shall comply with the building fire resistance rating requirements of the New York State Building and Fire Code. Final selections for miscellaneous framing, blocking and sheathing materials must be made to comply with the quantities and permissible locations permitted by the buildings construction classification.
- B. Perform work in accordance with the following agencies:
 - 1. Lumber Grading Agency: Certified by ALSC.
 - 2. Plywood Grading Agency: Certified by APA.
 - 3. Southern Pine Inspection Bureau (SPB).
 - 4. Western Wood Products Association (WWPA).
 - 5. American Wood Preserves Bureau (AWPB).
 - 6. Building Officials and Code Administrators (BOCA).
- C. Requirements of regulatory agencies. Comply with the following:

1. All lumber if permitted to be used is to be fire retardant treated. Fire retardant treated wood: Testing agency, UL label rating, acceptable to governing Building Officials.
2. All lumber and plywood shall be grade-marked.
3. In lieu of grade stamping exposed to view lumber and plywood, submit manufacturer's certificate under provisions of Section 01400 that products meet or exceed specified requirements.
4. Class "A" Fire rated roof sheathing shall comply with extended ASTM E-84, Factory Mutual Research Report J.I. IR9Q9.AC.

1.03 - REFERENCES

- A. ALSC - American Lumber Standards Committee: Softwood Lumber Standards.
- B. APA - American Plywood Association.
- C. APA/EWS - American Plywood Association - Engineered Wood Systems
- D. AWWA - (American Wood Preservers Association) C1 - All Timber Products Preservative Treatment by Pressure Process.
- E. WWPA - Western Wood Products Association.
- F. Lumber Grading:
 1. Standard Grading and Dressing Rules No. 16, current edition, for Douglas Fir, Western Hemlock, West Red Cedar, White Fir, and Sitka Spruce, published by West Coast Lumber Inspection Bureau, or
 2. "Current Grading Rules", issued by the Western Wood Products Association.
- G. ASTM D2559 - Adhesives for structural laminated wood products for use under exterior (wet use) exposure conditions.
- H. AITC - American Institute of Timber Construction
- I. Extended ASTM E84 Fire Test Method, Factory Mutual Research Report J.I. 1R9Q9. AC.
- J. BOCA: 2310.2: Fire Retardant Treated Wood (1993).
- K. ASTM C1177 – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

- L. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
- M. ASTM E136 – Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at a Temperature at 750°C.
- N. ASTM A153: Hot Dipped Galvanized Fasteners.

1.04 - SUBMITTALS

- A. Submit under provisions of Section 01310 manufacturer's certification that products meet or exceed specified requirements.
- B. Certification:
 - 1. Pressure Treated Wood: Submit pressure treated certification by treating plant stating chemicals and process used, net amount of salts retained and in conformance with applicable standards.
 - 2. Preservation Treated Wood: Submit certification for waterborne preservative that moisture content was reduced to 19% maximum, after treatment.
 - 3. Fire- Retardant Treatment: Submit certification by treating plant stating that fire-retardant treatment materials comply with governing ordinances and that treatment will not bleed through finished surfaces.

1.05 - DELIVERY, STORAGE AND HANDLING

- A. Do not handle products in a manner which will damage, warp or distort products.
- B. Do not store products directly on the ground; protect from elements.
- C. All materials shall be inspected upon receipt at job site. No faulty or damage materials shall be accepted. It shall be contractor's responsibility to produce finished items of work in first- class condition, free from all defects.

1.06 - WARRANTY

- A. Provide 30-year manufacturer's warranty for pressure treated and fire resistant treated wood items.
- B. Provide five year manufacturer's warranty for exterior grade sheathing.

PART 2 - PRODUCTS**2.01 - MATERIALS - LUMBER AND FRAMING**

- A. All lumber for blocking, plates and nailers located within a maximum distance of 18 inches from grade or in contact with masonry or concrete or for roof blocking shall be treated and be in accordance with AWPB Standards. All lumber shall be dried after treatment and have moisture content in each piece of 19% or less, or shall conform to the applicable grading standards for the species involved. All lumber shall be grade marked.
- B. Lumber Grading Rules: WWPA.
- C. Non- Structural Light Framing: Douglas Fir Larch species, No.2 grade, 19 percent maximum moisture content or equivalent stress grade.
- D. Miscellaneous Framing: No. 2 species, 19 percent maximum moisture content or equivalent stress grade.
- E. Interior lumber used for framing, blocking, furring shall be SPIB or WCLB treated with fire retardant to obtain flamespread rating of 25 or less when tested according to ASTM E-84. Treat cuts, etc. as recommended by manufacturer of flame retardant materials.
- F. Plywood Roof Sheathing: APA C-D Rated Sheathing; Structural I, Span Rating 40/20; Exposure Durability 1, tongue and groove.
- G. Plywood shall comply with APA Standards and be of the thickness indicated on Drawings.
- H. Moisture content of the plywood at the time of installation and at the time of roofing is installed shall be less than 19 percent.
- I. Rough hardware, nails, screws, bolts, etc., for securing lumber in place shall be commercial quality, suitable type and finish for interior dry location, galvanized or nonferrous hardware for all exterior work.

2.02 – SHEATHING

- A. Exterior Roof Sheathing: 3/4 inch CDX Plywood Sheathing.

2.03 - FASTENERS

- A. Nails and Fasteners: Hot-dipped galvanized steel for exterior, high humidity and treated wood locations, unfinished steel elsewhere.

- B. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.
- C. Lumber to lumber: Cement coated or annular threaded nails of sufficient length to penetrate 1.25 inches into adjoining members, except as otherwise indicated.
- D. Sheathing to metal framing: 1 1/4 inch deck screws @12 inch o.c. in each stud, or as recommended by the sheathing manufacturer or as required by code, whichever is more stringent.

2.04 - ACCESSORIES

- A. Sheathing Clips: Hot dipped galvanized steel, sized to suit framing conditions, 18 gage minimum, manufactured by SIMPSON STRONG TIE CO. INC., TECO PRODUCTS or specifically approved equal.
- B. Construction Adhesive: Waterproof; air cured, rubber based, cartridge dispensed, Liquid Nail 601, manufactured by MACCO ADHESIVES, THE GLIDDEN COMPANY, or approved equal.
- C. Provide accessories to conform to manufacturer's installation recommendations.

2.05- WOOD TREATMENT

- A. Fire-retardant treatment:
 - 1. Treatment is required for all framing, blocking, and nailers.
 - 2. Treat to flame spread rating of 25 or less and fuel contribution of 30 or less when tested in accordance with ASTM E84. Re-dry to maximum 19% moisture content.
 - 3. Each piece of treated wood shall bear UL label of compliance.
- B. Preservative treatment.
 - 1. Treatment is required for all framing, blocking and nailers within a maximum distance of 18 inches from grade or in contact with masonry or concrete.
 - 2. Alkaline Copper Quat (ACQ-C, ACQ-D, ACQ-D Carbonate), Copper Azole (CBA-A, CA-B), Sodium Borates (SBX/DOT) and Ammoniacal Copper Zinc Arsonate (ACZA) wood preservative.
 - 3. No CCA-treatment will be permitted.

PART 3 - EXECUTION**3.01 - EXAMINATION**

- A. Verify existing conditions under provisions of Division 1.
- B. Verify that walls and other substrates are at the proper elevations and ready to receive work of this section.

3.02 - PREPARATION OF SURFACES

- A. Surfaces to receive new wood members shall be free of all dirt, debris, and loose materials. Exposed surfaces shall be mechanically scraped if necessary, to remove projections.
- B. Surfaces shall have no free water present in any form (rain, dew, frost, snow or ice).
- C. Inspect exposed surfaces to determine if conditions are satisfactory for installation of new work

3.03 – INSTALLATION - SHEATHING

- A. Install sheathing fasteners in accordance with manufacturers written instructions.
- B. Fastening pattern and spacing shall be in accordance with manufacturer or code recommendations or as listed below, whichever is more stringent.
- C. Install Plywood sheathing continuously to two or more spans.
- D. Secure roof sheathing perpendicular to framing members with ends staggered and sheet ends over firm bearing. Use sheathing clips between sheets between roof framing members.
- E. Place roofing underlayments and building paper over sheathing, weather lap edges and ends.
- F. Install telephone and electrical panel boards with 3/4 inch plywood sheathing material where required. Oversize the panel by 12 inches on all sides.
- G. Lumber or plywood to lumber (and to metal studs):
 - 1. Nail spacing shall be maximum of 12 inches on center and staggered across face of piece. Fastener shall be located within three inches of each end of piece. Maximum spacing of 6 inches on center, eight feet each way from outside corners for roof edge blocking.
 - 2. Nail heads shall be flush with wood surface and nail shall penetrate adjoining piece minimum 1.25 inches.

- 3. The installed withdrawal resistance shall be a minimum of 100 pounds per nail.
- H. 1/2 inch CDX Plywood sheathing to framing (exterior walls): Fastener shall be No. 6 – 1-1/4" galvanized screws, minimum. Spacing shall be a maximum of 4-inches on center at edges and maximum 7-inch on center over field.

3.06 - TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

3.07 - WORKMANSHIP

- A. Carefully plan and lay out the work. Properly accommodate the work of other trades. Accurately saw-cut and fit blocking into the respective locations, true to line, grade, and level, as indicated or required, and permanently secure in proper position with spikes, nails, lag screws, bolts, hangers, or other fastenings to make the work substantial and rigid in all parts and connections.

3.08 – SCHEDULE

- A. Provide nailers, blocking, canting, curbs, furring, and reinforcement as called for in all other specified sections in accordance with all governing codes and in conformance with the requirements of this section.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Glass fiber reinforced polyester (FRP) roof panel for canopy structures.
- B. FRP board with FRP panels factory laminated to substrate backer.
- C. All other appurtenances, fasteners, closures and accessories necessary to provide a complete installation.

1.02 - SYSTEM DESCRIPTION

- A. Fabricate roof panel assemblies to meet all applicable codes including:
 - 1. New York State Building Code
 - 2. Occupational Safety & Health Act of 1970 (OSHA) regulations.
 - 3. Fire Code and Property Maintenance Code of New York State.
- B. Roof panel assemblies shall support a positive load of 37.5 psf and a negative wind load of -51.6 psf. Positive load should be the higher of live or snow load or a minimum load of 25 psf.
- C. Deflection limits for roof panel assemblies shall be L/240.
- D. Design items with sufficient strength for handling stresses.

1.03 - SUBMITTALS

- A. Submit under provisions of Section 013300 - Submittals.
- B. Product Data: Submit product literature on specified component products, including technical data demonstrating compliance with design criteria.
- C. Submit a complete list and description of materials to be furnished.
- D. Samples:
 - 1. Submit two (2) samples, minimum 6 inches square pieces, illustrating color, texture and finish for each of the following: roof panels and interior board.
 - 2. Substrate Backer: 12 inch square pieces, each type.
 - 3. Accessories and Moldings: 12 inches long, full section, each type.

4. Fasteners: One, each type.
 5. Adhesive: One pint, or standard size tube.
 6. Laminating Adhesive: One pint.
 7. Color Samples: FRP manufacturer's standard colors and textures.
- E. Shop Drawings: Indicate design load parameters, dimensions, adjacent construction, materials, thicknesses, fabrication details, required clearances, field jointing, tolerances, colors, finishes, methods of support and anchorages.
- F. Fabricator's Installation Instructions: Provide information indicating special procedures required and perimeter conditions requiring special attention.
- G. Independent laboratory test reports indicating that material being supplied is in compliance with ASTM E84. Certification must be composite material being supplied on this project. Data indicating resin performance only will not be accepted.
- H. Roof Panel shop drawings shall include layout plan, support locations, projections, and pertinent details of attachment to structure and laps.

1.04 - QUALITY ASSURANCE

- A. Materials shall comply with federal and local laws, applicable codes, and standards including:
1. ASTM E72: Strength of Panels for Building Construction
 2. ASTM E84: Surface Burning Characteristics of Building Materials
 3. ASTM D696: Coefficient of Linear Thermal Expansion of Plastics
 4. ASTM D2583: Indentation Hardness of Plastics
 5. ASTM D1494: Diffused Light Transmission
- B. Roofing and siding panels shall meet the design criteria listed herein for the spans shown on the drawings.
- A. The Manufacturer must successfully demonstrate to the Architect/Engineer that they have had a minimum of ten (10) years of successful and documented experience in the design, manufacture, and installation of grating systems of the size, quality, performance and reliability specified.
- B. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.05 – FIELD MEASUREMENT

- A. Verify that field measurements are as indicated on approved shop drawings.

1.06 - REGULATORY REQUIREMENTS

- A. All FRP products shall have a maximum ASTM E84 flame spread rating of 25 as measured in accordance with ASTM E84.

1.07 - OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 017820.
- B. Maintenance Data: Include instructions for stain removal and surface and gloss restoration.

1.08 - DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle products to site under provisions of Section 016500.
- B. All materials shall be delivered on site in original, unbroken packaging bearing the label of the manufacturer.
- C. When handling materials, spreader bars shall be used when lifting FRP panels and surfaces protected from cuts, gouges, abrasions, and impacts. Wire slings shall not be used unless panel is protected.
- D. During storage, bundled panels / boards shall be protected against standing water on top of and between sheets. Bundled panels / boards shall be kept under cover (but ventilated) and dry. Materials shall be stored off the ground for air circulation and with one end elevated to permit water drainage.
- E. Adhesives, resins, catalysts, and hardeners shall be packaged independently, and they shall be labeled and stored in a dry indoor storage area separate from the FRP materials. Storage area temperature shall remain between 70 and 85 degrees Fahrenheit for the entire storage period.
- F. All materials shall be carefully handled to prevent abrasion, cracking, chipping, twisting, and other deformations or damage.
- G. Store materials in an enclosed area free from contact with soil or water.

PART 2 - PRODUCTS**2.01 – ACCEPTABLE MANUFACTURERS**

- A. Enduro Composites.
- B. Crane Composites, Inc.
- C. Nudo Industries.
- D. Approved equal.

2.02 - MATERIALS

- A. Roof Panel Assemblies:
 - 1. Glass fiber reinforcements shall be continuous, straight and bi-directional along the length and width. Glass content shall be 48% by weight.
 - 2. Resin type shall be Isophthalic Polyester.
 - 3. Materials shall be protected from UV rays by all of the following:
 - a. UV stabilized resin with neopentyl glycol and acrylic monomer
 - b. UV acrylic polymer exterior coating, factory-applied with minimum .4 mil dry film thickness
 - c. Surfacing mat or veil
 - d. Embossed resin-rich surface
 - 4. Finish shall be embossed top, smooth bottom.
 - 5. Color shall be Enduro standard as selected by owner.
 - 6. Fasteners:
 - a. Structural fasteners shall be Type 316 stainless steel with seal washers installed per manufacturer's guidelines.
 - b. Panel side lap and flashing fasteners shall be Type 316 stainless steel SB2 grommets and installed per manufacturer's guidelines.
 - 7. Closures and Sealants:
 - a. EPDM closures shall match unit profile.
 - b. Sealant tape for roofing side and end laps shall be 3/32 x 1/2 in. thick non-shrink/non-hardening butyl tape.

- B. FRP Boards: Glass-fiber reinforced polyester plastic panels, ASTM D 3841, USDA accepted; factory laminated to Substrate Backer as specified herein.

1. Minimum Physical Properties for Class A (I) Panels:

PROPERTY	TYPICAL VALUE	TEST METHOD
Flexural strength (PSI)	15 x 103	ASTM D 790
Flexural modulus (PSI)	.75 x 106	ASTM D 790
Tensile strength (PSI)	7 x 103	ASTM D 638
Tensile modulus (PSI)	1.5 x 103	ASTM D 638
Impact strength (IZOD) (ft. lbs./in. notched)	12	ASTM D 256
Barcol hardness	40	ASTM D 2583
Coefficient of linear thermal expansion (in./in./F. degrees)	1.7 x 10-5	ASTM D 696
Water absorption (percent)	.4 maximum	ASTM D 570
Thermal conductivity (BTU in./hr./ft2/0F.)("K")	.3	ASTM C 177
Specific gravity	1.8	ASTM D 792

2. Fire Rating: Class A (I).
3. Nominal Thickness: 0.09 inch.
4. Finish: Pebble textured.
5. Substrate Backer: Class I rated fire retardant particleboard made from Western softwood particles and fire retardant chemicals bonded with resins and waxes; ANSI A208.1, Grade 1-M-1.

- a. Minimum Physical Properties of substrate backer:

PROPERTY	TYPICAL VALUE
Density (lbs./cu.ft.)	45.0
Modular of rupture (PSI)	1600
Modular of elasticity (PSI)	300,000
Internal bond (PSI)	80
Elongation (percent)	0.35
Screw-holding (face)	250
Screw-holding (edge)	225

- b. Finish: Suitable for laminating.
- c. Nominal Thickness: 1/2 inch.
6. Accessories and Moldings: One piece extruded aluminum, color to match plastic panels, thicknesses to match plastic panels.

7. Fasteners: Plastic board manufacturer's standard or recommended rivets sized to securely attach material to substrate, color to match plastic panels.
8. Laminating Adhesive: High strength waterproof structural adhesive recommended and approved by both the plastic panel manufacturer and the substrate backer manufacturer.

2.03 – PERFORMANCE AND DESIGN CRITERIA

- A. Size and locations shall be as indicated on contract drawings.
- B. Canopy Roof Panel:
 1. 7.2 x 1.5 Tuff Span Series 450 panel by Enduro or Equal.
 - a. Height of panel; 1 ½" (fluted)
 - b. Span Design: Single Span

2.04 – FABRICATION - FRP

- A. Fabricate components with the open mold spray-up method to provide a minimum 1/4 inch thick product.
- B. Brace shape with stiffeners to maintain shape as required.
- C. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- D. Finish other surfaces not in contact with the mold to match the molded surfaces in appearance.
- E. Finish trim corners and edges.
- F. Factory laminate plastic panels to substrate backer to form permanently adhered plastic boards.

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work. Beginning of installation means installer accepts existing substrate conditions.
- B. Provide items required to be embedded in masonry and concrete with setting templates, to appropriate sections.

3.02 - INSTALLATION**A. Fastening:**

1. For Type A or B stainless steel self-tapping screws, pilot holes must be drilled through the panel and support. Pilot holes are not required for self-drilling stainless steel screws, suitable for steel thickness of 1/4".
2. For SB2 Grommets used for side lap and flashing attachment, a pilot hole must be drilled through panels or flashing.

B. End laps shall be 6 inches minimum for roofing panels.**C. Install fabrications in accordance with approved shop drawings and fabricator's instructions.****D. Install items plumb and level, accurately fitted, free from distortion or defects to meet design requirements.****E. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.****F. Install items specified as indicated and in accordance with manufacturer's instructions.****G. Roof Panel:**

1. Fastened to Structure at every low rib.
2. Side Laps at 12" on center.
3. Minimum End Lap Length: 6".
4. Fasteners for attachment to structure:
 - a. Set with pilot holes for stainless steel screws.
 - b. Type 'B' Point screws with 3/8" hex head.
 - c. Provide .729" diameter neoprene seal washer at every screw.

H. FRP Boards:

1. Install moldings and trim plumb and level, within 1/8 inch in any 8 feet of length, in longest lengths practicable. Install division bars between panels in the same plane, inside corners at interior junctures, outside corners at external corners, and cap at top of panels and where panels abut dissimilar materials.
2. Attach moldings and trim to substrate with concealed fasteners spaced not more than 2 inches from ends and 12 inches on center.

3. Apply a continuous bead of silicone sealant to one side of channel trim piece. Install trim piece on leading edge of panel. Apply a continuous bead of silicone sealant to exposed channel and install the next panel. Continue in this manner until installation is complete.
4. Apply silicone sealant into each fastener hole before inserting fastener.

3.03 - TOLERANCES

- A. Maximum Variation from True Position: 1/8 inch.
- B. Maximum Offset from True Alignment: 1/8 inch.

3.04 - CLEANING

- A. Remove dirt and other foreign substances from exposed surfaces in accordance with manufacturer's printed cleaning instructions.

3.05 - PROTECTION

- A. Protect finished work from damage until project is accepted by the Owner.

END OF SECTION

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Modified bituminous sheet waterproofing.
- B. Related Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 - PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.03 - ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
 - 1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
- C. Qualification Data: For Installer.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.04 - QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.05 - FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.06 - WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.
 - 1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

PART 2 - PRODUCTS**2.01 - MATERIALS, GENERAL**

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, from single source from single manufacturer.

2.02 - MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
 - b. Grace Construction Products; W.R. Grace & Co. -- Conn; Bituthene 4000.
 - c. Henry Company; Blueskin WP 100/200.
 - 2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.

- c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
- d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
- e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
- f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
- g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.

2.03 - AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.
- G. Protection Course: Molded-polystyrene board insulation, ASTM C 578, Type I, 0.90-lb/cu. ft. minimum density, 1-inch minimum thickness.

2.04 - MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core[and a polymeric film bonded to the other side]; and with a vertical flow rate of 9 to 15 gpm per ft..
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc; CCW MiraDRAIN 6000 for vertical applications and CCW MiraDRAIN 8000 for horizontal applications.
 - b. Grace Construction Products; W.R. Grace & Co. -- Conn; Hydroduct 660.

2.05 - INSULATION

- A. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, shiplap edged.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Dow Chemical Company (The); STYROFOAM Brand Tongue and Groove Insulation .
 - b. Owens Corning Insulating Systems LLC.
 - c. Pactiv Corporation.
 - 2. Type VI, 40-psi minimum compressive strength.

PART 2 - EXECUTION**3.01 - EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 - SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

- F. Bridge and cover expansion joints with overlapping sheet strips of widths according to manufacturer's written instructions.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
 - b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.03 - MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Horizontal Application: Apply sheets from low to high points of walls to ensure that laps shed water.
- E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- F. Seal edges of sheet-waterproofing terminations with mastic.
- G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- I. Immediately install protection course with butted joints over waterproofing membrane.
 - 1. Board insulation may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.04 - MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install board insulation protection course before installing drainage panels.

3.05 - INSULATION INSTALLATION

- A. On vertical surfaces, set insulation units in adhesive or tape applied according to manufacturer's written instructions.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.06 - FIELD QUALITY CONTROL

- A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.
- B. Owner will engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.
- C. Prepare test and inspection reports.

3.07 - PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Foamed-insulation-core concealed fastener metal wall panels, with related metal trim and accessories.

1.02 - RELATED SECTIONS

- A. Section 05120 - Structural Steel Framing.
- B. Section 05400 – Cold-Formed Metal Framing.
- C. Section 07620 – Sheet Metal Flashing and Trim.

1.03 - REFERENCED STANDARDS

- A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:
 - 1. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
 - 2. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
- B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM): www.astm.org:
 - 1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 3. ASTM A 792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. ASTM A 240 – Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

5. ASTM C 518 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
6. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
7. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
8. ASTM D 1622 - Apparent Density of Rigid Cellular Plastics.
9. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
10. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
11. ASTM D 6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics
12. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
13. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.
14. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
15. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
16. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

D. National Fire Protection Association (NFPA)

1. NFPA 259 – Test Method for Potential Heat of Building Materials.
2. NFPA 285 – Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies.
3. NFPA 286 – Fire Test of Evaluating Conditions of Wall and Ceiling Finish to Roof Fire Growth.

E. FM Global (FM): www.fmglobal.com:

1. FM 4880 American National Standard for Evaluating Insulated Wall and Roof/Ceiling Assemblies
2. FM 4881 Approval Standard for Class 1 Exterior Wall Systems.

1.04 - QUALITY ASSURANCE

- A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer approved under an accredited third-party quality control program
- B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum ten years' experience in the manufacturing of similar products and successful use in similar applications.
 1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements.
 - b. Samples of each component.
 - c. Sample submittal from similar project.
 - d. Project references: Minimum of five installations not less than five years old, with Owner and Architect contact information.
 - e. Sample warranty.
 - f. Certificate from an accredited third-party Quality Control Program.
 2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements
 3. Approved manufacturers must meet separate requirements of Submittals Article.
- C. Installer Qualifications: Experienced Installer [certified by metal panel manufacturer] with minimum of five years' experience with successfully completed projects of a similar nature and scope.
 1. Installer's Field Supervisor: Experienced mechanic [certified by metal panel manufacturer] supervising work on site whenever work is underway.

1.05 - ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.
 - 1. Coordinate building framing in relation to metal panel system.
 - 2. Coordinate openings and penetrations of metal panel system.

1.06 - ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products.
- B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.
 - 1. Include data indicating compliance with performance requirements.
 - 2. Indicate points of supporting structure that must coordinate with metal panel system installation.
 - 3. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.
- C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification:
 - 1. Provide 12-inch long section of each metal panel profile.
 - 2. Provide color chip verifying color selection.

1.07 - INFORMATIONAL SUBMITTALS

- A. Product Test Results: Indicating compliance of products with requirements.
- B. Qualification Information: For Installer
- C. Warranty:

1. Submit manufacturer's written two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.
2. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

1.08 - CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.09 - DELIVERY, STORAGE, AND HANDLING

- A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping. Protect painted surfaces with a protective covering before shipping.
 1. Deliver, unload, store, and erect metal panels and accessory items without deforming panels or exposing panels to surface damage from weather or construction operations.
 2. Store in accordance with Manufacturer's written instructions.
 3. Shield foam insulated metal panels from direct sunlight until all components are installed.

1.10 - WARRANTY

- A. Special Manufacturer's Warranty: Submit Manufacturer's two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.
- B. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.
- C. Special Panel Finish Warranty: Submit Manufacturer's limited warranty on the exterior paint finish for adhesion to the metal substrate and limited warranty on the exterior paint finish for chalk and fade.
 1. Fluoropolymer Two-Coat System:

- a. Color fading per Hunter units per ASTM D 2244.
- b. Chalking in excess of [8] rating per ASTM D 4214.
- c. Failure of adhesion, peeling, checking, or cracking.

PART 2 - PRODUCTS

2.01 - MANUFACTURER

- A. Basis of Design Manufacturer: Metl-Span, a Division of NCI Group, Inc.; Lewisville, Texas Tel: (972) 221-6656. www.metlspan.com.
- B. Provide basis of design product, or comparable product approved by Architect prior to bid.

2.02 - PERFORMANCE REQUIREMENTS

- A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.
- B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E 72 or ASTM E 1592 applied in accordance with ICC AC 04, Section 4, Panel Load Test Option or Section 5, Panel Analysis Option:
 - 1. Wind Loads: Determine loads based on applicable building code, wind speed, importance factor, exposure category, and internal pressure coefficient indicated on drawings.
 - a. Wind Negative Pressure: Certify capacity of metal panels by testing of proposed assembly.
 - 2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/240 of the span with no evidence of failure.
- C. FM Approvals Listing: Comply with FM Approval 4881. Provide metal wall panel assembly listed in FM Approvals' "Approval Guide."
- D. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by indicated test standard as applied by testing and inspection agency acceptable to authorities having jurisdiction.

1. Surface-Burning Characteristics: The insulating core shall have been tested per ASTM E 84. The core shall have:
 - a. Flame spread index: 25 or less.
 - b. Smoke developed index: 450 or less.
 2. Room Test Performance: FM Global 4880: The panel assembly shall not support a self-propagating fire which reaches any limits of the 50' high corner test structure as evidenced by flaming or material damage of the ceiling of the assembly.
 3. Fire Propagation: The fire assembly shall meet the requirements of the standard for NFPA 285
 4. Fire Growth: The fire assembly shall meet the requirements of the standard for NFPA 286
 5. Potential Heat: Determined in accordance with NFPA 259
 - a. Fire Endurance Tests of Building Construction and Materials: The composite panel shall have to be tested per CAN/ULS S101. Meets 15 minute stay in place requirement.
 - b. Fire Test of Exterior Wall Assemblies. The composite panel shall have to be tested per CAN/ULS S134. Complies with the fire
 6. New York State Building Code Chapter 26: Panel Performance under the above test methods, shall meet the requirements of New York State Building Code, Chapter on foam plastics.
- E. Air Infiltration, ASTM E 283:
1. Maximum 0.01 cfm/sq. ft. at static-air-pressure difference of 20 lbf/sq. ft.
- F. Water Penetration Static Pressure:
1. ASTM E 331: No uncontrolled water penetration at a static pressure of 20 lbf/sq. ft.
 2. ASTM E 331 Modified (2 hour duration): No uncontrolled water penetration at a static pressure of 6.24 lbf/sq. ft.

- G. New York State Building Code Compliance: Provide insulated metal wall panels complying with requirements for installation under New York State Building Code outside of high velocity wind zone.
- H. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

2.03 - INSULATED METAL WALL PANELS

- A. Concealed Fastener, Insulated Metal Wall Panels with foam core: Structural metal panels consisting of flat exterior metal sheet with 7.2 rib pattern, and interior metal sheet with mesa profile, with factory foamed-in-place polyurethane core in thermally-separated profile, with tongue-and-groove panel edges, attached to supports using concealed fasteners.
 - 1. Basis of Design: Metl-Span, CF 7.2 Insul-Rib
 - 2. G-90 galvanized coated steel conforming to ASTM A 653 and/or AZ50 aluminum-zinc alloy coated steel, conforming to ASTM A 792, minimum grade 33, prepainted by the coil-coating process per ASTM A 755.
 - a. Exterior Face Sheet: 22 gauge thickness, with stucco embossed surface.
 - 1) Finish: Fluoropolymer two-coat system.
 - 2) Color: As selected by Architect from manufacturer's standard colors.
 - b. Interior Face Sheet: 24 gauge thickness, with stucco embossed surface and Mesa profile
 - 1) Finish: Fluoropolymer two-coat system
 - 2) Color: As selected by Architect from manufacturer's standard colors
 - 3. Panel Width: 36 inches
 - 4. Panel Thickness: 3 inch. Panel thickness measured from inside skin to top of high cell.
 - 5. Insulating Core: Polyurethane with zero ozone depletion potential blowing agent
 - a. Closed Cell Content: 90% or more as determined by ASTM D 6226

- b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 15 psi as determined by ASTM D 1621
 - c. Minimum Density: 2.0 pcf as determined by ASTM D 1622
 - d. Thermal Resistance R-Value: 12.29 hr * sq. ft./Btu per ASTM C 518 at 75 degrees Fahrenheit mean temperature.
 - 6. Heat Transfer Coefficient (U-factor): 0.0814 Btu/hr * sq. ft. * deg. F as determined by ASTM C 1363 at 75 degrees Fahrenheit mean temperature. Tested specimen must include at least two engaged side joints. For actual overall R and U values, refer to the Technical Bulletins on metlspan.com
- B. Concealed Fastener, Insulated Metal Wall Panels with foam core: Structural metal panels consisting of flat exterior metal sheet with the look of precast concrete finish, and interior metal sheet with a light mesa profile, with factory foamed-in-place polyurethane core in thermally-separated profile, with tongue-and-groove panel edges, attached to supports using concealed fasteners.
- 1. Basis of Design: Metl-Span, CF Tuff-Cast
 - 2. G-90 galvanized coated steel conforming to ASTM A 653 and/or AZ50 aluminum-zinc alloy coated steel, conforming to ASTM A 792., minimum grade 33, prepainted by the coil-coating process per ASTM A 755.
 - a. Exterior Face Sheet: 22 gauge thickness, with stucco embossed surface
 - 1) Finish: Fluoropolymer two-coat system.
 - 2) Color: As selected by Architect from manufacturer's standard colors.
 - b. Interior Face Sheet: 24 gauge thickness, with stucco embossed surface and a Light Mesa profile.
 - 1) Finish: Fluoropolymer two-coat system
 - 2) Color: As selected by Architect from manufacturer's standard colors
 - 3. Panel Width: 42 inches.
 - 4. Panel Thickness: 4 inches.

5. Insulating Core: Polyurethane with zero ozone depletion potential blowing agent
 - a. Closed Cell Content: 90% or more as determined by ASTM D 6226
 - b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 15 psi as determined by ASTM D 1621
 - c. Minimum Density: 2.0 pcf as determined by ASTM D 1622
 - d. Thermal Resistance R-Value: 32.57 deg. F * hr * sq. ft./Btu per ASTM C 518 at 75 degrees Fahrenheit mean temperature.
6. Heat Transfer Coefficient (U-factor): 0.0307 Btu/hr * sq. ft. * deg. F as determined by ASTM C 1363 at 75 degrees Fahrenheit mean temperature. Tested specimen must include at least two engaged side joints.

2.04 - METAL WALL PANEL ACCESSORIES

- A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.
- B. Flashing and Trim: Match material, thickness, and finish of metal panels.
- C. Panel Clips: ASTM A 653, G90 hot-dip galvanized zinc coating, one-piece, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.
- D. Panel Fasteners: Self-drilling or Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.
- E. Joint Sealers:
 1. Sealants: Provide Tape Mastic Sealants, Non-skinning sealants, and Urethane Sealants in accordance with manufacturers standards
 2. Vertical Joint Gasket: Manufacturers standard EPDM gasket. Color: Black.

2.05 - FABRICATION

- A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Fabricate metal panel joints configured to accept sealant providing weathertight seal.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.06 - FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
- B. Exterior Face Sheet Coil-Coated Finish System
 - 1. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621, [meeting solar reflectance index requirements].
 - a. Basis of Design: Metl-Span, Fluoropolymer.
- C. Interior Face Sheet Coil-Coated Finish System
 - 1. Silicone-Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat

PART 3 - EXECUTION**3.01 - EXAMINATION**

- A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.
 - 1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.
 - 2. Panel Support Tolerances: Confirm that metal panel supports are within tolerances acceptable to metal panel manufacturer but not greater than the following:
 - a. 1/4 inch in 20 foot in any direction.

- b. 3/8 inch over any single wall plane.
 - c. Girt Spacing 8 feet or more: 1/4 inch out only.
 - d. Girt Spacing Less Than 8 feet : 1/8 inch out only.
 - e. CF Architectural girt spacing less than 4 feet: 1/16 inch out only.
- B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.02 - METAL PANEL INSTALLATION

- A. Concealed-Fastener Insulated Metal Panels with foam core: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- B. Attach panels to metal framing using screws, fasteners, sealants, and adhesives recommended for application by metal panel manufacturer.
- 1. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer.
 - 2. Cut panels in field where required using manufacturer's recommended methods.
 - 3. Provide weatherproof jacks for pipe and conduit penetrating metal panels.
 - 4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer
- C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers
- D. Joint Sealers: Install sealants where indicated and where required for weatherproof performance of metal panel assemblies
- 1. Seal panel base assembly, openings, panel head joints, and perimeter joints using sealants indicated in manufacturer's instructions
 - 2. Seal wall panel joints; apply continuously without gaps in accordance with manufacturer's written instructions, approved shop drawings, and project drawings

3. Prepare joints and apply sealants per requirements of Division 07 Section.

3.03 - ACCESSORY INSTALLATION

- A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.
 1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
 2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
 3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.04 - FIELD QUALITY CONTROL

- A. Testing Agency; Engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.
- B. Water-Spray Test: After completing portion of metal panel assembly including accessories and trim, test 2-bay area selected by Architect for water penetration, according to AAMA 501.2.

3.05 - CLEANING AND PROTECTION

- A. Remove temporary protective films immediately in accordance with metal panel manufacturer's instructions. Clean finished surfaces as recommended by metal panel manufacturer.
- B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 – SUMMARY OF THE WORK****A. Scope:**

1. Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified and required to furnish and install modified bituminous roofing with manufacturer's standard twenty year no-dollar-limit guarantee and Contractor's two-year guarantee.
2. Modified bitumen membrane roofing as specified herein shall include, but not be limited to, preparation of subsurface, chemically adhered styrene butadiene styrene modified bituminous membrane, roof flashing application, scupper drains, roof insulation and cover board, vapor barrier and appurtenances.
3. Modified bitumen membrane roofing shall be provided where shown on the Contract Drawings, specified, or as required for a complete installation.
4. Types of products required include the following:
 - a. Vapor barrier and accessory materials.
 - b. Asphalt-glass ply felts.
 - c. Asphalt-glass venting base sheets.
 - d. Asphalt bitumen.
 - e. Surfacing aggregate.
 - f. Base flashing materials and protective coatings.
 - g. Roofing cement.
 - h. Walkway protection pads.
 - i. Roof expansion joint system.
 - j. Miscellaneous accessories and materials.

B. Coordination:

1. Review installation procedures under other Sections and coordinate installation of items that must be installed with built-up bituminous roofing Work.
2. Coordinate installation of roof insulation and associated Work to provide complete system complying with combined recommendations of manufacturers and installers involved in the Work.
3. Cooperate with inspection and test agencies engaged by Owner, or otherwise required to perform services, in connection with built-up bituminous roofing and associated Work.

C. Related Sections:

1. Section 03300 – Cast-In-Place Concrete
2. Section 06071 – Treated Timber and Lumber.
3. Section 06100 – Rough Carpentry.
4. Section 07111 – Bituminous Damp-proofing.
5. Section 07461 – Preformed Metal Siding.
6. Section 07620 – Sheet Metal Flashing and Trim.
7. Section 07920 – Joint Sealants.

1.02 – REFERENCED STANDARDS

- A. ASTM C165, Standard Test Methods for Measuring Compressive Properties Thermal Insulations.
- B. ASTM C203, Test Methods for Breaking Load and Flexural Properties of Block Type Thermal Insulation.
- C. ASTM C209, Test Methods for Cellulosic Insulating Board.
- D. ASTM C836, Specification for High Solids Content, Cold Liquid Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
- E. ASTM C1177, Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- F. ASTM C1289, Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- G. ASTM D36, Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus).

- H. ASTM D412, Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
- I. ASTM D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- J. ASTM D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2008
- K. ASTM D2126, Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- L. ASTM D2178, Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
- M. ASTM D2240, Test Method for Rubber Property – Durometer Hardness.
- N. ASTM D2829, Practice for Sampling and Analysis of Built-up Roofs.
- O. ASTM D4060, Standard Test Method for Abrasive Resistance of Organic Coatings by the Taber Abraser.
- P. ASTM D6083, Specification for Liquid Applied Acrylic Coating Used in Roofing.
- Q. ASTM D6162, Specification for SBS Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
- R. ASTM D6221, Specification for Reinforced Bituminous Flashing Sheets for Roofing and Waterproofing.
- S. ASTM E96, Standard Test Method for Water Vapor Transmission of Materials.
- T. Federal Specification HH-I-1972/Gen and HH-I-1972/2: Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate.
- U. FM Approval Guide.
- V. FM Loss Prevention Data 1-28R/1-29R, Roof Systems.
- X. FM Loss Prevention Data 1-28, Wind Loads to Roof Systems and Roof Deck Securement.
- Y. FM Loss Prevention Data 1-29, Above-deck Roof Components.
- Z. FM 4450, Class 1 Insulated Steel Deck Roofs.
- AA. FM 4470, Class 1 Roof Covers.
- BB. National Roofing Contractors Association (NRCA), NRCA Roofing and Waterproofing Manual.

CC. NRCA Roofing Materials Guide.

DD. UL Roofing Materials and Systems Directory.

EE. ULC-S704-01, Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.

FF. OSHA Occupational Safety and Health Administration

1.03 – QUALITY ASSURANCE

A. Qualifications:

1. Installer:

- a. Engage a single experienced roofing contractor as installer, skilled and with successful, documented experience in type of roofing and associated Work required and equipped to perform workmanship per recognized standards so that there will be undivided responsibility for performance of the Work.
- b. Installer of roofing and associated Work shall be franchised and a licensed applicator of roofing manufacturer and authorized to install built-up bituminous roofing systems with no-dollar-limit twenty year guarantees, or otherwise accepted in writing by roofing materials manufacturer for installation of fully guaranteed or bonded roofing.
- c. Installer shall have at least five years' experience with roofing projects of a magnitude equivalent to the required Work.

B. Component Supply and Compatibility:

1. Obtain primary roofing felts and asphalt bitumen from only one manufacturer, who publishes complete information on specified built-up bituminous roofing system, and offers to bond completed roofing installation per the Contract Documents. Obtain all secondary and associated materials from sources acceptable to manufacturer of the primary built-up bituminous roofing materials.

C. Pre-Roofing Meeting:

1. Prior to installing built-up bituminous roofing and associated Work, schedule and conduct pre-roofing meeting at Site with roofing installer, installer of each component of associated Work, installers of deck and substrate construction to receive roofing Work, installers of other work in and around roofing that will follow roofing Work, including

mechanical work (if any), Architect, and other representatives directly concerned with performance of the Work, including where applicable, insurers, test agencies, product manufacturers, authorities having jurisdiction, and Owner. Record discussions of pre-roofing meeting and decisions, agreements, and disagreements and provide copy of the record to each party attending. Review foreseeable methods and procedures related to roofing Work including:

- a. Review Project requirements, including Drawings, Specifications, and other Contract Documents.
 - b. Review required submittals, both completed and yet to be completed.
 - c. Review status of substrate including drying, structural loading limitations, and similar considerations.
 - d. Review availability of materials, products, tradesmen, equipment, and facilities required for avoiding delays.
 - e. Review required inspection, testing, certifying, and accounting procedures.
 - f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - g. Review Laws and Regulations and code compliance, environmental protection, fire, and similar considerations.
 - h. Review procedures required for protection of roofing during remainder of construction.
2. Reconvene pre-roofing meeting at earliest opportunity if additional information must be developed to conclude subjects under consideration.
 3. Record revisions or changes agreed upon, reasons for revisions or changes, and parties agreeing or disagreeing with them.

1.04 – SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Layout drawings of the proposed roofing system.

- b. Submit accurate layout of tapered insulation, designed and provided by the membrane manufacturer, showing the slopes to the drains.
 - 1) Show the cross section drawings illustrating the location and thickness of tapered insulation pieces and filler pieces.
 - 2) Show the thickness of the insulation system at high and low points.
 - c. Submit a scaled accurate layout of the wood nailers showing their required locations, and required spacing between nailers. Show the direction of the laps in relation to the slope of the deck and the wood nailers.
2. Product Data:
- a. Catalog Cuts, Specifications, installation instructions, and general recommendations from roofing materials manufacturer, for each type of roofing product required. Include manufacturer's data substantiating that products comply with the Contract Documents.
3. Samples:
- a. Labeled samples of each layer of roof membrane, flashing, roof drain, reglet, insulation, coverboard, and three of each type of fasteners. Samples will be reviewed by Architect.
 - b. Compliance with other requirements is responsibility of Contractor.
- B. Informational Submittals: Submit the following:
1. Certificates:
- a. Manufacturer's certification indicating that bulk bituminous materials (if any) delivered to the Site complies with required standards. Include statistical and descriptive data for each product. Indicate date obtained from manufacturer, where held and how transported prior to final heating and application on roof. Submit certificate with each load before load is used; or arrange with Architect for submittal of blanket certification to follow the last load, listing dates, quantities, and other statistical data for each load.
 - b. Asphalt Confirmation Number (ACN) for guaranteed Work as required by primary built-up bituminous roofing manufacturer.

- c. Submit continuous log showing time of heating and equiviscous temperature range for each load of bulk bitumen used in the Work.
 - d. Provide letter from the roofing membrane certifying the proposed roofing assembly, compatibility of materials and total R-value of the insulation system meets New York State Building Code.
 - e. Applicator Approval: The Contractor shall submit a document from the modified bitumen membrane roofing manufacturer stating that the subcontractor is an approved applicator for the specified materials. Include the following submittals for approval of the applicator:
 - 2. Field Quality Control Submittals: Submit the following:
 - a. Softening point test reports on daily samples of bitumen on the Project.
 - b. Research or evaluation reports indicating that products specified meet required ASTM standards and building code requirements in addition to FM and UL approvals listed in this Section.
 - c. Field tests as required by Owner's insurance carrier.
 - d. Results of specified field quality control tests and inspections, including roof drain and leader test and roof system flood test.
 - 3. Product manufacturer's installation instructions.
- C. Closeout Submittals: Submit the following:
- 1. Warranty:
 - a. Copies of two-year roofing warranty in form and content indicated by printed form attached to this Section, covering built-up bituminous roofing and associated Work as indicated, signed by Contractor and installer.
 - b. Copies of manufacturer's no-dollar-limit twenty-year roofing and flashing bond.

1.05 – DELIVERY, STORAGE, AND HANDLING

- A. Delivery of Products:

1. Deliver products in manufacturer's original, dry, unopened and undamaged containers and rolls, with labels intact and legible, and with designations as shown on approved Shop Drawings.
2. Deliver to Site products requiring fire-resistance classification with labels attached and packaged as required by labeling service.
3. Deliver materials in sufficient quantity to allow continuity of the Work.
4. Materials shall not be delivered to the project site before the time of installation.

B. Storage of Products:

1. Store roofing materials in a dry, well ventilated, weathertight place in manner that ensures that there is no possibility of moisture pick-up or other contamination. Remove wet and soiled materials from Site and do not use them in the Work.
2. Do not leave unused felts overnight on roof and when roofing Work is not in progress.
3. Store in manner that complies with fire and safety Laws and Regulations.
4. Store emulsions at temperatures above 40 degrees F.
5. Store materials on clean raised platforms with weather protective covering when stored outdoors.
6. Store rolled goods on end.
7. Keep combustible materials away from ignition sources.

C. Handling of Products:

1. Handle rolled goods to prevent damage to edges and ends.
2. Select and operate product handling equipment to not damage existing construction, built-up bituminous roofing, and system components already in place.
3. Materials shall be handled in such a manner so as to prevent inclusion of foreign materials.

1.06 – JOB CONDITIONS

A. Environmental Conditions:

1. Proceed with roofing and associated Work only when weather conditions will allow unrestricted use of products and quality control of the Work being installed, complying with the Contract Documents and recommendations of roofing products manufacturers.
2. Proceed only when Contractor and installer guarantee the Work as required and without reservations and restrictions.
3. Membrane Protection: Provide protection against straining and mechanical damage for newly applied roofing and adjacent surfaces throughout this project.
4. Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions, warranty and guarantee requirements.
 - a. Do not start roofing if rain is imminent, or ambient pressure is below 50°F, or to a damp, frosty, snow covered, or contaminated surface.
 - b. If rain occurs during roof membrane application, cease operations and protect deck, insulation, penetrations and membrane from water damage and intrusion.
5. Flame-heated Equipment:
 - a. Locate and use flame-heated equipment so as not to endanger the structure or other materials on the site or adjacent property. Location of flame -heated equipment shall be reviewed by Architect.
 - b. Do not place flame-heating equipment on roof.
 - c. Provide and maintain fire extinguisher at flame-heating equipment, staging area and on roof. Comply with all fire regulations. Ensure properly rated, charged and inspected fire extinguishers are on roof and staging area.
6. Limited Access: Prevent access by the public to materials, tools and equipment during the course of this project.
7. Debris Removal: remove all debris daily from the project site and take to a legal dumping area authorized to receive such materials.

1.07 – SCHEDULING

- A. Proceed with the roofing and associated Work after curbs, blocking, nailer strips, vents, and other projection through the substrate have been installed, following completion of substrate construction and framing of openings.
- B. Proceed with and complete the Work only when products, equipment, and tradesmen required for installing vapor barrier, roof insulation, cover boards, and roofing membrane system are at the Site and ready to follow with the Work immediately (same day) for a complete roofing system.
- C. Provide roofing and associated Work in manner that ensures a complete roofing system at end of each day's work. Do not advance installation of one material beyond that necessary for proper sequencing of the Work.
- D. Notification: Give a minimum of 5 days notice to the Architect and manufacturer prior to commencing any work and notify both parties on a daily basis of any change in work schedule.
- E. Safety: Familiarize every member of the application crew with all fire and safety regulations recommended by OSHA, NRCA and other industry or local governmental groups.

1.08 – WARRANTIES

- A. The Contractor shall furnish a written, single source warranty for 25 years from the date of Substantial Completion covering all system components, which shall agree that, during the warranty period, prompt repair or replacement of defective materials shall be made without additional cost to the County. In addition, the warranty shall cover the following:
 - 1. Single-Source special guarantee includes roofing piles, base flashings, liquid applied flashing, roofing membrane accessories, granule surfaced roofing membrane, roof insulation, fasteners, cover board, vapor retarder, walkway products, manufacturer's expansion joints, manufacturer's edge metal products, and other single-source components of roofing system marketed by the manufacturer.
 - 2. Guarantee Period: 25 years from the date of substantial completion.
 - 3. Hail rider: Guarantee shall have no exclusions for hail events up to 1.5 inches.
 - 4. Accidental Puncture Rider: Guarantee shall provide coverage for accidental puncture for up to 16 billed repair hours per year for the life of the guarantee.
- B. Installer's Guarantee: Submit Roofing Installer's guarantee, signed by Installer, covering work of this section, including all components of roofing system, for the following guarantee period:

1. Guarantee Period: Two (2) years from the date of substantial completion.

C. Guarantee Label:

1. Manufacturer shall furnish a guarantee label to be mounted by Contractor at building or other prominent location as directed by Architect.
2. Label shall be 8.5 inches by 11 inches minimum size and be laminated in a transparent enclosure for permanent protection, framed in suitable aluminum frame with clear glass front, and secured where directed by Architect.
3. Label shall contain the following information:
 - a. Type of system.
 - b. Name and address of manufacturer.
 - c. Name, address, and phone number of manufacturer's local representative.
 - d. Name, address, and phone number of Contractor.
 - e. Statement of warranty and its effective date.
 - f. Cautions and warnings against specific actions or types of misuse that will affect the guarantee or warranty.

PART 2 – PRODUCTS

2.01 – SYSTEM PERFORMANCE

A. System Description:

1. Built-up bituminous roofing system is defined to include thermal barrier, vapor barrier, roof insulation, cover board layers, one base ply sheet, and three additional plies of asphalt impregnated glass fabric roofing felts, layers of hot-applied asphalt bitumen, hot-applied asphalt flood coats with embedded aggregate, associated composition flashing and stripping, walkway protection course, and other auxiliary items, if any, embedded in the Work, as specified in the Contract Documents.
2. Complete system shall be field-fabricated into an assembly consisting of layers of waterproofing bitumen alternating with plies of reinforcing felts with gravel surfacing embedded in flood coats of hot bitumen. Roofing accessories, where required, shall be

flashed into the Work using manufacturer's recommended composition base flashing materials in an assembly that maintains bond specified.

3. Concrete:
 - a. Two ply fiberglass Vapor Barrier in hot-applied asphalt bitumen.
4. Insulation:
 - a. Bottom layer of Polyisocyanurate in hot-applied asphalt bitumen.
 - b. Top layer of perlite coverboard in hot-applied asphalt bitumen.
5. Roof Membrane:
 - a. Minimum three ply roof system
 - 1) Base and inner ply of fiberglass felt in hot asphalt bitumen.
 - 2) Cap membrane layer of polyester and fiberglass composite reinforced SBS, granulated cap membrane with pre-applied White Acrylic coating in hot-applied asphalt bitumen.

B. Performance Criteria:

1. Built-up bituminous roofing system shall be complete, continuous, and permanent, vapor-, weather-, and water-resistant barrier assembled using compatible components that resist, without failure, passage of water and withstand wind loads, thermally induced movements, and exposure to weather.
2. Provide built-up bituminous roofing, base flashings, and component materials that comply with FM 4450 and FM 4470 as part of roofing system and that are listed in FM's Approval Guide for Class 1, noncombustible construction. Identify materials with FM markings.
3. Provide materials and roofing systems that have been tested, listed, and labeled by UL for Class A rating, and bear the UL label on each package of materials shipped to Site, with a UL certificate of compliance.
4. Provide materials and roofing systems tested, listed and FM labeled for Class 1 rating.
5. Provide built-up bituminous roofing with Windstorm Resistance Classification rating of Class 1-90 in compliance with FM standards.

- C. Provide built-up bituminous roofing system, acceptable for use over manufacturer-approved substrates, and on slopes-to-drain up to three inches per foot. Installed weight of built-up bituminous roofing system shall not exceed 250 pounds per square.
- D. Provide a membrane roofing system that is identical to systems that have been successfully tested by qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7-02 or FM Loss Prevention Data 1-28 and 1-29, whichever is stricter.
- E. Source Limitations: Obtain all components from the single-source roofing system manufacturer guaranteeing the roofing system. All products used in the system shall be labeled by the single-source roofing manufacturer issuing the guarantee.

2.02 – MANUFACTURERS

- A. Products and Manufacturers: Provide one of the following:
 - 1. Johns Manville Roofing Systems Group
 - 2. CertainTeed Commercial Roofing Systems.
 - 3. Carlisle Syntec Systems.

2.03 – MATERIALS

- A. Vapor Retarder:
 - 1. Asphaltic: An asphalt coated, fiberglass ply felt produced by impregnating a high strength fiber glass mat with asphalt and subsequently treating with a unique liquid parting agent. The top surface is imprinted with laying lines..
 - a. Referenced Standard: ASTM D 2178, Type VI
 - b. Typical Physical Properties:
 - 1) Breaking Strength, minimum
 - i. Longitudinal (With the Fiber Grain): 60.0 lbf/inch
 - ii. Transverse (Across the Fiber Grain): 60.0 lbf/inch
 - 2) Pliability, ½ inch Radius Bend: No failures
 - 3) Net Dry Mass of Asphalt-impregnated Glass Felt

- i. Average of All Rolls: 7.0 lbs./100 ft² minimum
 - ii. Individual Rolls: 6.0 lbs./100 ft²
 - 4) Moisture at Time of Manufacture: 1.0% maximum
 - 5) Mass of Desaturated Glass Felt: 1.9 lbs./100 ft² minimum
 - 6) Bituminous Saturant (Asphalt): 3.0 lbs./100 ft² minimum
 - 7) Ash: 70-88%
 - 8) Parting Agent and Stabilizer: 3.0 lbs./100 ft² maximum
 - 2. Vapor Retarder Securement:
 - a. Adhered:
 - 1) Manufacturer's approved sheet .
- B. Roof Insulation:
- 1. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, select from manufacturer's standard sizes and of thicknesses indicated.
 - 2. Tapered Polyisocyanurate System:
 - a. A sloped, rigid roof insulation board composed of a closed cell polyisocyanurate foam core bonded in the foaming process to universal fiberglass reinforced facers. Provide to promote positive drainage.
 - b. Reference Standard
 - 1) ASTM C 1289
 - 2) Federal Specification HH-I-1972/Gen and HH-I-1972/2
 - 3) CAN/ULC-S704-01, Type 3, Class 2 (See CCMC Evaluation Report 13058-L)
 - c. Typical Physical Properties

- 1) Nominal Tapered Slope: 1/4 : 12
 - 2) ASTM C 209, Water Absorption (5 by Volume – 2 hours): 1 maximum
 - 3) ASTM D 2126, Dimensional Stability Change (7 days @ 158F, 90-100% RH
 - i. Lengthwise: <2%
 - ii. Crosswise: <2%
 - 4) ASTM D 1621, Compression Resistance (10% Consolidation): 20 psi (138 kPa) nominal
 - 5) ASTM C 209, Product Density – 2.0 pcf
 - 6) ASTM E 96, Moisture Vapor Transmission: <1 perm
 - 7) Service Temperature: -100 to 250°F
3. Thermal Layer Securement:
- a. Adhered
 - 1) Manufacturer's approved asphalt
- C. Cover Board:
1. Perlite: A homogenous insulation board, composed of expanded perlite, blended with selected binders and fibers. Provide with the top surface of the board sealed with an asphalt absorption resistive coating
 - a. Referenced Standard: ASTM C 728
 - b. Typical Physical Properties
 - 1) Nominal Thickness ¾ inch
 - 2) ASTM C 209, Water Absorption (% by Volume- 2 hours) 1.5 maximum
 - 3) ASTM C 165, Compression Resistance:
 - i. 5% Consolidation: 30 psi

- ii. 10% Consolidation: 40 psi
 - 4) ASTM C 209, Laminar Strength – 7 psi
 - 5) ASTM C 203, Flexural Strength – 65 psi
 - 6) ASTM C 209, Product Density – 9 pcf
 - 7) ASTM C 209, Dimensional Stability: 0.5% maximum
 - 2. Cover Board
 - a. Mechanically fastened to concrete deck.
- D. Membrane Layers:
 - 1. Ply Sheets:
 - a. An asphalt-coated, fiberglass ply felt produced by impregnating a fiberglass mat with asphalt and subsequently treating with a liquid parting agent. Provide with laying lines on the top surface.
 - b. Referenced Standard: ASTM D 2178, Type VI
 - c. Typical Physical Properties:
 - 1) Breaking Strength, minimum
 - i. Longitudinal (With the Fiber Grain): 60.0 lbf/inch
 - ii. Transverse (Across the Fiber Grain): 60.0 lbf/inch
 - 2) Pliability, 1/2 inch (13 mm) Radius Bend: No Failures
 - 3) Net Dry Mass of Asphalt-impregnated Glass Felt
 - i. Average of All Rolls: 7.0 lbs./100 ft² minimum
 - ii. Individual Rolls: 6.0 lbs./100 ft²
 - 4) Moisture at Time of Manufacture: 1.0% maximum
 - 5) Mass of Desaturated Glass Felt: 1.9 lbs./100 ft² minimum

- 6) Bituminous Saturant (Asphalt): 3.0 lbs./100 ft² minimum
- 7) Ash: 70-88%
- 8) Parting Agent and Stabilizer: 3.0 lbs./100 ft² maximum

2. SBS Cap:

- a. An Elastic modified bitumen sheet incorporating a composite fiberglass/ polyester reinforced mat coated with a blend of Styrene-Butadiene-Styrene rubber, asphalt and fire retardant additives that is surfaced with a reflective white ceramic-coated granule surfacing on the side to be exposed to the weather
- b. Referenced Standard:
 - 1) ASTM D 6162, Type II, Grade G
- c. Typical Physical Properties:
 - 1) Thickness 160 mils (4 mm)
 - 2) Reflectivity: .76
 - 3) Emissivity: .85
 - 4) SRI: 92
 - 5) Tensile Strength @ 0°F.
 - i. Machine Direction: 150 lbs. force/in. width
 - ii. Cross Machine Direction: 105 lbs. force/in. width
 - 6) Elongation @ 0°F.
 - i. Machine Direction: 4.0%
 - ii. Cross Machine Direction: 4.0%
 - 7) Tensile-Tear
 - i. Machine Direction: 150 lbs./in.
 - ii. Cross Machine Direction: 125 lbs./in.

- 8) Low Temperature Flexibility: -10°F.
- 9) Dimensional Stability
 - i. Machine Direction: 0.20% change.
 - ii. Cross Machine Direction: 0.20% change.
- 3. Membrane Securement
 - a. Adhered:
 - 1) Manufacturer's approved asphalt.
- E. Flashings:
 - 1. Becker Flashing Sheets:
 - a. An asphalt-coated, fiber glass ply felt produced by impregnating a fiber glass mat with asphalt and subsequently treating with a liquid parting agent. Provide with laying lines on the top surface
 - b. Referenced Standard:
 - 1) ASTM D 2178, Type VI
 - c. Typical Physical Properties:
 - 1) Breaking Strength, minimum
 - i. Longitudinal (With the Fiber Grain): 60.0 lbf/inch.
 - 2) Pliability, ½ inch (13 mm) Radius Bend: No Failures
 - 3) Net Dry Mass of Asphalt-impregnated Glass Felt
 - i. Average of All Rolls: 7.0 lbs./100 ft² minimum
 - ii. Individual Rolls: 6.0 lbs./100 ft²
 - 4) Moisture at Time of Manufacture: 1.0% maximum
 - 5) Mass of Desaturated Glass Felt: 1.9 lbs./100 ft² minimum

- 6) Bituminous Saturant (Asphalt): 3.0 lbs./100 ft² minimum
- 7) Ash: 70-88%
- 8) Parting Agent and Stabilizer: 3.0 lbs./100 ft² maximum

2. Primary Flashing Sheet

- a. A premium elastomeric, modified bitumen flashing sheet incorporating a fiber glass/polyester composite mat in a blend of SBS (Styrene-Butadiene-Styrene) rubber and high quality asphalt that is surfaced with a reflective white ceramic-coated granule surfacing on the side to be exposed to the weather.
- b. Reference Standard
 - 1) ASTM D 6221, Type I
- c. Typical Physical Properties
 - 1) Thickness: 160 mils
 - 2) Reflectivity: .76
 - 3) Emissivity: .85
 - 4) SRI: 92
 - 5) Tensile Strength @ 0°F
 - i. Machine Direction: 190 lbs. force/in. width
 - ii. Cross Machine Direction: 150 lbs. force/in. width
 - 6) Elongation @ 0°F
 - i. Machine Direction: 4.0%
 - ii. Cross Machine Direction: 4.0%
 - 7) Tensile-Tear
 - i. Machine Direction: 225 lbs./in.
 - ii. Cross Machine Direction: 200 lbs./in.

- 8) Low Temperature Flexibility: -10°F
- 9) Dimensional Stability
 - i. Machine Direction: 0.20% change
 - ii. Cross Machine Direction: 0.20% change
- 3. Liquid Applied Flashing
 - a. A liquid and fabric reinforced flashing system created with a stitch bonded polyester scrim and a two-component, moisture cured, elastomeric, liquid applied flashing material, consisting of an asphalt extended urethane base material and an activator.
 - b. Typical Physical Properties
 - 1) ASTM D 412, Tensile Strength: 600 psi
 - 2) ASTM D 412, Elongation: > 300%
 - 3) ASTM E 96 Method E [100°F (38°C), 100 mil sheet, Permeability to Water Vapor: 0.03 perms
 - 4) Working Time* @ 75°F: 30 min
 - 5) Rainproof After* @ 75°F: 4 h
 - 6) ASTM D 2240, Hardness @ 77°F: 65 Shore A
 - 7) Crack Bridging After Heat Aging: 1/8"
 - 8) ASTM D 36, Softening Point, Ring and Ball: 275°F
 - 9) ASTM C 836 Elastomeric Waterproofing: Exceeds All Criteria
 - 10) ASTM D 4060, Abrasion Resistance: 1.2 mg Loss
- 4. Flashing Securement
 - a. Adhered
 - 1) Manufacturer's approved asphalt

F. Protective and Reflective Liquid Applied Systems:

1. Coatings:

- a. An Energy Star, CRRC, and LEED Certified, 2 coat white acrylic roof coating system.
- b. Reference Standard
 - 1) ASTM D 6083
- c. Typical Physical Properties
 - 1) Initial Tensile Strength: 235 psi
 - 2) Initial Elongation: 245 %
 - 3) Dry Adhesion: 8.5 pli
 - 4) Wet Adhesion: 3.5 pli
 - 5) Tear Resistance (lbf/in): >80 pli
 - 6) 1000-hr Accelerated Weathering: No Cracking or Checking
 - 7) Elongation After Accelerated Weathering: 230%
 - 8) Permeance: <15 perms
 - 9) Water Swelling: <10%
 - 10) Fungi Resistance (Zero = No Growth): Zero Rating
 - 11) Volume Solids: 55 ± 1%
 - 12) Weight Solids: 69 ± 1%
 - 13) Viscosity: 120 ± 10 KU
 - 14) Density: 11.8 Lbs/Gallon (1.42 gms/liter)
 - 15) Percent Non Volatiles 69 ± 1%

G. Accessories

1. Walk Pad: A preformed, skid resistant board consisting of modified asphalt, reinforcements and fillers with a ceramic granule surface on both sides.
- H. Roof Drain: See Specification Section 15160 – Roof Drains.
- I. Wood Nailers: PS 20 Dimension Lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS a APA Exterior Grade plywood; pressure preservative treated.
1. Width: 3 ½-inches (90mm), nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it. Thickness: AS indicated on the contract drawings or if not indicated thickness shall be the same as thickness of roof insulation.
 2. Flashing: In accordance with Section 07620 Sheet Metal Flashing and Trim. Seal to provide work associated with Section 07620 Sheet Metal Flashing and Trim.
 3. Seal to and coordinate with work of Section 07461 Preformed Metal Siding for conductor head and leader. Test of scupper drain connection pipe to work of Section 07461 Preformed Metal Siding conductor head and leader
- J. Caulking/Sealants: A single component, high performance, elastomeric sealant conforming to ASTM D232, or ASTM C920. Acceptable types are as follows: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to sealants specified in Section 07900.

PART 3 – EXECUTION

3.01 – INSPECTION

- A. With installer, examine substrate and conditions under which built-up bituminous roofing and associated Work will be performed and notify Architect in writing of unsatisfactory conditions. Do not proceed with roofing and associated Work until unsatisfactory conditions are corrected.
- B. Verify that roof openings and penetrations are in place, set, and braced, and that roof drains are properly clamped into position.

3.02 – PREPARATION

- A. Removals:
1. Remove all roofing membrane, surfacing, coverboards, insulation, fasteners, asphalt, pitch, adhesives etc.
 - a. Remove an area no larger than can be re-roofed in one day.

2. Tear out all the base flashings, counter flashings, pitch pans, pipe flashings, and vents and like components necessary for application of new membrane
 3. Remove abandoned equipment curbs, skylights, smoke hatches, and penetrations,
 - a. Install decking to match existing as directed by Owner's representative.
 4. Raise, (disconnect by licensed craftsmen, if necessary) all HVAC units and other equipment supported by curbs to conform with the following:
 - a. Modify curbs as required to provide a minimum 8" base flashing height measured from the surface of the new membrane to the top of the flashing membrane
 - b. Nail top of flashing and install new metal counter flashing prior to re-installation of unit.
 - c. Perimeter nailers must be elevated to match elevation of new roof insulation.
 5. Immediately remove all debris from roof surface. Demolished roof system may not be stored on the roof surface.
- B. Protection:
1. Provide continuous protection of products against wetting and moisture absorption.
 2. Protect products against damage by construction traffic.
 3. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work
 - a. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
 - b. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
 - c. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
 - d. Prevent materials from entering and clogging drains and conductors.

- e. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator.
- 4. Do not allow fluid or plastic materials to spill or migrate beyond surfaces of intended application.

C. Structural Concrete Surface Preparation

- 1. Inspect concrete deck closely for:
 - a. Smoothness,
 - b. Cracks over 1/8 inch,
 - c. Spalling,
 - d. Rust Staining,
 - e. Excessive Deflection,
 - f. Moisture,
- 2. Concrete surface shall have a wood float or fine broom finish and shall be free from fins, ridges, voids, or entrained air holes.
- 3. Ensure that wood blocking has been installed as detailed as in the plans and specifications.
- 4. Ensure that all counter-flashing receivers, curbs, etc., are constructed in such a manner as to provide a minimum 8' base flashing height measured from the finished roof's surface to the top of the base flashing membrane.
- 5. Unacceptable areas should be brought to the attention of the Owner's Representative and must be corrected prior to installation of roofing system.

D. Surface Preparation:

- 1. Clean substrate of projections and substances detrimental to the Work. Sweep or vacuum all surfaces, removing all loose aggregate and foreign substances prior to commencement of roofing.

2. Voids, rock pockets, and rough surfaces shall be repaired with approved non-shrink grout, or shall be ground to match the unrepaired areas.
3. Install cant strips and all accessories as shown, and as recommended by the prime materials manufacturer.
4. Prime the substrate if recommended by roofing materials manufacturer, and comply with manufacturer's recommendations.
5. All sealant shall be allowed to cure crack free.
6. Prime metal flanges (all jacks, edge metal, lead drain flashings, etc.) and concrete masonry surfaces with a uniform coating of ASTM D41 asphalt primer.
 - a. Primer shall be applied at all junctures of horizontal and vertical surfaces in strict accordance with the manufacturer's approved instructions, and shall be allowed to dry tack free for a minimum of one hour to a maximum of eight hours. Flashing shall be applied to a minimum height of 8 inches on the vertical surface, and 4 inches on the deck surface. Flashing shall be terminated in accordance with the manufacturer's recommended details.
 - b. A thin film of primer shall be applied in a 4-foot square area around all scupper drains, and allowed to dry for a minimum of one hour to a maximum of eight hours, over which a 3-foot square section of non-exposed type flashing material shall be installed, centered on drains and onto the deck. Splices or seams shall not be allowed within 3 inches of drains. Flashing shall be terminated under the drain clamping ring, and the inner portion of flashing shall be cut away. Flashing shall be pressed against the primed surface to ensure good adhesion.
7. Install treated wood nailers as required to nail felts of built-up roofing membrane. Provide nailers of same thickness as insulation, set between insulation units, and anchored to deck. Space nailers not more than 4.0 feet apart and running perpendicular to slope of roof deck, unless alternate spacing is recommended by the built-up bituminous roofing manufacturer. Refer to Section 06100, Rough Carpentry for wood nailer requirements.
8. Install vapor barrier under all built-up bituminous roofing. Comply with written installation instructions of vapor barrier manufacturer and as shown on approved submittals.
9. Eliminate air pockets and "fishmouths" from vapor barrier.
10. Provide complete continuity of vapor barrier, including flashings.

11. Repair penetrations in vapor barrier before installing insulation.

3.03 – INSULATION LIMITATIONS

- A. Do not apply hot bitumen under condition that would cause foaming. Comply with field quality control requirements specified in the Contract Documents.
- B. Plastic Insulation: Do not apply hot bitumen directly to plastic insulation. Install one layer of cover board specified where recommended by NRCA Roofing and Waterproofing Manual, Technical Bulletin No. 9 and primary roofing manufacturer, for bonded construction.
- C. Install cover board over roof insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together and fasten to roof deck according to built-up bituminous roofing manufacturer's written instructions. Tape all joints in top layer of cover boards. Stagger joints between layers.
- D. Shingling of Plies: Except as otherwise required by unusual circumstances or as otherwise specified or shown, lay plies of bituminous membranes with felts shingled uniformly to achieve required number of plies. Lap 36-inch felts 27.5-inches for four-ply Work. Shingle plies perpendicular to long joint of rigid insulation boards and cover boards.

3.04 – INSTALLATION

- A. Bitumen Heating:
 1. Comply with NRCA Technical Bulletin No. 2 for equiviscous temperature ranges for built-up bituminous roofing asphalt. Provide viscosity of 125 centipoises for mop application and 75 centipoises for mechanical spreader application. Do not exceed 25 degrees F above or below EVT range as determined immediately before application of interply asphalt to substrate.
 2. Do not raise temperature above minimum normal fluid-holding equiviscous temperature more than one hour prior to time of application. Discard bitumen that has been held at temperature exceeding 500 degrees F for period exceeding three hours. Keep kettle lid closed unless adding roofing asphalt.
 3. Do not heat bitumen above temperature required to ensure that application viscosity results in adequate mopping weight and maximum penetration, coverage, and adhesion of felt plies, and maximum adhesion to substrates.
 4. Determine flash point of bitumen, either by information from bitumen producer or by suitable tests, and determine maximum fire safe handling temperature and do not exceed

such temperature in heating bitumen in no case heat bitumen to temperature higher than 25 degrees F below flash point.

5. For aggregate-surfaced flood coats of bitumen, asphalt may be applied at lower temperatures than for interply moppings. Limit application temperature to minimum required for proper embedment of aggregate and maximum that will permit retention of an aggregate coating of weight specified in primary roofing manufacturer's approved built-up bituminous system specification provided as part of approved submittals.
 6. Asphalt Mopping Weights: For interply mopping and for other moppings except as otherwise specified, apply bitumen at the following rate:
 7. Asphalt: Provide not less than 92 pounds of interply asphalt per 100 square feet for required number of roofing plies.
- B. Where slope-to-drain of roofing is between 1/4-inch and 1/2-inch in 12 inches, provide Type I (Dead Level) asphalt flood coat. Where slope-to-drain of roofing exceeds 1/2-inch in 12 inches, provide Type III (Steep) asphalt flood coat.
1. Where slope exceeds one inch in 12 inches, reduce initial bitumen pour to 35 pounds per 100 square feet and cast 50 percent of specified aggregate. Lightly roll initial course and allow for nominal cooling. Apply a second pour of bitumen of at least 35 pounds per 100 square feet and cast remaining 50 percent of specified aggregate.
 2. Valleys and Waterways: In valleys and waterways as shown, provide a double surfacing course as follows:
 - a. Reduce initial bitumen pour to 40 pounds per 100 square feet, cast 75 percent of specified weight of aggregate, lightly roll, and sweep unadhered aggregate from the surface; and
 - b. Without delay, pour additional bitumen amounting to 30 pounds per 100 square feet, and cast additional aggregate amounting to 25 percent of the specified weight.
- C. Installing Vapor Barrier:
1. Install Vapor barrier over approved substrate.
 - a. Prepare substrate as required by manufacturer of substrate and roof system manufacturer.

2. Start at low edge of the roof.
 - a. Install 2 pieces of asphalt fiberglass felt, shingle fashion.
 - 1) Lap plies 19" over each preceding ply.
 - 2) Embed each ply in a solid mopping of specified asphalt applied at the EVT.
 - b. Completely seal vapor barrier at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.
 3. Repair any defects or installation errors prior to next phase of roof system installation.
- D. Installing Insulation:
1. Initial Layer: Starting at the low edge of the roof, adhere thermal layer board in hot asphalt.
 - a. Install boards with long joints continuous
 - b. Stagger short joints.
 - c. Butt joints tightly.
 - 1) "Occasional" joint widths up to 1/8" will be allowed. Fill all any widths greater than 1/8" with scrap thermal layer to achieve constant surface.
 - 2) Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict the flow of water.
 - 3) Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
 - d. Embed each ply in a solid mopping of specified asphalt applied below the EVT.
 - e. Keep insulation absolutely dry at all times. Discard insulation that contains moisture.
 - 1) Install only as much insulation as can be covered with roofing membrane the same day.

- f. Repair any defects or installation errors prior to next phase of roof system installation.
 - 2. Second Layer: Starting at the low edge of the roof, adhere thermal layer board in hot asphalt.
 - a. Install boards with long joints continuous.
 - b. Stagger short joints.
 - c. Butt joints tightly.
 - 1) "Occasional" joint widths up to 1/8" will be allowed. Fill all any widths greater than 1/8" with scrap thermal layer to achieve consistent surface.
 - 2) Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict the flow of water.
 - 3) Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
 - d. Use tapered insulation panels in areas requiring slope to achieve a minimum slope of 1/4 inch per foot, and where required to redirect drainage.
 - e. Embed each ply in a solid mopping of specified asphalt applied below the EVT.
 - f. Keep insulation absolutely dry at all times. Discard insulation that contains moisture.
 - g. Install only as much insulation as can be covered with roofing membrane the same day.
 - h. Repair any defects or installation errors prior to next phase of roof system installation.
- E. Installing Cover Board:
 - 1. Starting at the low edge of the roof, adhere cover board in hot asphalt.
 - a. Install boards with long joints continuous.
 - 1) Cut and fit cover board within 1/4 inch of nailers, projections, and penetrations.

- b. Stagger short joints.
 - c. Butt joints tightly.
 - 1) "Occasional" joint widths up to 1/8" will be allowed. Fill all any widths greater than 1/8" with scrap cover board to achieve consistent surface.
 - d. Embed each ply in a solid mopping of specified asphalt applied below the EVT.
 - e. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict the flow of water.
 - f. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- 2. Keep cover board absolutely dry at all times. Discard cover board that contains moisture.
 - a. Install only as much cover board as can be covered with roofing membrane the same day.
 - 3. Repair any defects or installation errors prior to next phase of roof system installation.

F . Installing Roofing Membrane:

- 1. Installation Summary: Membrane Installation Sequencing (from substrate to uppermost ply).
 - a. Minimum 2-ply Type VI roofing felt.
 - b. Cap sheet of DynaKap FR CR.
 - c. Securement.
- 2. Manufacturers approved Type II or IV asphalt.
- 3. Unroll roofing membrane sheets and allow them to relax for minimum time period required by the manufacturer.
- 4. Placing Membrane Layers: Start at low edge of the roof deck.
 - a. Apply one 18 inch wide ply felt.
 - b. Apply subsequent ply felts full width on 2-ply line.

- 1) End Laps: 4 inch minimum
 - 2) Side Laps: 2 inch minimum
 - c. SBS Cap
 - d. Apply all membrane sheets full width.
 - 1) End Laps: 6 inch minimum, stagger end laps a minimum of 3 feet
 - 2) Side Laps: 4 inch minimum
 - e. Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids. Repair tears and voids in laps and lapped seams not completely sealed.
5. Securing Membrane: Install each layer so that it is firmly and uniformly set, in hot asphalt, without voids.
 - a. Installation Procedure
 - 1) Install at ply sheets at EVT to achieve manufacturer's required mopping weight.
 - 2) Install Cap Sheet at a temperature greater than 400°.
 - 3) Asphalt must bleed out from the side laps at all locations
 - 4) Correct dry edges of any depth
 - 5) Cut out all such edges and patch with an equal number of plies
 - b. Cold Weather Considerations: Strictly follow manufacturer's guidelines for cold weather installation to insure a wrinkle-free installation
 - 1) Utilize a close mopping technique
 - 2) Limit mop lead to a maximum of 4 feet in front of the roll and immediately unroll the sheet into the hot asphalt
 - 3) Edges should be 'scuffed in' immediately after rolling the sheet in the asphalt

- 4) Dry edges of any depth will not be tolerated
 - 5) Cut out all such edges and patch with an equal number of plies
 - 6) Ensure that all penetrations and edge conditions are sealed to prevent moisture and air drive into the roofing system.
 - 7) Transition membrane shall overlap adjoining work associated with Section 07461- Preformed Metal Siding.
- G. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane. Remove protective plastic surface immediately before installation.
1. Flashing at walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches high above membrane surface.
 - a. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
 - b. Provide termination directly to the vertical substrate as shown on roof drawings.
 2. Termination Bar: Completely prime metal flanges and allow to dry prior to installation. Turn the base ply down 2 inches past the roof edge and over the nailer. After the base ply and continuous cleat (if applicable) have been installed, set the flange in mastic and stagger nail every 3 inches on center. Strip-in the flange using the stripping-ply material, extending a minimum of 4 inches beyond the edge of the flange. Terminate the finish ply at the gravel-stop rise of the edge metal.
 - a. Caulk all exposed finish ply edges at gravel stops, waste stacks, pitch pans, vent stacks, etc., with a smooth continuous bead of approved sealant.
 3. Metal Pipe Flashings: Completely prime the metal pipe flanges and allow to dry prior to installation. After the base ply has been applied, set the flanges in mastic and strip-in the flange using the stripping-ply material, extending a minimum of 4 inches beyond the edge of the flange. Terminate the finish ply at the flange-sleeve juncture of the pipe flashing. Install a watertight umbrella to the penetration, completely covering the opening of the pipe flashing.

4. Roof Drains: Set 30-by-30 inch 4lb lead flashing sheet in a bed of Flashing Cement on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
5. Roof Scupper Drains: Flash drain using PermaFlash system. Clamp roofing membrane, flashing, and stripping into roof-drain clamping ring.
 - a. Install stripping according to roofing system manufacturer's written instructions.

H. Installing Flashings Accessories:

1. Temporary Flashings:
 - a. Provide a temporary waterproof seal at all membrane edges, penetrations, drains, etc. Unless complete flashings are installed immediately (same working day) following the membrane application.
2. Preparation:
 - a. Inspect walls, curb heights, counter-flashings, etc., and check for conformance with minimum base flashing height of eight (8").
 - b. Bring non-conforming areas to the attention of the Architect for correction.
3. Primer:
 - a. Prepare and prime substrate surfaces per manufacturer's instructions.
 - 1) Abrade and grind surfaces and clean metal surfaces to bare metal when recommended by the manufacturer.
 - 2) Follow manufacturer's recommendations for required temperature of substrate and materials, and for filling of voids.
 - b. Prime all masonry, metal, or concrete surfaces from the top of the roof membrane to the termination of the flashing level with asphalt primer at the rate of one (1) gallon per 100 square feet or as recommended by the manufacturer.
 - c. Allow the primer to dry thoroughly.

- d. Ensure that bonding surfaces to which the seal or flashing are to be placed are clean and free of moisture, dirt, grease, oil, loose material, foreign material, and debris.
4. Installing Flashings:
- a. Flashings are critical to the success of the roofing system and flashing conditions vary wildly. In addition to guidelines below, consult manufacturer for general flashing guidelines and project specific flashing design.
 - b. Provide seals or flashing at penetrations of the roof membrane as required for a watertight roof system, and as indicated on the Drawings, and as approved by the roof system manufacturer for inclusion in the roofing warranty.
 - c. Install three ply base flashing system using specified built-up felts and cap sheet at all intersections formed by changes of plane, and wherever curbed roof openings, wall, parapets, or other structure joint penetrates the roof.
 - 1) Asphalt Install flashing system in manufacturer's approved hot, steep asphalt at EVT for felts and great than 400° for cap sheet.
 - 2) Place flashing immediately in asphalt.
 - 3) Use only manageable portions of flashing material.
 - 4) Place flashing in asphalt to a firm and uniform bearing. Use measures to prevent movement or migration of the flashing system while asphalt cures.
 - 5) Add extra mechanical securement, where required. The fastener used must have a minimum 1" cap, plate or washer.
5. Fluid-Applied Flashing System
- a. Install 1-layer of PermaFlash system on all roof penetrations.
 - b. Install 2-layers of PermaFlash system on domed roofs. Allow first application to fully cure before installing second layer.
 - c. Follow manufacturer's instructions.

- 1) Lay out reinforcement fabric around penetration and cut to fit. Wrap fabric around penetration and bridge all vertical to horizontal transitions.
- 2) Apply fluid-applied flashing directly to prepared substrate. Adhere fabric by pressing into the fluid-applied flashing while still wet.
- 3) Completely cover fabric with at least 60 mil coat wet film thickness of fluid-applied flashing, and as required by the manufacturer.
- 4) Extend top coat of fluid-applied flashing system 2 inches beyond edges of reinforcement fabric.
- 5) Installing Walkway Pads/Splash Block/Protection Pad:
 - i. Set the pads in a solid bed of plastic cement compatible with the cap sheet material.
 - ii. Leave adequate space between pads so that positive drainage is not affected from installation.
- 6) Coordinate flashing interconnection with reglets, coping, scuppers and other roof edges. Refer to Section 07620 and 07710.

I. Walkway Installation:

1. Install walkway pads using units of size indicated, or if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.
2. Sweep away loose aggregate surfacing and set walkway pads in additional flood coat of hot roofing asphalt.
3. Walkway Cap Sheet Strips: Install roofing membrane walkway cap sheet strips over roofing membrane in cold-applied adhesive.
 - a. Set the pads in a solid bed of plastic cement compatible with the cap sheet material.
 - b. Leave adequate space between pads so that positive drainage is not affected from installation.

3.05 – FIELD QUALITY CONTROL

- A. Perform softening point tests on samples of bitumen on the Project, taken at beginning of each day's work and at two hour intervals during course of the work thereafter. Test by ring-and-ball test in compliance with ASTM D36.
- B. Test substrate for excessive moisture by pouring one pint of steep asphalt at 400 degrees F on deck, at start of each day's work, and at start of each roof area or plane. Substrate is too wet to proceed with built-up bituminous roofing Work if test sample foams or can be stripped after cooling.
- C. Perform tests required by insurance organizations as necessary for Owner to obtain fire and extended coverage in accordance with current insurance specifications, published by Owner's insurance carrier
- D. Flood Test:
 - 1. Membrane shall be allowed to cool, after which drains shall be plugged, and barriers installed to contain flood water. Acrylic elastomeric coating shall not be applied until test is complete and accepted for service.
 - 2. Surface shall be flooded with a 2-inch head of water above low point, and allowed to set for 24 hours. A weighted bucket with one gallon of water shall be placed in the flooded area to monitor evaporation levels. Surface shall be inspected for leaks, and membrane shall be repaired if leaks are found. After making repairs, system shall be retested.
 - 3. Roof Scupper and Leader Test: Upon approval of the flood test. Seal the end of the leader and allow water to run to the end of the leader. The drainage scupper, conductor head and leader shall allow to set for 24 hours. This test can run simultaneous with the flood test.
- E. Protection Coating: Subsequent to a successful flood test, Acrylic elastomeric coating shall be immediately installed by setting with mastic. If flood testing is delayed, membrane shall be temporarily covered for protection.
- F. Assist Owner in preparing and submitting of roof installation acceptance certification required in connection with fire and extended coverage insurance of built-up bituminous roofing and associated Work.
- G. Final Roof Inspection:

1. Arrange for roofing system manufacturer's registered roof observer (RRO) to review the flood test and inspect roofing installation upon completion and submit report to Architect. Report shall include results of flood test.
2. A punch list of items required for completion shall be complied by the contractor and the manufacturer's representative. Complete, sign, and mail the punch list form to the manufacturer's headquarters.
3. Verify that all drains, scuppers, etc., are functioning properly. Ensure that roof drains have adequate strainers.
4. Additional testing and inspecting, at contractor's expense, will be performed to determine compliance of replaced or additional work with the specified requirements.

3.06 – ADJUSTING AND CLEANING

- A. If interply weight or distribution of bitumen is below minimum tolerances, determine extent of area affected. Submit written report with manufacturer's recommended remedial measures to maintain bonded construction, and submit to Architect, before proceeding with remedial Work.
- B. If free water or harmful foreign materials are present between layers, remove affected area. Rebuild roof in clean, dry condition, in compliance with the Contract Documents.
- C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Replace or restore other work that is soiled or otherwise damaged by performance of roofing and associated Work.
- E. Only installer shall repair or replace deteriorated or defective roofing system Work.
- F. Certify that completed Work is in accordance with the Contract Documents, and without damage or deterioration (except for normal weathering) at time of submitting acceptable final Application for Payment.
- G. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer or affected construction.
- H. Protection:
 1. All components of the work shall be protected from detrimental weather and damage during construction.

2. Modified bitumen membrane roofing system shall be protected from all damage until final acceptance by the county.

3.07 – ATTACHMENTS

- A. The forms listed below, following the “End of Section” designation, are a part of this Specification section.
 1. Roofing Guarantee.

ROOFING GUARANTEE

WHEREAS

Company: _____

Address: _____

Telephone: _____

Herein called the "Roofing Contractor" has performed roofing and composition flashing work (hereinafter called the "Work") on the following Project:

Owner:

Address: _____

Telephone: _____

NAME AND TYPE OF BUILDING:

Address: _____

Area of Work: _____ Date of Readiness for Final Payment: _____

Guarantee Period: _____ Date of Expiration: _____

AND WHEREAS the Roofing Contractor has contracted (either directly with the Owner or indirectly as a Subcontractor to Contractor) to guarantee said Work against leaks and faulty or defective materials and workmanship for the designated guarantee period.

NOW THEREFORE the Roofing Contractor hereby guarantees, subject to the terms and conditions herein set forth, that during the guarantee period he will at his own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective Work, and as are necessary to maintain said Work in watertight condition. This guarantee is made subject to the following terms and conditions:

1. Specifically excluded from this guarantee are damages to the Work, other parts of the building, and building contents caused by: a) lightning, windstorm, hailstorm, and other unusual phenomena of the elements; b) fire; c) failure of the roofing system substrate including cracking, settlement, excessive deflection, deterioration, and decomposition; d) faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work; e) repeated vapor condensation on the bottom of roofing; and f) activity on the roofing by others including construction contractors, maintenance personnel, other persons, and animals whether authorized or unauthorized by the Owner. When the Work has been damaged by one or more of the foregoing causes, the guarantee shall be null and void until such damage has been repaired by the Roofing Contractor, and until the cost and expense thereof has been paid by the Owner or by another responsible party so designated.
2. The Roofing Contractor is not liable for consequential damages to either the other parts of the building or the building contents, resulting from leaks, faults, or defects of the Work.
3. During the guarantee period, if the Owner allows alteration of the Work by anyone other than the Roofing Contractor, including cutting, patching and maintenance in connection with penetrations,

attachment of other work, and positioning of anything on the roof, this guarantee shall become null and void upon the date of said alterations. If the Owner engages the Roofing Contractor to perform said alterations, the guarantee shall not become null and void, unless the Roofing Contractor, prior to proceeding with said Work shall have notified the Owner in writing showing reasonable cause for claim that said alterations would likely damage or deteriorate the Work, thereby reasonably justifying a termination of this guarantee.

4. During the guarantee period, if the original use of the roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use or service more severe than originally specified, the guarantee shall become null and void upon the date of said change.
5. The Owner shall promptly notify the Roofing Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the Roofing Contractor to inspect the Work, and to examine the evidence of such leaks, defects or deterioration.
6. This guarantee is recognized to be the only guarantee of the Roofing Contractor on said Work, and shall not operate to restrict or cut off the Owner from other remedies and recourses lawfully available to him in cases of roofing failure. Specifically, this guarantee shall not operate to relieve the Roofing Contractor of his responsibility for performance of the original Work, regardless of whether Roofing Contractor was in contract directly with the Owner or as a Subcontractor to the Owner's Contractor.

IN WITNESS THEREOF, this instrument has been duly executed this

_____ day of _____, 20_____.

Roofing Contractor's Signature: _____

Typed Name: _____

As Its (position): _____

And has been countersigned by Contractor issuing the Roofing Contractor's subcontract for said Work:

Name of Contractor: _____

Date: _____

Authorized Signature: _____

Typed Name: _____

As its (position): _____

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 – SUMMARY OF THE WORK**

- A. Scope:
1. Preparation for re-roofing as specified herein shall include, demolition and disposal of existing roofing system with the exception of the existing vapor barrier, preparing remaining existing substrate to receive new roofing system, and appurtenances.
 2. Preparation for re-roofing shall be accomplished where shown on the Contract Drawings, specified herein, or as required for a complete installation.

1.02 – PAYMENT

- A. No direct payment will be made for preparation for re-roofing, accessories, or appurtenances; the cost shall be included in the prices for the work.

1.03 – HANDLING AND DISPOSAL

- A. Handling of Materials: Existing roofing system materials shall be handled carefully so as not to damage any surrounding finished or natural areas.
- B. Disposal of Materials: Removed existing roofing system materials shall be hauled from site and properly disposed of in accordance with all applicable laws and regulations.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION**3.01 – PREPARATION**

- A. The Contractor shall protect all surrounding areas and surfaces from damage and staining during the preparation for re-roofing and application of new roofing system.
- B. Existing substrate shall be prepared in accordance with the contract drawings and specifications and the new roofing system manufacturer's instructions.

3.02 – DEMOLITION

- A. All existing roof material shall be removed with the exception of the existing vapor barrier. Care shall be taken so as not to damage the existing vapor barrier. The existing vapor barrier shall be retained for the proposed roof system. Refer to specification 07553 - Modified Bitumen Membrane and the contract drawing for the proposed roof work. Prepare the existing vapor barrier to accept the proposed roof system.

3.03 – PROTECTION

- A. All components of the Work shall be protected from detrimental weather and damage until construction operations are completed and acceptable to Architect.
- B. Work which cannot for reasons acceptable to Architect be covered with complete construction system before onset of weather detrimental to the Work shall be completely covered and protected in such a manner as to deflect water and weather from the installation without damaging adjacent Work.
- C. Prepared substrate shall be protected from all damage and abuse from all other Contractors and installers involved in the Work until Final Acceptance by the Owner.

3.04 – CLEANING AND REPAIR

- A. Where finished surfaces are soiled by any source of soiling caused by preparation for re-roofing work, cleaning shall be done in accordance with the recommendations of the manufacturer of the items whose surfaces have been soiled.
- B. Defaced or disfigured finishes caused by preparation for re-roofing work shall be repaired or replaced at no additional expense to the Owner.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install sheet metal flashing and trim.
2. Extent of the sheet metal flashing and trim includes but not limited to:
 - a. Complete systems of flashing and counterflashing at penetrations in roofing
 - b. Miscellaneous system components such as cast-in-place and built-in-place reglets and other accessory components for complete watertight systems.
 - c. Miscellaneous flashings not supplied by other Sections.
 - d. Miscellaneous accessories, fasteners and incidental system components necessary for a complete water- and weather tight permanent installation complying with all governing codes and the requirements of FM approval rating Class 1-90 construction installation and the recommendations of FM 1-49, without relying upon sealants or other non-metallic detailing and fabricating techniques to achieve weather- and watertightness.
3. The Work also includes:
 - a. Providing openings in sheet metal flashing and trim to accommodate the Work under this and other Sections and building into the sheet metal flashing and trim all items such as sleeves, anchor bolts, inserts and all other items to be embedded in sheet metal flashing and trim for which placement is not specifically provided under other Sections.
 - b. Providing openings in sheet metal flashing and trim to accommodate the work under other contracts and assisting other contractors in building into the sheet metal flashing and trim, piping, conduits, inserts and all other items required to penetrate sheet metal flashing and trim under other contracts.
4. Types of products required include the following:
 - a. Stainless steel sheet flashing.
 - b. Lead sheet flashing.

- c. Shop-formed, snap-lock metal coping flashing and shop-formed cap flashing requiring no exposed fasteners or splice-plates.
- d. Surface-mounted reglets and counterflashing.
- e. Built-in-place reglets and counterflashing.
- f. Flexible masonry flashing
- g. Miscellaneous flashing not supplied under other Sections.
- h. Complete selection of custom and premium custom-blended full-strength, polyvinylidene fluoride finishes and colors with extended life topcoat.
- i. Protective strippable film on all surfaces of snap-lock metal coping, extruded aluminum gravel stops, fascia extensions and metal coping corner and transition flashings.
- j. Miscellaneous accessories, fasteners, cleats and incidental sheet metal flashing and trim system components necessary for a complete installation.

B. Coordination:

- 1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the sheet metal flashing and trim Work.
- 2. Work advanced without sheet metal flashing and trim items that are specified to be cast-in-place or built-in-place as the Work advances, shall be stopped, demolished and rebuilt incorporating specified sheet metal flashing and trim Work, at no additional cost to Owner.

C. Related Sections:

- 1. Section 03300, Cast-In-Place Concrete.
- 2. Section 04201, Unit Masonry Construction.
- 3. Section 07111, Bituminous Dampproofing.
- 4. Section 07461, Preformed Metal Siding.
- 5. Section 07553, Modified Bitumen Membrane Roofing.

6. Section 07920, Joint Sealants.

1.02 - REFERENCED SECTIONS

- A. ASTM A240, Standard Specification for Chromium and Chromium Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
- B. ASTM A666, Specification for Annealed or Cold-Worked Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar.
- C. ASTM B 29, Specification for Refined Lead.
- D. ASTM B 32, Specification for Solder Metal.
- E. ASTM B 117, Practice for Operating Salt Spray (Fog) Apparatus.
- F. ASTM B 209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- G. ASTM B 749, Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- H. ASTM D 412, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers - Tension.
- I. ASTM D 522, Test Methods for Mandrel Bend Test of Attached Organic Coatings.
- J. ASTM D 523, Test Method for Specular Gloss.
- K. ASTM D 624, Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- L. ASTM D 746, Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
- M. ASTM D 968, Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
- N. ASTM D 1308, Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
- O. ASTM D 2240, Test Method for Rubber Property - Durometer Hardness.
- P. ASTM D 2244, Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
- Q. ASTM D 2247, Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
- R. ASTM D 3363, Test Method for Film Hardness by Pencil Test.

- S. ASTM D 3363, Test Method for Film Hardness by Pencil Test.
- T. ASTM D 4214, Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
- U. FM I-49, Factory Mutual Architecting Corporation, Perimeter Flashing.
- V. National Roofing Contractors Association, (NRCA). Low-Slope Membrane Roofing Construction Details Manual.
- W. Sheet Metal and Air Conditioning Contractors National Association, Incorporated, (SMACNA). SMACNA 1013, Architectural Sheet Metal Manual.
- X. The Society for Protective Coatings, (SSPC). Paint 12, Cold Applied Asphalt Mastic (Extra Thick Film).

1.03 - QUALITY ASSURANCE

A. Installer Qualifications:

1. Engage a single installer who is a recognized flashing and trim installer, skilled and experienced in the type of flashing and trim Work required, and equipped to perform workmanship in accordance with recognized standards so that there will be undivided responsibility for the performance of the Work. Submit name and qualifications to Architect along with at least three successfully completed Projects including names and telephone numbers of owners, architects and Architects, responsible for the project and the approximate contract price for flashing and trim work.
2. The installer of the sheet metal flashing and trim Work shall be franchised or otherwise accepted in writing by the built-up bituminous roofing materials manufacturer for installation of fully guaranteed built-up bituminous roofing Work in accordance with these Specifications.

B. Performance Criteria:

1. Sheet metal flashing and trim shall be permanently watertight, and not deteriorate in excess of manufacturers' published limitations.
2. Comply with fabrication details recommended by SMACNA and the sheet metal flashing and trim manufacturers, as approved by Architect at time of Working Drawing submission.

3. Provide completely weather- and watertight wall and roofing metal flashing systems. Contractor shall provide only the highest quality materials and methods of construction and installation as recommended by sheet metal flashing and trim manufacturers in compliance with governing authorities and as approved by Architect at time of Working Drawing submission.
4. Work advanced without built-in sheet metal flashing and trim Work shall be stopped, removed and rebuilt at no additional expense to Owner, even if discovered only after walls and other materials are in-place and completed.

1.04 - SUBMITTALS

A. Action Submittals: Submit the following:

1. Samples:
 - a. 12-inch square samples of specified sheet metal flashing and trim metals.
 - b. Each fastener type, clips, and support required, marked as to type of material and with their intended purposes in the work.
 - c. Each item of gravel stop and coping system, demonstrating assembly of system joint components and fasteners, securely mounted to substrate simulating actual installation in the Work.
 - d. Polyvinylidene fluoride manufacturer's color samples for final selection by Architect. After initial selection of colors by Architect from manufacturer's color charts, submit Architect's preliminary color choices on actual samples of metal substrate for final color selections by Architect.
 - e. Samples will be reviewed by Architect for color and texture only. Compliance with other requirements is the responsibility of Contractor.
2. Product Data:
 - a. Copies of manufacturer's specifications, installation instructions and general recommendations for sheet metal flashing and trim required. Include manufacturer's data substantiating that the materials comply with the requirements.
 - b. Submit full selection of manufacturer's standard, custom and premium color charts.

3. Shop Drawings:

1. Drawings showing the manner of forming, jointing and securing flashings and trim. Show fully dimensioned joint details and waterproof connections to adjoining Work and details at obstructions and penetrations.
2. Drawings showing the coordination of the Work of this Section with Section 04201, Unit Masonry Construction, and Section 07533, Modified Bitumen Membrane Roofing. Provide detailed Shop Drawings showing large scale details of sections and profiles of all sheet metal flashing and trim to be used in the Work, with all items, including fastener locations, cleats and other miscellaneous accessories necessary to complete the Work, fully dimensioned, properly located, quantified and presented such that sequence of installation is acceptable to each roofing system and adjacent construction material installer.

B. Informational Submittals: Submit the following:

1. Qualifications Statements: Installer's qualifications.

C. Closeout Submittals: Submit the following:

1. Guarantee: Submit guarantee as specified in section 1.07.
2. Warranty: Submit warranty as specified in section 1.07.

1.05 - DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver sheet metal flashing and trim materials in manufacturer's original, unopened, and undamaged containers and rolls, with labels intact and legible, indicating compliance with approved Shop Drawings.
2. Items delivered in broken, damaged, rusted, or unlabeled condition shall immediately be removed from Site and not offered again for approval by Architect.

B. Storage of Materials:

1. Store materials in an area undercover and protected from construction traffic.
2. Store materials in same package in which they were shipped, off the ground and on platforms protected from dirt and other contamination.

3. Store in a manner which does not permit water to remain on sheet metal flashing and trim materials and system components. Provide continuous protection of materials against wetting and contamination.

C. Handling of Materials:

1. Protect sheet metal flashing and trim from dents, scratches, warps and bends.
2. Remove strippable protective film, immediately proceeding installation of each system component.

1.06 - JOB CONDITIONS

A. Scheduling:

1. Do not proceed with sheet metal flashing and trim Work until curb and substrate construction, cant strips, blocking, reglets and other construction to receive the Work is completed.
2. Deliver materials to the Site in sufficient quantities to ensure uninterrupted progress of the Work.
3. Schedule the installation of sheet metal flashing and trim to coincide with the installation of built-up bituminous roofing, waterproofing, drains, piping, blocking, nailers, reglets, framing at openings, curbs, parapets and other adjoining and substrate Work.
4. Proceed with and complete the Work only when materials, equipment and knowledgeable tradesmen, required for the installation of sheet metal flashing and trim, are at the Site and are ready to follow, and integrate sheet metal flashing and trim Work with roofing Work, in order to maintain watertight conditions.

1.07 - GUARANTEE

- A. Provide coping and cap flashing manufacturer's fifteen year warranty against blow-off, leak, or premature membrane failure in winds of up to 110 miles per hour.
- B. Provide manufacturer's twenty-year warranty on the specified coil coated polyvinylidene fluoride based coating.
- C. Guarantee that the polyvinylidene fluoride based coating meets all criteria specified and will not spall, check, craze, peel or otherwise lose adhesion for a period of twenty years from the date of installation, to the extent that such shall create unsightly conditions or otherwise impair the intended architectural qualities of the building.

- D. In the event that the coil coated polyvinylidene fluoride based coating fails to meet the specified standards the manufacturer shall, at their own expense, replace or field paint, at the discretion of Owner, all areas affected by the failure. In the event that repainting is selected, it shall be done at mutually agreeable intervals throughout the term of the warranty.
- E. The warranty specified shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- F. The warranty does not apply where failure is caused by accidents, or external conditions or forces beyond the control of the manufacturer.

PART 2 - PRODUCTS

2.01 - SYSTEM PERFORMANCE

- A. Performance Criteria:
 - 1. Sheet metal flashing and trim shall be permanently watertight, and not deteriorate in excess of manufacturer's published limitations.
 - 2. Snap-lock coping shall be detailed, fabricated and installed to provide a minimum of FM 1-90 wind up-lift resistance and require no exposed fasteners of any kind.
 - 3. Comply with fabrication details recommended by FM, SMACNA, NRCA and the requirements of the sheet metal flashing and trim manufacturer, and as shown on approved Shop Drawings.

2.02 - MATERIALS

- A. Metal Sheet metal flashing and trim:
 - 1. Stainless Steel Sheet metal flashing and trim: Provide 26 gage sheet stainless steel, Type 316, complying with ASTM A 666, with No. 2D dead soft, fully annealed finish, unless required to be harder temper for proper forming and performance for application indicated.
 - 2. Lead Sheet metal flashing and trim: Provide sheet formed from common desilverized pig lead complying with ASTM B 29 and ASTM B 749; weighing 6.0 pounds per square foot.
 - 3. Aluminum Sheet metal flashing and trim: Provide aluminum complying with ASTM B 209, alloy 3003, temper H14. Provide sheet aluminum 0.032-inches thick with AA-C22A41 finish.

4. Asphalt Fabric and Copper Laminate Flashing: Provide two layers of asphalt impregnated glass laminated to copper core, formed into uniform flexible sheets not less than 7 ounces per square foot.
 - a. Product and Manufacturer: Provide one of the following:
- B. Formed Metal Coping, Caps and Trim: Provide smooth sheet of 16-gage, 5005-H134 aluminum alloy, complying with the following:
 1. Provide coping and cap flashings, sized as shown, that provides for independent mounting and full expansion and contraction over prefabricated 6-inch wide aluminum retainers, compression clips mounted 12 feet - 0 inches on centers, and 2-inch wide aluminum retainer plates with single compression pad mounted between dual compression clips.
 2. Provide system that incorporates a gutter bar with dual compression gaskets at each joint to drain water.
 3. System shall not incorporate exposed sealants.
 4. Provide internal face line-up splices at all joints.
 5. All coping and cap flashings shall have all corners mitered and continuously heliarc welded watertight prior to shop-painting. Exposed mechanical fasteners, blind rivets and similar methods are not approved for the Work. Reinforce metal at welds as may be required to provide welded seams.
 6. Concealed fasteners splice plates and neoprene compression pads shall be as recommended by the manufacturer.
 7. Products and Manufacturers: Provide one of the following:
 - a. Gutter Splice System TITE-LOC Coping by Peterson Aluminum Corporation.
 - b. Permasnap Coping by A.W.P. Hickman Company.
 - c. Or equal.
- C. Elastic Sheet Flashing:
 1. Polychloroprene synthetic rubber sheet, 1/16-inch thick, black, with the following physical properties:

- a. Hardness, ASTM D 2240: 50 to 70 Shore A.
 - b. Tensile Strength, ASTM D 412: 1500 psi.
 - c. Tear Strength, ASTM D 624: 120 pounds per linear inch.
 - d. Elongation, ASTM D 412: 300 percent.
 - e. Brittleness Temperature, ASTM D 746: -30°F.
2. Butyl synthetic rubber sheet, 1/16-inch thick, black, with the following physical properties:
- a. Hardness, ASTM D 2240: 50 to 70, Shore A.
 - b. Tensile Strength, ASTM D 412: 1200 psi.
 - c. Tear Strength, ASTM D 624: 200 pounds per linear inch.
 - d. Elongation, ASTM D 412: 300 percent.
 - e. Brittleness Temperature, ASTM D 746: -30°F.
3. Ethylene-propylene-diene monomer synthetic rubber sheet, 1/16-inch thick, black, with the following physical properties:
- a. Hardness, ASTM D 2240: 50 to 70, Shore A.
 - b. Tensile Strength, ASTM D 412: 1400 psi.
 - c. Tear Strength, ASTM D 624: 125 pounds per linear inch.
 - d. Elongation, ASTM D 412: 300 percent.
 - e. Brittleness Temperature, ASTM D 746: -75°F.

D. Flashing Reglets:

- 1. General:
 - a. Provide snap-lock type reglets of Type 304 stainless steel, 0.020-inches minimum thickness.

- b. Provide reglets that engage counterflashing by use of a snap-lock or spring-lock profile. System shall employ only mechanical interlocking features for securing counterflashing in reglet, without the need for clips or screws.
 - c. Provide manufacturer's standard Type 304 stainless steel spring-lock profile flashing, 5-1/8-inches high, designed to incorporate a positive air break and to engage spring-lock reglet flange.
 - d. Provide reglets with 1-inch end laps and spring-lock flashing with 3-inch end laps.
2. Cast-In-Place Reglets: Provide, cast-in-place reglets for concrete, with manufacturer's standard foam backer rod to prevent cement from entering reglet.
- a. Provide reglet with a vertical snap-lock engagement slot, 1-inch high by 1/2-inch deep with connector alignment clips and special staples for securing to formwork.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Type CO Concrete Reglet by Fry Reglet Corporation.
 - 2) Type CF Concrete Reglet with type 2 flashing by O'Keeffe's Architectural Building Products.
 - 3) Or equal.
3. Surface-Mounted Reglets: Provide reglets for surface mounting, with slots for expansion, and a complete line of manufacturer's standard accessories including drive pins, and 7/8-inch diameter stainless steel washers with neoprene facing.
- a. Provide engagement flange 2-1/2-inch high by 1/2-inch wide with snap-lock profile shaped to receive sealant at top lip edge and at mid-flange recess.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Type SM Surface Mounted Reglet by Fry Reglet Corporation.
 - 2) Type EN Surface Mounted Reglet by O'Keeffe's Architectural Building Products.
 - 3) Or equal.

E. Miscellaneous Materials:

1. Burning Rod for Lead: Same composition as lead sheet.
2. Solder for Copper: ASTM B 32, 50 percent tin and 50 percent lead, used with rosin flux.
3. Solder for Stainless Steel: ASTM B 32, 60 percent tin and 40 percent lead alloy grade 60A, used with an acid flux of the type recommended by the stainless steel manufacturer. Use a non-corrosive rosin flux over tinned surfaces.
4. Stainless Welding Rods: Type recommended by stainless steel sheet manufacturer for the type of metal sheets furnished.
5. Nails, Screws and Rivets: Same material as flashing sheet, or as recommended by manufacturer of flashing sheet.
6. Cleats: Same metal and gage as sheet being anchored, 2-inches wide, punched for two anchors.
7. Bituminous Coating: Refer to Section 07111, Bituminous Dampproofing.
8. Sealants: Refer to Section 07920, Joint Sealants.
9. Roofing Cement: Provide a medium to heavy trowel-grade, cut-back asphalt mastic roof cement reinforced with non-asbestos fibers, and containing petroleum solvents and special mineral stabilizers, complying with ASTM D 4586, Type II.
10. Base Flashing Felts: Asphalt-coated, polyester/glass scrim reinforced flashing sheet or as recommended by the manufacturer of the built-up bituminous roofing.

2.03 - FABRICATION

- A. Fabricated Metal Flashing: Shop-fabricate metal sheet metal flashing and trim to comply with profiles and sizes shown, and to comply with manufacturer's recommended details. Except as otherwise shown or specified, provide soldered flat-lock seams, and fold back metal to form a hem on the concealed side of exposed edges. Comply with metal producers' recommendations for tinning, soldering and cleaning flux from metal.
- B. Fabricated Elastic Flashings: Shop-fabricate elastic flashing to comply with profiles and sizes shown and to comply with elastomeric material manufacturer recommendations.
- C. Provide completely shop-fabricated corners and transition sheet metal flashing and trim for all coping, cap flashing and gravel stops; heliarc welded to ensure watertight joints. Grind all welds

smooth so as to be indistinguishable from surrounding surfaces. Finish with specified paint system after fabrication.

- D. Where fabricator does not recommend grinding welds smooth, comply with SMACNA formed metal details requiring double-lock seamed construction.

2.04 - ALUMINUM COPINGS, GRAVEL STOPS AND CAP FLASHING FINISHES

- A. Exposed Aluminum Polyvinylidene Fluoride Based Coating: Apply full strength polyvinylidene fluoride based coatings at the factory by coil coating for sheet material and spray coating for extruded or factory-fabricated material. Provide the following four coat finish system complying with the following:
1. Alkali clean and hot water rinse all surfaces to receive polyvinylidene fluoride based finish.
 2. Prepare a chemical conversion coating on the surface, using phosphates or chromates followed by a cold water rinse. Seal with a chromic acid rinse and dry, except where manufacturer recommends another method to achieve greater coating reliability.
 3. Apply a base prime coat of epoxy paint to the prepared surface in its coil form, by reverse roller coating. Fully cure in a gas-fired oven to a dry film thickness of 0.2 to 0.4-mils. Follow with a barrier coat, 1.0-mils thick.
 4. Apply color coat containing mica pearlescent or metallic flakes over the barrier coat by roller coating for coil material and airless or Ransburg Elastostatic Hand Spray for extrusions and fuse at a peak metal temperature of 440°F for a dry film thickness of 0.7-mils for coil coating and 1.2-mils for spray coating so that the total dry film is approximately 1.0-mil thick for coil material and 1.5-mils thick for extruded material.
 5. Apply clear fluoropolymer top coat to provide a dry film thickness of 0.4 to 0.8-mils. The entire four coat system shall have a dry film thickness of 2.6-mils, minimum.
 6. Provide the following physical properties, as proven by appropriate and recognized laboratory test methods acceptable to Architect:
 - a. Weathering, ASTM D 4214: Chalking, not more than No. 8, after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
 - b. Color Change, ASTM D 2244: No greater than 5 NBS units after removal of external deposits and after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.

- c. Humidity Resistance, ASTM D 2247; no blisters after 3000 hours.
- d. Salt Spray, ASTM B 117: Few scattered blisters no larger than ASTM No. 4, and no more than 1/16-inch creep from areas scribed to bare metal after 3000 hours.
- e. Dry Adhesion: No pick-off when tape tested over 1/16-inch cross hatch.
- f. Wet Adhesion: No pick-off when tape tested over 1/16-inch cross hatch; extruded material only.
- g. Boiling Water Adhesion: No pick-off when tape tested over cross hatch area after one hour immersion in distilled boiling water.
- h. Water Immersion: No pick-off when tape tested over cross hatch area after immersion in aerated distilled water 80 ±10°F after 500 hours.
- i. Abrasion Resistance, ASTM D 968: Coefficient of abrasion of 67, minimum.
- j. Gloss, ASTM D 523: 30±5 reflectivity at 60°F.
- k. Pencil Hardness, ASTM D 3363: HB-H minimum.
- l. Dry Film Thickness, ASTM D 3363: Primer, 0.2 to 0.4-mils; barrier coat, 1.0-mils; color coating, 0.7 to 1.5-mils; clear topcoat, 0.4 to 0.8-mils.
- m. Solvent Resistance: 100 Double MEK rubs minimum.
- n. Flexibility, ASTM D 522: No cracking prior to metal fracture.
- o. Acid Resistance, ASTM D 1308: 16 hour spot test with five percent hydrochloric acid - no effect.
- p. Alkali Resistance, ASTM D 1308: 16 hour spot test with five percent sodium hydroxide - no effect.

B. Colors: Provide the following:

- 1. Full selection of manufacturer's standard, custom and premium colors for final selection by Architect to match downspouts and conductor color.

PART 3 - EXECUTION**3.01 - INSPECTION**

- A. Contractor and installer shall examine the substrate and the conditions under which the sheet metal flashing and trim Work is to be performed, and notify Architect, in writing, of unsatisfactory conditions. Do not proceed with sheet metal flashing and trim Work until unsatisfactory conditions have been corrected in a manner acceptable to Architect.

3.02 - PREPARATION

- A. Before installing sheet metal flashing and trim, verify shapes, and dimensions to be covered.
- B. Prepare substrates as recommended by the sheet metal manufacturer.
- C. Clean the substrate of dust, debris, substances and interferences detrimental to the Work and prepare substrates as recommended by the sheet metal manufacturer.

3.03 - INSTALLATION

- A. General:
 - 1. Separate dissimilar metals from each other by painting each metal surface in the area of contact with a heavy application of bituminous coating, or by other permanent separation as recommended by the manufacturers of the dissimilar metals. Comply with the following:
 - a. Separate stainless steel from dissimilar metals, including regular steel and iron, and from cementitious materials by a course of roofing felt wherever possible. Where felt application is not possible, coat the stainless steel or the other material with a 15-mil bituminous coating. Where felt is applied under sheets which will be soldered or welded, cover felt with a course of building paper before installing stainless steel. Comply with manufacturer's recommendations for other forms of protection of the stainless steel against corrosion.
 - 2. Fabricate and install Work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves and avoidable tool marks, considering the temper and reflectivity of the metal. Provide uniform, neat flat-locked seams with minimum exposure of solder, welds and sealant. Except as otherwise shown, fold back the sheet metal to form a hem on the concealed side of exposed edges. All exposed edges of all sheet metal flashing shall be hemmed not less than 1/2-inch wide.

3. Conceal fasteners and expansion provisions wherever possible in exposed Work, and locate so as to minimize the possibility of leakage. Cover and seal Work as required for a watertight installation.
 - a. Provide cleat-type anchorages for metal flashings and trim wherever practical, arranged to relieve stresses from building movement, and thermal expansion and contraction.
 - b. Provide thermal expansion for running trim, flashing and other items exposed for more than 15 feet - 0 inch continuous length. Maintain a watertight installation at expansion seams. Locate expansion seams at 15 feet - 0 inch intervals, and 2 feet - 0 inch each side of corners and intersections.
 4. On vertical surfaces lap two-piece flashings a minimum of 4-inches.
 5. On sloping surfaces, for slopes of not less than 6-inches in 12-inches, lap unsealed flashings a minimum of 6-inches. For slopes less than 6-inches in 12-inches use soldered flat locked seams.
 6. For embedment of metal flashing flanges in built-up bituminous roofing or composition flashing or stripping, extend flanges for a minimum of 4-inches embedment.
- B. Installation of Stainless Steel Sheet metal flashing and trim:
1. Tin the edges of plain stainless steel to be soldered, for a width of 1-1/2-inches, using solder for stainless steel and acid flux. Remove every trace of acid flux residue from the metal promptly after tinning or soldering.
 2. Where welded joints are shown, provide upturned, 1/2-inch wide hooked flanges, and weld between adjoining sheets; lay seam flat.
- C. Installation of Lead Sheet metal flashing:
1. Where prefabricated units of lead flashing are to be set in felts the under side may be coated with roofing cement.
 2. Cut and shape lead sheets in place with minimum of 1-inch lapped joints, and form bends and folds to provide corners and intersections as shown. Shave or wire-brush joint areas immediately before sealing joint.
 3. Burn joints in lead sheets to provide true welded construction, exercising care to avoid reduction of sheet thickness.

- D. Installation of Aluminum Sheet metal flashing and trim: Bed base members and flashings of aluminum in roofing cement. Comply with manufacturer's instructions for installation and anchorage of units. Provide gasket-type washers under exposed screw and bolt heads. Shim and seal under units as required to provide continuous, level, plumb and true lines.
- E. Installation of Asphalt Fabric and Copper Laminate Flashing:
1. Comply with manufacturer's instructions for handling and installation of the flexible flashing materials, except where more stringent requirements are shown or specified.
 2. Build flexible masonry flashing Work into unit masonry construction as unit masonry construction Work progresses. Work advanced without built-in flashings shall be removed and rebuilt as required by Architect.
 3. Seal all joints between flashing membrane watertight.
 4. Coordinate the installation of flashing materials and associated Work so as to provide a complete system complying with the combined recommendations of manufacturers and installers involved in the Work.
- F. Installation of Metal Copings and Fascia Sections:
1. Install metal copings using concealed fasteners and plates in compliance with manufacturer's written recommendations as shown on approved Shop Drawings.
 2. Coping and cap flashings shall be installed with 3/8-inch wide butt joints 12 feet-0 inches on center, unless otherwise shown.
 3. Use all items supplied by the manufacturer for a complete, watertight and blow-off resistant installation.
 4. Set all flashings straight, level and plumb.
- G. Installation of Elastic Sheet metal flashing and trim:
1. Bond elastic sheet metal flashing and trim sheets to vertical substrates and to other surfaces as indicated or recommended by sheet manufacturer, and seam the end joints.
 2. On bituminous membranes provide not less than 4-inches of mechanically fastened cover over built-up composition base flashings.
- H. Installation of Reglets and Reglet Counterflashing:

1. For installation of cast-in-place reglets refer to Section 03300, Cast-In-Place Concrete.
2. For installation of built-in-place masonry reglets refer to Section 04201, Unit Masonry Construction.
3. Install surface-mounted reglets complying with manufacturer's written instructions to produce a watertight installation. Use sealant specified in Section 07920, Joint Sealants.
4. Install counterflashing with positive pressure against base flashing and reglet and with air break at mid-point to prevent capillary action. No screws or exposed fasteners shall be permitted in the finished Work except those required at each pre-punched hole for surface-mounted reglet attachment.
5. End lap counterflashing horizontally a minimum of 3-inches.
6. Overlap built-up composition base flashing with counterflashing a minimum of 4-inches vertically and fold lower edge back on itself for 1/2-inch.

3.04 - FIELD QUALITY CONTROL

- A. Polyvinylidene Fluoride Based Coatings: Determine conformity of sheet metal flashing and trim Work requiring painted finish to these Specifications as follows:
 1. The manufacturer of the sheet metal flashing and trim Work shall set aside and label samples of each component of the sheet metal flashing and trim Work from each production lot for the Project. Protect samples from weather.
 2. Make samples of sheet metal flashing and trim Work available at all times, for comparison with installed sheet metal flashing and trim Work as requested by Owner, for the full time of the warranty.
 3. Make color comparison measurements with a Hunter Tristimulus Color Difference Meter employing methods of computation in use at the National Bureau of Standards conforming to ASTM D 2224.

3.05 - ADJUSTMENT AND CLEANING

- A. Protect sheet metal flashing and trim until Final Acceptance of the Work.
- B. Do not permit workmen, or others, to step directly on flashing sheets in place, or to place or move equipment over sheet metal flashing and trim surfaces. Protect surfaces during installation of permanent covering work and adjoining Work.

- C. Neutralize excess flux as the Work progresses with five percent to percent washing soda solution and rinse thoroughly.
- D. Clean exposed surfaces of every substance which is visible or might cause corrosion or prevent uniform oxidation of the metal surfaces. Exercise extreme care to remove fluxes and ferrous metal particles, including welding splatter and grinding dust.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Provide Gutters and Downspouts and all associated Gutter and Downspouts accessories and components in accordance with the Contract Documents and as required to provide a complete and first class installation. The work of this section shall include, but not be limited to the following:
 - 1. Gutters and Downspouts.
 - 2. Accessories.

1.02 - RELATED SECTIONS

- A. Section 06100 – Rough Carpentry
- B. Section 07620 – Sheet Metal Flashing and Trim.

1.03 - REFERENCES

- A. ASTM B32 - Solder Metal.
- B. ASTM B209 - Aluminum and Aluminum Alloy Sheet and Plate.
- C. SMACNA - Architectural Sheet Metal Manual.

1.04 - SUBMITTALS

- A. Submit under provisions of the Division 1.
- B. Product Data: Provide data on prefabricated components and color options.
- C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods and installation details.
- D. Submit one full sized sample 12" long of each leader and gutter illustrating component design, finish color and configuration.

1.05 - REGULATORY REQUIREMENTS

- A. Conform to applicable code(s) for size and method of rain water discharge.

1.06 - DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of the Division 1.
- B. Stack preformed and prefinished material to prevent twisting, bending or abrasion, and to provide ventilation. Slope to drain.
- C. Prevent contact with materials during storage which may cause discoloration, staining or damage.

1.07 - COORDINATION

- A. Coordinate work under provisions of the Division 1.
- B. Coordinate the work with downspout discharge pipe inlets, where applicable.

PART 2 - PRODUCTS**2.01 - MANUFACTURERES**

- A. Design is based on products manufactured by ATAS International, Inc. 6612 Snowdrift Road, Allentown, PA 18106. Telephone: 610-395-8445.
- B. Or approved equal.

2.01 - MATERIALS

- A. Aluminum Gutter: ASTM B209, 3003 alloy, H14 temper, 0.040 inch shop finished kynar 500 fluoropolymer paint coating color Bone White (26).
- B. Aluminum Downspout: ASTM B209, 3003 alloy, H14 temper, 0.032 inch shop finished kynar 500 fluoropolymer paint coating color Bone White (26).

2.02 - COMPONENTS

- A. Gutters: 7" Box Gutter (or min. size as otherwise indicated on Contract drawings).
- B. Downspouts: SMACNA Rectangular profile and sized to match gutters.
- C. Accessories: Profiled to suit gutters and downspouts.
- D. Downspout Boot: Provide rubber escutcheon to connect leader to existing piping below grade

2.03 - ACCESSORIES

- A. Anchorage Devices: Type recommended by fabricator.
- B. Gutter Supports: Concealed straps, sized and fastened as appropriate for condition encountered.
- C. Downspout Supports: Concealed straps
- D. End Caps, Elbows: Fabricate to gutter profile
- E. Fasteners: Aluminum finish exposed fasteners same as flashing metal.
- F. Leaf Screen: Dome wire guard, 10 gauge welded screen, galvanized after fabrication, sized to fit downspout openings.
- G. Primer: Zinc chromate type.
- H. Protective Backing Paint: Bituminous.
- I. Splash Block: Provide a precast concrete splash block at each downspout location.

2.04 - FABRICATION

- A. Form gutters and leaders to profiles and sizes indicated in accordance with approved shop drawings.
- B. Fabricate with required connection pieces.
- C. Form sections square, true and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Design for expansion at joints.
- D. Hem exposed edges of metal.
- E. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints.

2.05 - FINISHES

- A. Apply bituminous protective backing on surfaces in contact with dissimilar materials.

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Verify existing conditions under provisions of the Division 1.
- B. Verify that surfaces are ready to receive work.

3.02 - INSTALLATION

- A. Install gutters and leaders, and accessories in accordance with manufacturer's instructions and approved shop drawings.
- B. Slope gutters 1/8" per foot minimum.
- C. Seal metal joints watertight
- D. Gutters to be fastened minimum 16" o.c
- E. Coordinate underground drainage system installation and elevations with final grade, downspout boot installation and leader locations.

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SUMMARY**

- A. Work Included: Provide factory-fabricated roof hatches for ladder access.

1.02 - SUBMITTALS

- A. Product Data: Submit manufacturer's product data.
- B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
- C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.03 - QUALITY ASSURANCE

- A. Manufacturer: A minimum of 5 years' experience manufacturing similar products.
- B. Installer: A minimum of 2 years' experience installing similar products.
- C. Manufacturer's Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.

1.04 - DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-ventilated area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.05 - WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS**2.01 - MANUFACTURER**

- A. Basis-of-Design Manufacturer: Type S-50TB Roof Hatch by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, (800)366-6530, www.bilco.com.

B. Approved equal from manufacturer's below:

1. Babcock Davis, 9300 73rd Avenue North, Brooklyn Park, MN 55428, (888) 412-3726, www.babcockdavis.com
2. Millcor, 5030 Corporate Exchange Blvd. SE, Grand Rapids, MI 49512, (800) 624-8642, www.milcorinc.com.

2.02 - ROOF HATCH

A. Furnish and install where indicated on plans metal roof hatch Type S-50TB, size width: 36" x length: 30" or as verified in field to match existing opening. Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

B. Performance characteristics:

1. Cover and curb shall be thermally broken to prevent heat transfer between interior and exterior surfaces.
2. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150th of the span or 20 psf wind uplift.
3. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
4. Operation of the cover shall not be affected by temperature.
5. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

C. Cover: Shall be 11 gauge aluminum with a 5" beaded flange with formed reinforcing members. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. Cover shall have a heavy extruded EPDM rubber gasket bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

D. Cover insulation: Shall be 3" thick polyisocyanurate with an R-value = 18 ($U=0.315 \text{ W/m}^2\text{K}$), fully covered and protected by an 18 gauge (1mm) aluminum liner.

E. Curb: Shall be 12" in height and of 11 gauge aluminum. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. The curb shall be formed with a 5-1/2" flange with 7/16" holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully

welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" on center, to be bent inward to hold single ply roofing membrane securely in place.

- F. Curb insulation: Shall be 3" (75mm) thick polyisocyanurate with an R-value = 18 (U=0.315 W/m2K).
- G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.
- H. Hardware:
 - 1. Heavy stainless steel pintle hinges shall be provided
 - 2. Cover shall be equipped with a spring latch with interior and exterior turn handles
 - 3. Roof hatch shall be equipped with interior and exterior padlock hasps.
 - 4. The latch strike shall be a stamped component bolted to the curb assembly.
 - 5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" \ diameter red vinyl grip handle to permit easy release for closing.
 - 6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be Type 316 stainless steel hardware to withstand highly corrosive environments.
 - 7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
- I. Finishes: Factory finish shall be mill finish aluminum.

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 - INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
 - 1. Test units for proper function and adjust until proper operation is achieved.
 - 2. Repair finishes damaged during installation.
 - 3. Restore finishes so no evidence remains of corrective work.

3.03 - ADJUSTING AND CLEANING

- A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. This Section describes a system of Firestopping as a material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in/ joints between fire rated wall and floor assemblies. Complete technical services as available from the manufacturer and on-site technical representation by manufacturer's Technical Representative during the time of delivery, storage and installation of the work of this Section and other work which may affect the work of this Section as specified herein is also included. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install and place into satisfactory service, all firestopping work.

1.02 - RELATED SPECIFICATIONS

- A. Section 03300 - Cast-In-Place Concrete.
- B. Section 07900 - Caulking and Sealants.
- C. Section 16131 - Electrical Conduit Systems

1.03 - REFERENCES

- A. Test Requirements: ASTM E-814-02, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
 - 1. UL Fire Resistance Directory:
 - a. Firestop Devices (XHJI)
 - b. Fire Resistance Ratings (BXUV)
 - c. Through-Penetration Firestop Systems (XHEZ)
 - d. Fill, Voids, or Cavity Material (XHHW)
 - e. Forming Materials (XHKU)

- 2. Alternate "Omega Point Laboratories Directory" (updated annually).
- C. Test Requirements: UL 2079, "Tests for Fire Resistance of Building Joint Systems" (July 1998.)
- D. Test Requirements: ASTM E 1966-01, "Standard test method for Fire Resistive Joint Systems"
- E. Inspection Requirements: ASTM E 2174 – 01, "Standard Practice for On-site Inspection of Installed Fire Stops."
- F. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- G. ASTM E-84-01, Standard Test Method for Surface Burning Characteristics of Building Materials.
- H. NFPA 70 - National Electric Code 1999 with amendments for NHBC.
- I. CSBC – Connecticut State Building Code.

1.04 - SYSTEM DESCRIPTION

- A. Only tested firestop systems shall be used in specific locations but not limited to the following:
 - 1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
 - 2. Safing slot gaps between edge of floor slabs and curtain walls.
 - 3. Openings between structurally separate sections of wall or floors.
 - 4. Gaps between the top of walls and ceilings or roof assemblies.
 - 5. Expansion joints in walls and floors.
 - 6. Openings and penetrations in fire-rated partitions or walls containing fire doors.
 - 7. Openings around structural members which penetrate floors or walls.

1.05 - SUBMITTALS

- A. General: Prepare and submit specified submittals in accordance with Division 1 Submittals Section.

- B. Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.
- C. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in drawing.
- D. Product Samples: Submit representative samples of the following for approval.
- E. Submit material safety data sheets provided with product delivered to job-site.
- F. The Contractor Certificate: Submit written certification that installer has current Approved Applicator status with fireproofing material manufacturer.
- G. Test Reports: Submit for approval the following:
 - 1. Copies of test reports verifying compliance with physical properties specified herein.
 - 2. Copies of testing agencies background and experience in performing similar tests to those specified.

1.06 - QUALITY ASSURANCE

- A. Installer Qualifications: Installing company should have at least five (5) years experience in work of the type required by this Section, who can comply with manufacturer's warranty requirements, and who is an Approved installer as determined by fireproofing system manufacturer.
- B. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- C. Manufacturer Qualifications: Firestopping materials and all accessory products shall be provided by a single manufacturer with a minimum of five (5) years experience in the direct production and sales of firestop systems. The Manufacturer shall be capable of providing field service representation during construction, approving an acceptable installer, recommending appropriate installation methods, and certified by a Professional Engineer licensed to practice in the State of Pennsylvania.

- D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field installation to establish procedures to maintain required working conditions and to coordinate this work with related and adjacent work. Verify that final fireproofing details comply with fireproofing manufacturer's current installation requirements and recommendations.
- E. Materials: Obtain fireproofing from a single manufacturer to assure material compatibility.
- F. Inspection: The manufacturer's representative shall inspect fireproofing installation periodically during application to verify that fireproofing has been installed in accordance with manufacturer's guidelines and recommendations

1.07 - PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling: Deliver materials in factory sealed and UL labeled packaging. Sequence deliveries to avoid delays, while minimizing on-site storage. Handle and store following manufacturer's instructions, recommendations and material safety data sheets. Protect from construction operation related damage, as well as, damage from weather, excessive temperatures and prolonged sunlight. Remove damaged material from site and dispose of in accordance with applicable regulations.
- B. Storage: Do not double-stack pallets during shipping or storage. Protect fireproofing materials from moisture, excessive temperatures and sources of ignition. Provide cover, top and all sides, for materials stored on-site, allowing for adequate ventilation.

1.08 - PROJECT CONDITIONS

- A. Substrate Condition: Proceed with work only when substrate construction and preparation work is complete and in condition to receive fireproofing system.
- B. Weather Conditions: Perform work only when existing and forecasted weather conditions are within the guidelines established by the manufacturer of the fireproofing materials. Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- C. Do not use materials that contain flammable solvents.
- D. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.
- E. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

- F. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

1.09 - WARRANTY

- A. Fireproofing Warranty: Upon completion and acceptance of the work required by this Section, the fireproofing materials manufacturer will provide a written one (1) year system warranty covering both materials and labor. Issuance of Manufacturer's System Warranty requires the following: (1) Manufacturer's Approved Applicator to install fireproofing products; and (2) installed in all applicable horizontal and vertical construction joints. The manufacturer's warranty shall be independent from any other warranties made by the Contractor under requirements of the Contract Documents and may run concurrent with said warranties.

PART 2 - PRODUCTS

2.01 - MANUFACTURER

- A. Subject to compliance with through penetration firestop systems (XHEZ) and joint systems (XHBN) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below:
 - 1. Hilti, Inc., Tulsa, Oklahoma
 - a. Telephone: 800-879-8000
 - 2. 3M Fire Protection Products., St. Paul MN.
 - a. Telephone: 800-942-7229
 - 3. Tremco, Inc., Beachwood, OH.
 - a. Telephone: 216 292-5000
 - 4. Provide products from the above acceptable manufacturers; no substitutions will be accepted.
- B. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

- C. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- D. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.02 - MATERIALS

- A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
 - 1. Hilti FS-ONE Intumescent Firestop Sealant
 - 2. Hilti CP 604 Self-leveling Firestop Sealant
 - 3. Hilti CP 620 Fire Foam
 - 4. Hilti CP 606 Flexible Firestop Sealant (for paint application only)
 - 5. Hilti CP 601s Elastomeric Firestop Sealant
- C. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 - 1. Hilti CP 601s Elastomeric Firestop Sealant
 - 2. Hilti CP 606 Flexible Firestop Sealant
- D. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
 - 1. Hilti CP 672 Speed Spray
 - 2. Hilti CP 601s Elastomeric Firestop Sealant
 - 3. Hilti CP 606 Flexible Firestop Sealant

4. Hilti CP 604 Self-leveling Firestop Sealant
- E. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.
1. Hilti CP 677 Speed Plugs
 2. Hilti CP 767 Speed Strips
- F. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant
- G. Foams, intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable
1. Hilti FS-ONE Intumescent Firestop Sealant
 2. Hilti CP 618 Firestop Putty Stick
 3. Hilti CP 620 Fire Foam
 4. Hilti CP 601s Elastomeric Firestop Sealant
 5. Hilti CP 606 Flexible Firestop Sealant
- H. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Hilti CP 618 Firestop Putty Stick
- I. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
1. Hilti CP 617 Firestop Putty Pad
- J. Materials used for complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
1. Hilti CP 637 Trowelable Firestop Compound

2. Hilti FS 657 FIRE BLOCK
 3. Hilti CP 620 Fire Foam
- K. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
1. Hilti FS 657 FIRE BLOCK
- L. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
1. Hilti CP 672 Speed Spray
 2. Hilti CP 601s Elastomeric Firestop Sealant
 3. Hilti CP 606 Flexible Firestop Sealant (white for acrylic paint)
 4. Hilti CP 604 Self-Leveling Firestop Sealant
- M. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
- N. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated

PART 3 - EXECUTION

3.01 - INSPECTION

- A. The installer shall examine conditions of substrates and other conditions under which this Section work is to be performed and notify the Contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturer's warranty requirements.
1. Verify penetrations are properly sized and in suitable condition for application of materials.
 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 - SURFACE PREPARATION

- A. Protect adjacent work areas and finish surfaces from damage or contamination from fireproofing products during installation operations.
- B. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- C. Responsible trades to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.
- D. Concrete Substrates: Concrete to receive fireproofing shall be of sound structural grade with a smooth finish, free of debris, oil, grease, maintenance, dirt, dust, or other foreign matter which will impair the performance of the fireproofing and that which does not comply with manufacturer's warranty requirements.

3.03 - GENERAL INSTALLATION GUIDELINES

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
 1. Seal all holes or voids made by penetrations to ensure an fire, air and water resistant seal.
 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 3. Protect materials from damage on surfaces subjected to traffic.
- C. Weather or not indicated on the contract drawings all firestopping shall be provided and shall maintain the fire integrity of the assemblies indicated as work of this project.

3.04 - FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 - ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 – SUMMARY OF THE WORK****A. Scope:**

1. Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install caulking and sealants.
2. Extent of each type of caulking and sealant is shown or indicated and includes the following:
 - a. Interior and exterior joints in equipment and construction systems not filled by another material, and that are not required to be open for operation.
 - b. Exposed-to-view joints of all fire-rated sealants.
 - c. Joints specified to be re-caulked.

B. Coordination:

1. Review installation procedures under other Sections and coordinate installation of items to be installed with or before caulking and sealants.
2. Coordinate final selection of caulking and sealants so that materials are compatible with all caulking and sealant substrates specified.

C. Related Sections:

1. Section 03300, Cast-In-Place Concrete.
2. Section 04201, Unit Masonry Construction.
3. Section 07533, Modified Bituminous Roofing.
5. Section 08100, Hollow metal Doors and Frames.
6. Section 08332, Overhead Rolling Service Doors.
7. Section 08800, Glass and Glazing.

1.02 – REFERENCES

- A. ASTM C510, Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
- B. ASTM C661, Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
- C. ASTM C793, Test Method for Effects of Accelerated Weathering on Elastomeric Joint Sealants.
- D. ASTM C794, Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
- E. ASTM C920, Specification for Elastomeric Joint Sealants.
- F. ASTM C1021, Practice for Laboratories Engaged in Testing Building Sealants.
- G. ASTM C1087, Test method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
- H. ASTM C1193, Guide for Use of Joint Sealants.
- I. ASTM C1247, Practice for Durability of Sealants Exposed to Continuous Immersion in Liquids.
- J. BAAQMD Regulation 8, Rule 51.
- K. FS TT-S-00227, Sealing Compound: Elastomeric Type, Multi-component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).
- L. NSF/ANSI Standard 61, Drinking Water System Components - Health Effects.
- M. SCAQMD Rule 1168.

1.03 – QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer:
 - a. Engage a single installer, approved by product manufacturer, regularly engaged in caulking and sealant installation and with successful experience in applying types of products required, and who employs only tradesmen with specific skill and successful experience in the type of Work required.
 - 2. Testing Laboratory:

- a. Furnish services of independent testing laboratory qualified according to ASTM C1021, for conducting testing required.

B. Component Supply and Compatibility:

1. Obtain materials only from manufacturers who will, if required:
 - a. Test caulking and sealants for compatibility with substrates for conformance with FS-TT-S-00227, and recommend remedial procedures as required.
2. Before purchasing each sealant, investigate its compatibility with joint surfaces, joint fillers, and other materials in joint system. Provide products that are fully compatible with actual installation condition, verified by manufacturer's published data or certification, and as shown on approved Shop Drawings and other approved submittals.

C. Product Testing: Provide test results of laboratory pre-construction compatibility and adhesion testing, as specified in Section 3.01 of this Section, by qualified testing laboratory, based on testing of current sealant formulations within a 36-month period preceding the Notice to Proceed for the Work.

1. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920 and, where applicable, to other standard test methods.
2. Test other joint sealants for compliance using specified post-construction field adhesion test.

1.04 – SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Schedule of caulking and sealants installation, indication each specific surface where caulking or sealants are to be provided and the material proposed for each application.
2. Product Data:
 - a. Copies of manufacturer's data sheets including color charts, specifications, recommendations, and installation instructions for each type of sealant, caulking compound, and associated miscellaneous material required. Include

manufacturer's published data, indicating that each product complies with the Contract Documents and is intended for the applications shown or indicated.

b. Product test reports.

3. Samples:

a. Actual cured material samples of each type of caulking and sealant specified, in each of manufacturer's standard colors.

b. Samples will be reviewed by Architect for color and texture only. Compliance with other requirements is responsibility of Contractor.

B. Informational Submittals: Submit the following:

1. Certificates:

a. Certify that materials are suitable for intended use and materials meet or exceed requirements of the Contract Documents.

b. Certification from manufacturer that products furnished are appropriate for surfaces and conditions to which they will be applied.

c. Certify that applicator is approved by manufacturer.

2. Field Quality Control Submittals:

a. Pre-construction and post-construction field test reports.

b. Compatibility and adhesion test reports.

c. Contractor's Field Test Report Logs:

1) Indicate time present at the Site.

2) Include observations and results of field tests, and document compliance with manufacturer's installation instructions and supplemental instructions provided to installers.

3. Qualifications: Submit qualifications for:

a. Installer.

- b. Testing laboratory (if not already submitted under Section 01416, Special Inspections furnished by Owner, or Section 01416, Special Inspections Furnished by Contractor).

C. Closeout Submittals: Submit the following:

- 1. Operation and Maintenance Data:
 - a. Recommended inspection intervals.
 - b. Instructions for repairing and replacing failed sealant joints.
- 2. Warranty: Submit written warranties as specified in this Section.

1.05 – DELIVERY, STORAGE AND HANDLING

A. Delivery of Products:

- 1. Deliver products in caulking and sealant manufacturer's original unopened, undamaged containers, indicating compliance with approved Shop Drawings and approved Sample color selections.
- 2. Include the following information on label:
 - a. Name of material and Supplier.
 - b. Formula or Specification Section number, lot number, color and date of manufacture.
 - c. Mixing instructions, shelf life, and curing time, when applicable.

B. Storage of Products:

- 1. Do not store or expose materials to temperature above 90 degrees F or store in direct sunlight.
- 2. Do not use materials that are outdated as indicated by shelf life.
- 3. Store sealant tape in manner that will not deform tape.
- 4. In cool or cold weather, store containers for sixteen (16) hours before using in temperature of approximately 75 degrees F.
- 5. When high temperatures prevail, store mixed sealants in a cool place.

C. Handling:

1. Do not open containers or mix components until necessary preparatory Work and priming are complete.

1.06 – JOB CONDITIONS

A. Environmental Conditions:

1. Do not install caulking and sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
2. Proceed with the Work when forecasted weather conditions are favorable for proper cure and development of high-early bond strength.
3. Where joint width is affected by ambient temperature variations, install elastomeric sealants when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.
4. When high temperatures prevail, avoid mixing sealants in direct sunlight.
5. Supplemental heat sources required to maintain both ambient and surface temperatures within the range recommended by manufacturer for material applications are not available at the Site.
6. Provide supplemental heat and energy sources, power, equipment, and operating, maintenance, and temperature monitoring personnel.
7. Do not use heat sources that emit carbon dioxide or carbon monoxide into areas of caulking, sealants, and painting Work, and areas where Owner's personnel or construction personnel may work. Properly locate and vent such heat sources to outdoors so that caulking and sealants and other Work are unaffected by exhaust.

1.07 – WARRANTY

- A. Provide written warranty, signed by manufacturer and Contractor, agreeing to repair or replace sealants that fail to perform as air-tight and watertight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified

in approved Shop Drawings and other submittals, as an inherent quality of material for exposure indicated.

1. Provide manufacturer warranty for period of one year from date of Substantial Completion of caulking and sealants Work.
2. Provide installer warranty for period of two years from date of Substantial Completion of caulking and sealants Work.

PART 2 – PRODUCTS

2.01 – SYSTEM PERFORMANCE

- A. Provide elastomeric joint sealants for interior and exterior joint applications that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. VOC Performance Criteria:
 1. VOC content of sealants used shall comply with current VOC content limits of SCAQMD Rule 1168. Sealants used as fillers shall comply with or exceed requirements of BAAQMD Regulation 8, Rule 51.
 - a. Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L.
- C. Provide colors selected by Architect from caulking and sealant manufacturer's standard and custom color charts. "Or equal" manufacturers shall provide same generic products and colors as available from manufacturers specified.

2.02 – MATERIALS

- A. Exterior and Interior Horizontal and Vertical Joints; Submerged and Intermittently Submerged in Potable Water or Water That Will be Treated to Become Potable:
 1. Two-component Polyurethane Sealant:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikaflex- 2c NS by Sika Corporation.

- 2) Vulkem 245 by Tremco Sealant/Waterproofing Division of RPM International, Inc.
 - 3) Or equal.
- b. Two-component, moisture cured, gun grade, polyurethane sealant, complying with:
- 1) FS TT-S-00227E, Type II, Class A; ASTM C920, Type M, Grade NS, Class 25.
 - 2) Adhesion-in-Peel, FS TT-S-00227E, ASTM C794 (Minimum five pounds per linear inch with no adhesion failure): 18 pounds.
 - 3) Hardness (Standard Conditions), ASTM C661: 25 (Shore A).
 - 4) Stain and Color Change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
 - 5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
 - 6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
 - 7) VOC Content: 220 g/L, maximum.
 - 8) Listed in NSF/ANSI 61
- B. Exterior and Interior Horizontal and Vertical Joints; Submerged and Intermittently Submerged in Wastewater:
1. Two-component Polyurethane Sealant:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikaflex- 2c NS by Sika Corporation.
 - 2) Vulkem 227 by Tremco Sealant/Waterproofing Division of RPM International, Inc.
 - 3) Or equal.

- b. Polyurethane based, two-component elastomeric sealant complying with:
 - 1) FS TT-S-00227E: Type II (non-sag) Class A and ASTM C920, Type M, Grade NS, Class 25.
 - 2) Adhesion-in-Peel, FS TT-S-00227E and ASTM C794: (Minimum five pounds per linear inch with no adhesion failure): 18 lbs.
 - 3) Hardness (Standard Conditions), ASTM C661: 25 (Shore A).
 - 4) Stain and color change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
 - 5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
 - 6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
 - 7) VOC Content: 220 grams per liter, maximum.

C. Exterior and Interior Vertical Joints; Non-submerged:

- 1. Two-component Polyurethane Sealant:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Sikaflex- 2c NS by Sika Corporation.
 - 2) Dymeric 240 FC by Tremco Sealant/Waterproofing Division of RPM International, Inc.
 - 3) Or equal.
 - b. Polyurethane based, two-component elastomeric sealant complying with:
 - 1) FS TT-S-00227E: Type II (non-sag) Class A and ASTM C920, Type M, Grade NS, Class 25.
 - 2) Adhesion-in-Peel, FS TT-S-00227E and ASTM C794: (Minimum five pounds per linear inch with no adhesion failure): 10 pounds.
 - 3) Hardness (Standard Conditions), ASTM C661: 25 to 35 (Shore A).

- 4) Stain and color change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
- 5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
- 6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
- 7) VOC Content: 100 g/L, maximum.

D. Exterior and Interior Horizontal Joints; Non-submerged:

1. Two-component Polyurethane Sealant:

a. Products and Manufacturers: Provide one of the following:

- 1) Sikaflex- 2c SL by Sika Corporation.
- 2) THC/900 by Tremco Sealant/Waterproofing Division of RPM International, Inc.
- 3) Or equal.

b. Polyurethane based, two-component elastomeric, self-leveling sealant complying with the following:

- 1) FS TT-S-00227E, Type I (self-leveling) Class A. and ASTM C920, Type M, Grade P, Class 25
- 2) Water Immersion Bond, FS TT-S-00227E: Elongation of 50 percent with no adhesive failure.
- 3) Hardness (Standard Conditions), ASTM C661: 35 to 45.
- 4) Stain and Color Change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
- 5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
- 6) VOC Content: 165 g/L, maximum.

E. Miscellaneous Materials:

1. Joint Cleaner: As recommended by caulking and sealant manufacturer.
2. Joint Primer and Sealer: As recommended for compatibility with caulking and sealant by caulking and sealant manufacturer.
3. Bond Breaker Type: Polyethylene tape or other plastic tape as recommended for compatibility with caulking and sealant by caulking and sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of caulking and sealant. Provide self-adhesive tape where applicable.
4. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with caulking and sealant by caulking and sealant manufacturer. Provide size and shape of rod that will control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide highly-compressible backer to minimize possibility of sealant extrusion when joint is compressed.
5. Low-temperature Catalyst: As recommended by caulking and sealant manufacturer.

F. Products for Other Applications:

1. Glazing Sealants: Refer to Section 08800, Glass and Glazing.
2. Compressible Filler: Refer to Section 04090, Masonry Anchorage and Reinforcing.

PART 3 – EXECUTION

3.01 – INSPECTION

- A. Examine joint surfaces, substrates, backing, and anchorage of units forming sealant rabbet, and conditions under which caulking and sealant Work will be performed, and notify Architect in writing of conditions detrimental to proper and timely completion of the Work and performance of sealants. Do not proceed with caulking and sealant Work until unsatisfactory conditions are corrected.
- B. Laboratory Pre-construction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers for testing indicated below samples of materials that will contact or affect joint sealants.

1. Use ASTM C1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit at least eight pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For products that fail tests, obtain joint-sealant manufacturer's written instructions for corrective measures including using specially formulated primers.
5. Immersion Testing: ASTM C1247 for potable water and wastewater.
6. Testing will not be required if joint sealant manufacturers submit joint preparation data based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted and mock-up field testing is acceptable.

3.02 – PREPARATION

- A. Protection: Do not allow caulking and sealants to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces including rough textured materials. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or caulking and sealant materials.
- B. Joint Surface Preparation:
 1. Clean joint surfaces immediately before installing sealant compound. Remove dirt, weakly adhering coatings, moisture and other substances that would interfere with bonds of sealant compound as recommended in sealant manufacturer's written instructions as shown on approved Shop Drawings.
 2. If necessary, clean porous materials by grinding, sandblasting, or mechanical abrading. Blow out joints with oil-free compressed air or by vacuuming joints prior to applying primer or sealant.
 3. Roughen joint surfaces on vitreous coated and similar non-porous materials, when sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or steel wool to produce a dull sheen.
 4. Concrete Joint Preparation: Refer to Section 03251, Concrete Accessories

C. Mixing:

1. Comply with sealant manufacturer's written instructions for mixing multi-component sealants.
2. Thoroughly mix components before use.
3. Add entire contents of activator can to base container. Do not mix partial units.
4. Mix contents for minimum of five minutes or as recommended by sealant manufacturer, until color and consistency are uniform.

3.03 – INSTALLATION

- A. Install caulking and sealants after adjacent areas have been cleaned and before joint has been cleaned and primed, to ensure caulking and sealant joints will not be soiled. Replace caulking and sealant joints soiled after installation.
- B. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or indicated in the Contract Documents, only as acceptable to Architect.
- C. Prime or seal joint surfaces as shown on approved Shop Drawings and approved other submittals. Do not allow primer or sealer to spill or migrate onto adjoining surfaces. Allow primer to dry prior to applying sealants.
- D. Apply masking tape before installing primer, in continuous strips in alignment with joint edge to produce sharp, clean interface with adjoining materials. Remove tape immediately after joints have been sealed and tooled as directed.
- E. Confirm that compressible filler is installed before installing sealants. Refer to Section 04201, Unit Masonry Construction, for locations.
- F. Do not install sealants without backer rods and bond breaker tape.
- G. Roll back-up rod stock into joint to avoid lengthwise stretching. Do not twist, braid, puncture, or prime backer rods.
- H. Employ only proven installation techniques that will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface slightly below adjoining surfaces. Where horizontal joints are between a horizontal

surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

- I. Install sealants to depths recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of bead.
 - 1. For horizontal joints in sidewalks, pavements, and similar locations sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but not more than 5/8-inch deep or less than 3/8-inch deep.
 - 2. For vertical joints subjected to normal movement and sealed with elastomeric sealants and not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2-inch deep or less than 1/4-inch deep.
- J. Remove excess and spillage of compounds promptly as the Work progresses.
- K. Cure caulking and sealant compounds in compliance with manufacturer's instructions and recommendations, to obtain high-early bond strength, internal cohesive strength, and surface durability.

3.04 – FIELD QUALITY CONTROL

- A. Post-construction Field Adhesion Testing: Before installing elastomeric sealants, field-test joint sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform ten tests for the first 1,000 feet of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform one test for each 1,000 feet of joint length thereafter, and minimum of one test per each floor per elevation.
 - c. Test Method: Test joint sealants according to Method A, Field-applied Sealant Joint Hand Pull Tab, and Method D, Water Immersion in Appendix X1 of ASTM C1193. For joints with dissimilar substrates, verify adhesion to each substrate separately by extending cut along one side and verifying adhesion to opposite side. Repeat procedure for opposite side.

- d. Inspect joints for complete fill, absence of voids, and joint configuration complying with specified requirements. Record results in a log of field adhesion tests.
- e. Inspect tested joints and report on whether:
 - 1) Sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - 2) Sealants filled the joint cavities and are free of voids.
 - 3) Sealant dimensions and configurations comply with specified requirements.
- f. Record test results in a log of field adhesion tests. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- g. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- h. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other requirements will be satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- i. Do not proceed with installation of elastomeric sealants over joint surfaces that have been painted, lacquered, waterproofed, or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with FS TT-S-00227, has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

B. Water Leak Testing: Field test for water leaks as follows:

1. Flood the joint exposure with water directed from a 3/4-inch diameter garden hose, without nozzle, held perpendicular to wall face, two feet from joint and connected to water system with 30 psi minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 feet per minute.
2. Test approximately five percent of total joint system, in locations that are typical of every joint condition, and that can be inspected easily for leakage on opposite face. Conduct test in presence of Architect, who will determine actual percentage of joints to be tested and actual period of exposure to water from hose, based on extent of observed leakage or lack of observed leakage.
3. Where nature of observed leaks indicates potential of inadequate joint bond strength, Architect may direct that additional testing be performed at a time when joints are fully cured, and before Substantial Completion.

3.05 – ADJUSTING AND CLEANING

- A. Where leaks and lack of adhesion are evident, replace sealant.
- B. Clean adjacent surfaces of sealant and soiling resulting from the Work. Use solvent or cleaning agent recommended by sealant manufacturer. Leave all finish Work in neat, clean condition.
- C. Protect sealants during construction so that they will be without deterioration, soiling, or damage at time of readiness for final payment of the Contract.

3.06 – PROTECTION

- A. During and after curing period, protect joint sealants from contact with contaminating substances and from damage resulting from construction operations or other causes, so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original Work.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SUMMARY OF THE WORK**

- A. Work Included: Hollow Metal Doors, Frames, Labeled Doors, and Labeled Frames.
- B. Related Work Described Elsewhere:
 - 1. Aluminum Doors and Frames: Section 08120
 - 2. Hardware: Section 08700
 - 3. Glazing: Section 08800

1.02 - QUALITY ASSURANCE

- A. Qualifications of Installers: Use only personnel thoroughly trained and experienced in skills required and completely familiar with manufacturer's recommended methods of installation.
- B. Codes and Standards:
 - 1. Comply with pertinent codes and regulations.
 - 2. Manufacture labeled doors and frames in accordance with specifications and procedures of Underwriters' Laboratories, Inc.
 - 3. Comply with Nomenclature in American National Standards Institute Publication A123. 1-1967 "Nomenclature for Steel Door and Steel Door Frames".

1.03 - SUBMITTALS

- A. Submit Shop Drawings for review in accordance with Section 01340 of these specifications.

1.04 - PRODUCT HANDLING:

- A. Protection:
 - 1. Deliver, store and handle metal doors and frames in a manner to prevent damage and deterioration.
 - 2. Provide proper packaging to protect doors and frames during transportation and storage.
 - 3. Store doors upright, in a protected area, at least one inch off the ground and with 1/4" air space between individual pieces.

4. Protect pre-finished and hardware pieces as required.
 5. Protect installed work and materials of other trades.
- B. Replacements: In event of damage, make necessary repairs and replacements.

PART 2 - PRODUCTS

2.01 - GENERAL

- A. Doors and frames shall be product of one manufacturer.
- B. Acceptable Manufacturers:
1. CECO Corp.
 2. Republic Steel Corp.
 3. Steelcraft Manufacturing Co.
 4. Tex Steel Corp.
- C. Pre-clean and shop prime each door and frame. Finish painting will be at least job site.

2.02 - METAL FRAMES

- A. Type and Design:
1. Full-flush design
 2. Labeled or non-labeled as scheduled
 3. 16 gauge unless otherwise indicated
 4. Properly reinforced for finish hardware
- B. Finish Hardware: Secure templates from hardware supplier and accurately install or make provisions for finish hardware at factory.

2.03 - METAL DOORS

- A. General: Accurately fabricate to match doors to be installed in them.
- B. Type and Design:
1. Types and sizes as shown on Drawings.

2. Labeled or non-labeled as required for scheduled door.
3. 16 gauge unless otherwise indicated.
4. Reinforce for door hardware.

2.04 - ANCHORS

- A. Rigidly attach frames to construction with masonry or stud anchors as required.
 1. Stud Wall: Provide and install 8 anchors per frame.
 2. Masonry Wall: Provide and install 6 anchors per frame.

PART 3 - EXECUTION

3.01 - SURFACE CONDITIONS

- A. Inspection:
 1. Inspect installed work of other trades and verify that such work is complete to a point where this installation may commence.
 2. Verify that doors and frames may be installed in accordance with codes, regulations, the original design, approved Shop Drawings and manufacturer's recommendations.
- B. Discrepancies:
 1. In event of discrepancy, notify Engineer.
 2. Do not proceed until discrepancies have been resolved.

3.02 - INSTALLATION

- A. Metal Doors and Frames: Install in accordance with approved Shop Drawings and manufacturer's recommendations, anchoring all components firmly in position for long life under hard use.
- B. Finish Hardware:
 1. Install hardware in accordance with manufacturer's recommendations.
 2. Eliminate hinge-bound conditions.
 3. All items shall be firmly anchored in position and operate smoothly.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SUMMARY OF WORK**

- A. Scope:
 - 1. Location(s) of overhead rolling doors are indicated on the Drawings.
 - 2. Furnish and install manual, overhead, insulated rolling doors as complete functioning assemblies.
- B. Related Sections:
 - 1. Section 08710 – Finish Hardware.

1.02 - SYSTEM DESCRIPTION

- A. Design Requirements
 - 1. Wind loading: Design and reinforce rolling doors to withstand a 20 PSF wind loading pressure.
 - 2. Cycle life: Design doors for a “normal use” cycle of 20 cycles per day.

1.03 - QUALITY ASSURANCE

- A. Manufacturer's Qualifications: ISO 9001 registered, with a minimum of five years' experience in producing overhead rolling service doors.
- B. Installer's Qualifications: Shall have written approval by the service door manufacturer and a minimum five years' successful experience in installing overhead rolling service doors.

1.04 - SUBMITTALS

- A. Comply with the applicable provisions of Section 01340.
- B. Submit the following:
 - 1. Manufacturer's product data showing major door components and accessories, material characteristics and finishes.
 - 2. Manufacturer's technical data indicating compliance with system design requirements.
 - 3. Evidence of quality assurance compliance.

4. Shop drawings showing interface with adjacent work and other special conditions indicated on the Drawings and not covered by standard product data.
5. Manufacturer's written installation instructions.

1.05 - DELIVERY, STORAGE AND HANDLING

- A. Follow manufacturer's written recommendations for delivery, storage and handling.
- B. Door components shall be delivered to the project site with original packaging intact, including all identifying labels.
- C. Store door components in a secure area safe from exposure to weather and construction activities.

1.06 - WARRANTY

- A. Provide one year warranty against defects in materials and workmanship.

1.07 - OPERATING AND MAINTENANCE DATA

- A. Provide Operating and Maintenance Manuals in accordance with Section 01730.

PART 2 - PRODUCTS

2.01 - ACCEPTABLE MANUFACTURERS

- A. Cornell Iron Works, Inc., Mountaintop, PA, 1-800-233-8366, www.cornelliron.com, shall be the basis of specification.
- B. Overhead Door of Washington, D.C., Beltsville, MD, 1-301-937-1800 (subject to the requirements of this Section).
- C. Equivalent products of other manufacturers, pre-bid approved in accordance with Section 01630, shall be acceptable.

2.02 - ROLLING SERVICE DOOR (Basis of Design)

- A. Cornell "Thermiser" Insulated Door.
- B. Operation: Manual chain operation using reduction gears.
- C. Mounting: Interior face-of-wall mounting on prepared door opening.

2.03 - DOOR MATERIALS AND CONSTRUCTION

- A. Curtain slat material: No. 6F, 24 gauge galvanized steel exterior, 24 gauge galvanized steel interior. Steel: Commercial quality with ASTM A653, Grade 40 galvanized steel zinc coating (G90).
- B. Insulation: 7/8" thick foamed in place closed cell urethane foam; R-value = 6.33.
- C. Curtain slat construction: Double skin, interlocking roll formed slats, 15/16" thick with riveted nylon endlocks. Provide windlocks to meet specified wind load.
- D. Bottom bar: Reinforced, extruded aluminum interior face with full depth insulation. Exterior slat shall match curtain slat material.
- E. Finishes:
 - 1. Exterior slat finish: Phosphate treatment of galvanized steel, followed by a baked-on polyester powder coat (minimum 2.5 mil cured film thickness). Color: As selected by Architect from manufacturers standard color range; allow a minimum of 32 colors.
 - 2. Interior slat finish: Phosphate treatment of galvanized steel, followed by a "light gray" baked-on polyester enamel coating (minimum 0.6 mil cured film thickness).
 - 3. Bottom bar finish:
 - a. Exterior face: Match exterior curtain slats
 - b. Interior face: Mill finish aluminum
- F. Guides:
 - 1. Fabricate from minimum 3/16" structural steel angles. Top of inner and outer guides shall be flared outwards to form a "bellmouth" for entry of curtain slats into guides. Provide removable guide stoppers. The top 16 1/2" of coil side guide angles shall be removable.
 - 2. Guide finish: ASTM A123, Grade 85, zinc coating, hot dipped galvanized.
- G. Counterbalance shaft assembly:
 - 1. Barrel shall be a steel pipe, capable of supporting curtain load with a maximum deflection of 0.03 inches per foot of width.

2. Spring balance: Oil tempered, heat treated steel helical torsion spring assembly. Effort required to operate shall not exceed 25 lbs. Assembly shall be equipped with wheel for applying and adjusting spring torque.

H. Brackets:

1. Fabricate from minimum 3/16" steel plate with permanently lubricated ball or roller bearings at rotating support points. Brackets shall support counterbalance assembly and form end closures.
2. Finish: Phosphate treatment followed by a "light gray" baked-on polyester powder coat, minimum 2.5 mil cured film thickness.

I. Hood:

1. 24 gauge galvanized steel with reinforced top and bottom edges and 1/4" intermediate support brackets.
2. Finish: Phosphate treatment followed by "light gray" baked-on polyester enamel coating.

J. Weatherstripping:

1. Bottom bar: Replaceable, 3-point compressible vinyl gasket extending into guides.
2. Replaceable vinyl strip, sealing against fascia side of curtain.
3. Lintel Seal: Nylon brush seal filled at doorhead.
4. Hood: Neoprene/rayon baffle to resist air flow above coil.

K. Locking: Master Keyable cylinder supplied under Section 08710. Cylinder shall be operable from both sides of bottom bar.

L. Vision Panels: 10" x 1 1/2" x 3/4" thick, oval acrylic panes set in curtain slats with double sided foam glazing tape and fully contained. Refer to Drawings for number and placement.

M. Manual chain hoist: Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide.

PART 3 - EXECUTION**3.01 - INSPECTION**

- A. Examine substrates of adjacent work on which rolling door assembly shall be installed. Verify that conditions are in accordance with approved shop drawings and that conditions are suitable for proper installation and operation of rolling door.
- B. Notify Architect and Owner's Representative of any unsatisfactory conditions encountered during examination. Do not proceed until corrective work has been completed.

3.02 - INSTALLATION

- A. Install doors complete with required accessories and operating hardware. Installation shall be in accordance with manufacturer's written instructions and the approved final shop drawings.
- B. Apply a continuous bead of sealant along both edges of each guide angle and along the perimeter of the hood assembly.

3.03 - ADJUSTMENTS

- A. Following completion of installation, lubricate, test and adjust doors to ensure ease of operation, free from warp, twist or distortion.

3.04 - CLEANING

- A. Clean surfaces soiled by work of this Section in accordance with manufacturer's written instructions.
- B. Remove all surplus materials and debris associated with the work of this Section from the project area and dispose of legally.

3.05 - DEMONSTRATION

- A. Demonstrate proper operation and maintenance to the Owner's personnel.

+ + END OF SECTION + +



+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SUMMARY OF THE WORK****A. Scope:**

1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install finish hardware.
2. Extent of door hardware is specified. Door finish hardware is defined to include all items known commercially as finish hardware, except special types of unique and non-matching hardware specified in the same Section as the door and door frame.
3. Types of finish hardware required include the following:
 - a. Hinges.
 - b. Pivots.
 - c. Flush bolts and dust proof strikes.
 - d. Door closers.
 - e. Overhead holders and stops.
 - f. Cylinders for doors specified in other Sections.
 - g. Coordinators.
 - h. Astragals.
 - i. Weatherstripping and seals.
 - j. Thresholds.
 - k. Silencers.
 - l. Floor stops.
 - m. Wall stops.
 - n. Miscellaneous items and accessories for a complete installation functioning in compliance with the requirements of governing authorities having jurisdiction at the Site.

- o. Temporary hardware for temporary protection and/or temporary operation of doors.

B. Coordination:

- 1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or before, the finish hardware.
- 2. Coordinate the Work of other Sections to provide clearances and accurate positioning of recessed or cast-in-place items.

C. Related Sections:

- 1. Section 06100, Rough Carpentry.
- 2. Section 07920, Joint Sealants.
- 3. Section 08100, Hollow Metal Doors and Frames.
- 4. Section 08332, Overhead Rolling Service Doors.

1.02 - REFERENCED STANDARDS

- A. ANSI A117.1, Accessible and Usable Buildings and Facilities.
- B. ANSI/BHMA A156.1, Butts and Hinges.
- C. ANSI/BHMA A156.3, Exit Devices.
- D. ANSI/BHMA A156.4, Door Controls - Closers.
- E. ANSI/BHMA A156.5, Auxiliary Locks and Associated Products.
- F. ANSI/BHMA A156.6, Architectural Door Trim.
- G. ANSI/BHMA A156.7, Template Hinge Dimensions.
- H. ANSI/BHMA A156.8, Door Controls - Overhead Stops and Holders.
- I. ANSI/BHMA A156.13, Mortise Locks and Latches, Series 1000.
- J. ANSI/BHMA A156.16, American National Standard for Auxiliary Hardware.
- K. ANSI/BHMA A156.18, Hardware - Materials and Finishes.

- L. ANSI/BHMA A156.21, Thresholds.
- M. ANSI/BHMA A156.22, Door Gasketing and Edge Seal Systems.
- N. ANSI/BHMA A156.24, Delayed Egress Locks.
- O. ANSI/DHI A115.1, Preparation of Mortise Locks in 1-3/8-inch and 1-3/4-inch Standard Steel Doors and Frames.
- P. ANSI/NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- Q. ASTM E329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
- R. FF-TT-S-00227.
- S. NIST, U. S. Standard.
- T. NFPA 70, National Electric Code.
- U. NFPA 80, Fire Doors and Fire Windows.
- V. NFPA 101, Life Safety Code.
- W. SDI 109, Hardware for Standard Steel Doors and Frames.
- X. SDI 118, Basic Fire Door Requirements.
- Y. UL 10B, Fire Tests of Door Assemblies.
- Z. UL 10C, Positive Pressure Fire Tests of Door Assemblies.
- AA. UL, Building Materials Directory.
- BB. UL, List of Inspected Fire Protection Equipment and Material.

1.03 - QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Provide finish hardware and accessories manufactured by firms specializing in the production of this type of Work and complying with specified standards of ANSI, BHMA, DHI, NFPA, HMMA, SDI and UL.

2. Provide finish hardware from manufacturers who are members of BHMA and participate in BHMA certification programs.

B. Installer's Qualifications:

1. The finish hardware installer shall have in his employ an architectural hardware consultant. The architectural hardware consultant shall be a member of the Door and Hardware Institute, (DHI), who has passed the DHI certification examine and successfully completed an apprenticeship program. The architectural hardware consultant shall be responsible for preparing finish hardware schedules and Shop Drawings and be present at the Site for the purpose of checking and supervising the Work of the installer during the time of installation and adjustment of the finish hardware Work, and shall prepare a written field report on status of completed finish hardware installation as specified.
2. Submit name and qualifications of the installer and hardware consultant to Architect.

C. Architectural Hardware Consultant Qualifications:

1. A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

D. Component Supply and Compatibility:

1. Finish hardware equipment manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
2. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the finish hardware manufacturer.

E. Testing Agency Qualifications: The independent testing agency shall demonstrate to Architect's satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated in accordance with ASTM E 329, without delaying the Work.

F. Source Quality Control:

1. Obtain each type of finish hardware item from only one manufacturer.
2. Provide finish hardware schedule, for submission to, and for approval by, Architect, prepared in compliance with specified DHI standards.

3. Comply with specified BHMA standards.

G. Requirements of Regulatory Agencies:

1. Provide door finish hardware for fire-resistance-rated openings in compliance with NFPA 80.
2. Provide only finish hardware that has been tested, listed and labeled by UL for the types and sizes of doors required, and complies with the requirements of the door and door frame labels.
3. Modify features of finish hardware items specified, and provide additional accessories and features as required to meet UL and NFPA 80 requirements, at no additional cost to the Owner.
4. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.

H. Preconstruction and Keying Conference: Conduct conference at Project site to comply with requirements in Section 01210, Preconstruction Conference. In addition to Owner, Contractor, and Architect, conference participants shall also include Architectural Hardware Consultant and Owner's security consultant.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review required testing, inspecting, and certifying procedures.
3. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Address for delivery of keys.

1.04 - SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Submit the following:
 - a. Copies of manufacturer's data for each item of finish hardware. Include whatever information may be required to show compliance with specified requirements, and include instructions for installation and for maintenance of operating parts and exposed finishes. Include mounting heights and locations for each item of finish hardware. Provide Architect with latest complete technical catalogue of all available finish hardware manufactured by proposed manufacturers, even if manufacturer specified by Architect is submitted by Contractor to perform the Work. Furnish templates to fabricators of other Work, which is to receive finish hardware.
 - b. Copies of the Door Finish Hardware Schedule, prepared by the Architectural Hardware Consultant, in the manner and format specified, complying with the actual construction Progress Schedule requirements (for each draft). Include explanation of abbreviations, symbols, and codes used to present scheduled information.
 - i. Prepare and submit Door Finish Hardware Schedule in compliance with DHI standards.
 - c. Based on the finish hardware requirements specified, organize the final Door Finish Hardware Schedule into "hardware sets," indicating complete designation of every item required for each door or opening. Furnish initial draft of schedule at the earliest possible date, in order to facilitate the fabrication of other Work which may be critical in the Project Schedule. Furnish final draft of schedule after Samples, manufacturer's data sheets, coordination with Shop Drawings for other Work, delivery schedules and similar information have been completed and accepted.
 - d. Include a separate keying schedule, showing clearly how Owner's final instructions on keying of locks have been fulfilled.
 - e. Door Finish Hardware Schedules are intended for coordination of the Work. The Architect's review will be for general quality and features of units; compliance with all other requirements is the exclusive responsibility of the Contractor. Review and acceptance by Architect does not relieve Contractor of responsibility to fulfill the requirements as shown and specified.

- f. Field Report: Architectural Hardware Consultant's written field report on condition of each item of finish hardware actually present on each door at the project site with each item referenced to approved Shop Drawings. Final approval or final payment shall not be provided to Contractor until field report has been submitted to and approved by the Architect.
 - g. Maintenance Manual: Upon completion of the Work, furnish five copies of detailed maintenance manuals, including the following information:
 - i. Product name and manufacturer.
 - ii. Name, address, e-mail address and telephone number of manufacturer and local distributor.
 - ii. Detailed procedure for routine maintenance and cleaning.
 - iv. Detailed procedures for repairs such as dents, scratches and staining.
 - v. Parts identification manual and maintenance manuals for each piece of finish hardware.
2. Samples
- a. A six (6) inch sample of each type of strip and saddle specified.
- B. Informational Submittals:
- 1. Test Reports: Submit for approval certified independent laboratory test reports for BHMA certification program and certification tests for each type of product specified.
 - 2. Qualification Data:
 - a. Installer.
 - b. Architectural Hardware Consultant.

1.05 - DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
- 1. Deliver all items of finish hardware in manufacturer's original, undamaged packages, bearing accurate representation of the item within each package.

2. Pack each piece of finish hardware separately, complete with screws, keying, instructions and templates, tagged to correspond with items submitted on approved Shop Drawings and as specified.

B. Storage and Protection:

1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
2. Provide secure storage area for finish hardware items, secured by locks and accessible only to finish hardware installer, Architect and Contractor.
3. Store finish hardware in manufacturers' original packages.

C. Acceptance at Site:

1. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Architect, in writing, if any loss or damage exists to equipment or components. Items that arrive in a damaged condition shall be removed from the Site and not offered again for acceptance. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.
2. Hardware shall be checked against the approved hardware schedule upon delivering to the project site by hardware supplier and after it is installed to insure proper operation.

1.06 - COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.07 - WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.

- b. Faulty operation of operators and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
- 2. Warranty Period: 3 years from date of Substantial Completion, except as follows:
 - a. Exit Devices: 2 years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

1.08 - MAINTENANCE

A. Maintenance Service

- 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- 2. Maintenance Service: Beginning at Substantial Completion, provide 6 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.01 - SYSTEM PERFORMANCE

A. Design Criteria:

- 1. Where the finish, shape, size, fire-resistance-rating, frequency of use, or function of a member receiving finish hardware is such as to prevent, or make unsuitable, the types of finish hardware specified, furnish similar types having as nearly as practicable the same operation but of type or kind more appropriate to the design intension and requirements of governing authorities having jurisdiction at the Site. Clearly identify and highlight to Architect all such required modifications on Shop Drawings submitted for approval.
- 2. If finish hardware for any location is not specified, provide finish hardware equal in design and quality to adjacent finish hardware specified for comparable openings at no additional cost to Owner.

3. Furnish finish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements, as necessary for proper installation and function.
4. Unless otherwise specified, comply with DHI, Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames and Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames.

2.02 - DETAILS OF CONSTRUCTION

A. General:

1. Hand of Door: The Drawings show the swing or hand of each door leaf (left, right, reverse bevel, etc.). Furnish each item of finish hardware for proper installation and operation of the door swing as shown.
2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with labels required by governing authorities having jurisdiction at the Site.
3. Base Metals: Produce finish hardware units of the basic metal and forming method specified, using the manufacturer's standard metal alloy, composition, temper and hardness. Do not substitute materials or forming methods for those specified.
4. Fasteners: Manufacture door finish hardware to conform to published templates, generally prepared for machine screw installation. Do not provide finish hardware, which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
5. Furnish screws for installation, with each finish hardware item. Provide Phillips flat-head screws except as otherwise specified. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces on other Work, to match the finish of such other Work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
6. Provide fasteners which are compatible with both the unit fastened and the substrate, and which will not cause corrosion or deterioration of finish hardware, base material or fastener.
7. Provide concealed fasteners for finish hardware units, which are not exposed when the door is closed, except to the extent no standard manufacturer units of the type specified are available with concealed fasteners. Do not use through bolts for installation where

the bolt head or the nut on the opposite face is exposed in other Work under any condition, except where it is not possible to adequately reinforce the Work and use machine screws or concealed fasteners of another standard type to satisfactorily avoid the use of through bolts.

8. Tools for Maintenance: Furnish two complete sets of specialized tools as required for Owner's continued adjustment, maintenance, removal and replacement of finish hardware.

2.03 - HARDWARE TYPES

A. Mortise Hinges:

1. Templates and Screws: Provide only template-produced units.
2. Base Metal: Except as otherwise specified, fabricate hinges from stainless steel and finish to match the latch and lock set.
3. Number of Hinges: Provide three hinges on each door leaf of less than 60-inches in height; provide one additional hinge for next 30-inches of door height or fraction thereof; provide two additional hinges for each 30-inches, or fraction thereof, for doors above 90-inches tall.
4. Hinge Size: Except as otherwise specified or as required to comply with UL and NFPA, provide hinges of the following sizes:
 - a. Interior Doors:
 - i. Average Use, Maximum 36-Inches Wide: 4-1/2-inch standard weight (0.134-inches).
 - ii. Heavy Use, Maximum 36-Inches Wide: 4-1/2-inch heavy-weight (0.180-inches).
 - b. Exterior Doors, Maximum 36-Inches Wide: 4-1/2-inch heavy-weight (0.180-inch).
5. Types of Hinges: Provide full-mortise type, ball-bearing hinges, swaged for mortise applications, inner leaf beveled, square cornered, unless manufacturer's recommendations indicate that half-mortise, half-surface, full-surface or other type should be used for the frame and door type or condition.
6. Hinge Pins: Except as otherwise specified, provide hinge pins as follows:

- a. Pins: Stainless steel.
 - b. Exterior Doors: Non-removable pins. Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed.
 - c. Tips: Slope ends of hinge barrel.
- 7. Conform to ANSI/BHMA A156.7.
 - 8. Comply with UL, List of Inspected Fire Protection Equipment and Materials and NFPA 80 requirements.
 - 9. Products and Manufacturers: Provide one of the following:
 - a. FBB 199 and FBB 191 by Stanley Commercial Hardware, Division of The Stanley Works.
 - b. T4B3386 and TB3313 by McKinney Products Company, an ASSA ABLOY Group company.
- B. Heavy-Duty Continuous Geared hinges:
- 1. Provide: Continuous Concealed Geared Full Surface Hinges: Complying with ANSI/BHMA A156.26, aluminum, manufactured of 3 interlocking aluminum extrusions (2 hinges leaves and 1 cover channel), door leaf and jamb leaf geared together for entire hinge length and joined by cover channel.
 - 2. Templates and Screws: Provide only template-produced units.
 - 3. Hinge Length: 1-inch shorter than nominal height of door.
 - 4. Hinge Grade: Extra Heavy Duty.
 - 5. Product and Manufacturer: Provide one of the following:
 - a. 1200-600 XHD by Hager Companies.
 - b. Or approved equal.
- C. Panic Exit Devices:

1. Strikes: Provide manufacturer's standard wrought stainless steel jamb-mounted top latch bolt and bottom latch bolt for each location and use shown to allow independent opening and closing of each leaf of double doors with panic exit devices; complying with UL List of Inspected Fire Protection Equipment and Materials and NFPA 80 requirements.
2. Lock Throws: Provide minimum of 3/4-inch latch bolt throw complying with UL List of Inspected Fire Protection Equipment and Materials and NFPA 80 requirements.
3. Provide concealed vertical rod type exit device and mortise type exit devices as specified.
4. Provide the following features and materials:
 - a. Latch Bolt: Two-piece; mechanical; anti-friction, stainless steel.
 - b. Dead Bolt: One-piece, stainless steel with two enclosed hardened-steel roller armor pins.
 - c. Case: Wrought steel, zinc dichromatized.
 - d. Cylinders: High-security; brass; pick- and drill-resistant; ANSI/BHMA A156.5 - E09211A.
 - e. Armor Front: 8-inches by 1-1/4-inches wide, minimum; steel.
 - f. Escutcheon: 8-inches by 2-1/2-inches wide by 3/16-inches thick, minimum; stainless steel, US 32D.
 - g. Hubs: Sintered steel, copper infiltrated.
 - h. Crossbar: Oval, seamless with interlocking expansion collets and roll pins; knurled, satin stainless steel, 0.062-inches minimum thickness, with steel reinforcing tube.
 - i. Concealed bolts: Minimum 1/2-inch diameter, stainless steel.
5. Backset: Provide minimum backset of 2-3/4-inches.
6. Finish: US 32D satin.
7. ANSI/BHMA: A156.3, Type 3 and Type 8, Grade 1; F08, entrance by lever, key locks or unlocks lever for entrances shown as accessible to people with disabilities as required by ADAAG; and F05, entrance by thumb piece, key locks or unlocks thumb piece.

8. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
 9. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
 10. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
 11. Products and Manufacturers: Provide one of the following:
 - a. 1530-L8 (F) and -T8 (F) Series Mortise Exit Devices and 1520(F) CVR Concealed Vertical Rod Exit Devices; with Escutcheon Trim and Augusta - ASL Lever Handles and Thumbpiece/Handle/Cylinder Unit by Yale Commercial Locks and Hardware, an ASSA ABLOY Group company.
 - b. ED6600 Series Mortise Exit Devices and ED 6800 Concealed Vertical Rod Exit Devices; with Escutcheon Trim and Newport – N4M Lever Handles and D Grip T7M Thumb piece/Handle/Cylinder Unit by Corbin Russwin Architectural Hardware, an ASSA ABLOY Group company.
 - c. Or equal.
- D. Cylinders and Keying System:
1. Review the keying system with Owner has and provide the type required to integrate with Owner's existing system.
 2. Furnish all locks with manufacturer's cylinders for interchangeable-core pin tumbler inserts. Furnish only temporary inserts for the construction period, and remove these before Substantial Completion. Construction control keys and cores shall not be part of Owner's permanent keying system. Permanent cores and keys shall be furnished to Owner prior to Substantial Completion.
 3. Comply with the Owner's instructions for master keying and, except as otherwise specified, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.

4. Permanent keys and cores shall be stamped with the applicable key mark for identification. These visual key control marks or codes shall not include the actual key cuts. Permanent keys shall also be stamped "DO NOT DUPLICATE".
5. Cylinder Material: Brass, bronze or Series 300 stainless steel.
6. Cylinder Features: Seven-pin, high-security, removable core.
7. Key Material: Nickel silver.
8. Key Quantity: Furnish three keys for each lock and five keys for each master and grandmaster system. Provide one extra key blank for each lock. All keys are to be shipped directly to County Locksmith Department.
9. Products and Manufacturers: Provide one of the following:
 - a. Schlage Primus XP
 - b. Sargent Restricted System

E. Overhead, Surface-Mounted, Door Closers:

1. Provide all doors, unless specially shown or specified as being provided with floor-mounted or concealed overhead closers, with surface-mounted overhead door closers. Provide both active and inactive door leafs with closers.
2. Size of Units: Except as otherwise specified, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather, and anticipated frequency of use.
3. Where parallel arms are specified, and for closers on exterior doors, provide closer unit one size larger than recommended for use with standard arms.
4. Use parallel arm arrangement for doors that would otherwise have the door closer appearing in finished corridors or entries.
5. Comply with UL, Building Materials Directory, and List of Inspected Fire Protection Equipment and Materials, and NFPA 80. Modify closers specified as required. UL 10C and UBC 7-2c positive pressure requirements for fire-rated openings.
6. Provide hold open feature for all non-fire-resistant-rated doors, unless otherwise specified.

7. Provide offset bracket mounting on exterior doors. Select all arms to clear weather-stripping, and overhead door holders.
8. Provide long arm to allow door to swing 180 degrees where long arm will eliminate floor-mounted stops.
9. Provide closers with spring power adjustment feature capable of increasing spring power 15 percent minimum in all closer sizes.
10. Provide individual regulating valves for closing and latching speeds, and separate adjustable back check valve.
11. Provide delayed closing action feature on all door closers. Position valve at top of closure.
12. Provide the following materials and features:
 - a. Full Metal Cover: Aluminum.
 - b. Case: Cast-iron.
 - c. Arms: Plated to match full metal covers.
 - d. Other Parts: Steel.
 - e. Extreme temperature fluid.
 - f. Security torx machine screws.
 - g. Ten-year warranty.
 - h. Provide manufacturer's optional corrosion protection.
13. Finishes: US 26D satin chrome. Color coordinate all arms and other accessories.
14. Highly Corrosive Atmospheres: Provide all closers with specified manufacturer's optional corrosion protection.
15. ANSI/BHMA: A156.4, Grade 1.
16. Products and Manufacturers: Provide one of the following:

- a. DC8000 Series by Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
- b. 4040 Series by LCN Closers, an Ingersoll Rand Company.
- c. Or equal.

F. Coordinators:

1. Provide coordinator device on all pairs of doors required or specified to have automatic flush bolts, or panic exit devices. Comply with UL, List of Inspected Fire Protection Equipment and Material, and NFPA No. 80 requirements. Meets ANSI/BHMA A156.3, Type 21A.
2. Provide manufacturer's standard carry bar and strike on all pairs of doors equipped with coordinator.
3. Materials: Aluminum.
4. Finish: US26D Satin Chrome Plated
5. Coordinate Placement of coordinator with overhead closers and flush bolts.
6. Product and Manufacturer: Provide one of the following:
 - a. COR with FL filler bar by Ives, Part of Allegion
 - b. Or approved equal.

G. Astragals:

1. Provide metal split-astragal bars, not less than 1/8-inch by 2-inches, for exposed flathead screw mounting on both leafs of all pairs of doors. Comply with UL and NFPA requirements for types and locations of astragals.
2. Provide astragal of extruded aluminum with clear anodized finish.
3. Products and Manufacturers: Provide one of the following:
 - a. No. 351 Series by Pemko Manufacturing Company.
 - b. No. McK297 by McKinney, an ASSA ABLOY Group company.

c. Or equal.

H. Weatherstrip Gasketing:

1. Provide perimeter weatherstrip at all exterior doors. Provide stripping and seals for interior doors where scheduled in the Finish Hardware Schedule, at end of Part 3.
2. Continuity of Gasketing: Except as otherwise specified, stripping at each opening shall be continuous and without unnecessary interruptions at door corners and hardware.
3. Replaceable Seal Strips: Resilient or flexible seal strip of every unit shall be easily replaceable and readily available from stocks maintained by the manufacturer.
4. Provide bumper-type weatherstrip at jambs and head, including a resilient insert and metal retainer strip, surface-applied, of the following metal, finish and resilient bumper material:
 - a. Housing: Extruded aluminum with dark bronze anodized finish; 0.062-inch minimum thickness of main walls and flanges.
 - b. Dimensions: 1-3/8-inches by 7/8-inches, stop-mounted.
 - c. Seals: Closed-cell extruded silicone.
 - d. ANSI/BHMA: A156.22, R3E264.
 - e. Products and Manufacturers: Provide one of the following:
 - i. No. 350DSPK and 2891 DPK (for parallel arms) by Pemko Manufacturing Company.
 - ii. No. 770D Compress-O-Matic and No. 429A (for parallel arms) by Zero International.
 - iii. Or equal.
5. Provide heavy-duty, surface-mounted, automatic drop-seal door-bottom unit of manufacturer's standard design, with operating seal bar of the following material, retained in an extruded metal bar and capable of operating to close a 3/4-inch gap (from door bottom to floor or threshold). House mechanism and operating bar in the following metal housing, for mounting in doors as follows:

- a. Housing: Extruded aluminum, 0.062-inch thick, with mill aluminum finish.
 - b. Seal: Neoprene.
 - c. Mounting: Surface-mounted.
 - d. ANSI/BHMA: A156.22, R3E344.
 - e. Products and Manufacturers: Provide one of the following:
 - i. No. 4301 DPKL by Pemko Manufacturing Company.
 - ii. No. 367 D by Zero International.
 - iii. Or equal.
- I. Standard and Extended Thresholds:
- 1. All exterior and interior doors shall be provided with thresholds.
 - 2. Metal: Mill finish extruded aluminum.
 - 3. Surface Pattern: Fluted tread, manufacturer's standard.
 - 4. Provide countersunk stainless steel screws and expansion shields.
 - 5. Width:
 - a. Standard Threshold: 6-1/8-inches wide and of length sufficient to span full width of rough openings, coped and scribed neatly at and around door frames.
 - b. Extended Threshold: 9-1/8-inches wide and of length sufficient to span full width of rough openings, coped and scribed neatly at and around door frames.
 - 6. Construction:
 - a. Two-piece, complying with manufacturer's recommendations.
 - 7. Profile: Provide manufacturer's unit, which conforms to the minimum size and profile requirements specified.
 - a. For doors equipped with panic hardware, including floor bolts, provide profile with stop bar of proper size and shape to function as the strike plate for the floor bolts.

8. Thickness: 1/2-inch, minimum.
 9. ANSI/BHMA: A156.21, J12100.
 10. Products and Manufacturers:
 - a. Standard Threshold: Provide one of the following:
 - i. 253X3AFG by Pemko Manufacturing Company.
 - ii. 8426A by National Guard Products.
 - iii. Or equal.
 - b. Extended Threshold: Provide one of the following:
 - i. 255X5AFG by Pemko Manufacturing Company.
 - ii. 8429A by National Guard Products.
 - iii. Or equal.
- J. Silencers:
1. Provide silencers for all door frames.
 2. Provide pneumatic design that, once installed, forms an air pocket to reduce noise.
 3. Provide minimum of three per strike side of door jambs.
 4. ANSI/BHMA: A156.16, BHMA 6.5, L03011.
 5. Products and Manufacturers: Provide one of the following:
 - a. SR64 by IVES Hardware, an Ingersoll-Rand Company.
 - b. Series 307D by Hager Companies.
 - c. Or equal.
- K. Wall and Floor Stops: Provide the following where scheduled in List of Finish Hardware Items at end of Part 3:
1. Dome-Type Floor Stops:
 - a. Cast bronze extra heavy-duty wall mounted door stop, one per leaf.

- b. Coordinate height of dome-type floor mounted doors stops with threshold condition and undercut of door.
 - c. Finish: US 26D satin chrome.
 - d. ANSI/BHMA: A156.16, L12161.
 - e. Products and Manufacturers: Provide one of the following:
 - i. FS13/ R14, FS17 by IVES Hardware, an Ingersoll-Rand Company.
 - ii. Trimco BL243F by Triangle Brass Manufacturing Company.
 - iii. Or equal.
2. Wall Stops:
- a. Cast bronze extra heavy-duty wall mounted door stop, one per leaf.
 - b. Convex rubber bumper.
 - c. ANSI/BHMA: A156.16, L12101.
 - d. Products and Manufacturers: Provide one of the following:
 - i. WS401CVX by IVES Hardware, an Ingersoll-Rand Company.
 - ii. Trimco 230W by Triangle Brass Manufacturing Company.
 - iii. Or equal.
- L. Automatic and Constant Latching Flush Bolts:
- 1. Latch: Inactive door remains latched until the active door is opened, releasing the automatic bottom bolt and then the top bolt can be manually released. Inactive door will relatch automatically when closed.
 - 2. Compliance: BHMA A156.16, fits standard ANSI A115.4 door and Frame preparations.
 - 3. Non-handed, with $\frac{3}{4}$ backset.
 - 4. Products and Manufacturers: Provide one of the following:
 - a. FB5IP by Ives, an Allegion division.

b. Or equal by Hager or Rockwood.

M. Dust-Proof Strikes:

1. Provide brass dust-proof strikes which incorporate a slotted plunger raised to flush position by spring tension for all flush bolts.
2. Provide 5/8-inch inside diameter dust-proof strikes; threshold mounted and surface mounted.
3. Finish: B.H.M.A. 610, US 7 Satin brass, blackened, bright relieved, clear coated.
4. Products and Manufacturer: Provide one of the following:
 - a. DP-1 and DP-2 by Ives, an Allegion company.
 - b. Or approved equal by Hager or Rockwood.

N. Sealants: Provide elastomeric sealant complying with FS TT-S-00227, Type 2 (non-sag) Class A for use with thresholds.

2.04 - HARDWARE FINISHES

- A. Provide matching finishes for finish hardware units at each door or opening, to the greatest extent possible in compliance with NIST U. S. Standards or ANSI/BHMA A156.18.
- B. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of finish hardware exposed at the same door or opening. In general, match all items to the manufacturer's standard finish for the latch and lock set for color and texture.

PART 3 - EXECUTION

3.01 - INSPECTION

- A. Contractor shall examine the substrate to receive finish hardware, and the conditions under which the Work will be performed, and notify the Architect, in writing, of unsatisfactory conditions. Do not proceed with the finish hardware Work until unsatisfactory conditions have been corrected in a manner acceptable to Architect.

3.02 - PREPARATION

- A. Templates: Furnish finish hardware templates to each fabricator of doors, frames and other Work to be factory-prepared for the installation of finish hardware. Check the Shop Drawings of such

other Work, to confirm that adequate provisions are made for the proper installation of the finish hardware.

- B. Prepare Work to receive finish hardware Work in compliance with ANSI/DHI A115.1.
- C. Surface-Applied Door Hardware: NFPA 80: Drill and tap doors and frames according to ANSI A250.6.

3.03 - INSTALLATION

- A. Installer shall check and approve the installation before operation. Installer shall assure that the system operates to the Owner's satisfaction.
- B. Mount finish hardware units at heights recommended in, Door and Hardware Institute, "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames" and "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames", except as otherwise specified or required to comply with governing authorities having jurisdiction at the Site, HMMA 830 and ADAAG requirements.
- C. Install each finish hardware item in compliance with the manufacturer's instructions and recommendations and approved Shop Drawings. Wherever cutting and fitting is required to install finish hardware onto or into surfaces that are later to be painted or finished in another way, install each item completely, then remove, and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.
- G. Screw thresholds to substrate with No. 10 or larger screws, of the proper type for permanent anchorage and of bronze or stainless steel that will not corrode in contact with the threshold metal.

- H. Set thresholds in a bead of elastomeric sealant to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealant before sealant cures to a firm set.
- I. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Lubricate moving parts with the type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- J. Final Adjustment: Where finish hardware installation is made more than one month prior to Substantial Completion, return to the Work during the week prior to acceptance or occupancy, and make a final check and adjustment of all finish hardware items in each space and area. Clean and re-lubricate operating items as necessary to restore proper function and finish of finish hardware and doors. Adjust door control devices to compensate for final operating of heating and ventilating equipment.
- K. Provide manufacturer's authorized representative to instruct and train Owner's personnel in proper adjustment and maintenance of finish hardware during the final adjustment of finish hardware.
- L. Finish hardware, which is blemished or defective, will be rejected even though it was set in place before defects were discovered. Remove and replace with new finish hardware. Repair all resultant damage to other Work.
- M. Continued Maintenance Service: Approximately six months after the acceptance of finish hardware in each area, the installer, accompanied by the representative of the latch and lock manufacturer and Architectural Hardware Consultant, shall return to the Project and re-adjust every item of hardware to restore proper function of doors and finish hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Clean and lubricate operational items wherever required. Replace finish hardware items that have deteriorated or failed due to faulty design, materials or installation of finish hardware units.

3.04 - FIELD QUALITY CONTROL

- A. Provide a written field report, prepared by installer's Architectural Hardware Consultant, identifying actual condition, location, manufacturer, and product designation for each item of finish hardware actually present on each door at the Site, including whether finish hardware is adjusted and operating properly, compared with each item referenced to approved Shop Drawings and Contract requirements.
- B. Installer's Architectural Hardware Consultant shall provide opinions to, and assist Engineer in determining, acceptability of installation as Work proceeds. All comments and discussions, conversations and meetings with Engineer shall be included in written field report for submission to Engineer for review and approval at completion of finish hardware installation.
- C. As part of written field report to be submitted to Engineer for approval, recommend remedial actions for Work not in compliance with these Specifications. No payment for Work shall be made until remedial recommendations and actions have been approved by Engineer and incorporated into the Work.

3.05 - DOOR FINISH HARDWARE SCHEDULE

- A. Scheduled items for each door are generic and rely on information specified above. The listing of hardware functions and types provided are only a general guideline for the final Door Finish Hardware Schedule. Contractor shall submit a Door Finish Hardware Schedule acceptable to all governing authorities having jurisdiction at the Site.
- B. Provide the following finish hardware items:
 - 1. HDW Set 1 (Exterior, No UL label)
 - a. Continuous hinge.
 - b. Cylinder.
 - c. Panic Exit Devices.
 - d. Overhead Surface-Mounted Door Closer with parallel arm.
 - e. Standard Threshold.
 - f. Weatherstripping.
 - 2. HDW Set 2 (Exterior Pair, No UL label)

- a. Continuous hinges (pair).
 - b. Panic Exit Devices (active leaf).
 - c. Cylinder (active leaf).
 - d. Flush bolt top and bottom (passive leaf).
 - e. Dust proof strike (passive leaf).
 - f. Overhead Surface-Mounted Door Closers with Parallel Arm (both leaves).
 - g. Extended Threshold.
 - i. Weatherstripping (pair) with split astragal.
3. HDW Set 3 (Interior, No UL label)
- a. Mortise hinges (1-1/2 pair).
 - b. Cylinder.
 - c. Panic Exit Devices.
 - d. Overhead Surface-Mounted Door Closer.
 - e. Silencers (3 each).
4. HDW Set 4 (Interior Pair, No UL label)
- a. Mortise hinges (3 pairs).
 - b. Cylinder (active leaf).
 - c. Panic Exit Devices (active leaf).
 - d. Flush bolt top and bottom (passive leaf).
 - e. Dust proof strike (passive leaf).
 - f. Overhead Surface-Mounted Door Closers with Parallel Arm (both leaves).
 - g. Coordinator.

- h. Silencers (6 each).
- 5. HDW Set 5 (Interior Pair, No UL label)
 - a. Mortise hinges (3 pairs).
 - b. Cylinder (active leaf).
 - c. Panic Exit Devices (active leaf).
 - d. Flush bolt top and bottom (passive leaf).
 - e. Dust proof strike (passive leaf).
 - f. Overhead Surface-Mounted Door Closers with Parallel Arm (both leaves).
 - g. Coordinator.
 - h. Silencers (6 each).
 - i. Extended Threshold.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install glass and glazing.
2. Extent of glass and glazing is shown.
3. Types of products required include the following.
 - a. Insulated Laminated Glass
 - b. Insulated Spandrel Glass
 - c. Laminated Safety Glass
 - d. Structural and non-structural glazing sealants.
 - e. Miscellaneous glazing, spacers, tapes and other materials.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the glass and glazing Work.

C. Related Sections:

1. Section 07920, Joint Sealants.
2. Section 08100, Hollow Metal Doors and Frames.

1.02 - REFERENCED STANDARDS

- A. AAMA 800, Voluntary Specifications and Test Methods for Sealants.
- B. ANSI Z97.1, Safety Glazing Materials Used in Buildings.
- C. ASTM C162 – Standard Terminology of Glass and Glass Products.
- D. ANSI/ASTM E 1300, Practice for Determining Load Resistance of Glass in Buildings.
- E. ASCE 7, Minimum Design Loads for Buildings and Other Structures.

- F. ASTM C 864, Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- G. ASTM C 920, Specification for Elastomeric Joint Sealants.
- H. ASTM C 1021, Practice for Laboratories Engaged in Testing of Building Sealants.
- I. ASTM C 1036, Specification for Flat Glass.
- J. ASTM C 1048, Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
- K. ASTM C 1172, Specification for Laminated Architectural Flat Glass.
- L. ASTM C 1376, Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
- M. ASTM E 1300, Standard Practice for Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load.
- N. ASTM E 2188, Standard Test Method for Insulating Glass Unit Performance.
- O. ASTM E 2189, Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
- P. ASTM E 2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.
- Q. 16 CFR, Consumer Product Safety Commission, CPSC Part 1201, Safety Standard for Architectural Glazing Materials.
- R. GANA, Glazing Manual.
- S. GANA, Laminated Glass Design Guide.
- T. GANA, Glass Tempering Division, GTA 95-1-31, Specification for Decorative Architectural Flat Glass.
- U. GANA Sealant Manual; Glass Association of North America.

1.03 - QUALITY ASSURANCE

- A. Fabricator Qualifications:
 - 1. Provide laminated and insulating glass fabrications from fabricators who are licensed by primary glass manufacturer to produce specified units and with documented skill and

successful experience in this type of Work and who agree to employ only tradesmen who are trained, skilled and have successful experience in this type of Work.

2. Provide laminated and insulating glass fabrications from fabricators who are members of GANA or SIGMA and participate in certification programs.
3. Obtain laminated and insulating glass fabrications from fabricators who will, if required, send a qualified technical representative to the Site, for the purpose of assisting the Architect with opinions on the acceptability of materials and installation methods.

B. Installer's Qualifications:

1. The installer of the glass and glazing materials shall be a firm with documented skill and successful experience in the installation of the types of materials required and who agrees to employ only tradesmen who are trained, skilled and have successful experience in the types of materials and glazing systems specified and who are certified under the National Glass Association Glazier Certification Program as Level 3 (Master Glaziers).
2. Submit records of experience and certifications to the Architect.

C. Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or referenced standards:

1. GANA Publications
2. AAMA Publications
3. IGMA/IGMAC Publications

D. Safety glass products in the US are to comply with CPSC 16 CFR Part 1201 for Category II materials.

E. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing specified, as documented according to ASTM E 548.

F. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct testing specified, as documented according to ASTM E 548.

G. Source Limitation: All materials provided under this Section shall be obtained from a single supplier or manufacturer who, with Contractor, shall assume full responsibility for the

completeness of the Work. The supplier or manufacturer shall be the source of information on all material furnished regardless of the manufacturing source of that material.

H. Regulatory Requirements:

1. Safety Glass: Comply with ANSI Z97.1, with label on each piece of glass as required by governing authorities having jurisdiction.
2. Insulating Glass products are to be permanently marked either on spacers or at least one insulating unit component with appropriate certification label of Insulating Glass Certification Council (IGCC).

I. Codes: Comply with applicable requirements of codes referenced in Section 01420, References.

1.04 - SUBMITTALS

A. Samples: Submit the following:

1. 12-inch square samples of each type of glass required.
2. Insulating glass samples need not be hermetically sealed, but edge construction, wavelength-selective interlayer and low-E coatings shall be included and identified. Include specially prepared samples with each interlayer film product's identity marked on film and incorporated into sample.
3. Submit 12-inch long samples of each color for each type of exposed-to-view glazing sealant and gasket. Install sample between two strips of material similar to, or representative of, channel surfaces where sealant or gasket will be used, held apart to represent typical joint widths.
4. Review of samples by Architect will be for color, texture and pattern only. Compliance with other requirements is the responsibility of Contractor.

B. Shop Drawings: Submit the following:

1. Copies of manufacturers' specifications, product data sheets, installation instructions for each type of glass, glazing sealant or compound, gasket and associated miscellaneous material and all recommended installation precautions for required materials and components, which are not included in other submittals, specified in other Sections. Coordinate the submittal of such other data with this submittal, and with the submittal of samples required by other Sections.

2. Structural performance calculations indicating that detailing and fabrication have been based on the results of the required analysis and performance criteria specified.
 3. Plans and elevations showing location of each type and kind of glass specified and details of glazing system. Include manufacturer's recommendations for glazing.
 4. Manufacturer's and fabricator's guarantees, as specified.
 5. Fabricator's qualifications.
 6. Installer's qualifications.
 7. Age of silicone sealant.
 8. Performance analysis of each configuration of insulating glass incorporating wavelength selective interlayer or low E coating using LBL-35-298, Window 4.1.
 9. Certification that fabricated products comply with manufacturer's published performance.
 10. Dimensions and details of manufacturer's glue line thickness and bite dimensions and verifications.
- C. Test Reports: Submit the following:
1. Certified laboratory test reports for required performance tests in compliance with ASTM E 548.
 2. Provide wavelength-selective insulating glass or low-E glass manufacturer's computer-aided sheet engineering analysis to determine deflection and rabbet depth for individual applications, specified loadings, performance requirements, support criteria and other parameters, in order to indicate compliance with these Specifications.
 3. Wavelength-selective polyester film insulating glass or low-E glass fabricator's computer performance analysis of each glass configuration including two (2) filled interlayers for insulating glass units.
 4. Structural silicone sealant performance features and calculations indicating sealant joints have been detailed and fabricated in compliance with silicone sealant manufacturer's recommended guidelines for dissimilar metal adhesion. Structural and other performance calculations for the structural silicone joints shall be prepared, signed and stamped with the seal of a Registered Professional Engineer, licensed to practice in the State of New York, and recognized as an expert in the required Work.

5. Adhesion and compatibility test report from glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
6. Certified laboratory test reports for required performance tests in compliance with NFRC CAP 1 Certification Agency Program.

1.05 - DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
2. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
3. Transport large panes of glass in vertical position with spacers to prevent contact between panes and edges.

B. Storage and Protection:

1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
2. Protect glass and glazing materials according to manufacturer's and fabricator's written instructions to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
3. For insulating glass that will be exposed to substantial altitude changes, comply with insulating glass fabricator's written recommendations for venting and sealing to avoid hermetic seal ruptures.
4. Glass delivered to the job site with manufacturer's markings are applied at the job, use either neutral or slightly acidic adhesive. In no case shall marking materials or adhesives be alkaline. Any staining of glass by alkaline material will be cause for rejection.
5. The edges of all tempered and insulating glass shall be protected from damage and edges shall not be modified in any way after the glass leaves the factory. Nipping of any glass to reduce size will not be permitted.

6. All glass shall be delivered with manufacturer's labels showing type, thickness and quality of the material (and UL label is required). These labels shall not be removed until the glass is set and final approval has been secured.

C. Acceptance at Site:

1. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Architect, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

- D. Field Measurements: When construction schedule permits, verify field measurements with drawing dimensions prior to fabrication of glass products.

1.06 - SPECIAL WARRANTIES

- A. General: The special warranties specified in this Article shall not deprive Owner of other rights or remedies Owner may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under the Contract Documents.

B. Special Warranties:

1. Laminated Glass: Provide written warranty, signed by the fabricator and Contractor and running to benefit of Owner, agreeing to replace, for a period of five-years from the date of Substantial Completion, glass units that show deterioration, as specified. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
2. Insulating Glass: Provide written warranty, signed by the fabricator and Contractor and running to the benefit of Owner, agreeing to replace, for a period of ten-years from the date of Substantial Completion, glass that shows signs of deterioration, as specified. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
3. Coated Glass: Provide written warranty, signed by the fabricator and Contractor and running to the benefit of Owner, agreeing to replace, for a period of ten-years from the date of Substantial Completion, glass that shows signs of deterioration, as specified. Defects include peeling, cracking, and other indications of deterioration in coating.

4. Structural Silicone: Provide structural silicone manufacturer's twenty-year limited adhesion warranty and non-staining warranty for silicone structural adhesive, commencing from the date of Substantial Completion. Perform all testing required to achieve the warranties.

C. Workmanship Guarantee:

1. The contractor shall guarantee all work against defective material or workmanship for a period of one year following acceptance of the work.

PART 2 - PRODUCTS

2.01 - SYSTEM PERFORMANCE

- A. Design Criteria: For glass performance, manufacture, size, type, construction and thickness, comply with the following:
1. Provide glass and glazing systems capable of withstanding normal thermal movements and wind and impact loads without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants (both structural and weather-resisting) to remain watertight, airtight and to maintain structural performance characteristics specified; deterioration of glazing materials; or other defects in construction.
 2. Normal Thermal Movement: Provide glass that allows for thermal movements resulting from a maximum temperature range of 120°F in ambient and 180°F surface temperature acting on glass framing members and glazing components. Base structural performance calculations on surface temperatures of materials caused by both solar heat gain and nighttime-sky loss.
 3. Comply with requirements of Consumer Product Safety Commission, Part 1201, Safety Standards for Architectural Glazing Materials, for all the Work.
 4. Structural Performance: Provide structural calculations for analysis of required glass thicknesses for glass lites shown, that are used to establish final fabricating and detailing requirements. Indicate compliance with the following minimum criteria for all glass shown:
 - a. Project Wind Speed: 110 miles per hour based on ASCE 7-10 and the building code of New York State.
 - b. Importance Factor: Category 1.25; $I_w = 1.15$; Design Factor: 1.15.

- c. Exposure Category: Exposure C; $C_e = 1.13$.
 - d. Wind Stagnation Pressure: $q_s = 12.6$ psf.
 - e. Long-Duration Loading: One month.
 - f. Short-Duration Loading: Sixty seconds, based on three-second gust speed.
 - g. Probability of Breakage for Vertical Glazing: Eight lites per 1,000 under wind action.
 - h. Maximum Lateral Deflection: For glass supported on all four edges, provide thickness required to limit center deflection at design wind pressure to 1/50 times the short side length or 1-inch, whichever is less.
5. Glass thicknesses shown are minimums. Confirm glass thicknesses by analyzing Project structural loadings and in-service conditions using glass manufacturer's recommended load tables and other structural performance criteria specified. Where manufacturer's load tables indicate acceptability of lesser thickness material than required by performance criteria specified, provide specified thicknesses and features as a minimum. Where load tables indicate the need for greater thickness, or additional features, than specified, provide greater thicknesses and features at no additional cost to Owner. Comply with practice for determining minimum thickness and types of glass, to resist loadings required by governing authorities having jurisdiction at the Site, according to ANSI/ASTM E 1300.
6. Test sealant in accordance with sealant manufacturer's recommendations.
7. Provide each configuration of insulating glass incorporating wavelength-selective interlayers or low-E coatings.
8. Glazing Sealant System Compatibility:
- a. Glazing sealants shall be compatible with the channel surfaces, joint fillers, insulating glass sealing system, laminated glass interlayer material and other materials in contact with the glazing channel in compliance with ASTM C 1087.
 - b. Provide only materials and manufacturer's recommended variation of the specified materials, which are known to be fully compatible with the actual installation conditions, as shown by manufacturer's published data or certification submitted to Engineer for approval.

9. Adhesion of Elastomeric Joint Sealants: Comply with ASTM C 793 and ASTM C 794.
10. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer-aided software design, expressed as Btu/square foot by height by degree F.
11. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer-aided software design.
12. Solar Optical Properties: NFRC 300.

B. Definitions:

1. Sealed Insulating Glass Unit Surfaces and Coating Orientation:
 - a. Surface 1- Exterior surface of outer pane (surfacing facing outdoors of outboard lite).
 - b. Surface 2- Interior surface of outer pane (surface facing indoors of outboard lite).
 - c. Surface 3- Exterior surface of inner pane (surface facing outdoors of inboard lite.)
 - d. Surface 4- Room side surface of inner pane (surfacing facing indoors of inboard lite.)
2. Two-ply laminated glass: Two sheets of monolithic glass bonded together with a plastic interlayer by heat and pressure.

2.02 - MANUFACTURERS

A. Manufacturers shall be as listed below:

1. PPG Industries.
2. Oldcastle Glass.
3. Viracon, Inc.
4. Pilkington, Inc.

2.03 - MATERIALS

A. Insulated, Fully Tempered Glass (All exterior door vision lites)

1. Insulating Glass Units: Provide preassembled units consisting of two lites of glass separated by a dehydrated interspace, and complying with ASTM E 2190 for Class C units, permanently and hermetically sealed together at edges with spacers and sealant.
 2. System Sealing: Dual seal with polyisobutylene primary sealant and silicone secondary sealant, complying with ASTM C 1249.
- B. Laminated Safety Glass (glazing unit 1): 9/16" tempered float glass fabricated in autoglave with heat, plus pressure, free of foreign substances and air products.
1. Outboard Lite 9/16-inch Clear
 - a. Surface #1: 1/4-inch Pilkington Clear
 - b. Interlayer: 0.060-inch Clear PVB
 - c. Surface #2: 1/4-inch Clear
 2. Transmittance:
 - a. Visible Light: 51%
 - b. Solar Energy: 27%
 - c. Ultraviolet: <1% Ultraviolet defined as 300 to 380 nanometers (nm)
 3. Reflectance:
 - a. Visible Light Exterior: 6%
 - b. Visible Light Interior: 6%
 - c. Solar Energy: 5%
 4. ASHRAE U-Value:
 - a. Winter Nighttime: 0.95 Btu/hr-ft²-°F
 - b. Summer Daytime: 0.86 Btu/hr-ft²-°F
 - c. Shading Coefficient: 0.56
 - d. Solar Heat Gain Coefficient: 0.49

- e. Relative Heat Gain: 124 Btu/hr-ft²-°F
 - f. Light to Solar Gain: 1.04
- C. Insulating Clear Glass on (glazing unit 2) shall be 1-inch thick glass lite separated by a dehydrated airspace that is hermetically dual sealed with a primary seal of polyisobutylene (PIB) and a secondary seal of silicone or an organic sealant.
- 1. Glazing composition:
 - Outboard Lite: ¼-inch Guardian Sunguard AG43 on Clear Laminated radiant Low-E #2.
 - Airspace: ½-inch cavity (air filled)
 - Inboard Lite: ¼-inch Clear Laminated
 - 2. Transmittance:
 - a. Visible Light: 40%
 - b. Solar Energy: 23%
 - c. UV: 23%
 - 3. Reflectance:
 - a. Visible Light Exterior: 30%
 - b. Visible Light Interior: 15%
 - c. Solar Energy: 33%
 - 4. ASHRAE U-Value:
 - a. Winter Nighttime: 0.31 Btu/hr-ft²-°F
 - b. Summer Daytime: 0.29 Btu/hr-ft²-°F
 - c. Shading Coefficient: 0.33
 - d. Solar Heat Gain Coefficient (SHGC): 0.29
 - e. Relative Heat Gain: 71 Btu/hr-ft²-°F

- f. Light to solar Gain: 1.38

2.04 - GLAZING SEALANTS, TAPES AND GASKETS

A. General:

1. Colors: Provide black or other natural color wherever no other color is available. Wherever material is not exposed-to-view, provide manufacturer's standard color, which has the best overall performance characteristics for the application shown.
 - a. Provide manufacturer's standard colors as shown or, if not shown, provide color selected by Engineer from manufacturer's standard colors to either blend or contrast with adjoining surfaces.
2. Hardness specified is intended to indicate the general range necessary for overall performance. Submit glazing and sealant manufacturer's recommendations for actual hardness for each condition of installation and use. Except as shown or specified, provide glazing materials within the following ranges of hardness (Shore A, fully cured, at 75°F):
 - a. 15 to 35 for elastomeric compounds and tapes used with rigid stops and frames for large glass sizes (in excess of 100 united inches). Provide material sufficiently hard to withstand exposure to abrasion and vandalism.
 - b. 25 to 50 for rubber-like curing compounds used with rigid stops and frames for medium and small glass sizes (less than 100 united inches). Provide materials sufficiently hard to withstand impact of moving sash and doors.
 - c. 35 to 60 for molded gaskets used with rigid stops and frames, depending upon strength needed for application or insertion of units.
 - d. 75 to 80 for structural gaskets (not supported by stops).
3. Provide size and shape of gaskets and preformed glazing units as recommended by the manufacturer and as indicated on approved Shop Drawings.
4. Comply with ASTM C 920 and other requirements for each liquid-applied, chemically curing sealant specified.
5. Where additional movement capability is specified, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement, in compliance with ASTM C 719, to withstand the specified percentage change in the joint width existing

at the time of installation and remain in compliance with other requirements in ASTM C 920 for uses shown.

B. Preformed Butyl Rubber Back-Bedding Mastic Glazing Tape:

1. Preformed tape of polymerized butyl or mixture of butyl and polyisobutylene with inert fillers with built-in spacer of synthetic rubber, solvent-based with minimum 95 percent solids, non-sag consistency, tack-free time of 24 hours or less, paintable, non-staining, complying with AAMA 806.3.
2. Products and Manufacturers: Provide one of the following:
 - a. Polyshim II Glazing Tape by Tremco, Incorporated.
 - b. Extru-Seal Butyl Glazing Tape by Pecora Corporation.
 - c. Or equal.

C. Dense Compression Wedge Gaskets:

1. Provide molded or extruded, closed-cell silicone wedge gaskets in compliance with ASTM C 1115, Type C.

D. Exterior, One-Part, Silicone Rubber Sealant:

1. Silicone rubber-based, one-part elastomeric sealant, complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, G, A and O.
2. Products and Manufacturers: Provide one of the following:
 - a. Spectrem I by Tremco, Incorporated.
 - b. 863 Architectural Silicone Sealant by Pecora Corporation.
 - c. Or equal.

2.05 - MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standards, requirements of manufacturers of glass and glazing materials for applications shown, and approved Shop Drawings. Provide materials with a proven record of compatibility with surfaces shown and specified.

- B. Setting Blocks: Elastomeric material, 80 to 90 Shore A durometer hardness, with proven compatibility with sealants used in the Work and as recommended by the glass manufacturer.
- C. Spacers and Edge Blocks: Elastomeric blocks or continuous extrusions, with a Shore A durometer hardness recommended by glass manufacturer to maintain lites in place and to limit lateral movement for installation shown, and with proven compatibility with sealants used in the Work.
- D. Cylindrical Glazing Sealant Backing: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam complying with ASTM C 1330, Type O (open-cell material), proven to be compatible with sealants used, flexible and resilient, with 5 to 10 psi compression strength for 25 percent deflection.
- E. Cleaners, Primers and Sealers: Type recommended by sealant, gasket and glass manufacturer.

2.06 - FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Glass manufacturer's recommended glazing channel dimensions are intended to provide for necessary minimum bite on the glass, minimum edge clearance and adequate sealant thicknesses, with reasonable tolerances. Contractor shall be responsible for correct glass size for each opening, within the tolerances and necessary dimensions established on approved Shop Drawings.

2.07 - TOLERANCES

- A. Allowable Tolerances: Provide fully tempered and heat-strengthened glass, formed by horizontal roller-hearth process, free of tong marks, and not exceeding the following flatness tolerances (either face, any direction, any location) based on 1/4-inch glass thickness with inversely proportionate tolerances for other thicknesses:
 - 1. For 12-inch Run: 1/16-inch bow.
 - 2. For 3-foot Run: 1/8-inch bow.
 - 3. For 7-foot Run: 1/4-inch bow.
 - 4. For 10-foot Run: 3/8-inch bow.

2.08 - SOURCE QUALITY CONTROL

- A. To the greatest extent possible, provide each type of glass and glazing materials from one manufacturer.

- B. Providing insulating glass with a certified Class A rating according to SIGMA.
- C. Obtain glass and sealant test results for product test reports from qualified testing agencies regularly engaged in the business of testing glass and sealant products.

PART 3 - EXECUTION

3.01 - INSPECTION

- A. Contractor shall examine the framing and glazing channel surfaces, backing, removable stop design, and the conditions under which the glass and glazing is to be performed, and notify Architect, in writing, of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the glazing until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.
- B. Environmental Requirements: Installation of glass products at ambient air temperature below 40 degrees F is prohibited.

3.02 - PREPARATION

- A. Clean the glazing channel, or other framing members to receive glass, immediately before glazing. Remove coatings, which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.
- B. Apply primer or sealer to joint surfaces wherever recommended by sealant and glass manufacturer.

3.03 - INSTALLATION

- A. General:
 - 1. Comply with combined recommendations of glass, window and glazing products manufacturers and other materials used in glazing, except where more stringent requirements are shown or specified, and as shown on approved Shop Drawings.
 - 2. Comply with GANA, Glazing Manual, except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials, as accepted by Engineer on approved Shop Drawings.
 - 3. Inspect each piece of glass immediately before installation, and remove from Site all that have observable edge damage or face imperfections.

4. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.
5. Cut and install tinted glass as recommended in manufacturer's technical bulletin as provided on approved Shop Drawings.
6. Install sealants as recommended by sealant manufacturers, and as recommended on approved Shop Drawings.
7. Do not attempt to cut, seam, nip or abrade glass on Site, which is tempered, heat strengthened, or coated.
8. Do not proceed with installation of liquid glazing sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
9. Proceed with glazing only when forecasted weather conditions are favorable to proper cure and development of high early bond strength. Wherever channel action is affected by ambient temperature variations, install glazing sealants only when temperatures are in the middle third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation or compression, and bond stress will not be excessive at extremely low or high temperatures.
10. Coordinate the installation of the glass and glazing Work with the Progress Schedule in order to avoid delay of Project.

B. Tape and Sealant Glazing:

1. Place setting blocks in sill rabbets, sized and located to comply with referenced glazing publications. Set blocks in thin course of compatible sealant for heel bead. Position glass on setting blocks and press against tape for full contact.
2. Provide spacers for glass lites where the length plus width is larger than 4 foot-2 inches. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

3. Provide 1/8-inch minimum bite for spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
4. Provide edge spacers shown on approved Shop Drawings and as required to prevent glass lites from moving sideways in glazing channel.
5. Cut glazing tape to length and set against permanent stops. Install horizontal strips first, extending over width of opening, before applying vertical strips.
6. Remove paper backing from tape. Place glazing tape on free perimeter of glass. Install tapes continuously. Do not stretch tape to make them fit openings. Place joints in tapes at corners of openings with adjoining lengths butted together, not lapped. Seal butt joints of tape with joint sealant.
7. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
8. Install removable stop, avoiding displacement of tape, and exert pressure on tape for full continuous contact. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Calk space above glazing tape to top of glazing stop. Tool exposed surfaces of sealant compounds to provide a substantial "wash" away from the glass.
9. Clean and trim excess glazing materials from the installation, and eliminate stains and discolorations.
10. Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
11. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended on approved Shop Drawings and to prevent corners from pulling away; seal corner joints and butt joints with sealant as recommended by gasket manufacturer and as shown on approved Shop Drawings.

- C. Dry Gasket Glazing: Install glass in gaskets as recommended by the glass and window manufacturer. Refer to Section 08120, Aluminum Doors and Frames.
- D. Structural Sealant Glazing: Install glass using a system of structural silicone sealants as recommended by the glass and sealant manufacturers.
- E. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.
- F. The installer shall advise Contractor of procedures required for the protection of glass and glazing sealants and compounds during the construction period, so that they will be without deterioration or damage, other than normal weathering, at the time of Substantial Completion.
- G. Furnish specific instructions on the precautions and provisions required to prevent glass damage resulting from the alkaline wash from concrete surfaces and similar sources of possible damage.
- H. Protect exterior glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass.
- I. Remove and replace glass, which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including natural causes, accidents and vandalism.
- J. Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other work.
- K. Remove non-permanent labels and wash and polish glass on both faces not more than four days prior to Substantial Completion. Comply with glass manufacturer's recommendations for cleaning.

3.04 - FIELD QUALITY CONTROL

- A. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air-tight, deterioration of glazing materials and other defects in the Work.
- B. After nominal cure of exterior glazing sealants, which are exposed to the weather, test for water leaks. Flood the joint exposure with water directed from a 3/4-inch hose held perpendicular to wall

face, 2 foot-0 inches from joint, connected to a water system with 30 psi minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 foot-0 inches per minute.

- C. Test approximately five percent of total glazing system, in locations which are typical of every joint condition, and which can be inspected easily for leakage on opposite face. Conduct tests in the presence of Architect, who will determine the actual percentage of joints to be tested and the actual period of exposure to water from the hose, based upon the extent of observed leakage, or lack thereof.
- D. Repair glazing installation at leaks or, if leakage is excessive, replace glazing sealants as directed by Architect.
- E. Wherever nature of observed leakage indicates the possibility of inadequate glazing joint bond strength, Architect may direct that additional testing be performed at a time when joints have been fully cured, followed by natural exposure through both extreme temperatures, and returned to the range of temperature in which it is feasible to conduct testing. Repair or replace Work as required and directed by the Engineer.

3.05 - ADJUSTING AND CLEANING

- A. Before and after installation, all work shall be properly protected against damage.
- B. On completion and prior to turning the project over to the Owner, all metal work and glass shall be cleaned and left in perfect condition. Glass shall be washed outside and inside.
- C. Make required adjustments.
- D. Thoroughly clean all glass and mirrors just before final acceptance by the Owner, or sooner if authorized by Architect.
- E. Remove excess glazing compound and foreign materials.
- F. Replace broken or defective glass and hardened, uneven, defective or otherwise non-complying glazing compound.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and apply paint systems.
 - a. Contractor is responsible for surface preparation and painting of all new and existing interior and exterior items and surfaces throughout the Project areas included under this and other Sections.
2. Extent of painting includes the Work specified below. Refer to Article 2.2 of this Section where all surfaces of generic types are specified for preparation and painting according to their status, intended function, and location, using the painting system for that surface, function, and location as specified, unless specifically identified on the Drawings as a surface not to receive specified painting system.
 - a. All new items except where the natural finish of the material is specified as a corrosion-resistant material not requiring paint; or is specifically indicated in the Contract Documents as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint them the same as adjacent similar materials or areas.
 - b. Mechanical and process items to be painted include:
 - 1) Piping, pipe insulation, pipe hangers, and supports, including electrical conduit.
 - 2) Ductwork and insulation.
 - 3) Motors, mechanical equipment, and structural supports.
 - 4) Odor Control and Foul Air Ductwork supports.
 - 5) Building Framing, Structures, and Exposed Metal Deck.
 - 6) Marking of Piping and Electrical Conduits.
 - 7) Accessory items.
 - c. Surface preparation and painting of all new items, both interior and exterior, and other surfaces, including items furnished by Owner, are included in the Work, except as otherwise shown or specified.
 - d. All materials, equipment, steel tanks, piping, galvanized conduit thread repair and all other items interior and exterior, concealed and exposed, submerged, intermittently submerged shall be painted, whether or not specific reference is herein made to the Documents.
 - e. Approved stepped-down mock-ups for all painting systems showing all components of the surface preparation and paint system application before start of Work. Check all dry film thicknesses; demonstrate methods of surface

preparation, and methods of application, and obtain Architect's approval of colors and textures to be used in the Work.

B. Coordination:

1. Review installation, removal, and demolition procedures under other Sections and coordinate them with the Work specified in this Section.
2. Coordinate painting of areas that will become inaccessible once equipment and similar fixed items have been installed.
3. Coordinate primers with finish paint materials to provide primers that are compatible with finish paint materials. Review other Sections where primed surfaces are provided, to ensure compatibility of total painting system for each surface. Contractor is responsible for coordinating compatibility of all shop primed and field painted items in other Sections.
4. Furnish information to Architect on characteristics of finish materials proposed for use and ensure compatibility with prime coats used. Provide barrier coats over incompatible primers or remove and repaint as required. Notify Architect in writing of anticipated problems using specified painting systems with surfaces primed by others. Reprime equipment primed in factory and other factory-primed items that are damaged or scratched.

C. Related Sections:

1. Section 03350, Concrete Finishes
2. Section 04220, Concrete Unit Masonry
3. Section 05120, Structural Steel
4. Section 05300, Metal Decking
5. Section 05500, Metal Fabrication
6. Section 07920, Joint Sealants.
7. Section 08100 – Metal Doors and Frames.
8. Section 08332 – Overhead Rolling Service Doors.

D. Work Not Included: The following Work is not included as painting Work, or are included under other Sections:

1. Shop Priming: Shop priming of structural metal, miscellaneous metal fabrications, other metal items and fabricated components such as shop-fabricated or factory-painted process equipment, plumbing equipment, heating and ventilating equipment, electrical equipment, and accessories shall conform to applicable requirements of this Section but are included under other Sections.
2. Pre-finished Items:

- a. Items furnished with such finishes as baked-on enamel, porcelain, and polyvinylidene fluoride shall only be touched up at Site by Contractor using manufacturer's recommended compatible field-applied touchup paint.
 - b. Items furnished with finishes such as chrome plating or anodizing.
 - 3. Concealed Surfaces: Non-metallic wall or ceiling surfaces in areas not exposed to view, and generally inaccessible areas.
 - 4. Concrete floors, unless specifically shown as a surface to be painted.
 - 5. Face brick, and prefaced concrete unit masonry.
 - 6. Fiberglass grating, treads and doors.
 - 7. Collector bearings, shafts and chains, wood flights, wood stop logs, and wood or fiberglass baffles.
 - 8. Corrosion-Resistant Metal Surfaces: Where the natural oxide of item forms a barrier to corrosion, whether factory- or Site-formed, including such materials as copper, bronze, muntz metal, terne metal, and stainless steel.
 - 9. Operating Parts and Labels:
 - a. Do not paint moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sensing devices, interior of motors, and fan shafts.
 - b. Do not paint over labels required by governing authorities having jurisdiction at Site, or equipment identification, performance rating, nameplates, and nomenclature plates.
 - c. Cover moving parts and labels during the painting with protective masking. Remove all protective masking upon completion of Work. Remove all paint, coatings, and splatter that comes in contact with such labels.
 - 10. Structural and miscellaneous metals covered with concrete need not receive primers, intermediate, or finish coats of paint, except in the case of dissimilar materials or otherwise noted.
 - 11. Existing structures, equipment, and other existing surfaces and items unless otherwise shown or specified.
- E. Description of Colors and Finishes:
- 1. Color Selection:
 - a. A maximum of ten different colors will be selected by Architect in addition to color-coding of pipelines, valves, equipment, ducts, and electrical conduit.
 - 2. Color Coding of Pipelines, Valves, Equipment, and Ducts:

- a. In general, color-coding of pipelines, valves, equipment and ducts shall comply with applicable standards of ANSI A13.1, ANSI Z535.1 and 40 CFR 1910.144. Specifically, provide color-coding for pipelines per Table 09900-B, Pipeline Color Table following below. Colors shall be brilliant, distinctive shades matching the existing colors. Paint colors are provided as a standard of quality; equivalent colors matching these colors will be acceptable to Architect. Provide Architect with direct color comparisons of colors available from Manufacturer submitted at time of Shop Drawing submission.
 - b. The color of the final coats shall match as closely as possible, without custom blending, the color of the specific pipeline service.
 - c. For equipment on roofs or exposed to view, the color shall be selected by Architect.
3. After approval by Architect of colors and Shop Drawing submittals and prior to beginning painting Work, Architect will furnish color schedules and samples for surfaces to be painted listed in Article 2.1, Painting Systems.

1.02 - REFERENCED STANDARDS

- A. SSPC- Society of Protective Coatings
 1. SSPC PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
 2. SSPC SP 1, Solvent Cleaning.
 3. SSPC-PA2, Hand Tool Cleaning.
 4. SSPC SP 6, Commercial Blast Cleaning.
 5. SSPC-SP7, Brush-off Blast Cleaning.
 6. SSPC-SP 10, Near-White Blast Cleaning.
 7. SSPC-SP 13, Surface Preparation of Concrete
- B. Fed. Spec.- Federal Specifications and Standards of the General Services Administration
 1. TT-C-542F
 2. TT-650D
 3. TT-P-1511B
 4. TT-P-96D
- C. Mil. Specs.- Specifications and Standards of the Department of Defense of the United States Government
 1. MIL-C-22750F
 2. MIL-P-23377G

3. MIL-C-22750F

4. MIL-P-26915C

D. ASTM- American Society for Testing Materials

1. ASTM C811- Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfaces
2. ASTM D3359- Measuring Adhesion by Tape Test
3. ASTM D4258- Practice for Surface Cleaning Concrete for Coating
4. ASTM D4263, Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
5. ASTM D4541, Test Methods for Pull-Off Strength of Coatings Using Portable Adhesion-Testers.
6. ASTM E329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
7. Green Seal, Inc. Paint, (GS-11).
8. GLUMRB, Recommended Standards for Wastewater Facilities.
9. National Association of Piping Fabricators, NAPF 500-03, Surface Preparation Standard For Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings And/or Special Internal Linings.

1.03 - DEFINITIONS

A. Standard coating terms defined in ASTM D16 apply to this Section, including:

1. Paint: Pretreatment and all painting system materials, such as primer, emulsion, enamel, organic/inorganic polymer coating, stain sealer and filler, and other applied materials whether used as prime, filler, intermediate, or finish coats.
2. Exposed: All items not covered with cement plaster, concrete, or fireproofing. Items covered with these materials shall be provided with specified primer only, except where specified as a surface not to be painted. Exposed-to-view surfaces include areas visible after permanent or built-in fixtures, convector covers, ceiling tile, covers for finned tube radiation, grilles, and similar covering products are in areas scheduled to be painted.
3. Low VOC: All interior and exterior field-applied coatings that have maximum VOC content as listed in OTC Model Rule for Architectural and Industrial Maintenance Coatings.
4. OTC: Ozone Transport Commission, which recommends standard VOC content levels in several Northeastern and Mid-Atlantic states.

1.04 - QUALITY ASSURANCE

A. Applicator Qualifications:

1. Engage a single applicator that regularly performs installation of paint materials, with documented skill and successful experience in installing types of products required and that agrees to employ only trained, skilled tradesmen who have successful experience in installing types of products specified.
 2. Submit name and qualifications to Architect along with following information for at least three successful, completed projects:
 - a. Names and telephone numbers of owner and design professional responsible for project.
 - b. Approximate contract cost of paint products.
 - c. Amount of area painted.
 3. Submit to Architect proof of acceptability of applicator by manufacturer.
- B. Testing Agency Qualifications: Provide an independent testing agency for testing specified in this Section. Testing agency shall be selected by Owner and paid for by Contractor. To qualify for approval, submit documentation demonstrating to satisfaction of Architect, that testing agency has experience and capability to satisfactorily conduct testing required without delaying the Work, in accordance with ASTM E329.
- C. Source Quality Control:
1. Obtain materials from manufacturers that will provide services of a qualified manufacturer's representative at Site at commencement of painting Work, to advise on products, mock-ups, installation, and finishing techniques and, at completion of Work, to advise Architect on acceptability of completed Work and during the course of the Work as may be requested by Architect.
 2. Certify long-term compatibility of all coatings with surfaces. Compatible shop and field coats shall be provided.
 3. Do not submit products that decrease number of coats, surface preparation, or generic type and formulation of coatings specified. Products exceeding VOC limits and chemical content specified will not be approved.
 4. Architect may review manufacturers' recommendations concerning methods of installation and number of coats of paint for each painting system. Contractor shall prepare construction costs based on painting systems, number of coats, coverage's and installation methods specified.
 5. Submit "or equal" products, when proposed, with direct comparison to products specified, including information on durability, adhesion, color and gloss retention, percent solids, VOC's grams per liter, and recoatability after curing.
 6. "Or equal" manufacturers shall furnish same color selection as manufacturers specified, including intense chroma and custom pigmented colors in all painting systems.
 7. Color Pigments: Provide pure, non-fading, applicable types to suit surfaces and services to be painted. Comply with:

- a. Lead and Chromate: Lead and chromate content shall not exceed amount permitted by authorities having jurisdiction.
 - b. Areas subject to hydrogen sulfide fume exposure will be identified by Architect. Through Contractor, paint manufacturer shall notify Architect of colors that are not suitable for long-term color retention in such areas.
 - c. Manufacturer shall identify colors that meet the requirements of authorities having jurisdiction at Site for use in locations subject to contact with potable water or water being prepared for use as potable water.
 - d. Comply with paint manufacturer's recommendations on preventing coating contact with levels of carbon dioxide and carbon monoxide that may cause yellowing during application and initial stages of curing of paint.
8. Obtain each product from one manufacturer. All coats of paint for any particular surface shall be from the same manufacturer. Multiple manufacturing sources for the same system component are unacceptable.
 9. Certify product shelf life history for each product source for materials manufactured by the same manufacturer, but purchased and stored at different locations or obtained from different sources.
 10. Constantly store materials to be used for painting Work between 60 degrees F and 90 degrees F, and per paint manufacturer's written recommendations, for not more than six months. Certify to Architect that painting materials have been manufactured within six months of installation and have not, nor will be, subjected to freezing temperatures.

D. Regulatory Requirements:

1. Comply with VOC content limits of OTC Model Rule for Architectural and Industrial Maintenance Coatings:
 - a. Industrial Maintenance Coatings: 340 grams per liter.
 - b. Interior and Exterior Non-Flat Coatings: 250 grams per liter.
2. Comply with the following:
 - a. 29 CFR 1910.144, Safety Color Code for Marking Physical Hazards.
 - b. 40 CFR, Subpart D-2001, National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - c. Resource Conservation and Recovery Act of 1976 (RCRA).
 - d. SW-846, Toxic Characteristic Leaching Procedure (TCLP).
3. Comply with authorities having jurisdiction at Site for blast cleaning, confined space entry, and disposition of spent abrasive and debris.
4. Painting systems for surfaces in contact with potable water or water being treated for potable use shall not impart any taste or odor to the water or result in any organic or

inorganic content in excess of the maximum allowable contaminant level established by applicable Laws and Regulations. All such painting systems shall be approved by the applicable regulatory agency. Revise painting systems specified herein to provide Supplier's regulatory agency approved painting system(s) where required.

5. Comply with governing regulations for air quality and material disposal regulations. Revise painting systems specified herein in order to provide Supplier's regulatory agency approved coating systems where required.

E. Air Pollution Code Requirements:

1. All paints, solvents, varnish and coatings specified in this contract shall conform to all Ozone Transportation Commission (OTC) requirements
2. The contractor shall furnish the Architect with certification of compliance from the manufacturer that the paints, solvents, varnishes and coatings conform to the Ozone Transportation Commission (OTC) requirements.

1.05 - SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Submit the following:
 - a. Copies of manufacturer's technical information and test performance data, including paint analysis, VOC and chemical component content in comparison to maximum allowed by the Contact Documents, and application instructions for each product proposed for use.
 - b. List each material and cross-reference to the specific painting system and application, including a list of site-specific surfaces to which painting system will be applied. Identify by manufacturer's catalog number and general classification. State number of gallons of each product being purchased for delivery to Site and square foot area calculated to be covered by each painting system specified based on theoretical loss of 20 percent. Where actual area to be covered by paint system exceeds area submitted to Architect for that system, proof of additional material purchase shall be provided to Architect. Calculated coverage shall be as specified for each component of each painting system specified. This requirement does not take precedence over Contractor's responsibility to provide dry film thickness required for each component of each painting system.
 - c. Identify maximum exposure times allowable for each paint system component before next coat of paint can be applied. Submit proposed methods for preparing surfaces for subsequent coats if maximum exposure times are exceeded.
 - d. Information on curing times and environmental conditions that affect curing time of each paint system component and proposed methods for accommodating variations in curing time. Identify this information for each painting system in the Work.
 - e. Specification for spray equipment with cross-reference to paint manufacturer's recommended equipment requirements.
2. Samples: Submit the following:

- a. Color Chart: The Contractor shall submit the manufacturer's standard color chart for color selection for painting of items other than process piping, valves, pipe line equipment, pump casings, blowers and other mechanical equipment and their drive units, all of which shall be in conformance with the "BACKGROUND COLOR" of the General Color Code specified in Division 15.
- b. Paint Samples: The Contractor shall submit two one-quart samples of each required kind of paint material, or the ingredients thereof which are to be mixed in the job. Samples shall be labeled as required under Article 1.7, and shall include the certificate of the manufacturer stating the actual percentages by weight and volume of all ingredients entering into the mixture. Upon request, further samples shall be provided as the work progresses. Painting materials shall not be applied without written approval of samples by the Architect.
- c. Painted Surface Samples: Upon request, duplicate samples of the results obtained by painting and finishing various materials on the work shall be submitted. Such samples, and the approved paint applied thereto, shall be applied in strict conformance with these specifications. Finished areas shall be considered adequate for the purpose of determining the quality of the work. All painting work shall be performed in a quality equal to the approved samples. Where equipment is customarily shipped with a standard finish, samples of the proposed color and finish shall be submitted for approval prior to shipping.

B. Informational Submittals:

- 1. Certificates: Submit the following:
 - a. Certificate from paint manufacturer stating that materials meet or exceed Contract Documents requirements.
 - b. Evidence of shelf life history for all products verifying compliance with the requirements of the Contract Documents.
 - c. Contractor shall provide notarized statement verifying that all painting systems are compatible with surfaces specified that coatings in immersion service contain no water soluble solvents or corrosion inhibitive (active) pigments with slight water solubility. All painting systems components shall be reviewed by an authorized technical representative of paint manufacturer for use as a compatible system. Verify that all painting systems are acceptable for exposures specified and that paint manufacturer is in agreement that selected systems are proper, compatible, and are not in conflict with paint manufacturer's recommended specifications. Show by copy of transmittal form that a copy of letter has been transmitted to paint applicator.
- 2. Test Reports: Submit the following:
 - a. Certified laboratory test reports for required performance and analysis testing in compliance with ASTM E329.
 - b. Adhesion testing plan and procedures.
 - c. Results of adhesion testing on existing surfaces containing paints or other coatings to be topcoated with paint systems specified. Prior to adhesion testing,

submit a testing plan establishing methods, procedures and number of tests in each area where existing coatings are to remain and become substrate for painting Work. Based on results of adhesion testing, recommend methods, procedures, and painting system modifications, if necessary, for proceeding with Work.

- d. Locations of and test methods for soil sampling before beginning Work and after Substantial Completion.
 - e. Proposed methods for testing, handling, and disposal of waste generated during Work.
 - f. Results of alkalinity and moisture content tests performed in accordance with ASTM D4262 and ASTM D4263.
 - g. Results of tests of film thickness, holidays, and imperfections.
- 3. Manufacturer's Instructions: Provide paint manufacturer's storage, handling, and application instructions prior to commencing painting Work at Site.
 - 4. Manufacturer's Site Reports: Provide report of paint manufacturer's representative for each visit to Site by paint manufacturer's representative.
 - 5. Special Procedure Submittals: Submit the following:
 - a. Proposed protection procedures for each area of Work, explaining methods of protecting adjacent surfaces from splatter, for confining application procedures in a manner that allows other work adjacent to surface preparation and painting Work to proceed safely and without interruption.
 - b. Site-specific health and safety plan.
 - c. Procedures for maintaining acceptable application, curing and environmental conditions during and after painting systems application.
 - d. Procedures for providing adequate lighting, ventilation, and personal protection equipment relative to painting Work.
 - 6. Qualifications: Submit qualifications data specified in Article 1.4 of this Section for the following:
 - a. Applicator.
 - b. Testing laboratory
- C. Closeout Submittals:
- 1. Maintenance Manual: Upon completion of the painting Work, furnish Architect five copies of detailed maintenance manual including the following information:
 - a. Complete and updated product catalog of paint manufacturer's currently available products including complete technical information on each product. Identify product names and numbers of each product used in the painting Work.

- b. Name, address, e-mail address and telephone number of manufacturer, local distributor, applicator and technical representative.
 - c. Detailed procedures for routine maintenance and cleaning.
 - d. Detailed procedures for light repairs such as dents, scratches and staining.
- 2. Statement of Application: Upon completion of the painting Work, submit a notarized statement to Architect signed by Contractor and painting applicator stating that Work complies with requirements of the Contract Documents and that application methods, equipment, and environmental conditions were proper and adequate for conditions of installation and use.

1.06 - DELIVERY, STORAGE, AND HANDLING

- A. Product Delivery Requirements: Deliver products to Site in original, new, undamaged and unopened packages and containers, accurately and legibly and accurately labeled with the following:
 - 1. Project and Contract No.
 - 2. Name of the Manufacturer
 - 3. Address of the Manufacturer
 - 4. Generic Name of Paint or Ingredients
 - 5. Brand and Trade Mark
 - 6. Schedule Letter as Listed Herein
 - 7. Percent Solids by Volume
 - 8. Net Quantity
 - 9. Date of Manufacturer
 - 10. Date Packed
- B. Safety Requirements: All painting materials specified herein, and ingredients of coatings containing substances that are potentially toxic or hazardous shall be shipped with warning labels. These products shall be applied in strict conformance with the safety requirements of the following:
 - 1. The Manufacturer
 - 2. The National Paint and Coatings Association (NPCA)
 - 3. The Society of the Plastics Industry (SPI)
 - 4. The Manufacturing Chemist Association (MCA)
 - 5. The Steel Structures Painting Council (SSPC)

6. The United States Government Occupational Safety and Health Act (OSHA)
 7. Ozone Transportation Commission (OTC)
 8. The Health and Safety Requirements of the State of New York
- C. Product Storage Requirements:
1. Store acceptable materials at Site.
 2. Store in an environmentally controlled location as recommended in paint manufacturer's written product information. Keep area clean and accessible. Prevent freezing of products.
 3. Store products that are not in actual use in tightly covered containers.
 4. Comply with health and fire regulations of authorities having jurisdiction at Site.
- D. Product Handling Requirements:
1. Handle products in a manner that minimizes the potential for contamination, or incorrect product catalyzation.
 2. Do not open containers or mix components until necessary preparatory work has been completed and approved by Architect and painting Work will start immediately.
 3. Maintain containers used in storing, mixing, and applying paint in a clean condition, free of foreign materials and residue.

1.07 - SITE CONDITIONS

- A. Site Facilities:
1. Supplemental heat sources, as required to maintain both ambient and surface temperatures within range recommended by paint manufacturer for paint system application, are not available at Site.
 2. Provision of supplemental heat energy sources, power, equipment, and operating, maintenance and temperature monitoring personnel is responsibility of Contractor.
 3. Do not use heat sources that emit carbon dioxide or carbon monoxide into areas being painted. Properly locate and vent such heat sources to exterior such that paint systems are unaffected by exhaust.
- B. Environmental Requirements:
1. Apply water-base paints when the temperature of surfaces to be painted and ambient air temperatures are between 55 degrees F and 90 degrees F, unless otherwise permitted by paint manufacturer's published instructions.
 2. Surfaces to be painted shall be at least 5 degrees F above dew point temperature and be dry to the touch. Apply paint only when temperature of surfaces to be painted, paint products, and ambient air temperatures are between 65 degrees F and 95 degrees F, unless otherwise permitted by paint manufacturer's published instructions.

3. Apply paint system within shortest possible time consistent with manufacturer's recommended curing instructions for each coat. If chemical, salt, or other contamination contacts paint film between coats, remove contamination per SSPC SP 1 and restore surface before applying paint.
4. Do not paint tanks or pipelines containing fluid without specific permission of Architect and only under conditions where "sweating" of outside surface of vessel being painted is not likely to occur within 24 hours of paint application.
5. Do not apply epoxy paints if ambient temperature is expected to go below 50 degrees F within twelve hours of application. Follow manufacturer's instructions when manufacturer's published recommendations require a higher minimum ambient temperature.
6. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent. Do not apply paint to damp or wet surfaces or when surfaces will reach dew point due to falling or rising temperatures and humidity conditions during course of paint application, unless otherwise permitted by paint manufacturer's published instructions.
7. Do not paint unacceptably hot or cold surfaces until such surfaces can be maintained within temperature and dew point ranges acceptable to paint manufacturer. Arrange for surfaces to be brought within acceptable temperature and dew point ranges as part of painting Work.
8. Moisture content of surfaces shall be verified to Architect as acceptable prior to commencement of painting using methods recommended by paint manufacturer.
9. Painting may be continued during inclement weather only if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer for application and drying.
10. Provide adequate illumination and ventilation where painting operations are in progress.

C. Protection:

1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently, or not to be painted.
2. During surface preparation and painting, facility shall remain in operation. Use procedures that prevent contamination of process or cause or require facility shutdown.
3. Coordinate and schedule surface preparation and painting to avoid exposing employees of Contractor, Owner, Architect and others not involved with surface preparation and painting, to hazards associated with painting Work. Provide required personnel safety equipment per requirements of authorities having jurisdiction at Site.
4. Submit protection procedures to be employed by Contractor to Architect. Do not begin surface preparation and painting Work in any area until Architect accepts protection techniques proposed by Contractor.
5. When working with flammable materials, provide fire extinguishers and post caution signs warning against smoking and open flame.

1.08 - MAINTENANCE

- A. Extra Materials: Furnish, tag, and store an additional one percent by volume of all coatings and colors installed. Provide a minimum of one gallon of each coating and color. Store in unopened containers as specified until turned over to Owner.

PART 2 - PRODUCTS**2.01 - PAINTING SYSTEM MANUFACTURERS**

- A. Products and Manufacturers: Where referenced under painting systems provide products manufactured by the following:
 - 1. Tnemec Company, Inc. (TCI).
 - 2. The Carboline Company, part of StonCor Group, an RMP Company (TCC).
 - 3. PPG Protective & Marine Coatings (PPG PMC).
 - 4. Pittsburgh Architectural Finishes (PPG PAF)
 - 5. Benjamin Moore & Company (BMC).
 - 6. ICI Paints (ICI).
 - 7. The Sherwin-Williams Company (SWC)
- B. Product Substitutions: Proprietary protective coatings included herein by brand name or trademark are given solely as standards of quality and for bidding purposes and do not preclude the use of an approved equivalent.
 - 1. Equivalents: Equivalent products shall be of standard, regularly produced product of a manufacturer. Equivalent products shall be submitted on their applicable published printed literature that states the generic type, instructions for use, solids by volume, application rates, and chemical components of vehicles and solids. Equivalent products shall be accompanied by a list of projects where each of the coatings has been used on new construction and has rendered satisfactory service for at least three years. Should the manufacturer's literature of the product being offered call for higher film thickness, the greater film thickness shall be applied, and the submitted schedule shall so state.

2.02 - PAINTING SYSTEMS

- A. New Cast-In-Place Concrete (Underside of Roof Slabs, Columns, and Beams), Non-Submerged, Interior:
 - 1. Surface Preparation: Refer to Paragraphs 1.7.B., 3.2.A., 3.2.B.3., 3.2.B.5., 3.2.B.6. and 3.2.B.7.
 - 2. Filler, Surfacer and Patching Compound:
 - a. Generic Components:
 - 1) Minimum 38 percent solids, vinyl acrylic block filler; 61 grams per liter VOC, maximum.

- b. Products and Manufacturers: Provide one of the following:
 - 1) Speedhide Latex Block Filler 6-7 (PPG PAF); Latex Block Filler M88 (BMC); Prep and Prime Block Filler 3010 (ICI); One coat 7.0 to 14.5 dry mils.
 - 3. Primer:
 - a. Generic Components:
 - 1) Minimum 30 percent solids, 100 percent acrylic; 50 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Pure Performance Acrylic Primer 9-900 (PPG PAF); Eco Spec Interior Latex Primer Sealer 231 (BMC); Devflex 4020 PF (ICI); One coat, 0.8 dry mils.
 - 4. Finish: Semi-Gloss:
 - a. Generic Components:
 - 1) Minimum 36 percent solids, 100 percent acrylic latex, gloss; 50 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Pure Performance Acrylic Semi-Gloss 9-500 (PPG PAF); Pristine Eco Spec Latex Enamel, 224 (BMC); Dulux Lifemaster 2000-9200 (ICI); Two coats, 1.4 dry mils, per coat.
- B. New or Existing Cast-In-Place Concrete Floors, Interior:
 - 1. Refer to Section 09961 – Slip Resistant Floor Coating System.
- C. New Ferrous Metals, Structural Steel, Miscellaneous Ferrous Metals, Exterior Surfaces of Valves, Exterior Surfaces of Ferrous Piping, and Exterior Surfaces of All Ferrous Metal; Non-submerged, Interior:
 - 1. Surface Preparation: Refer to Paragraphs 1.7.B., 3.2.A., 3.2.C.1., 3.2.C.2.
 - 2. Shop Primer:
 - a. Generic Components:
 - 1) Minimum 66 percent volume solids, build, two-component, cycloaliphatic amine-catalyzed epoxy or polyamido-amine epoxy coating; 300 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:

- 1) Amercoat 370 (PPG PMC); Series N69 Hi-Build Epoxoline (TCI); Carboguard 954 HB (TCC): One coat, 4.0 to 6.0 dry mils.
3. Field Primer and Touch-Up:
 - a. Generic Components:
 - 1) Minimum 100 percent volume solids, high-build, two-component, polyamide-catalyzed epoxy; 8 grams per gallon VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Amerlock Sealer (PPG PMC); Series N69 Hi-Build Epoxoline (TCI); Carboguard 954 HB (TCC); Cor-Cote HP (SWC): One coat.
4. Finish: Gloss:
 - a. Generic Components:
 - 1) Minimum 80 percent volume solids, high-build, chemical-resistant, high-gloss, modified, polyamine- or polyamidoamine-catalyzed epoxy finish; 180 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Amerlock 2/400 Series (PPG PMC); Series 104 H.S. Epoxy (TCI); Carboguard 890 LT (TCC); Cor-Cote HP (SWC):
 - a) Horizontal Surfaces: One coat, 6.0 to 12.0 dry mils.
 - b) Vertical Surfaces: One coat, 4.0 to 8.0 dry mils.
- D. New Ferrous Metals, Non-Ferrous Metals and Exterior Surfaces of Piping; Submerged or Intermittently Submerged, including up to 4.0 above liquid surface; Interior and Exterior:
 1. Surface Preparation: Refer to Paragraphs 1.7.B., 3.2.A., 3.2.C.1., 3.2.C.2., and 3.2.E.
 2. Factory Primer:
 - a. Generic Components:
 - 1) Minimum 66 percent solids, two-component, cycloaliphatic amine-catalyzed epoxy or polyamido-amine epoxy; 334 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Amercoat 370 (PPG PMC); Series N69 Hi-Build Epoxoline (TCI); Carboguard 954 HB (TCC); Macropoxy HS Epoxy (SWC): One coat, 4.0 dry mils.
 3. Shop Prime/Touch-Up/Finish, Satin:

- a. Generic Components:
 - 1) Minimum 80 percent volume solids, high-build, two-component, polyamide-catalyzed epoxy or polyamido-amine epoxy; 180 grams per gallon VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Amerlock 2/400 Series (PPG PMC); Series N69 Hi-Build Epoxoline (TCI); Carboguard 890 LT (TCC); Dura-Plate UHS (SWC): Three coats, 4.0 to 15.0 dry mils, per coat.
- E. New Galvanized Metal, and Fiberglass; Non-submerged, Interior:
- 1. Surface Preparation: Refer to Paragraphs 1.7.B., 3.2.A., 3.2.D., 3.2.E. and 3.2.F.
 - 2. Primer:
 - a. Generic Components:
 - 1) Minimum, 39 percent volume solids single-component, self-cross linking acrylic primer-sealer, 140 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Pitt Tech EDF 90-812 Series (PPG PMC); Series 115 Uni-Bond DF (TCI); Galoseal Wash Primer (TCC); One coat, 2.0 to 4.0 dry mils.
 - 3. Finish: Satin:
 - a. Generic Components:
 - 1) Minimum, 41 percent volume solids, single component, self-cross linking acrylic; 208 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Pitt Tech EDF 90-812 Series (PPG PMC); Series 116 Uni-Bond (TCI); Carbocrylic 3359 (TCC);: One coat, 2.0 to 4.0 dry mils.
- F. New and Existing Aluminum in Contact with Dissimilar Materials:
- 1. Surface Preparation: Refer to Paragraphs 1.7.B., 3.2.A. and 3.2.D.
 - 2. Primer/Finish:
 - a. Generic Components:
 - 1) Minimum 80 percent volume solids, high-build, two-component, polyamido-amine or polyamine epoxy; 180 grams per gallon VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:

- 1) Amerlock 2/400 Series (PPG PMC); Series N69 Hi-Build Epoxoline 100 (TCI); Carboguard 954 HB (TCC); Dura-Plate UHS (SWC): Two coats, 4.0 to 15.0 dry mils, per coat.
- G. New and Existing Exterior Surfaces of Ductile Iron Pipe; Buried Exterior:
1. Refer to Section 15061, Ductile Iron Pipe.
- H. New and Existing Concrete Masonry Block Surfaces, Interior:
1. Surface Preparation: Refer to paragraphs 1.7B, 3.2A, 3.2B.
 2. Primer-Filler:
 - a. Generic Components:
 - 1) Minimum 50 percent volume solids, waterborne acrylic primer/sealer; 100 grams per liter VOC, maximum .
 - b. Products and Manufacturers:
 - 1) Environfill Series 130 (TCI); Sanitile 100 (TCC); Heavy Duty Block Filler (SWC): One coat.
 3. Finish: Satin:
 - a. Generic Components
 - 1) Minimum 40 percent volume solids, polyamide epoxy topcoat; 150 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Hi-Build Epoxoline II Series L69 (TCI); Carboguard 894 (TCC); B73-360 Series Pro-Industrial Water-Based Catalyzed Epoxy (SWC): Two coats, 4.0 to 6.0 dry mils, per coat.
- I. New Pipe and Duct Insulation, Cloth, Paper and Canvas Jacketed; Non-submerged, Interior:
1. Surface Preparation: Refer to Paragraphs 1.7.B., 3.2.A. and 3.2.G.
 2. Primer:
 - a. Generic Components:
 - 1) Minimum 38 percent volume solids single-component, self-cross linking acrylic primer-sealer; 159 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series 115 Uni-Bond DF (TCI); Sanitile 120 (TCC); (PPG PMC); One coat, 2.0 to 4.0 dry mils.

3. Finish: Satin:
 - a. Generic Components:
 - 1) Minimum 37 percent volume solids, single component, self-cross linking acrylic; 226 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series 1029 Enduratone (TCI); Carbocrylic 3358 (TCC); (PPG PMC); One coat, 2.0 to 4.0 dry mils.
- J. New PVC and CPVC Piping and Fiberglass Insulation Covering; Non-submerged, Interior/Exterior:
 1. Surface Preparation: Refer to Paragraphs 1.7.B., 3.2.A. and 3.2.F.
 2. Primer:
 - a. Generic Components:
 - 1) Minimum 37 percent volume solids single-component, self-cross linking acrylic primer-sealer or polyamido-amine epoxy coating; 226 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series N69 Hi-Build Epoxoline (TCI); Sanitile 120 (TCC); One coat, 2.0 to 4.0 dry mils.
 3. Intermediate:
 - a. Generic Components:
 - 1) Minimum 37 percent volume solids single-component, self-cross linking acrylic primer-sealer or polyamido-amine epoxy coating; 226 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Series N69 Hi-Build Epoxoline (TCI); Carbocrylic 3359 (TCC); One coat, 2.0 to 4.0 dry mils.
 4. Finish: Semi-Gloss/Gloss:
 - a. Generic Components:
 - 1) Minimum 59 percent volume solids, single component, Aliphatic Acrylic Polyurethane; 340 grams per liter VOC, maximum.
 - b. Products and Manufacturers: Provide one of the following:

- 1) Series 1075U Endura-Shield II (TCI); Carbothane 130 (TCC); One coat, 2.0 to 4.0 dry mils.

2.03 - JOINT SEALANTS

- A. Refer to Section 07920, Joint Sealants.

2.04 - INSTRUMENTS

- A. Instruments:
 1. Contractor shall purchase for Owner two new dry-film thickness gauges for checking film thickness, and one set of visual standards to check surface preparation. Calibrate dry film thickness gauge at the Site using Bureau of Standards standard shim blocks. Provide one holiday detector for holiday testing. The holiday detector will remain the property of Contractor.
 2. Products and Manufacturers: Provide the following:
 - a. Film Thickness Testers: Model FM-III manufactured by Mikrotest, or equal.
 - b. Holiday detector shall be Model M-1 as manufactured by Tinker & Rasor, or equal.
 - c. Visual Standards: ASTM D2200, Swedish Standards, SSPC VIS 1.

2.05 - SNAP-ON PIPE MARKERS

- A. Snap-On Pipe Markers:
 1. Wrap around labels to attach to pipe with no string, straps or adhesives.
 2. Manufacturers:
 - a. Custom B-689 High Performance Pipe Markers by Brady USA, Incorporated – Signmark Division
 - b. Brimar: System #1 Pipe Markers
 - c. Or Equal.

PART 3 - EXECUTION**3.01 - INSPECTION**

- A. Contractor shall examine areas and conditions under which painting Work is to be performed and notify Architect in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to Architect.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film capable of performing in accordance with claims made in paint manufacturer's product literature for surfaces and conditions encountered.

3.02 - SURFACE PREPARATION**A. General:**

1. Test for moisture content of surfaces before commencement of painting Work. Test for moisture in concrete in compliance with ASTM D4263. Report results to Architect before commencing Work.
2. Perform preparation and cleaning procedures as specified herein and in strict accordance with paint manufacturer's approved instructions for each surface and atmospheric condition.
3. Contractor shall provide effective surface-applied protection for in place items that do not require painting prior to surface preparation and painting operations.
4. Contractor shall remove as necessary items that must be field-painted where adjacent surfaces cannot be completely protected from splatter or overspray. Following completion of painting of each space or area, the removed items shall be reinstalled by workers skilled in the trades involved.
5. Clean surfaces to be painted before applying painting system components. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning.
6. Prepare surfaces that were improperly shop-painted and abraded or rusted shop-painted surfaces as specified.

B. Cast-In-Place Concrete:

1. Prepare surfaces of concrete unit masonry to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and other contamination using soap and water. Surfaces shall be clean and dry at time of paint system application.
2. Concrete unit masonry that cannot be adequately cleaned using soap and water shall be acid etched with a commercial solution of 15 percent muriatic acid.
3. Prepare and clean cast-in-place concrete and precast concrete surfaces per ASTM D4259 to provide a uniform and continuous anchor profile of approximately one mil. Provide mechanical abrading and abrasive blasting per ASTM D4259. Use 40 to 80-mesh abrasive and clean, dry, compressed air. Compressed air cleanliness shall be per ASTM D4285. Pressure at blasting nozzle shall not exceed 80 pounds per square inch. Do not concentrate blast on surface; instead, move at a fairly rapid rate to provide a surface free of laitants and contaminants. Provide post-surface preparation cleaning per ASTM D4258 to remove loose material. Surface preparation shall open all surface air holes by removing laitance shoulders surrounding air holes. Vacuum surfaces to remove dust and sand, and wash with potable water.
4. Where paint system is for chemical containment barrier protection, repair cracks and expansion joints in concrete and provide 2-inch radius cove base fillets at equipment pads and containment walls as part of complete chemical containment paint system Work. Use materials and techniques recommended by manufacturers of the paint and concrete repair products.

5. Remove from cast-in-place concrete fins, projections, and other surface irregularities that would protrude above level of finished intermediate fillers and surfacers. Remove by chipping and scarification by mechanical abrasion.
6. Using specified filler and surfacer, patch cast-in-place concrete and precast concrete surfaces as required to completely fill surface air holes and honeycombing. Level all protrusions, grind filler and surfacing compounds smooth, and level with adjacent surfaces.
7. Perform tests per ASTM D4262 and ASTM D4263 to verify alkalinity and moisture content of surfaces to be painted, and report findings to Architect. If, in Architect's opinion, surfaces are sufficiently alkaline to cause blistering and burning of paint, correct the condition before applying paint. Provide suitable testing materials for alkalinity and moisture tests. Do not paint surfaces where the moisture content exceeds eight percent.
8. Where a concrete unit masonry block filler is specified, spot patch holes and cracks with a putty knife using specified block filler. Apply to large surfaces by airless spray and backroll uniformly using a roller with a synthetic nap cover. Follow with a rubber squeegee to provide a smooth finish.

C. Ferrous Metals:

1. Ferrous Metals except Ductile and Cast Iron:
 - a. Comply with paint manufacturer's recommendations for type and size of abrasive to provide a surface profile that meets manufacturer's painting system requirements for type, function, and location of surface. Verify that paint manufacturer-recommended profiles have been achieved on prepared surfaces. Report profiles to Architect using Test Method C of ASTM D4417.
 - b. Clean non-submerged ferrous surfaces including structural steel and miscellaneous metal to be shop-primed, of all oil, grease, dirt, mill scale, and other contamination by commercial blast cleaning complying with SSPC SP 6 at time of paint system application, using SSPC VIS 1 as a standard of comparison.
 - c. Clean submerged ferrous surfaces including structural steel and miscellaneous metal to be shop-primed of all oil, grease, dirt, mill scale, and other contamination by near-white blasting complying with SSPC SP 10 at time of painting system application, using SSPC VIS 1 as a standard of comparison.
 - d. Clean non-submerged, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale, and other contamination by commercial blasting complying with SSPC SP 6 at the time of painting system application, using SSPC VIS 1 as a standard of comparison.
 - e. Clean submerged ferrous surfaces that have not been shop-coated or that have been improperly shop-coated of all oil, grease, dirt, mill scale, and other contamination by near-white blasting complying with SSPC SP 10 at time of painting system application, using SSPC VIS 1 as a standard of comparison.
 - f. Touch-up shop-applied prime coats that have damaged or have bare areas with primer recommended by paint manufacturer after commercial blasting complying

with SSPC SP 6 at the time of painting system application, using SSPC VIS 1 as a standard of comparison, to provide a surface profile of not less than one mil.

- g. Power tool-clean per SSPC SP 3 to remove welding splatter and slag.

2. Ductile and Cast Iron:

- a. Comply with paint manufacturer's recommendations and NAPF 500-03 for type and size of abrasive to provide a surface profile meeting paint manufacturer's requirements for type, function and location of surface. Verify that paint manufacturer-recommended profiles are achieved on prepared surfaces.
- b. Clean submerged and non-submerged ductile and cast iron surfaces to be shop-primed of all oil, grease, dirt, mill scale, and other contamination by solvent cleaning and abrasive blasting complying with NAPF 500-03-01, NAPF 500-03-04, and NAPF 500-03-05 at time of paint system application.
- c. Clean submerged ductile and cast iron that have not been shop-coated or that have been improperly shop-coated of all oil, grease, dirt, mill scale, and other contamination by solvent cleaning and abrasive blasting complying with NAPF 500-03-01, NAPF 500-03-04, and NAPF 500-03-05 at time of paint system application.
- d. Touch-up shop-applied prime coats that are damaged or have bare areas with primer recommended by paint manufacturer, after power tooling complying with NAPF 500-03 at the time of painting system application.

- D. Non-Ferrous Metal Surfaces: Prepare non-ferrous metal surfaces for painting by light whip blasting or by lightly sanding with 60- to 80-mesh sandpaper.
- E. Galvanized (Zinc-Coated) Surfaces: Prepare galvanized surfaces for painting by lightly sanding with 60- to 80-mesh sandpaper or by light whip blasting.
- F. PVC and CPVC Piping and Fiberglass: Lightly sand and clean surfaces to be painted. Fiberglass surfaces shall be prepared by solvent washing to remove wax and other contaminants, before abrading surfaces with 60- to 80-mesh sandpaper to provide an anchor pattern with scratches no further apart than 1/16-inch.
- G. Covering on Pipe Insulation:
 - 1. Remove all oil and surface contaminants as recommended by paint and insulation cover manufacturer for surface and application required.
 - 2. Do not cut or damage insulation and covering.

3.03 - PROTECTION OF PROPERTY AND STRUCTURES

- A. Protect property and structures adjacent to the Work from waste residues resulting from cleaning, surface preparation and paint application.
- B. Use shrouding, vacuum blasting, or other approved methods for cleaning and surface preparation of exterior surfaces.

- C. During blast cleaning and surface preparation of interior and exterior surfaces, control discharge of dust and grit, using shrouding, negative-pressure containment/dust collection systems, or other means to protect adjacent property and structures and prevent dust/grit from escaping. Similarly control removal and temporary storage of residues to protect adjacent property and structures.
- D. For painting of exterior surfaces, use rollers, shrouding or other approved methods as required to protect adjacent property and structures from wind-blown paint residues.
- E. Submit proposed procedures for cleaning, surface preparation and paint application describing methods for protecting adjacent property and structures from residues. Do not proceed with cleaning, surface preparation or painting until proposed procedures are approved by Architect.

3.04 - MATERIALS PREPARATION

A. General:

- 1. Mix and prepare paint products in strict accordance with paint manufacturer's product literature.
- 2. Do not mix painting materials produced by different manufacturers, unless otherwise permitted by paint manufacturer's instructions.
- 3. Where thinners are required, they shall be produced by paint system manufacturer unless otherwise permitted by paint manufacturer's product literature and submitted to and accepted by Architect with Shop Drawings.

B. Tinting:

- 1. Where multiple coats of the same material are to be provided, tint each undercoat a lighter shade to facilitate identification of each coat of paint.
- 2. Tint undercoats to match color of finish coat of paint, but provide sufficient difference in shade of undercoats to distinguish each separate coat. Provide a code number to identify material tinted by manufacturer.

C. Mixing:

- 1. For products requiring constant agitation, use methods in compliance with manufacturer's product literature to prevent settling during paint application.
- 2. Mix in containers placed in suitably sized non-ferrous or oxide resistant metal pans to protect floors from slashes or spills that could stain the floor or react with subsequent finish floor material.
- 3. Mix and apply paint in containers bearing accurate product name of material being mixed or applied.
- 4. Stir products before application to produce a mixture of uniform density and as required during the application. Do not stir into the product film that forms on surface; instead, remove film and, if necessary, strain product before using.
- 5. Strain products requiring such mixing procedures. After adjusting mixer speed to break up lumps and after components are thoroughly blended, strain through 35 to 50-mesh screen before application.

3.05 - APPLICATION**A. General:**

1. Apply paint systems by brush, roller, or airless spray per manufacturer's recommendations and in compliance with Paint Application Specifications No. 1 in SSPC Volume 2, where applicable. Use brushes best suited for type of paint applied. Use rollers of carpet, velvet back, or high pile sheeps wool as recommended by paint manufacturer for product and texture required. Use air spray and airless spray equipment recommended by paint manufacturer for specific painting systems specified. Submit a list of application methods proposed, listing paint systems and location.
2. Paint dry film thicknesses required are the same regardless of the application method. Do not apply succeeding coats until previous coat has completely dried.
3. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is uniform finish, color, and appearance, particularly for intense chroma primary colors. Ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a film thickness equivalent to that of flat surfaces.
4. Surfaces of items not normally exposed-to-view do not require the same color as other components of system of which they are part, but require the same painting system specified for exposed surfaces of system.
5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint before final installation of registers or grilles.
6. Paint backs of access panels and removable or hinged covers to match exposed surfaces.
7. Paint aluminum parts in contact with dissimilar materials with specified paint system.
8. Paint tops, bottoms, and side edges of doors the same as exterior surfaces.
9. Omit field-applied primer on metal surfaces that have been primed in the shop. Touch-up paint shop-primed coats and pre-finished items only when approved by Architect using compatible primers and manufacturer's recommended compatible field-applied finishes.
10. Welds shall be stripe-coated with intermediate or finish coat of paint after application of prime coat.

B. Minimum/Maximum Paint Film Thickness:

1. Apply each product at not less than, nor more than, manufacturer's recommended spreading rate, and provide total dry film thickness as specified.
2. Apply additional coats of paint if required to obtain specified total dry film thickness.
3. Maximum dry film thickness shall not exceed 100 percent of minimum dry film thickness, except where more stringent limitations are recommended by paint manufacturer for a specific product.

C. Scheduling Surface Preparation and Painting:

1. As soon as practical after preparation, apply first-coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting. Apply first-coat material before subsequent surface deterioration due to atmospheric conditions existing at time of surface preparation and painting. Surfaces that have started to rust before first-coat application is complete shall be brought back to required standard by abrasive blasting.
 2. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and application of another coat of paint does not cause lifting or loss of adhesion to undercoat.
 3. Scarify primers and other painting system components by brush-blasting if paint has been exposed for lengths of time or under conditions beyond manufacturer's written recommendations for painting systems required, intended use, or method of application proposed for subsequent coats of paint.
 4. Schedule cleaning and painting so that dust and other contaminants from cleaning process do not fall on wet, newly painted surfaces.
- D. Prime Coats: Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects caused by insufficient sealing.
- E. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage.
- F. Brush Application:
1. Brush out and work all brush coats onto surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections are unacceptable. Neatly draw all glass and color break lines.
 2. Brush-apply primer or first coats, unless otherwise permitted to use mechanical applicators.
- G. Mechanical Applicators:
1. Use mechanical methods for paint application when permitted by governing ordinances, manufacturer, and approved by Architect.
 2. Limit roller applications, if approved by Architect, to interior wall finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.
 3. Where spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double back with spray equipment for purpose of building up film thickness of multiple coats in one pass.
- H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint Work not in compliance with specified requirements as required by Architect.

3.06 - FIELD QUALITY CONTROL

- A. Architect may invoke the following material testing procedure at any time, and any number of times, during field painting Work:
1. Contractor shall engage service of an independent testing laboratory to sample paints used, as designated by Architect. Samples of products delivered to the Site shall be obtained, identified, sealed, and certified as to being products actually applied to the surfaces in each area, in the presence of Contractor.
 2. A testing laboratory selected by Owner and paid for by Contractor shall perform appropriate tests for any or all of the following:
 - a. Abrasion resistance.
 - b. Apparent reflectivity.
 - c. Flexibility.
 - d. Washability.
 - e. Absorption.
 - f. Accelerated weathering.
 - g. Dry opacity.
 - h. Accelerated yellowness.
 - i. Recoating.
 - j. Skinning.
 - k. Color retention.
 - l. Alkali resistance.
 - m. Quantitative materials analysis.
 3. If the test results show that the products being used do not comply with the specified requirements, Contractor may be directed to stop painting Work and remove non-complying paint, and shall prepare and repaint surfaces coated with the rejected paint with material complying with the Contract Documents.
- B. Notify Architect after completing each coat of paint. After inspection and checking of film thickness, holidays, and imperfections, and after acceptance by Architect, proceed with succeeding coat. Perform testing using testing instruments specified in Article 2.4 of this Section.
1. Architect will witness all testing and shall be notified of scheduled testing at least twenty-four hours in advance.
 2. Apply additional coats, if required, to produce specified film thickness and to correct holidays and to completely fill all surface air holes.

- C. For magnetic substrates, measure thickness of dry film nonmagnetic coatings following recommendations of SSPC PA-2. These procedures supplement manufacturers' approved instructions for manual operation of measurement gauges and do not replace such instructions.
- D. Record time, location, number of coats, dry film thickness, holidays, and other imperfections and submit testing results to Architect.

3.07 - PROTECTION OF NEW FINISHES

- A. Provide signs that read, "Wet Paint" as required to protect newly painted finishes. Remove temporary wrappings provided for protection of the Work and work of other contractors after completion of painting.

3.08 - ADJUSTING AND CLEANING

- A. Correct damages to work of other trades through cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. During progress of Work, remove from Site all discarded paint materials, rubbish, cans, and rags at end of each workday.
- C. Upon completion of painting, clean paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, while avoiding scratching or otherwise damaging finished surfaces.
- D. At completion of work of other trades, touch-up and restore damaged or defaced painted surfaces as determined by Architect
- E. The Contractor shall rectify any failures or breakdowns, loosening of the paint or coatings within a year after acceptance of work, regardless of the paint systems used. This will require the removal of the entire coating where failure occurs and repainting the coating system previously specified. Patching will not be allowed.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION**

- A. Provide Floor Coating System and all associated floor coating system accessories and components in accordance with the Contract Documents and as required to provide a complete and first class installation. The work of this section shall include, but not be limited to the following:
 - 1. Seamless, non-pervious, high-build, epoxy floor coating and integral cove base, including surface preparation, primers, and finish coats to provide a watertight installation.
- B. Floors in the new Belt Filter Press Room and ancillary rooms (basement level mechanical equipment room) are painted as of work of this section.

1.02 – RELATED SECTIONS

- A. Concrete – Section 03300.

1.03 – INSTALLER QUALIFICATIONS

- A. Manufacturer approved Installer, who has technical qualifications, currently approved in writing, and facilities to install specified systems with documented experience installing specified item on a minimum three similar projects.

1.04 - DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products as per manufacturer's instructions.
- B. Deliver material to job site in clean, clearly labeled containers and inspect prior to start of job.
- C. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- D. Store material in a dry, enclosed area protected from the elements. Keep temperature of storage area between 60o and 90o F.

1.05 - ENVIRONMENTAL REQUIREMENTS

- A. Verify that concrete has cured no less than 28 days under good conditions.
- B. Verify supply of adequate utilities, including electric, water, heat (between 60 deg. F and 90 deg. F) and lighting of no less than 80 ft candles measured at wall surface.

- C. Maintain ambient temperature required by manufacturer three days prior to, during and 24 hours after installation of materials.
- D. Free work area of other trades during, and for a period of 24 hours, after installation.
- E. Protect finished wall from damage by subsequent trades.

1.06 - SUBMITTALS

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- B. Manufacturer's Installation Instruction: Indicate special procedures and perimeter conditions requiring special attention.
- C. Samples: Provide 3" x 3" minimum sample of material. Provide all types of texture, material and color options.
- D. Submit manufacturers certification that applicator is approved by the manufacturer to install system.
- E. Submit manufacturers and installers warranty/guarantees.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface and suggested schedule for cleaning.

1.07 - WARRANTY

- A. Submit a three-year installer warranty against defects in material and workmanship upon substantial completion of installation.
- B. Provide 5-year manufacturer's warranty. Include coverage against product delamination from substrate and degradation of surface finish.

1.08 - REFERENCES

- A. ASTM D1044 - Resistance of Transparent Plastic Materials to Abrasion.
- B. ASTM D3363 - Hardness Testing.

PART 2 - PRODUCTS**2.01 - PRODUCT DESCRIPTION**

- A. A nominal 1/4", 3-component STONCLAD, GS, heavy-duty Epoxy Floor Coating as manufactured by STONHARD a division of STONCOR Group, Inc. 1-800 257-7953.
- B. Or approved equal.

2.02 - PHYSICAL PROPERTIES

Compressive Strength	10,000 psi
(ASTM C-579) after 7 days	
Tensile Strength	1,750 psi
(ASTM C-307)	
Flexural Strength	4,000 psi
(ASTM C-580)	
Flexural Modulus of Elasticity	2.0 x 10 ⁶ psi
(ASTM C-580)	
Hardness	85 to 90
(ASTM D-2240, Shore D)	
Bond Strength	>250 psi
(ASTM D-4541)	
Impact Resistance	>160 in./lbs.
(ASTM D-4226)	
Abrasion Resistance	0.06 gm max. weight loss
(ASTM D-4060, CS-17)	
Slip Resistance Index	Wet 0.66
(ASTM F-1679)	
Flammability	Self-extinguishing
(ASTM D-635) Extent of burning 0.25 in. max.	
Thermal Coefficient of	
Linear Expansion	1.5 x 10 ⁻⁵ in./in.°C
(ASTM C-531)	
Water Absorption	0.2%
(ASTM C-413)	
Heat Resistance Limitation.	140°F/60°C (for continuous exposure)
	200°F/93°C (for intermittent spills)
Cure Rate	24 hours for normal operations
(@ 77°F/25°C)	

2.03 - MATERIALS

- A. Stonclad GS:

1. Stonclad Primer - two (2) component, penetrating, UV resistant epoxy primer.
 2. Stonclad GS Base – A three-component, troweled mortar consisting of epoxy resin, curing agent and color quartz silica aggregate.
 3. Stonclad Grout Coat – A two-component, clear, UV resistant epoxy sealer.
 4. Stonseal GS7 Clear Flat – A two-component, non-reflective, waterborne, aliphatic polyurethane coating.
- B. Color: to be chosen by Engineer from manufacturers full line of color choices.

2.04 - ACCESSORIES

- A. Primers, Catalyst, and Fillers: types recommended by flooring manufacturer.
- B. Expansion Joints/Joint Fillers: Stoneflex sealants manufactured by Stonhard or approved equal. Sealant shall be compatible and approved by floor coating manufacturer.
- C. Waterproofing:
1. Stonhard Stonproof RH7 to be applied on floors prior to flooring system installation and per manufacturers instructions.
- D. Cove Base: Provide 4" integral sanitary cove base.

PART 3 - EXECUTION

3.01 - PREPARATION

- A. Create a surface profile as required by manufacturer to obtain proper adhesion.
- B. Verify that surface is dry and perfectly clean, free of all oil, grease, detergent film, form release agents, sealers and/or curing compounds and textured for proper chemical and mechanical bond of new floor coating system.
- C. Perform moisture tests to ascertain moisture content of existing conditions scheduled to receive coatings are within manufacturer's tolerance.
- D. Verify that surfaces are smooth with a maximum variation of 1/4 inch in 10 feet, slope positively to drains, and are ready to receive work.

- E. Seal all cracks, patch, smooth and slope all floor areas scheduled for new floor coating as required. Slope all floor areas to drains.
- F. Vacuum clean substrate.
- G. Apply primers and waterproofing as per manufacturer's recommendations.

3.02 - INSTALLATION

- A. Adhere strictly to manufacturer's current written instructions.
- B. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- C. The contractor shall notify the Architect in writing of any conditions which will prevent him from starting work. The start of installation in each area shall be an indication of the contractor's acceptance of the surfaces as being satisfactory for installing specified material and he will automatically assume the responsibility for any unacceptable finish work caused by known conditions.
- D. Prime all surfaces with Stonblend primer in accordance with manufacturer instructions.
- E. Apply STONPROOF RH7 and RV7 to horizontal and vertical surfaces.
- F. Apply base coat of STONCLAD GS BASE. Material shall be mixed, just prior to use, in accordance with the prescribed directions. The base material shall be screed applied and trowel finished. Allow a minimum of 8 hours curing time before applying the grout coat.
- G. Apply grout coat of STONCLAD GROUT COAT. Grout coat shall be applied immediately after mixing. Poured onto the floor in the form of a bead, the liquid shall be spread over the surface using a squeegee. Once the first coat is finished, apply a second coat immediately over the first coat in wet-on-wet application.
- H. After the first grout coat has cured for at least 12 hours, apply the first coat of sealer.
- I. Apply sealer of STONSEAL GS7 using a medium nap roller..
- J. After approximately 6 hours, apply a second coat of sealer.
- K. Apply second coat of sealer STONSEAL GS7 using a medium nap roller..
- L. Dispose of application debris properly.

- M. Form base with same materials as floor coating. Form $\frac{1}{2}$ radius cove for base.
- N. Install expansion joints and/or joint filler as per manufacturer's instructions.

3.03 - PROTECTION OF FINISHED WORK

- A. Protect finished work until work is complete and cured.
- B. Prohibit traffic on floor finish for 48 hours after installation, or as per manufacturer's instructions.
- C. Barricade area to protect flooring until fully cured.

3.04 - TOLERANCES

- A. Maximum variation with floor plan: $\frac{1}{32}$ inch.
- B. Minimum thickness of floor coating: $\frac{1}{8}$ inch.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SUMMARY OF THE WORK****A. Scope:**

1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install identification devices.
 - a. General Contractor shall be responsible for all identification devices throughout the Project as shown and as specified herein.
2. Extent of identification devices is shown and, where indicated, as specified.
3. Types of products required include the following:
 - a. Room identification, information, entry and directional signs.
 - b. Health, safety, warning, and fire extinguisher location signs.
 - c. Stainless steel fasteners, supports, very-high-bond high-performance mounting tape, primers and other accessories.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or before, the identification devices.
2. Coordinate adhesives and fasteners with mounting surfaces. Review other Sections in order to ensure compatibility of identification device mounting accessories for the various surfaces.

C. Related Sections:

1. Section 08100, Hollow Metal Doors and Frames.
2. Section 09900, Painting.

1.02 - REFERENCES

- A. AA SAA-46, Standards for Anodized Architectural Aluminum.
- B. AA DSA-45, Designation System for Aluminum Finishes.

- C. ANSI A13.1 Scheme for the Identification of Piping Systems.
- D. ANSI A117.1, Accessible and Usable Buildings and Facilities.
- E. ANSI Z535.1, Safety Color Code.
- F. ANSI Z535.2, Environmental and Facility Safety Signs.
- G. ANSI Z535.3, Criteria for Safety Symbols.
- H. ANSI Z535.4, Product Safety Signs and Labels.
- I. ANSI Z535.5, Accident Prevention Tags (for Temporary Hazards).
- J. ASTM A 167, Specification for Stainless and Heat-Resisting Chromium -Nickel Steel Plate, Sheet, and Strip.
- K. ASTM E 527, Practice for Numbering Metals and Alloys (UNS).
- L. CAS Registry Numbers for Specific Chemical Identity.
- M. CDA, Properties of Cast Copper Alloys.
- N. NFPA 704, Standard System for the Identification of the Hazards of Materials for Emergency Response.
- O. OSHA 1970, Title 29, Code of Federal Regulations Part 1910.1200, Hazard Communication Standard.
- P. OSHA 1970, Title 29, Code of Federal Regulations Part 1910, Subpart Z, Toxic and Hazardous Substances.
- Q. OSHA 1970, Title 29, Code of Federal Regulations Part 1910.144, Safety Color Code for Marking Physical Hazards.
- R. OSHA 1970, Title 29, Code of Federal Regulations Part 1910. 145, Specification for Accident Prevention Signs and Tags.

1.03 - QUALITY ASSURANCE

- A. Identification Devices Manufacturers:
 - 1. Engage firms specializing in the production of the types of products specified, in compliance with specified standards, with a documented record of successful in-service

performance, and who can provide sufficient production capacity to avoid delaying the Work.

2. Submit name and experience record of manufacturers to Architect.

B. Component Supply and Compatibility:

1. Obtain each separate type of identification device from a single supplier and from a single manufacturer.
2. Colors shall be brilliant, distinctive shades, matching the safety colors specified in ANSI Z535.1 and OSHA 1910.144.

C. Requirements of Regulatory Agencies:

1. All accident prevention signs and tags shall comply with OSHA 1910.145.
2. All health, safety and warning signs shall comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3 and OSHA 1910.144 and 1910.145, unless otherwise specified. The colors shall be those of opaque glossy samples as specified in Table 1 of ANSI Z535.1. Safety symbol pictograms shall be incorporated into each sign, in addition to text.

D. Codes: Comply with applicable requirements of New York State Building Code, latest edition.

1.04 - SUBMITTALS

A. Samples: Submit the following:

1. Each color and finish of exposed materials and accessories required for identification devices.
2. Actual full-size sample of each type of permanent signage incorporating all features specified.
3. Architect's review of samples will be for color and texture only. Compliance with all other requirements is the responsibility of Contractor.
4. List of spare parts recommended by the manufacturer. The list shall describe each part, the quantity recommended, and the unit price of each part.

B. Shop Drawings: Submit the following:

1. Copies of manufacturer's technical data for each product specified including fabrication and erection information for all identification devices. Show anchorages and accessory items.
2. Complete selection of each specified manufacturer's standard and custom colors, alphabetic styles, graphic layouts and pictograms.
3. Drawings showing extent of the Work and all details required for the Work referencing system components provided as samples. Drawings shall include, but not be limited to, the following:
 - a. Complete details for all signs giving sizes and styles of lettering and colors.
 - b. Complete schedules for all nameplates, signs, and building name letters giving location, message, letter, size, color, and method of attachment.
 - c. Details of fabrication and attachment of all items.
 - d. Complete location plan for all sign types.

1.05 - PROJECT CONDITIONS

A. Field Measurements:

1. Verify dimensions in areas of installation. Take measurements at the Site before fabrication and indicate dimensions on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
2. Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to dimensions established for identification devices Work.

B. Scheduling:

1. Coordinate the delivery of templates, instructions and directions for installation of anchorage devices with other Work to avoid delay.

PART 2 - PRODUCTS

2.01 - SYSTEM PERFORMANCE

A. Performance Criteria:

1. Details for identification devices shown, such as alphabet representation, letter spacing, borders designs, and other graphic features, are generic and intended to establish text, general positions and symbols only.
2. Contractor shall submit for approval complete, camera-ready, color graphic layouts based on specified requirements and recommendations from manufacturer.

B. Allowable Tolerances:

1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16-inch measured diagonally.

2.02 - MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products be submitted for approval.

1. Standard Signs, Raised Signs, and Projected Signs:

- a. Sign Graphics, Inc., Richmond, VA
- b. ASI Sign Systems, Inc.
- c. Or approved equal.

2. Hazard/Safety/Regulatory Signs

- a. Lab Safety Supply - B120 Series (fiberglass)
- b. Or approved equal.

2.03 - MATERIALS

A. Standard Signs: Standard signs shall be as follows:

1. All letters, numbers and/or symbols shall contrast with their background and shall consist of characters on a contrasting background, framed with decorative options, Model 110S square linear accent by ASI Sign System, Inc. or approved equal.
2. Sign characters and background shall have satin finish.
3. Plate material shall be acrylic approximately 1/8-inch thick, with surface painted, both face and returns. Coating shall be acrylic polyurethane paint, satin finish color shall be as selected from manufacturer's standard. Color as selected by Architect from

manufacturer's full range provide Pantone Matching System (PMS colored coatings, including inks and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

4. Lettering style shall be Helvetica medium, upper case.
5. Frames: Fabricate frames to profile indicated; comply with the following requirements for materials and corners:
 - a. Material: Brushed Aluminum
 - b. Corner Condition: Square
6. All mounting hardware shall be provided, with the manufacturer' standard holes and screws.
7. Aluminum Sheet and Plate: ASTM B 209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of 5005-H15.
8. Finishes:
 - a. General:
 - 1) Comply with NAAMM "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 2) Protection mechanical finishes from damage by applying strippable, temporary protective covering before shipping.
 - 3) Appearance of Finish Work: Variation in appearance of abutting or adjacent pieces are acceptable if they are within on-half of range of approved Samples. Noticeable variations in same pieces are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assemblies or installed to minimize contrast.
 - b. Aluminum Finishes:
 - 1) Clear Anodic Finish: Manufacture's standards clear anodic coating, 0.018mm or thicker, over a satin (directionally textured mechanical finish.

9. Tactile and Braille Copy shall be as follows:
 - a. Raised signs shall be of the three-in-one construction style having the following characteristics:
 - 1) One-piece construction with tactile characters and symbols raised 1/32-inch from sign plate face. Added-on or engraved characters are unacceptable.
 - 2) Grade 2 braille raised 1/32-inch from sign plate face and placed directly below each line of letters or numbers. Braille shall remain color of faceplate.
 10. All letters, numbers and symbols shall contrast with their background and shall consist of contrasting color characters to a background.
 11. All mounting hardware shall be provided, with manufacturer's standard holes and screws.
 12. Plastic door numbers and room nameplates shall be made from laminated phenolic engraving stock, with 3/4 inch high standard block lettering, "Helvetica" style. Door numbers, plates and shall be as indicated on the contract drawings. Provide door numbers and room nameplates on all doors for all designated rooms indicated on the signage schedule at the end of this section:
- B. Accident prevention signs are classified as follows:
1. Danger signs shall indicate an immediately hazardous situation which, if not avoided, will result in death or serious injury. Danger is limited to the most extreme situations. Color scheme shall be red, black and white.
 2. Warning signs shall indicate a potentially hazardous situation which, if not avoided, could result in death or serious injury. Color scheme shall be orange background, with a black and orange panel with black letters.
 3. Caution signs shall indicate a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Caution signs may also be used to alert against unsafe practices. Color scheme shall be yellow background, with a black panel with yellow letters.

4. Notice signs shall indicate a statement of company policy as the message relates directly or indirectly to the safety of personnel or protection of property. Color scheme shall be white background, with a blue panel with white letters.
 5. General safety signs shall indicate general instructions relative to safe work practices, reminders of property safety procedures, and the location of safety equipment. Color scheme shall be white background, with a green panel with white letters.
 6. Fire prevention signs shall indicate the location of exit or emergency fire fighting equipment. Color shall be red and white.
 7. Directional arrow signs shall indicate the direction to exit, emergency equipment, safety equipment and other locations important to safety. Color shall be red and black.
 8. Plate material shall be fiberglass reinforced polyester with protected graphics, approximately 0.10-inch thick.
 9. Lettering style shall be Helvetica medium, upper case.
 10. All mounting hardware shall be provided, with manufacturer's standard holes and screws.
- C. Attachments: All attachments and anchors necessary for concealed installments of identifying devices shall be furnished.
1. Very-High-Bond High-Performance Bonding Tape:
 - a. Provide all surface-mounted identification devices with very-high-bond foam tape backing except where specifically specified as requiring mechanical fasteners.
 - b. Provide a very-high-bonding pressure sensitive joining system consisting of double-coated conformable acrylic foam tape and release liners:
 - c. Thickness: 0.045-inch.
 - d. Tape Width: 1-1/2-inches.
 - e. Color: Dark grey.
 - f. Bonding Adhesive: Acrylic; very-high-bond, solvent and shear resistance.
 - g. Primer: High-performance tape manufacturers recommended acrylic primer.
 - h. Products and Manufacturers: Provide one of the following:

- 1) Scotch Brand (Very-High-Bond) 4942 VHB Double Coated Acrylic Foam Tape and No. 94 Acrylic Primer by 3M Industrial Tape and Specialties Division.
 - 2) Or equal.
2. Furnish inserts, and mechanical and adhesive anchoring devices as specified for the installation of identification devices.
 - a. Fasteners: Provide fasteners of non-magnetic stainless steel of size and type required and recommended by individual identification device manufacturers.
 - b. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts. Use toothed stainless steel or lead expansion bolts for drilled-in-place anchors.

2.04 - FABRICATION

A. Shop Assembly:

1. Fabricate and preassemble items in the shop to the greatest extent possible.
2. Disassemble units only to the extent necessary for shipping and handling limitations.
3. Clearly mark units for reassembly and coordinated installation.

PART 3 - EXECUTION

3.01 - INSPECTION

- A. Contractor and his installer shall examine the substrates and conditions under which the identification devices are to be installed and notify Architect, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Architect.
- B. Field Measurements: Where sizes of signs are determined by dimension of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

3.02 - INSTALLATION

A. General:

1. Install identification devices and components as directed by Architect, securely mounted with concealed very-high-bond acrylic foam tape or mechanical/chemical fasteners where specified. Attach signs to surfaces in accordance with the manufacturer's instructions, unless otherwise shown. Installation of signs to railings is to match existing field conditions.
2. Mount signages in locations shown. Signs shall be surface mounted with centerlines at 60" above finish floor unless otherwise noted.
3. Lightly mark and locate the position of all identification devices. Obtain Architect's approval of all locations before mounting. Install level, plumb, and at the proper height. Repair or replace damaged units as directed by Architect.
4. Install very-high-bond acrylic foam tape on back of identification devices using a full perimeter of specified tape. Leave no gaps in tape perimeter at back of identification devices; peel off second release liner and press onto surfaces.
5. Install level, plumb, and at the specified height.
6. Identifying devices shall be installed after final field finish has been applied and thoroughly dried.
7. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

3.03 - PROTECTION AND CLEANING

- A. After installation, clean soiled identification device surfaces according to manufacturer's instructions.
- B. System components which are dislodged, damaged, expanded, broken, penetrated or crushed by subsequent installation operations or damaged by detrimental weather shall be immediately replaced with undamaged material in compliance with the Specifications and properly protected as specified.
- C. Protect units from damage until Final Completion by Owner.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all portable fire protection equipment Work.
2. Extent of portable fire protection equipment Work is shown and specified.
3. Types of portable fire protection equipment Work required includes:
 - a. Dry chemical extinguishers.
 - b. Carbon dioxide extinguishers.
 - c. Mounting accessories and miscellaneous fasteners.

B. Coordination:

1. Review installation procedures under other Sections and coordinate installation of items that must be installed with or before portable fire protection equipment.

C. Related Sections:

1. Section 10400, Identification Devices.

1.02 - REFERENCES**A. Standards referenced in this Section are:**

1. UL Fire Classification Rating.
2. NFPA 10, Portable Fire Extinguishers.

1.03 - QUALITY ASSURANCE**A. Component Supply and Compatibility:**

1. Provide portable fire protection equipment products from one manufacturer.

B. Regulatory Requirements: Provide portable fire extinguishers approved and labeled by UL.

1.04 - SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: Submit the following:
 - a. Manufacturer's technical data, certification of UL rating, and installation instructions for portable fire protection equipment.
 - 2. Shop Drawings shall include but not be limited to:
 - a. Complete detail and installation drawings for Fire Extinguishers.
 - b. Steel column mounting hardware.

PART 2 - PRODUCTS**2.01 - PRODUCTS AND MANUFACTURERS:**

- A. General: Provide manufacturer's standard mounting brackets for portable fire extinguishers size as specified.
- B. Carbon Dioxide Fire Extinguishers: Provide (4) per building:
 - 1. Carbon Dioxide (CO₂) fire extinguishers shall be 10 lb. capacity, portable carbon dioxide type with wall mounts, having Underwriters' Laboratories rating of 10-BC; Ansul Sentry Model CD-10-82 or approved equal by Amerex, Firemaster or General Fire Extinguisher.
- C. First Aid Cabinets:
 - 1. Provide one first aid cabinet per building. First aid cabinets shall be a Fisher Scientific Co. Catalog #19-035-116, or equal. Mounting brackets for sheet metal mounting shall be provided. Cabinet shall be field located as directed by the Architect.

PART 3 - EXECUTION**3.01 - INSPECTION**

- A. Examine substrates and conditions under which portable fire protection equipment will be installed and notify Architect in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Architect.

3.02 - INSTALLATION OF FIRE EXTINGUISHERS

- A. When exact locations of portable fire protection equipment are not shown on Drawings, locate as directed by Architect.
- B. Securely fasten products to structure, square and plumb, per Supplier's instructions. Steel column mounts for extinguishers shall be securely mounted to steel columns with stainless steel bolts and shields.
- C. Mounting heights shall be:
 - 1. Install fire extinguishers with gross weight greater than 40 pounds with top of fire extinguisher no more than 3.5 feet above finished floor.
 - 2. Install fire extinguishers with gross weight less than 40 pounds with top of fire extinguisher no more than 4.0 feet above finished floor.
 - 3. Clearance between bottom of fire extinguisher and finished floor shall be at least four inches.
- D. Recharge fire extinguishers provided under this Contract so that most recent inspection date coincides as nearly as possible with date of Substantial Completion. Inform Owner in writing of next required inspection and recharging date.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 – SECTION INCLUDES**

- A. Stop gates.

1.02 – QUALITY ASSURANCE

- A. The stop gate shall be the product of a manufacturer having 10 years or more experience of successful design and manufacture of low leakage stop gates under similar design conditions. All welds shall be performed by welders with AWS certification.

1.03 – PERFORMANCE REQUIREMENTS

- A. Stop gates shall not be shop fabricated by the Contractor.
- B. Each stop gate shall operate freely and smoothly without binding.
- C. Maximum allowable leakage shall be 0.1 gallons per minute per foot of wetted perimeter regardless of the direction of unbalanced head. Acceptable manufacturers: Whipps Inc., Athol, Massachusetts, Series 509, or Engineer approved equal.

1.04 - SUBMITTALS

- A. Comply with the requirements contained in Section 01330 - Submittals. The following documents shall be submitted:
 - 1. Plan and section of each stop gate, to scale, showing all components, including the frame, seat seal, handle and slide.
 - 2. Design calculations and supporting data for all gates showing stresses, loads, and deflection for critical parts under design head conditions. At a minimum, these shall include the operating load, slide deflection, slide bending stress and shear stress in stiffener welds.
 - 3. Storage, handling and installation instructions.

PART 2 - PRODUCTS**2.01 - STOP GATE**

- A. The frame shall consist of 1/4" minimum thickness extruded aluminum (Alloy 6061-T6) incorporating ultra high molecular weight (UHMW) polymer seat/seal facings on both the upstream and downstream sides of the slide, designed to be embedded in concrete. Each seat/seal will be shaped to provide two bearing surfaces and two sealing edges. The gate side guides, and invert shall have a minimum weight of 4 lbs./ft. for wall mounted and 3 lbs./ft. for embedded. A neoprene seal shall be attached to the slide. All necessary assembly and anchor bolts shall be type 304 (type 316 optional) stainless steel and shall be provided by gate manufacturer.
- B. The slide shall be minimum thickness of 1/4" aluminum plate (Alloy 6061-T6) reinforced with stiffeners as required so that at the design head the slide will not deflect more than 1/360th of its width and stress is limited to 7,600 PSI. Slide stiffeners shall have a minimum weight of 2.5 lbs./ft. The slide shall be provided with a cast aluminum offset lifting handle. Dual lifting handles shall be provided on gates wider than 36".
- C. Frames shall be one-piece for the full height of the frame.
- D. All aluminum components shall be of mill finish.

- E. Adhesive anchors – Ramset/Red Head Epcon System or Hilti HIT system, ½ inch minimum diameter, Type 304 stainless steel, provided by the gate manufacturer.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Install gates true and plumb, in accordance with the written instructions provided by the manufacturer.
- B. Aluminum in contact with concrete shall have a heavy shop coat of non-ozone depleting bitumastic paint.
- C. Install anchor bolts in accordance with the written instructions provided by the manufacturer.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Work of this Section includes:
 - 1. Flanged and mechanical joint plug, butterfly, pinch, and check valves for large diameter process piping.
 - 2. Valve actuators, floor stands, and floor stand extension rods with intermediate supports.
 - 3. Combination sewage air / vacuum valves
 - 4. Trench adapter type valve boxes
 - 5. Grooved end stainless steel butterfly and ball valves for all size piping
- B. *All valves installed in pipelines where the pipe is specified or shown to be any grade or diameter of stainless steel, regardless of end connection style, shall also be stainless steel.*
- C. *All valves installed in pipelines where the pipe is specified or shown to be any diameter of ductile iron, regardless of end connection style, shall be cast iron body style valve.*
- D. For the purposes of this specification, large diameter piping shall be considered pipe with a diameter equal to or greater than 3 inches nominal diameter.

1.02 – RELATED SECTIONS

- A. Section 11350 – Sludge Thickening Equipment for valves furnished and installed under that Section, if any.
- B. Section 15060 - Pipe Hangers and Supports
- C. Section 15145 - Large Piping and Fittings

1.03 – REFERENCES

- A. ANSI B16.1 – Cast Iron Pipe Flanges and Flanged Fittings
- B. ANSI-B31.1 – Power Piping
- C. ANSI B31.9 - Building Services Piping

- D. ASTM A48 – Gray Iron Castings
- E. ASTM A126 – Gray Iron Castings for Valves, Flanges and Pipe Fittings
- F. ASTM A312 – Seamless & Welded Austenitic Stainless Steel Pipe
- G. ASTM A351 – Austenitic Gray Iron Castings
- H. ASTM A436 – Austenitic Gray Iron Castings
- I. ASTM A536 – Ductile Iron Castings
- J. ASTM A743 – Castings, Iron Chromium, Iron-Chromium-Nickel, Corrosion Resistant for General Application
- K. ASTM A744 – Specifications for Castings, Iron-Chromium-Nickel, Corrosion Resistant for Severe Service
- L. ANSI/AWWA C606 – Grooved and Shouldered Joints
- M. AWWA C504 - Standard for Rubber Seated Butterfly Valves
- N. AWWA C507 – Ball Valves, 6 in. through 48 in.
- O. AWWA C508 - Swing - Check Valves for Water Works Service, 2 in. through 24 in.
- P. AWWA C509 – Resilient Seated Gate Valves for Water Supply
- Q. AWWA C540 – Power Actuating Devices for Valves and Service Gates
- R. AWWA C606 – Grooved and Shouldered Joints
- S. AWWA C800 - Underground Service Line Valves and Fittings

1.04 - SUBMITTALS

- A. The Contractor shall submit separate valve schedules for each valve type (or style) that shall form the index of the shop drawing submittal. Each valve schedule shall provide the following information in tabular form and the Engineer reserves the right not to review the submittal until such time as all of the specified information is provided without claims for delay:
 - 1. Shop drawing reference number

2. Manufacturer's valve tag designation
 3. Abbreviated process piping application as shown on Contract Drawing PD-1, if shown.
 4. Quantity
 5. Diameter
 6. End connection
 7. Packing
 8. Actuator type
 9. Accessories
 10. List of AWWA, ANSI, and ASTM applicable standards
 11. Body material
 12. Stem material
 13. Gasket material to be used with the valve (if applicable)
- B. The remaining shop drawing submittal package shall include the following and be submitted in accordance with the requirements contained in Section 01330:
1. Dimensional prints valves and actuators.
 2. Valve specifications including materials of construction and features of design.
 3. Shop drawings for extension rods and guides indicating diameter, length, and material.
 4. Drawings for installation and support of guides.
 5. Catalog cuts and dimensional data for floor stands.
 6. Catalog cuts for valve boxes with cover casting indicated.
 7. Painting system catalog cuts.
- C. Installation, operations and maintenance instructions for each type valve prepared in accordance with the requirements contained in Section 01782.

- D. A Warranty Certificate shall be provided from each valve manufacturer.

1.05 - QUALITY ASSURANCE

- A. Manufacturer's name and pressure rating shall be cast on the valve body.
- B. All exposed valves shall be flanged joints or grooved joints.
- C. All buried valves shall be mechanical joints with joint restraint.

1.06 - DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect, and handle products under the provisions of Section 01650.
- B. Completely follow the manufacturer's recommended short and long term storage procedures. Partial payment requests for valves delivered to the site, but not yet installed, will not be processed if valve deliveries and storage requirements of the manufacturer are not followed.
- C. Deliver and store valves in shipping containers with labeling in place until the time that the valve is to be installed.

1.07 – FIELD SERVICES

- A. The valve and valve accessory Supplier(s) shall supply and credit to the Owner the costs for field services as specified in Section 01450 - Quality Control.
- B. The following field services shall be provided as a minimum in accordance with the requirements contained in Section 01750 - Starting and Adjusting:
 - 1. One (1) day totaling one (1) trip by each valve manufacturer for providing installation instruction to the Contractor. The Contractor shall be responsible for all costs associated with having the manufacturer present should the Contractor require more days of installation instruction.
 - 2. One (1) day totaling one (1) trip by each valve manufacturer to field check the completed installation and verify proper operation during normal plant operating conditions.

1.08 - WARRANTY

- A. The manufacturer shall guarantee all valve components to be free from defects in design, materials and workmanship for a period of one (1) year commencing on the date the valve was placed into permanent and consistent operation.

- B. During the guarantee period, if any part or equipment component is defective or fails to perform when operating at design conditions and if the equipment has been installed and is being operated and maintained in accordance with the written instructions provided by the manufacturer, the manufacturer shall repair or exchange at the discretion of the Owner such defective part(s) free of any and all charges. The manufacturer will be responsible for the cost of labor and all other expenses resulting from the repair or replacement of the defective part(s) and from installation of part(s) furnished by this Warranty.

PART 2 - PRODUCTS

2.01 – BUTTERFLY VALVES – EXPOSED

- A. Flanged Valve Construction – Cast Iron Body:
1. Flanged end butterfly valves - 2-1/2 inch and larger shall be of the EPDM-seated, tight closing type, with cast body and disc, and 150 psi working pressure. Valves shall conform to the requirements specified in AWWA C504 Standard for Rubber-Seated Butterfly Valves.
 2. Valve body shall be cast iron per ASTM A-126, Class B, with integrally cast hubs for shaft bearing housing, and 125 pound flanged ends faced and drilled in accordance with ANSI B16.1, Standard for Cast Iron Flanges.
 3. Valve disc shall be symmetrical about the shaft axis with no external ribs, cast of alloy cast iron per Military Specification MIL 6-858a, Class I. Valve shaft shall be of a solid one-piece design of centerless ground 18-8 stainless steel or high strength steel (70,000 psi) completely isolated from line fluid. Disc movement shall be 90 degrees open to closed.
 4. Taper pins, lockwashers and nuts shall be 18-8 stainless steel. Valve seat shall be of molded natural rubber, recess mounted, bonded and mechanically secured to the valve body or disc. Seat shall provide leak free shutoff at 150-psi differential. Sleeve type bearings of self-lubricating material shall be installed in the hubs of the valve body, designed for maximum load of 2,500 psi or one-fifth the compressive strength of the material, whichever is highest.
 5. A shaft seal shall be provided in the valve body hub where the shaft extends through it. The one-piece cast gland follower studs and nuts shall be bronze. Packing shall be self-adjusting split "V" type, or triple "O" ring.
- B. Grooved Valve Construction – Cast Iron Body:

1. Grooved end valves shall be provided in conformance with pipe and coupling specified in specification section 15145 - Large Piping and Fittings.
2. Grooved end butterfly valves - 2-1/2 inch and larger shall be of the EPDM-seated, tight closing type, with cast body and disc, and 175 psi working pressure. Valves shall conform to the requirements specified in AWWA C504 Standard for Rubber-Seated Butterfly Valves.
3. Valve body shall be ductile iron per ASTM A-536.
4. Valve disc shall be narrow profile type and offset about the shaft. Disc shall ride on stainless steel upper and lower stems. Valve disc shall be of ductile iron construction, black PPS coated. Disc movement shall be 90 degrees open to closed.
5. All wetted parts shall be 304 stainless steel.

C. Manufacturers: Dezurik, Crane or Victaulic

2.02 - BUTTERFLY VALVES - BURIED

- A. Material: Cast iron body conforming to ASTM A126, Class B or A48, Class 40, or ductile iron body conforming to ASTM A536, Grade 65-45-12.
- B. Pressure: 150 psi working pressure.
- C. Valve shaft: The valve shaft shall be a one-piece unit extending through the valve bearings into the valve disc. The shaft shall be 18-8 stainless steel, Type 302, 303, 304, 316 or Monel, or if carbon steel with 18-8 stainless steel journals.
- D. Valve discs: The disc movement shall be 90° open to shut. Discs shall be of cast iron conforming to ASTM A48, Class 40, or if alloy cast iron conforming to ASTM A436, Type 1 or 2.
- E. Valve seats: Valve seats shall provide tight shutoff for Class 150B-150 psi upstream, zero psi downstream pressure differential.
- F. The valve shall be field repairable and may be disassembled in the field for seat replacement. Rubber seats mounted on the disc shall be clamped thereon. Rubber seats mounted on valve bodies shall be cemented and clamped, bonded or vulcanized to the valve body. Rubber seats shall be made of EPDM material.
- G. Valve bearings: Valves shall be fitted with sleeve type bearings contained in the hubs of the valve body. A bearing shall be provided on the shaft outboard of the shaft seal or in the operator

housing to protect the shaft seal from thrust forces developed in the operating mechanisms. Each valve shall be equipped with either one or two thrust bearings set to hold the valve disc securely in the center of the valve seat.

H. Manufacturers: Dezurik, Crane or Victaulic

2.03 - CHECK VALVES

- A. Horizontal Swing Arm Check Valves: Quiet closing, outside lever and weight with adjustable air cushion chamber, ASTM A126 C1.B cast iron body and valve disc, stainless steel shaft, bronze seal and gate rings, watertight on closing, horizontal, rubber seat ring, 175 psi working pressure. Swing check valves shall be manufactured by Golden Anderson, Fig. No. 250-0 or Clow.
- B. Ball check valves shall be as specified in Section 11316 – Submersible Sewage Pumps.

2.04 – PLUG VALVES

- A. Exposed and Buried Valves – Flanged / Mechanical Joint Ends:
1. Valves shall be of the non-lubricated eccentric type equipped with resilient faced, balanced plugs and shall be furnished with end connections as specified below.
 2. Port area for valves less than 6-inch diameter shall be at least 80% of full pipe area. Port areas of 6 inch and larger valves shall be at least 100% of full pipe area.
 3. Valve bodies shall be of ASTM A126, Class B, and cast iron. All exposed nuts, bolts, springs, washers, etc., shall be stainless steel. Resilient plug facings shall be of Nitrile Butadiene suitable for use with septic sewage (hydrogen sulfide).
 4. Valves shall be furnished with corrosive resistant seats. Seats in 3-inch diameter and larger valves shall have a welded-in overlay of high nickel content on all surfaces containing the plug face.
 5. Valves shall be furnished with replaceable, permanently lubricated, stainless steel sleeve-type bearings in the upper and lower journals.
 6. Valve pressure ratings shall be as follows and shall be established by hydrostatic tests as specified by ANSI Standard B16.1. Pressure ratings shall be 175 psi for valves through 12-inch diameter, 150 psi for valves in sizes 14 inch through 36-inch diameter. Valves shall provide drip-tight shutoff up to the full pressure ratings. Valves shall be capable of providing drip-tight shutoff up to the full valve rating with pressure in either direction.

7. Valve shaft seals, bearings and seats shall comply with applicable portions of AWWA C504 and C507.
8. Valve actuator shall operate valve at a pressure differential up to 50 psi.
9. Buried: Mechanical joint, gear actuator and enclosure for buried installation.
10. Exposed: Flanged joint, gear actuator with handwheel.
11. Manufacturer: Dezurik or Clow

B. Exposed Valves – Grooved Ends:

1. Circular port area shall allow for pigging of lines. Port areas of 6 inch and larger valves shall be at least 100% of full pipe area.
2. Valve bodies shall be of AWWA C-606 and C509 cast iron, coated with alkyd enamel. All exposed nuts, bolts, springs, washers, etc., shall be stainless steel. Eccentric resilient plug facings shall be of Nitrile Butadiene suitable for use with septic sewage (hydrogen sulfide).
3. Valves shall be furnished with corrosive resistant seats. Seats in 3-inch diameter and larger valves shall have a welded-in overlay of high nickel content on all surfaces containing the plug face.
4. Valves shall be furnished with replaceable, permanently lubricated, stainless steel sleeve-type bearings in the upper and lower journals.
5. Valve pressure ratings shall be as follows and shall be established by hydrostatic tests as specified by ANSI Standard B16.1. Pressure ratings shall be 175 psi for valves through 12-inch diameter, 150 psi for valves in sizes 14 inch through 18-inch diameter. Valves shall provide drip-tight shutoff up to the full pressure ratings. Valves shall be capable of providing drip-tight shutoff up to the full valve rating with pressure in either direction.
6. Exposed valves by Victaulic with grooved ends: 6-inch diameter and larger, with gear operator with handwheel. Valve actuator shall operate valve at a pressure differential up to 50 psi. Smaller than 6" diameter shall be provided with handle operator and required stem extension unless stated otherwise.

C. Submerged Service:

1. All plug valves located below water level shall be furnished with a side mounted gear

actuator, floor stand extension rod, manufacturer's stainless steel valve stem guide, and floor stand (if Shown on the Contract Drawings).

2. Extension rods: Type 304 stainless steel
3. Manufacturer: Dezurik or Clow

2.05 - BUTTERFLY AND PLUG VALVE - WORM GEAR OPERATORS:

- A. Worm gear operators shall be required on all exposed valves that are 6" nominal size and larger and shall be self-locking as noted on the contract plans. Valves less than 6" nominal diameter shall be provided with lever type manual operators unless otherwise indicated. All operators shall be provided with memory stops. The gear operators shall be permanently lubricated, totally enclosed, with adjustable stops for the open and closed position, and valve disc position indicator. The operator shall be designed so that a pull of not more than 80 pounds will produce an output torque sufficient to operate the valve under actual line pressures and velocities.
- B. Valves shall be equipped with hand wheels and position indicators.
- C. Valves installed six (6) feet above finished floor or higher shall be provided with chainwheel operators and stainless steel chain.
- D. Actuators shall be manufactured by the valve manufacturer.

2.06 - BUTTERFLY AND PLUG VALVE - ELECTRIC VALVE ACTUATORS:

- A. The electric motor operator shall be designed to move the valve from fully open position to fully closed when electrical power is applied, and hold the valve in any intermediate position between full open and closed without creeping or fluttering. Valve, reducer, electric motor operator and accessories shall be furnished complete, ready for installation, from a single manufacturer. Electric motor enclosure shall meet NEMA 4 construction. However, for the 18-inch plug valve actuators at the inlet to each of the rotary screens located in the headworks building (3 total), the enclosure is to be rated for use in a Class I, Division I environment.
- B. Electrical control housing shall be heavy cast aluminum and built to meet NEMA 4, watertight construction through the use of non-intrusive commissioning and local adjustment using an infrared valve setting tool. The terminal compartment shall be sealed from the other areas by a double seal, thus maintaining watertight integrity during installation. However, for the 18-inch plug valve actuators at the inlet to each of the rotary screens located in the headworks building (3 total), the control housing is to be rated for use in a Class I, Division I environment.

- C. Heavy-duty motor shall operate from 120 VAC (nominal); single-phase input source. Thermal cutout switches shall be provided in case of motor overload. Internal heaters shall be provided to prevent damage from condensation within housing. However, for the 18-inch plug valve actuators at the inlet to each of the rotary screens located in the headworks building (3 total), the motor is to be rated for use in a Class I, Division I environment, and shall operate from 460V, 3 phase power.
- D. Provide two non-intrusive selectors on the actuator: one for "Local/Stop/Remote" selection. Each position shall be pad lockable and one for "Open/Close" control.
- E. Provide with backlit liquid crystal display to indicate valve position, valve alarms and battery status. Also provide with three LEDs (red, green and yellow) for indication of open, closed and intermediate position, respectively.
- F. Actuator housing shall be factory filled for life with premium grease and sealed. No lubrication shall be required for the life of the unit.
- G. Internal limit setpoints shall be preset at the factory and furnished for each extremity of valve disc travel. Adjustment of each limit switch within one-half degree of disc travel shall be possible via the infrared "IQ setting tool" for signal or auxiliary control.
- H. Manual operation shall be provided. Hand wheel shall be automatically disengaged from the drive during electrical operation of the actuator. Hand wheel shall be engaged by means of a hand/auto selection lever. Actuator shall be able to be locked in either manual or automatic position via lockable padlock hasp, padlock provided by others. Emergency disengagement of the motor drive shall be accomplished by depressing and holding the hand/auto lever during electric operation of the valve.
- I. Electric valve actuators shall be manufactured by Rotork, Inc., IQ Range model.

2.07 – FLOOR STANDS

- A. Manufacturer: Floor stands and accessories shall be furnished by the valve manufacturer.
- B. Floor stands shall be heavy pattern type, with non-rising stem, handwheel, and valve position indicator. Ball thrust bearings shall be used. Floor stands shall be factory primed and factory painted using the paint system specified in Section 09910 for exterior ferrous metals or an equivalent paint system may be used if approved by the Engineer.

2.08 - VALVE BOXES

- A. All buried plug and gate valves shall be provided with a 2-inch square nut.

- B. Valve boxes shall be provided for all buried valves. Valve boxes shall be assembled unit composed of the valve box, extension stem, and a self-centering alignment ring. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. Valve box assemblies shall be adjustable to accommodate variable trench depths.
- C. The entire assembly shall be made of minimum ¼-inch heavy wall high-density polyethylene. All components shall be joined with a permanent locking design. The valve box section shall be adaptable to fit inside a standard valve box upper section.
- D. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be galvanized steel square tubing. The stem assembly shall have a built-in device that keeps the stem assembly from disengaging at its fully extended length. The extension stem shall be torque tested to 1,000 foot-pounds.
- E. All valve boxes shall come complete with a 2-inch high top extension for final adjustment prior to paving/grading.
- F. The valve box shall be manufactured by American Flow Control or equal.
- G. Cover: Cast in the cover the word, "WATER" or "SEWAGE", as applicable.
- H. Handles: Furnish one operator handle for each buried valve at 42 inches above top of box.
- I. Where existing valve boxes are being used, provide a retrofit valve box insert by American Flow Control.

2.09 – GROOVED END STAINLESS STEEL VALVES

- A. All valves installed in pipelines where the pipe is specified or shown to be any grade or diameter of stainless steel, regardless of end connection style, shall also be stainless steel.
- B. Body and disc: Grade CF8M stainless steel conforming to ASTM A351, A743, and A744.
- C. Stems and hardware: Type 316 stainless steel.
- D. Bearings: PTFE impregnated glass fabric with 316 stainless steel backing and/or PEEK.
- E. Handle: 316 stainless steel.
- F. Gear Operator: 300 series stainless steel housing with aluminum bronze quadrant and steel worm gear. All valves with a diameter of 6-inches and greater shall be provided with a gear operator. All valves with a diameter less than 6-inches shall be provided with a lever lock handle.

- G. Disc seal: Grade "L" silicone compound (red color coded) for all air service applications; EPDM (green color coded) for all other service applications.
- H. Valves shall be manufactured by Victaulic.

2.10 – MANUALLY OPERATED PINCH VALVES

- A. Valves are to be of full cast metal body, mechanical pinch type with flange joint ends on both the body and the sleeve trim. The valve shall have face-to-face dimensions of standard gate valves, in accordance with ANSI B16.10 up 12" size. The flanges shall be drilled to mate with ANSI B16.1, Class 125/ANSI B16.5, and Class 150 flanges.
- B. The sleeve trim shall be one piece construction with integral flanges drilled to be retained by the flanges bolts. The sleeve trim shall be reinforced with calendared nylon or calendared polyester fabric to match service conditions. The sleeve trim shall be connected to the pinch bar by tabs imbedded in the sleeve trim-reinforcing ply. All internal valve metal parts are to be completely isolated from the process fluid by the sleeve trim
- C. For full port and reduced port sleeves, the port areas shall be 100% of the full pipe area at the valve ends. For Cone and Variable Orifice sleeves the inlet port area shall be 100% of the full area, reducing to a smaller port at the outlet.
- D. The steel mechanism shall be double acting with pinching of the sleeve trim occurring equally from two sides. ACME threads shall be used on all valve mechanism. There shall be no cast parts in the operating mechanism. The stem shall be non-rising and have a non-rising handwheel. The handwheel shall be constructed of welded, tubular steel and be connected to the stem by means of a single retaining bolt. The handwheel shall be fitted with a lubrication fitting to allow lubrication of the stem. A valve position indicator rod shall pass through the center of the stem, retaining bolt, and handwheel to provide visual position indicator. Bevel gear operators shall be provided on all valves over 8" size. Lifting eyelets shall be provided on the top of the valve body where applicable.
- E. The inner tube elastomer shall be EPDM.
- F. Rotating the handle clockwise shall lower a pinch bar above the sleeve, while raising a pinch bar below the sleeve simultaneously, pinching the sleeve closed at the center of the valve. Turning the handle counter-clockwise shall separate the two pinch bars to open the valve.
- G. All valves shall be of the Series 75 as manufactured by the Red Valve Co., Inc of Carnegie, PA 15106

2.11 - COMBINATION SEWAGE AIR/VACUUM VALVES

- A. A.R.I. Flow Control Accessories, Model D-020, or equal.
- B. The valve body shall be funnel-shaped and fabricated of stainless steel.
- C. 3-inch inlet, maximum working pressure if 230 psi, stainless steel inner parts and float. Valve shall automatically exhaust large quantities of air, gas and vapor during the filling of pipeline. Valve shall allow air to re-enter system during draining or when a vacuum occurs.
- D. Self-cleaning with drainage outlet ball valve.

PART 3 - EXECUTION**3.01 - GENERAL**

- A. Valves and valve accessories shall be installed by workers thoroughly experienced in such work and all valve work shall be properly supported and aligned and present a neat and workmanlike appearance.
- B. Support exposed valves as specified in Section 15060 and in accordance with the manufacturer's recommendations.

3.02 - INSTALLATION

- A. Inspection, Handling and Storage:
 - 1. Valves and boxes found to be either defective or damaged shall be rejected and immediately removed from the job site.
 - 2. Handling - Valves and boxes shall be loaded and unloaded by lifting with hoists or skidding under control with ropes in order to avoid shock or damage. Valves and boxes shall not be dropped.
 - 3. Storage - Valves, floor stands, joint accessories and valve boxes, if stored, shall be kept safe from damage. The interior of the valve and the joint accessories shall be kept free from dirt or foreign matter at all times.
- B. Plug valves shall be installed with the pressure side correctly placed.
- C. Set valves in a plumb or level position, as applicable.
- D. Install check valves for proper direction of flow. Adjust cushion chamber check valve to prevent

water hammer at service conditions.

- E. Assemble flanged joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
- F. Secure all floor stands to support members using stainless steel hardware. Field touchup floor stands after installation.
- G. Provide valve boxes on buried valves. Center and plumb valve boxes over buried valve actuators. Set box flush with final finished grade. Construct 12-inch by 12-inch concrete pad around each valve box top section.
- H. Paint all valve box covers OSHA yellow as soon as they have been installed. Place a 2 ft. tall traffic cone over each valve installed in areas to be paved. Stencil the word "VALVE" on the cone. Keep the cone in place until final paving is completed.
- I. Valve boxes in grassed areas shall be furnished with a 4-inch by 4-inch pressure treated wood post to a height of 3 feet above finished grade and 3 feet below grade. Paint each post OSHA yellow as soon as the valve has been installed.
- J. Paint all cast iron valves and floor stands in accordance with Section 09910 – Painting. Do not paint stainless steel valves.
- K. All flanged valves shall be furnished and installed with a style 128-flange adapter by Dresser Industries, Inc. or equal with restrained collar if installation warrants as directed by Engineer.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 – SUBMITTALS**

- A. Product Data: Catalog sheets and installation instructions for each type or size pump.
- B. Schedule: Pump schedule showing pump specifications and application.
- C. Quality control submittals:
 - 1. Performance curves for each pump, showing gpm, brake HP and efficiency from free delivery to shut-off. Chart curves on manufacturer's factory tests shall be conducted in accordance with the recommended procedures of the Hydraulic Institute, and certified thereto by the manufacturer.
 - 2. Include parallel pump curve and system curve for parallel operating pumps. Design flow does not include standby pump (if any).
- D. Contract Close Out Submittals:
 - 1. Operation, Maintenance Data, and Parts Lists: Deliver 2 copies, for each type of pump or pumping apparatus, to the Owner.

1.02 – MAINTENANCE

- A. Spare Parts: Deliver one spare set of mechanical seals for each size and type of pump equipped with mechanical seals, to the Director's Representative, who will sign receipt for same. Furnish seals of type as required for the particular pump application and the chemical water treatment being utilized. Suitably box and label spare seals as to their usage.

1.03 - WARRANTY

- A. Provide a Warranty Certificate from the manufacturer typed on company letterhead and signed by an authorized officer of the manufacturer. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located. The Warranty Certificate shall be submitted, verbatim and without exception, as follows:

"(Name of Manufacturer)" guarantees all components of the system to be free from defects in design, materials and workmanship for a period of one (1) year commencing on the date the system was permanently placed on-line, and the mechanical equipment functions without flaw.

During the guarantee period, if any part or equipment component is defective or fails to perform when operating at design conditions and if the equipment has been installed and is being

operated and maintained in accordance with the written instructions we provided, then we shall repair or exchange such defective part (s).

The warranty shall be a limited warranty against defects in materials and workmanship. The mixing chamber shall be warranted for the life of the system against failure for plugging for any reason. The warranty shall exclude failure due to over pressure or freezing. Non-manufacturer warranty will be unacceptable.

Agreed upon this _____ day
(Date)

by _____ of
(Name of Authorized Agent)

_____,
(Name of Manufacturer)

who, by signing this document, affirms that he/she is legally authorized to submit this warranty on behalf of the Supplier.

AUTHORIZED SIGNATURE

DATE

NOTARY

DATE

PART 2 – PRODUCTS

2.01 – PUMPS – GENERAL

- A. Design pumps to operate continuously without overheating bearings or motors at every condition of operation on the pump curve, or produce noise audible outside the room or space in which installed.
- B. Equip pumps complete with electric motor and drive assembly, unless otherwise indicated. Design pump casings for the indicated working pressure and factory test at 1-1/2 times the designed pressure.
- C. Manufacture domestic hot water pumps of all-bronze construction.
- D. Pumps of the same type, shall be the product of a single manufacturer, with pump parts of the same size and type interchangeable.

2.02 – PUMPS – VERTICAL MULTISTAGE

- A. Manufacturers:

1. Goulds Model ESV;
2. Grundfos;
3. Approved equal
4. Any proposed alternate must be proven to provide at least an equal level of performance, reliability, versatility and quality to the system specified. If, after installation, it is shown that the alternate system does not provide an equal level of performance, reliability, versatility and quality to that specified, the contractor shall replace the system with the specified system at their sole cost.

B. Conditions of Service:

Capacity (gpm)	TDH (ft)	Power (hp)	RPM	Quantity
200	100	10	3500	1

C. Pump Construction:

1. The pump casing shall be of deep drawn, laser welded cast 316L stainless steel and shall be capable of withstanding maximum working pressures of 360 psi. Piping connections shall be in-line and shall be compatible with ANSI raised flanges.
2. Wear rings composed of PPS shall be provided within each stage. Wear rings must be self-centering and easily replaceable.
3. Impellers shall be of enclosed design and construction of AISI 316L stainless steel. Impellers shall provide internal thrust balance in each stage.
4. Each stage shall have a bowl with attached diffuser and be constructed of AISI 316L stainless steel.
5. The seal housing shall be of concave design and shall hold the seal faces below the top-most part of the pump casing.
6. The pump shaft seal shall be rotary face and be constructed of elastomer.
7. The pump shall have shaft sleeves made of tungsten carbide and ceramic bearings. Shaft height shall be set with a standard spacer.

- D. The pump drive motor shall be NEMA standard design TC frame suitable for vertical mounting and close coupled to the pump unit. Motors shall be of standard manufacturers catalog design and must

not use special bearings as a thrust handling device. The motor power shall be sufficient for the pump size as contained in Part A. Motor shall be 3 phase, 60Hz, 460V with a TEFC enclosure, standard efficiency with a 1.15 service factor.

PART 3 – EXECUTION

- A. Install in-line circulating pumps between pipe flanges in piping systems. Install overhead pipe supports, both sides of in-line pumps, installed in horizontal piping runs.
- B. Each pump shall be hydrostatically tested by the manufacturer in accordance with Hydraulic Institute Standards at a minimum of 350 psi.
- C. Production performance testing will be conducted by the manufacturer on each pump unit. Head at five operating points (two above, two below, and one at the design point) will be measured to verify performance.
- D. The Contractor shall not ship the pump from the factory until certified curves have been approved by the Engineer.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION**

- A. This Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of progressive cavity pumps, variable speed drives as applicable, motors and controls. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications and the manufacturer's recommendations.

1.02 – QUALITY ASSURANCE

- A. Each pump shall be designed and constructed to operate satisfactorily with a minimum of noise, vibration, cavitation and a reasonable long service life when operated continuously or intermittently. Pumps shall be located and connected as shown on the Drawings.
- B. Pumps shall be designed for the operating conditions indicated as scheduled in Table 1 of this Section. The operating range of the pump shall include rated head and maximum head conditions. The pump shall be non-overloading throughout this operating range.
- C. Pumps will be used in the service of pumping municipal water treatment plant blended and macerated primary and secondary sludge
- D. Each pump shall be factory tested prior to shipment.
- E. The test shall consist of checking the unit at its rated speed over the full head range and at shutoff for capacity, efficiency and brake horsepower to properly establish the performance curve.
- F. Certified copies of test reports for each pump shall be submitted to the Engineer for approval before shipment. The test reports shall indicate the suction conditions and shall show in graphic form the following information:
 - 1. Capacity vs. head curve in U.S. gallons per minute and feet.
 - 2. Efficiency vs. flow curve in percent.
 - 3. Brake horsepower vs. flow curve
 - 4. Speed of rotation
 - 5. Certified bearing life calculations in accordance with AFBMA standards. Speed of rotation.

- G. The standards of the Hydraulic Institute shall govern all procedures and calculations of these tests.
- H. Any proposed substitutions from manufacturers other than that specified will require full compliance with the requirements of Specification Section 01630 – Product Substitution Procedures.
- I. After the bid opening, consideration will only be given to other alternate manufacturers/suppliers who can demonstrate to the Engineer that their equipment complies with these Specifications and has had successful and documented experience with the size, quality, performance and reliability to that specified. Consideration for any other alternate manufacturer shall include the proposed equipment's application and ability to provide equal service and performance as intended by these specifications. All modifications to structures, piping, valves, equipment layout, electrical connections, wiring (runs, wire sizes, service circuit sizes) and coordination with ancillary or interconnected systems or equipment necessitated by a substitution shall be reviewed and approved by the Engineer at the cost of the Contractor.
- J. All systems shall be designed, furnished, and installed to achieve the conditions of service specified herein.
- K. The Supplier shall have at least ten (10) years of experience in the design and manufacturing of top opening inline sludge macerators.
- L. The cost for any construction modifications shall be included in the cost as bid and no additional cost shall be paid by the Owner for acceptance of alternate equipment and any required installation modifications.
- M. The brand name products specified were chosen based on past performance, compatibility and constitute a standard for quality and performance for the specific purpose for which the top opening inline sludge macerators are intended. Products other than that specified will be considered for use under the provisions set forth as follows:
 - 1. The named products constitute the "Base Bid" progressive cavity pumps. All bidders are advised to provide "Base Bid" pricing since the magnitude of the expenses involved with engineering redesign or modifications may be difficult to determine during the bidding period. Refer to the Contract General Conditions regarding product substitutions.
 - 2. If alternate equipment is proposed, the Supplier shall prepare and submit to the Engineer three (3) copies of the "Evaluation Documentation" as listed below. The information shall be in a form that is neat, clear, precise, legible, and computer drafted and prepared so as to allow the Engineer to evaluate the proposed equipment. The "Evaluation

Documentation” shall be hand delivered directly to the Engineer at least ten (10) calendar days prior to the date set for the bid opening. The pre-bid “Evaluation Documentation” shall consist of the following:

- a. Progressive cavity sludge pump dimensional data and pump performance curve.
 - b. Descriptive technical information for the proposed product(s) highlighted to show the differences between the proposed unit(s) and the specified unit(s). Descriptive technical information shall include model numbers, type, sizes, weights, performance data, and materials of construction.
 - c. List of facilities showing facility name, active contact name and telephone number, years in service, design conditions and parameters, and design engineer's name and current telephone number of the company.
 - d. The Supplier shall state if he/she complies with each and all Sections of the Specifications. Any variance from the specified equipment shall be listed and a description of each variance must be in letter form. Facsimile transmissions will not be accepted.
- N. Failure to submit the above listed information ten (10) calendar days prior to the date set for the bid opening shall be cause for non-evaluation and the product will not be considered for the project.
- O. The Engineer will issue an addendum of approved products prior to the date set for the bid opening.
- P. The acceptance of products prior to the bid date does not relieve the Contractor of his/her responsibility regarding the performance or ability to meet the requirements of the Contract Documents.
- Q. After contract execution submit shop drawings in compliance with the requirements contained in Section 01330 - Submittals. The Contractor shall remain fully responsible for all design revisions, including but not limited to, the following: structural, mechanical, electrical, and instrumentation because of the utilization of substitute equipment. Refer to product substitution procedures in the Contract General Conditions, for costs associated with redesigns and/or modifications caused by the use of a substitute product offered by the Contractor.
- R. All costs, including other prime contractor, engineering, and legal costs, associated with accommodating alternate equipment shall be borne by the Contractor.

1.03 – DESIGN REQUIREMENTS

- A. The Contract Drawings have been prepared based on the installation of three (3) Seepex SCT progressing cavity pumps manufactured by Seepex. If other listed manufacturer's or an equal manufacturer's equipment is submitted which requires an arrangement differing from that shown on the plans or if the details of design and construction are different from those specified, the Contractor shall prepare and submit for review the necessary design calculations along with the necessary structural, electrical, instrumentation, mechanical and architectural drawing revisions. All revised design drawings shall be prepared by a NYS licensed Professional Engineer. The manufacturer shall prepare and submit for review along with the required shop drawings, a specific listing of the material, design and construction differences between the proposed equipment and the specified equipment. All work associated with accommodating the submitted equipment shall be at no additional cost to the Owner. All re-design costs associated with evaluating alternate equipment that does not conform to the requirements specified herein shall be reimbursed to the Engineer by the Contractor.
- B. Three (3) pumps shall be provided to convey blended and macerated primary and secondary sludge to each of the belt filter presses as indicated on the Contract Drawings.
- C. The progressive cavity sludge pump equipment shall be identified with a corrosion resistant nameplate, securely affixed in a conspicuous place. Nameplate information shall include equipment model number, serial number, suppliers name and location.

1.04 - WARRANTY

- A. Provide a Warranty Certificate from the manufacturer typed on company letterhead and signed by an authorized officer of the manufacturer. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located. The Warranty Certificate shall be submitted, verbatim and without exception, as follows:

"(Name of Manufacturer)" guarantees all components of the system to be free from defects in design, materials and workmanship for a period of five (5) years commencing on the date the system was permanently placed on-line, and the mechanical equipment functions without flaw.

During the guarantee period, if any part or equipment component is defective or fails to perform when operating at design conditions and if the equipment has been installed and is being operated and maintained in accordance with the written instructions we provided, then we shall repair or exchange such defective part (s).

The warranty shall be a 100% parts and labor warranty, including wear and tear to the progressive cavity pumps. This warranty shall include, but not be limited to mechanical seals, cutting screens, and blades. Non-manufacturer warranty will be unacceptable.

Agreed upon this _____ day

(Date)

by _____ of
(Name of Authorized Agent)_____,
(Name of Manufacturer)

who, by signing this document, affirms that he/she is legally authorized to submit this warranty on behalf of the Supplier.

AUTHORIZED SIGNATURE_____
DATE_____
NOTARY_____
DATE**1.05 - SUBMITTALS**

- A. Comply with the requirements contained in Section 01330 - Submittals. The following documents shall be submitted:
- B. Technical descriptive data for each equipment item in the system showing model number(s), sizes, capacities, weights, horsepower, motor and voltage information, and similar type information. Catalog cuts are acceptable if they contain the necessary information.
- C. Field wiring diagram for each motor operated piece of equipment.
- D. Detailed specifications and data covering materials used, parts, instrumentation devices, and other accessories forming a part of the equipment.
- E. Control panel wiring schematic.
- F. Catalog cuts of every device inside the control panel.
- G. Storage, handling and Manufacturer's installation instruction and certification.
- H. Warranty Certificate prepared in accordance with the requirements contained herein.
- I. List of spare parts and miscellaneous equipment to be provided under this Section.
- J. Manufacturer Start-up Report (MSR) in accordance with paragraph 3.01 herein.
- K. Operations and Maintenance Manual prepared in accordance with the requirements contained in Section 01730 - Operations and Maintenance Data.

1.06 – DELIVERY STORAGE AND HANDLING

- A. Pumps shall be stored and protected in accordance with the written instructions supplied by the Manufacturer.
- B. Pumps shall be completely drained prior to shipment. Suction and discharge ports shall be provided with plastic plugs. Each pump shall be secured to a wooden skid to facilitate handling and storage.

PART 2 - PRODUCTS**2.01 - MANUFACTURERS**

- A. Progressive cavity pumps:
 - 1. Seepex SCT.
 - 2. Netzsch NEMO® with FSIP® Pro.
 - 3. Or approved equal.
 - 4. Any proposed alternate must be proven to provide at least an equal level of performance, reliability, versatility and quality to the system specified. If, after installation, it is shown that the alternate system does not provide an equal level of performance, reliability, versatility and quality to that specified, the contractor shall replace the system with the specified system at their sole cost.
- B. Pump mechanical motor shall be furnished by pump manufacturer as an integral unit. Variable speed drive/motor starter shall be furnished by others under Division 16.

2.02 - MATERIALS

- A. The pumps shall be heavy duty, positive displacement, progressive cavity type. Mounting features will allow the normal vertical port to be rotated to 90 degree intervals perpendicular to the center of the pump.
- B. The body castings of the pumps shall be thick-walled cast iron. The suction housing shall incorporate two rectangular inspection ports, 180 degrees apart and provide access to the universal joint(s) within the suction housing. All cast parts will be smooth and free of sand holes, blowholes and other defects.
- C. Suction and discharge connections shall be flanged conforming to ANSI B16.1, Class 1, 125 lb.

- D. The rotor shall be a machined and polished chrome-plated, single helix. It shall have a nominal chrome plate of 0.020-inch for a maximum abrasion resistance. The chrome plating shall provide a minimum Rockwell "C" value of 57 to 60.
- E. The stator design shall either consist of two halves and assembled with a segment retainer for positioning the stator halves, and adjusting segments to seal the stator halves and adjust the stator clamping referred to as SCT, Smart Conveyor Technology, or be configured with a large inspection cover, split coupling rod and two cartridge seals. Both configurations shall allow for full service of the pump in place without requiring disassembly of connecting pipe and associated pipe manifold fittings. The stator material shall be medium high acrylonitrile Buna "N" rubber stator of approximate 65-70 Durometer hardness (Shore A). The stator halves shall be held in place by structural steel retainers.
- F. The universal joints shall be of the grease, lubricated, totally enclosed sealed and shielded, crowned gear or pin type. The operating angle of these joints shall not exceed 3 degrees off center. They shall be of adequate design to transmit the required thrust and torque while allowing the rotor to move in its eccentric path. The joint seal shall be designed to prevent any liquid from contaminating the universal joint, while the shield shall be designed to prevent any foreign objects from rupturing the seal. The low angularity shall maximize universal joint life.
- G. A connecting rod shall connect the universal joints of the eccentrically moving rotor and the drive shaft. The connecting rod shall be connected to a solid drive shaft or shall pass through the suction housing/shaft seal area within a hollow drive shaft quill. This connecting rod shall be rigid and not susceptible to chipping.
- H. The drive shaft shall be of two-part design with the chrome-plating. The drive shaft shall be removable for repair without removing the bearings from the bearing housing or disconnecting the driver.
- I. The bearings will be of the grease lubricated ball or tapered roller type. Fittings shall be located in the bearing housing to permit occasional re-lubrication. The B-10 life of the bearings shall exceed 100,000 hours under maximum operating conditions of this Section. The bearing casting shall utilize a bolted bearing cover plate held in place by a 720-degree retaining ring.
- J. The stuffing box shall be equipped with a single cartridge mechanical seal or packing. Fittings will be provided for flushing or grease lubrication of packing. The pump casting design shall allow for 270-degrees access to the seal area for adjustment of the gland or repacking of the pump without removing any of the bearings or drive shaft parts.

- K. All nameplates shall be corrosive resistant metal and contain the manufacturer's name, pump size and type, serial number, speed, capacity, head rating and other pertinent data.

2.03 - DRIVE

- A. Due to space constraints a vertical upright gear motor shall drive the pump, with a NEMA C face connection between the motor and the gearbox. The gearbox shall employ helical reduction gearing. The gear reduction units shall be designed 'with a service factor of 2.0 and meet the requirements of AGMA Service Classification II. Gears shall run in an oil bath and the reducer housing shall be equipped with oil fill, drain and level indication located in a convenient position. Gears shall be full fillet, radius forged and carburized. Gearbox housings shall be single piece iron castings with internal reinforcements.
- B. The gear motor shall be connected to the pump through a flexible coupling or C-face mounting.

2.04 – DRY RUN PROTECTION

- A. Pump controls for run dry protection via mag-meter shall be described in Section 13402 – Measurement and Control Instrumentation.

2.05 – SHOP PAINTING

- A. All materials specified under this Section shall be shop primed as part of the work under this Section. Surface preparation and paint shall be as specified in Section 09910 - Painting.

2.06 – ACCESSORIES

- A. Dry running protection device (TSE) shall be provided with sensor sleeve fitted to the stator of the pump with integrated temperature sensor. Separate TSE control device shall be provided by pump manufacturer and installed within pump motor cabinet inside MCC by Contractor
 - 1. Connection head shall be (IP55).
 - 2. Voltage: 110-115V/50-60Hz
 - 3. Temperature Coefficient: NTC
 - 4. Material sensor sleeve: 1.4404
 - 5. Material connection head: aluminum

2.07 – SPARE PARTS

- A. The following spare parts shall be provided for each size pump:

1. Rotor
2. Stator
3. Universal joint kit
4. Mechanical Seal
5. Dry Running Protection Device (TSE)

PART 3 - EXECUTION

3.01 - GENERAL

- A. All components of the system shall be installed in accordance with the written and /or verbal instructions provided by the manufacturer as per the approved shop drawings.

3.02 - INSTALLATION

- A. Anchorage: Stainless steel anchor bolts, nuts and washers shall be furnished by the equipment manufacturer as well as any templates necessary for setting the anchorage. Placement of the anchor bolts shall be done by the Contractor from certified dimensional shop drawings and templates supplied by the equipment manufacturer.
- B. Level and grouting:
 1. Level and align pump and motor in accordance with the respective manufacturer's published data
 2. Grout pump and motor with non-shrink grout in accordance with the ACI and the Grout pump and motor with non-shrink grout in accordance with the ACI and the equipment manufacturer's and grout manufacturer's published specifications.

3.03 - FIELD QUALITY CONTROL

- A. Following installation, operating tests will be performed to demonstrate to the Engineer that the progressive cavity pumps will function in a satisfactory manner. The Contractor shall make, at Contractor's own expense, all necessary changes, modifications and/or adjustments required to ensure satisfactory operation.
- B. Furnish the services of a factory representative for one, eight-hour day during the installation phase of the equipment. The factory representative shall have full knowledge and experience in the installation of the type of equipment being installed.

- C. Furnish the services of a factory representative, having complete knowledge of proper operation start up procedure and maintenance requirements, for one, eight-hour day, to inspect the final installation and supervise a test run of the equipment.
- D. Furnish the services of a factory representative, having complete knowledge of the operational and maintenance requirements of the system, for one, eight-hour day. The factory representative shall instruct the Owner's personnel in the proper operation and maintenance of the equipment.
- E. Prior to acceptance of the work of this section, thoroughly clean all installed materials, equipment and related areas in accordance with Section 01710 – Cleaning.

TABLE 1: Progressive Cavity Pumps

Equipment No.	Sludge Feed Pumps: P1, P2 & P3
Location	Existing DAF Building Basement
Service	Co-settled Primary & Secondary Municipal Waste Sludge
Viscosity (cP/mPas)	<500
PercentSolids	2-5%
Rated Capacity (gpm)	200
Rated Pressure (psi)	32
Total Dynamic Suction Head (ft.)	-15
SpeedRange, rpm	111 - 285
Body Casting Material	1.4408 / AISI 316
Stator Material	NBR - Perbunan
Rotor Material / Coating	1.2436 / tool steel AISI D6 Ductile Chromium
Seal Lubrication	Pumped Fluid
Horsepower	15
Drive Make / Model	Nord SK42ALXF/160MH4

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION**

- A. This Section includes furnishing all labor, materials, equipment and services necessary to furnish and install the inline sludge macerators and the associated motor controller(s) as it is specified herein and shown on the Contract Drawings.

1.02 – QUALITY ASSURANCE

- A. The inline sludge macerators and accessories shall be furnished by one single Supplier. This requires the Supplier to be responsible for the development, design, fabrication, assembly, delivery, and proper sustained operation of the inline sludge macerators, but does not require that all system equipment and accessories be the products of one single manufacturer.
- B. The design, manufacture, and installation of this equipment will meet or exceed the applicable provisions and recommendations of the following codes and standards:
1. American Society for Testing and Materials (ASTM) A 36: Standard Specification for Carbon Steel Plate
 2. American Society for Testing and Materials (ASTM) A 536-84: Standard Specification for Ferritic Ductile Iron Castings
 3. American Iron and Steel Institute (AISI) 4130 Heat Treated Alloy Steel
 4. American Iron and Steel Institute (AISI) 4140 Heat Treated Hexagon Steel
 5. Cutter Material Hardness: 550 brinell hardness
 6. National Electrical Manufacturer's Association (NEMA) Standards
 7. National Electrical Code (NEC)
 8. Underwriters Laboratory (UL and cUL)
- C. The inline sludge macerators specified herein and as shown to be installed on the Contract Drawings, is manufactured by Vogelsang USA. The specified unit provides a standard of quality, specification dimensions and performance required for this project.

- D. Any proposed substitutions from manufacturers other than that specified will require full compliance with the requirements of Specification Section 01630 – Product Substitution Procedures.
- E. After the bid opening, consideration will only be given to other alternate manufacturers/suppliers who can demonstrate to the Engineer that their equipment complies with these Specifications and has had successful and documented experience with the size, quality, performance and reliability to that specified. Consideration for any other alternate manufacturer shall include the proposed equipment's application and ability to provide equal service and performance as intended by these specifications. All modifications to structures, piping, valves, equipment layout, electrical connections, wiring (runs, wire sizes, service circuit sizes) and coordination with ancillary or interconnected systems or equipment necessitated by a substitution shall be reviewed and approved by the Engineer at the cost of the Contractor.
- F. All systems shall be designed, furnished, and installed to achieve the conditions of service specified herein.
- G. The Supplier shall have at least ten (10) years of experience in the design and manufacturing of inline sludge macerators.
- H. The cost for any construction modifications shall be included in the cost as bid and no additional cost shall be paid by the Owner for acceptance of alternate equipment and any required installation modifications.
- I. The brand name products specified were chosen based on past performance, compatibility and constitute a standard for quality and performance for the specific purpose for which the inline sludge macerators are intended. Products other than that specified will be considered for use under the provisions set forth as follows:
 - 1. The named products constitute the "Base Bid" inline sludge macerators. All bidders are advised to provide "Base Bid" pricing since the magnitude of the expenses involved with engineering redesign or modifications may be difficult to determine during the bidding period. Refer to the Contract General Conditions regarding product substitutions.
 - 2. If alternate equipment is proposed, the Supplier shall prepare and submit to the Engineer three (3) copies of the "Evaluation Documentation" as listed below. The information shall be in a form that is neat, clear, precise, legible, and computer drafted and prepared so as to allow the Engineer to evaluate the proposed equipment. The "Evaluation Documentation" shall be hand delivered directly to the Engineer at least ten (10) calendar

days prior to the date set for the bid opening. The pre-bid "Evaluation Documentation" shall consist of the following:

- a. inline sludge macerators dimensional data and pump performance curve.
 - b. Descriptive technical information for the proposed product(s) highlighted to show the differences between the proposed unit(s) and the specified unit(s). Descriptive technical information shall include model numbers, type, sizes, weights, performance data, and materials of construction.
 - c. List of facilities showing facility name, active contact name and telephone number, years in service, design conditions and parameters, and design engineer's name and current telephone number of the company.
 - d. The Supplier shall state if he/she complies with each and all Sections of the Specifications. Any variance from the specified equipment shall be listed and a description of each variance must be in letter form. Facsimile transmissions will not be accepted.
- J. Failure to submit the above listed information ten (10) calendar days prior to the date set for the bid opening shall be cause for non-evaluation and the product will not be considered for the project.
- K. The Engineer will issue an addendum of approved products prior to the date set for the bid opening.
- L. The acceptance of products prior to the bid date does not relieve the Contractor of his/her responsibility regarding the performance or ability to meet the requirements of the Contract Documents.
- M. After contract execution submit shop drawings in compliance with the requirements contained in Section 01330 - Submittals. The Contractor shall remain fully responsible for all design revisions, including but not limited to, the following: structural, mechanical, electrical, and instrumentation because of the utilization of substitute equipment. Refer to product substitution procedures in the Contract General Conditions, for costs associated with redesigns and/or modifications caused by the use of a substitute product offered by the Contractor.
- N. All costs, including other prime contractor, engineering, and legal costs, associated with accommodating alternate equipment shall be borne by the Contractor.

1.03 – DESIGN REQUIREMENTS

- A. The Contract Drawings have been prepared based on the installation of one (1) RotaCut RC300 inline grinder manufactured by Vogelsang. If other listed manufacturer's or an equal manufacturer's equipment is submitted which requires an arrangement differing from that shown on the plans or if the details of design and construction are different from those specified, the Contractor shall prepare and submit for review the necessary design calculations along with the necessary structural, electrical, instrumentation, mechanical and architectural drawing revisions. All revised design drawings shall be prepared by a NYS licensed Professional Engineer. The manufacturer shall prepare and submit for review along with the required shop drawings, a specific listing of the material, design and construction differences between the proposed equipment and the specified equipment. All work associated with accommodating the submitted equipment shall be at no additional cost to the Owner. All re-design costs associated with evaluating alternate equipment that does not conform to the requirements specified herein shall be reimbursed to the Engineer by the Contractor.
- B. One unit shall be provided for use within the influent sludge piping upstream of the progressive cavity sludge feed pumps.
- C. The inline sludge grinder equipment shall be identified with a corrosion resistant nameplate, securely affixed in a conspicuous place. Nameplate information shall include equipment model number, serial number, suppliers name and location.

1.04 - WARRANTY

- A. Provide a Warranty Certificate from the manufacturer typed on company letterhead and signed by an authorized officer of the manufacturer. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located. The Warranty Certificate shall be submitted, verbatim and without exception, as follows:

"(Name of Manufacturer)" guarantees all components of the system to be free from defects in design, materials and workmanship for a period of two (2) years commencing on the date the system was permanently placed on-line, and the mechanical equipment functions without flaw.

During the guarantee period, if any part or equipment component is defective or fails to perform when operating at design conditions and if the equipment has been installed and is being operated and maintained in accordance with the written instructions we provided, then we shall repair or exchange such defective part (s).

The warranty shall be a 100% parts and labor warranty, including wear and tear to the inline sludge macerator. This warranty shall include, but not be limited to mechanical seals, cutting screens, and blades. Non-manufacturer warranty will be unacceptable.

Agreed upon this _____ day

(Date)

by _____ of
(Name of Authorized Agent)_____
(Name of Manufacturer)

who, by signing this document, affirms that he/she is legally authorized to submit this warranty on behalf of the Supplier.

AUTHORIZED SIGNATURE_____
DATE_____
NOTARY_____
DATE**1.05 - SUBMITTALS**

- A. Comply with the requirements contained in Section 01330 - Submittals. The following documents shall be submitted:
- B. Technical descriptive data for each equipment item in the system showing model number(s), sizes, capacities, weights, horsepower, motor and voltage information, and similar type information. Catalog cuts are acceptable if they contain the necessary information.
- C. Field wiring diagram for each motor operated piece of equipment.
- D. Detailed specifications and data covering materials used, parts, instrumentation devices, and other accessories forming a part of the equipment.
- E. Control panel wiring schematic.
- F. Catalog cuts of every device inside the control panel.
- G. Storage, handling and Manufacturer's installation instruction and certification.
- H. Warranty Certificate prepared in accordance with the requirements contained herein.
- I. Electrical/pneumatic requirements, schematic diagrams, and details of components included.
- J. List of spare parts and miscellaneous equipment to be provided under this Section.
- K. Manufacturer Start-up Report (MSR) in accordance with paragraph 3.01 herein.

- L. Operations and Maintenance Manual prepared in accordance with the requirements contained in Section 01730 - Operations and Maintenance Data.

1.06 – DELIVERY STORAGE AND HANDLING

- A. The unit(s) shall be stored and handled in accordance with the written instructions supplied by the Manufacturer.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. The inline sludge macerator:
 - 1. Vogelsang RotaCut Model No. RC3000
 - 2. Borger Rotorrake Pure Model No. RR 6000
 - 3. or approved equal.
 - 4. Any proposed alternate must be proven to provide at least an equal level of performance, reliability, versatility and quality to the system specified. If, after installation, it is shown that the alternate system does not provide an equal level of performance, reliability, versatility and quality to that specified, the contractor shall replace the system with the specified system at their sole cost.

2.02 - MATERIALS

- A. The equipment casing, including hinged or bolted quick access cleanout cover shall be steel, SAE 1015 hot dipped galvanized.
- B. The drive shaft shall be constructed from steel, AISI 4140, tensile strength 150,000 psi minimum.
- C. Cutter blades shall be cast steel, AISI 4130, through hardened to 48-50 Rockwell C or steel, X50CrMoW9-1-1, hardened to 45 Rockwell C.
- D. The cutter screen shall be Hardox 550, through hardened to 550 brinell hardness.
- E. Seals shall be Buna-N.
- F. All fasteners, bolts, nuts, washers and keys shall be ANSI 304 stainless steel.

- G. All frame parts and assemblies shall be fabricated from sheets and plates of 304 stainless steel with a 2B finish conforming to ASTM A240.
- H. All welding in the factory shall use shielded arc, inert gas, MIG or TIG method. Filler wire 304 shall be added to all welds to provide for a cross section equal to or greater than the parent metal. Butt welds shall fully penetrate to the interior surface and provide gas shielding to interior and exterior of the joint. Interior weld beads shall be smooth, evenly distributed, with an interior projection not exceeding 1/16 inch beyond the inner diameter of the air header or fitting. All welds will be finished to include the following as a minimum:
 - 1. Remove all pointed protrusions from underside and face of welds and remove all weld spatter.
- I. Field welding of stainless steel will not be permitted, except to connect customer piping to frame influent and effluent connections.

2.03 – INLINE SLUDGE MACERATORS

- A. The macerator shall include a body, cover hinge mechanism, cutting assembly, automatic cutting control, drive unit, and controls.
- B. The unit shall include a motor driven single shaft type with all cutting elements mounted on the drive unit shaft. The macerator design shall be of the type that provides access to all cutting elements by a single, hinged cover. Macerator's using dual shaft cutting elements or cutting elements mounted on separate frames will not be accepted.
- C. Body and Cover Hinge Mechanism:
 - 1. The macerator body shall consist of a drum with flanged piping connections, flanged cleanout (6-inch minimum) and hinged top cover plate. The cover plate shall be reinforced to bear the weight to the drive and cutter assembly and shall be held in place by one or more quick-opening latches. The cover plate shall be sealed with an O-ring seal to sustain an internal pressure of not more than 30 psig. Piping connections shall be 125 psi ANSI B16.1 and shall be located at 180 degrees (in plan) from each other and shall be concentric with each other. The flanges shall be located in the upper half of the drum to permit storage for periodic removal of heavier objects in the flow processed by the machine. A mounting frame shall be provided to permit anchor bolting the macerator to the housekeeping pad indicated. Installation details shall conform to the requirements.
 - 2. The top cover hinge mechanism shall be reinforced and of sufficient strength to, when the cover has been opened, to hold the drive unit, cover plate and cutter assembly firmly in a

position which places the cutter shaft in essentially a horizontal position with the cutter assembly exposed for maintenance. The hinge assembly shall also provide sufficient strength to allow removal and reassembly of the drive and cutter assembly. The top cover hinge hatch shall be locked into place with a simple hand latch for easy access. A hydraulic mechanism shall provide both assist and shock dampening action during the opening/closing process. A NEMA safety switch shall be provided with contacts set to open when the cover latch is not in the engaged position. Top covers shall be ASTM A 536-84 ductile iron and bottom covers shall be ASTM A 36 hot rolled plates.

3. Internally, the macerator shall be configured to induce a rotational effect in the flow processed by the machine to encourage centrifugal separation of heavy objects such as stones and metal items.

D. Cutting Assembly:

1. The cutting assembly shall consist of a matched cutter (consisting of a star shaped multiple arm mounting of a minimum of 4 cutting blades) and hardened cutter screen selected to provide the specified particle passing size. The cutter shall mount the blades to effect efficient cutting in both the forward and reverse direction. Screens shall be designed to be reversed by maintenance personnel to provide extended life before they must be replaced.

E. Automatic Cutting Control:

1. The cutter shall rotate on the drive shaft and be held in position against the grid / screen by an automatic tensioning device. The automatic tensioning device, Auto Cut Control (ACC) shall automatically adjust the tension of the cutting blades without manual user intervention. Using high pressure air over the top of an oil chamber to keep the blades tensioned at all times. The ACC controls shall have one air canister and one oil canister with a pressure regulator between them. Each canister shall have their own pressure gauge to verify pressure, and pressure valve to add pressure via a simple hand pump. The ACC shall use a hydraulic cylinder to adjust the blades for optimum cutting performance. When the blades have completed their running time the control panel shall indicate the blades need to be replaced, after the ACC loses pressure on the blades. Macerators without automatic tensioning devices shall not be considered.

F. Drive Unit:

1. The drive unit shall consist of an electric motor, operating through a TWO-STAGE planetary gear to achieve an operating speed of 177 rpm. The concentric shaft,

planetary gear shall be designed in accordance with AGMA 6010-E for continuous heavy duty shock loading and shall be sealed in grease. The drive motor shall be of the type specified and shall be energy efficient, conforming to the requirements of the specifications. The mechanical seal on the gear output shaft shall be a non-metallic design using an O-ring seal in a bath of hydraulic fluid to protect the gear motor from entrance of sludge into the gear motor enclosure.

G. Individual Cutters and Spacers:

1. The inside configuration of both the individual cutters and the individual spacers shall be hexagonal so as to fit the shafts with a total clearance not to exceed 0.015-inch (0.38-mm) across the flats to assure positive drive, minimize wear on the cutters, and increase the compressive strength of the spacers.
2. Individual cutters and spacers shall be AISI 4130 Heat Treated Alloy Steel, surface ground for uniformity and through-hardened to a minimum 45-50 Rockwell C.
3. Cutter configuration shall consist of one shaft with individual 5-tooth double-edged cutters and one shaft with individual 11-tooth cam cutters. To maintain particle size, the height of the tooth shall not exceed 1/2-inch (13-mm) above the root diameter. Cutter root diameter overlap shall not be less than 1/16-inch (1.6-mm) or greater than 1/4-inch (6-mm) to maintain the best possible cutting efficiency while incurring the least amount of frictional losses.
4. The cutter shall exert a minimum force of 450-lbs./HP (2680-N/kW) continuously and 1430-lbs./HP (8530-N/kW) at momentary load peaks at the tooth tip.

2.04 – MOTOR CONTROLLER(S)

- A. This section details the general requirements for the sewage grinder(s) motor controls.
1. The macerator shall be furnished with a full set of operating controls enclosed in a type NEMA 4X 316 stainless steel enclosure for field mounting as indicated. The controls shall include the following:
 - a. 480 volt, 3 phase, 60 cycle reversing starter.
 - b. Automatic reversing every 2 Hours for self-sharpening.
 - c. Overload protection system, operating on motor amperage, to reverse the macerator motor on preset (adjustable) rise in motor current.

- d. Forward and reverse (red) operation indicating lights
 - e. Power available (amber) indicator
 - f. Hand (green) operation indicator
 - g. Cover latch disengaged indicator (white)
 - h. Hand-Off-Automatic switch
 - i. Auto tensioning system for cutter position for blade change (red)
 - j. Interlock with cover safety switch to prevent unit operation when the cover is unlatched.
2. The controller shall be equipped with a HAND-OFF/RESET-AUTO three position selector switch. In OFF/RESET the macerator shall not run. In HAND the macerator shall run. In AUTO the macerator shall start and stop shall be controlled by a remotely located dry contact.
3. When a macerator jam condition occurs in either the HAND or AUTO mode the controller shall stop the grinder, then reverse its rotation to clear the obstruction. If the jam is cleared, the controller shall return the grinder to normal operation. If the jam condition still exists, the controller shall go through two additional reversing cycles within 30-seconds (3-times total) before signaling a grinder overload condition. When a grinder overload condition occurs, the controller shall shut the grinder off and activate a relay and fail indication.
4. If the grinder is stopped due to a fail condition and a power failure occurs, the fail indicator shall reactivate when power is restored.
5. Controller reset shall be from local panel controls.
6. The controller shall have indicator lights for POWER ON, RUN, and FAIL conditions.
7. The controller shall provide overcurrent protection for the motor through an overload relay mounted directly on the starter contactor.
8. The controller shall be rated 3-HP, 460 volts, 3 phase, 60 Hz.
9. Short circuit protection requires that a properly sized circuit breaker or fuses be installed by others.

- B. This section details the specific requirements for the sewage grinder(s) motor control(s) enclosure.
 - 1. Enclosures shall be NEMA 4X 316 stainless steel with lever type lockable circuit breaker disconnect and shall be suitable for wall mounting. Doors shall have hinges and corrosion resistant latches.
 - 2. Enclosure shall house the control devices, relays, terminal blocks, and reversing motor starter.
- C. This section details the specific requirements for the sewage grinder(s) motor control(s) control devices.
 - 1. Pilot Devices shall be mounted on the enclosure front panel.
 - 2. Indicators shall be integral transformer type with low voltage long life 6-volt lamps. Lamps and the selector switch shall be heavy duty NEMA 4X type.
 - 3. Two normally open status contacts shall be provided. One for a RUN signal and one for FAIL signal. The contacts shall be rated at 2-Amp, 120-VAC, resistive load.
- D. This section details the specific requirements for the inline sludge macerator motor control(s) motor starter.
 - 1. Starter shall be full voltage reversing type with 120-volt operating coils.
 - 2. Forward and reverse contactors on the starter shall have both mechanical and electrical interlocks.
 - 3. The overload (OL) relay shall be adjustable so that the range selected includes the FLA (full load amperes) rating and service factor.

2.05 – SPARE PARTS

- A. Supplier shall provide the following spare parts for each unit:
 - 1. Four (4) complete sets of gaskets for the unit
 - 2. Two (2) complete sets of all cutting blades and plates
- B. Macerator spare parts shall be packaged in containers suitable for long term storage and shall bear labels clearly designating the contents and the equipment for which they are intended.

PART 3 - EXECUTION**3.01 - GENERAL**

- A. All components of the system shall be installed in accordance with the written and /or verbal instructions provided by the manufacturer.
- B. All components shall be fully tested and verified for service by the manufacturer. The manufacturer shall provide a MSR as specified in Section 01650 - Starting of Systems. An amount equal to 0.50 % of the scheduled value for the work of this Section shall be retained until the report has been furnished.

3.02 - INSTALLATION

- A. Macerator and controller shall be installed in accordance with the supplier's installation instructions, and in compliance with all OSHA, local, state, and federal codes and regulations.

3.03 - FIELD QUALITY CONTROL

- A. Supplier shall provide the services of a factory trained representative to check installation and to start-up each grinder. Factory representative shall have complete knowledge of proper installation, operation, and maintenance of equipment supplied. Representative shall inspect the final installation and supervise a start-up test of the equipment.
- B. Performance
 - 1. Performance testing will be performed for each grinder(s) installation. The manufacturer will conduct a performance test using the owner's liquid to determine the actual system operating conditions and verify that the unit meets the requirements specified herein.
 - 2. Should the grinder(s) fail to meet the requirements specified herein, manufacturer will, at its own expense, make all necessary modifications to the equipment until these requirements are satisfied.
- C. Manufacturer's representative required to provide one (1) trip and a minimum of two (2) consecutive eight-hour days on site for start-up assistance, troubleshooting, functional testing, training owner's operating personnel, and performance testing.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Zeta-Lyte® metering pump.
- B. Poly-Gone® metering pump
- C. Accessories.

1.02 – RELATED SECTIONS

- A. Section 15141 – Facility Piping

1.03 - SHOP DRAWINGS

- A. Submit under provisions of Section 01330.
- B. Submit catalog cuts, installation instructions, wiring diagrams and Operations & Maintenance Manuals.

1.04 – EXTRA MATERIALS

- A. Provide one (1) complete pump repair kit for each pump furnished, including spares.
- B. Provide one (1) spare 4-function valve for each pump.

PART 2 - PRODUCTS**2.01 – EQUIPMENT**

- A. Zeta-Lyte® Metering Pump
 - 1. Zeta-Lyte® metering pump shall be electrically driven pump suitable for pumping Zeta-Lyte® at a maximum of 17 gallons per hour at a maximum of 125 psi backpressure. Adjustable range of pump shall be 100:1 and be such that a feed rate of 0.5 gallons per hour at 32 psi can be accurately and reliably obtained. Actual feed rate shall be approximately 0.5 gallons per hour and shall be set during start-up services.
 - 2. Peristaltic type single head solution electronic metering pump with stroke adjustable 1% to 100%. Pumps shall be Model Flex-Pro A2 by Blue-White Ind. or approved equal. Equipment and accessories shall be provided to accept piping, valves, etc. specified for the project. Pump shall include manual adjustment feature.

3. Drive shall be totally enclosed with no moving parts. Solid state electronic pulser shall be fully encapsulated. Electronics shall be housed in a chemical resistant enclosure at the rear of the pump for maximum protection. Operating voltage: 115V.
4. Pump control panel to be NEMA 4X enclosure. 115V, single-phase controls. 9-feet of power cord to be available with grounded plug suitable for standard wall outlet. Fused disconnect switch enclosure to be mounted separate from control panel box.

B. Poly-Gone® Metering Pump

Poly-Gone® metering pump shall be electrically driven pump suitable for pumping Poly-Gone® at a maximum of 17 gallons per hour at 125 psi backpressure. Adjustable range of pump shall be 100:1 and be such that a feed rate of 0.25 gallons per hour at 100 psi can be accurately and reliably obtained. Actual feed rate shall be approximately 0.25 gallons per hour and shall be set during start-up services.

1. Peristaltic type single head solution electronic metering pump with stroke adjustable 1% to 100%. Pumps shall be Model Flex-Pro A2 by Blue-White Ind. or approved equal. Equipment and accessories shall be provided to accept piping, valves, etc. specified for the project. Pump shall include manual adjustment feature.
2. Drive shall be totally enclosed with no moving parts. Solid state electronic pulser shall be fully encapsulated. Electronics shall be housed in a chemical resistant enclosure at the rear of the pump for maximum protection. Operating voltage: 115V.
3. Pump control panel to be NEMA 4X enclosure. 115V, single-phase controls. 9-feet of power cord to be available with grounded plug suitable for standard wall outlet. Fused disconnect switch enclosure to be mounted separate from control panel box.

2.02 – ACCESSORIES

A. Zeta-Lyte® and Poly-Gone® Metering Pump and Manifold Skid

1. Provide 37" wall-mount manifold pump skid as manufactured by Tuff Skid or approved equal.
2. Skid to be single molded piece consisting of high density polyethylene.
3. Skid to allow placement of a two separate chemical feed pumps.
4. Pumps, controls and piping manifold to be mounted directly onto skid.

5. Piping within skid to be 1/2-inch diameter flexible reinforced hose.

B. Drum Containment Pallet

1. Provide drum containment pallet as manufactured by Walter's West End Supply, Lindenhurst, New York or approved equal.
2. Pallet to be constructed of 10-gauge continuously welded sidewalls and subfloors, designed for indoor use only, and provide secondary containment of at least 30% of total volume stored at drum storage area.
3. Pallet must be installed in strict accordance with all applicable regulations including, but not limited to, the New York State Uniform Fire Prevention and Building Code, Article 12 of the Suffolk County Sanitary Code and all local building and plumbing department ordinances.
4. All work is to be in strict accordance with applicable National Fire Prevention Association recommendations. Grounding of the containment unit and/or its contents may be required.
5. All work is to be in strict accordance with applicable National Electric Code specifications and requirements. The systems must be properly bonded to ground.
6. The pallet's integrity is to be tested by filling with water and observing for leakage for a minimum of two hours. Ensure that the portable containers are not within the containment unit when the test is being performed.
7. The facility owner shall be responsible for ensure that all required permits for installation of the pallet have been secured.
8. Pallet must be secured to floor or wall of building. All portable containers stored on the unit must be secured to the unit.
9. Pallet shall be furnished with the following equipment and accessories:
 - a) Four (4) 2-inch x 2-inch x 36-inch 11-gauge removable corner posts.
 - b) Removable zinc plated safety retention chain.
 - c) 1/4-inch galvanized floor bar grating.
 - d) 10-gauge portable container loading ramp.

C. Injection Quills

1. Injection quill assembly to be manufactured by SAF-T-FLO or approved equal, complete with retractable solution tube, corporation stop, adapters, safety chain, restrain hook, and bushings. Must be rated to 150 psi. Solution tube sizing to match line sizing.
 - a) Zeta-Lyte® and Poly-Gone® Injection: Brass corporation stop and compression nuts, integral check valve with Viton seals, PVC solution tube with 45 degree bevel injection end. Solution tube length to be ½ diameter of pipe.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. General:

1. Pumps, and piping runs shall be braced, properly supported, neat and orderly in appearance and parallel to walls and floors where possible. Minor deviations from the plans may be made to achieve this when necessary.
2. Pump, valves and piping shall be securely mounted, painted and labeled in accordance with NCDPW standards.

B. Install pump and manifold skid in accordance with manufacturer's installation instructions.

C. Connect suction and discharge piping to skid.

3.02 - STARTUP

- A. Provide services of manufacturer's representative for calibration and startup of chemical feed systems. Submit written report from manufacturer's representative covering inspection and startup of installed system.
- B. Demonstrate system operation to Owner.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 – SECTION INCLUDES**

- A. The work of this Section includes all labor, material, equipment and services necessary to furnish, install and start-up two (2) new belt filter presses, including all appurtenances as specified herein and shown on the Contract Drawings for the dewatering of co-settled primary and secondary sludge generated by the Glen Cove Wastewater Treatment Plant. In addition, the Contractor shall furnish and install all necessary valves, interconnecting piping and wiring, instrumentation, anchor bolts and other necessary appurtenances for a complete and operating installation. All equipment specified herein and shown on the Contract Drawings shall be furnished and installed by the Contractor.
- B. The belt filter press system shall come complete, and with restricting the generality of the following, shall consist of:
 - 1. Two (2) 2-belt filter presses with high solids gravity belt sections
 - 2. One (1) belt wash system for each belt filter press
 - 3. One (1) hydraulic power system for each belt filter press
 - 4. One (1) polymer mixing valve for each belt filter press
 - 5. One (1) system control panel for each belt filter press
 - 6. Spare parts

1.02 – QUALITY ASSURANCE

- A. Each belt filter press shall be of the continuous belt design with three distinct dewatering zones including a gravity dewatering zone, an adjustable wedge or low pressure zone and a shear/pressure zone and shall consist of a galvanized steel frame, dewatering belts, an inlet flocculation/distributor, belt support/wiper bars, drainage elements, drums, rollers, bearings, discharge blades, a belt drive unit, belt tracking and tensioning systems, a belt wash system and a filtrate/belt washwater drainage system. Each belt filter press shall be factory assembled including all internal piping, valving, wiring and control devices and shall be shipped as a complete assembly except that the dewatering belts shall be shipped separately in suitable containers to prevent accidental damage.
- B. Consideration will be given only to products of manufacturers who can demonstrate that their equipment fully complies with all requirements of the specifications and contract documents. The

equipment shall be supplied by a firm which has been regularly engaged in the design, fabrication, assembly, testing, start-up and service of full scale belt filter presses, of the same model and size as proposed, operating in the U.S., with similar sludges, for a period of not less than ten (10) years prior to the bid date of this contract.

- C. All components of the sludge dewatering equipment shall be engineered for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.
- D. Compliance with the performance requirements of the specifications will not relieve the contractor of his responsibilities of supplying equipment having the specified structural, mechanical, corrosion resistant and operational features. Deviations from the requirements specified shall not be permitted.

1.03 – DESIGN REQUIREMENTS

- A. The Contract Drawings have been prepared based on the installation of two (2) new Winklepress High Solids Type 97, 2.0-meter effective width belt filter presses with high-solids extensions manufactured by Alfa-Laval Ashbrook Simon - Hartley. If other listed manufacturer's or an equal manufacturer's equipment is submitted which requires an arrangement differing from that shown on the plans or if the details of design and construction are different from those specified, the equipment will be considered as a substitution and the Contractor will be required to prepare and submit for review the necessary design calculations along with the necessary structural, electrical, instrumentation, mechanical and architectural drawing revisions to the layout(s) indicated on the Contract Plans in accordance with Section 01600 – Materials and Equipment, Paragraph 1.06.

1.04 – PERFORMANCE REQUIREMENTS

- A. The sludge dewatering equipment shall be designed to adequately condition and dewater the sludge such that a dewatered sludge cake is produced that easily discharges from the dewatering unit, without blinding, and that may be handled by the pump or conveying equipment.
- B. Each unit shall be designed to operate in the environment for which it is intended, continuously or intermittently on demand, and shall perform the required dewatering operations without spillage of water or sludge beyond the nominal machine envelope.
- C. The description of the sludge to be fed to the belt filter press (es) is as follows:
 - 1. Type of sludge: co-settled primary and secondary sludge from a Biological Nutrient Removal (BNR) process which is stored within the un-aerated primary settling tanks

2. Sludge feed concentration: 2% solids (minimum) – 5% solids (maximum)
3. Hydraulic throughput, solids throughput, cake solids concentration, solids capture (combined filtrate and wash water) and polymer use requirements:
 - a. Average Feed Solids (% solids) = 2.0%
 - b. Average Volatile Solids (% solids) = 91%
 - c. Average Hydraulic Throughput (gpm/foot) = 75 gpm
 - d. Average Solids Throughput (lbs DS/hr) = 1,546 lbs DS/hr
 - e. Average Active Polymer (lbs/ton of DS in feed) = 6.0 lbs of active polymer/ton DS
 - f. Design Cake Solids Output (% solids) = 20%
 - g. Design Solids Capture (% solids) = 95%

1.05 - WARRANTY

- A. Provide a Warranty Certificate from the manufacturer typed on company letterhead and signed by an authorized officer of the manufacturer. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located. The Warranty Certificate shall be submitted, verbatim and without exception, as follows:

“(Name of Manufacturer) guarantees all components of the system to be free from defects in design, materials and workmanship under normal use and service for a period of one (1) year commencing on the date the system was permanently placed on-line, and the mechanical equipment functions without flaw, not to exceed eighteen (18) months from the date of delivery.

The manufacturer shall warrant the frame and the coating for a period of three years from the date of start-up, not to exceed three and a half years from the date of delivery. Any defects or corrosion occurring within the warranty period shall be repaired or replaced at no additional cost to the owner.

The manufacturer shall warrant the rollers and the coating to be free from manufacturing defects for a period of three years from date of start-up, not to exceed three and a half years from the date of delivery. Neither the rollers nor coating shall require preventive maintenance during the warranty period. The warranty shall include all parts and labor and shall cover the cost of repairing or replacing any item that fails during the warranty period, provided the damage is not due to misuse or neglect by others.

The manufacturer of the belt filter press shall warrant the complete bearing assembly, as specified herein, for a period of five years from the date of start-up, or acceptance of the equipment, whichever occurs first. The warranty shall include all parts and labor for repairing or replacing any bearing assembly part that fails during the warranty period.

The manufacturer shall warrant that the belts shall have a minimum life of 2,000 hours continuous operation at the rated design conditions but not if subjected to abrasive or corrosive conditions.

Agreed upon this _____ day
(Date)

by _____ of
(Name of Authorized Agent)

(Name of Manufacturer)

who, by signing this document, affirms that he/she is legally authorized to submit this warranty on behalf of the Supplier.

AUTHORIZED SIGNATURE

DATE

NOTARY

DATE

1.06 - SUBMITTALS

- A. Comply with the requirements contained in Section 01330 - Submittals. The following documents shall be submitted:
- B. Field wiring diagram for each motor operated piece of equipment.
- C. Detailed specifications and data covering materials used, parts, instrumentation devices, and other accessories forming a part of the equipment.
- D. Control panel wiring schematic.
- E. Catalog cuts of every device inside the control panel.
- F. Storage, handling and Manufacturer's installation instruction and certification.
- G. Warranty Certificate prepared in accordance with the requirements contained herein.
- H. List of spare parts and miscellaneous equipment to be provided under this Section.
- I. Manufacturer Start-up Report (MSR) in accordance with paragraph 3.01 herein.
- J. Operations and Maintenance Manual prepared in accordance with the requirements contained in Section 01730 - Operations and Maintenance Data.

PART 2 - PRODUCTS**2.01 - MANUFACTURERS**

- A. The sludge thickening system (i.e. belt filter press and associated controls) shall be:
1. Alfa Laval AS-H, Winklepress High Solids, Type 97
 2. Komline Sanderson, GRSL-2.0
 3. Or approved equal.
 4. Any proposed alternate must be proven to provide at least an equal level of performance, reliability, versatility and quality to the system specified. If, after installation, it is shown that the alternate system does not provide an equal level of performance, reliability, versatility and quality to that specified, the contractor shall replace the system with the specified system at their sole cost.

2.02 – MATERIALS OF CONSTRUCTION

- A. All materials used in the construction of the sludge dewatering equipment shall be of the best quality and entirely suitable in every respect for the service required. All structural steel shall conform to the ASTM Standard Specification for Structural Steel, Designation A36. All iron castings shall conform to the ASTM Standard Specifications for Gray Iron Castings, Designation A48, and shall be of a class suitable for the purpose intended. Other materials shall conform to the ASTM Specifications where such specifications exist; the use of such materials shall be based on continuous and successful use under similar conditions of service.
- B. Unless otherwise specified herein, all materials in contact with polyelectrolyte or sludge shall be of Type 316 stainless steel. All steel plates and shapes shall have a minimum thickness of 1/4 inch.
1. Bearing housings: Nylon coated cast iron
 2. Belt support grids,
 - a. Gravity Zone: Stainless steel, 10 gauge fitted with U.H.M.W. Polyethylene wiper bars.
 - b. Wedge zone: Stainless steel, 10 gauge fitted with U.H.M.W. Polyethylene wiper bars.
 3. Belt wash housing: Stainless steel, 14 gauge

4. Belt wash spray tube and nozzles: Stainless steel.
5. Belt wash piping: Schedule 80 PVC.
6. Chicanes: Galvanized carbon steel support rods, galvanized cast iron holders and U.H.M.W. polyethylene blades.
7. Discharge chute: Stainless steel, 10 gauge
8. Doctor blades: U.H.M.W. polyethylene
9. Drain trays: Stainless steel, 14 gauge.
10. Drain tray piping: Schedule 80 PVC.
11. Electrical junction box: Stainless steel, NEMA 4X.
12. Electrical conduit: Standard S/O Cord
13. Electrical switch enclosures: NEMA 4X. (press mounted)
14. Frame Carbon steel, hot dip galvanized, ASTM 123 Coating Grade 100 minimum
15. Hardware, fasteners, 316 stainless steel springs, clips, etc.
16. Hydraulic tubing, hardware: Stainless steel rigid tubing, stainless hardware
17. Hydraulic cylinders:
 - a. body: FRP tube with high strength glass filled nylon head
 - b. rod: Solid 316 stainless steel with hard surface treatment
 - c. hardware: 316 stainless steel
18. Miscellaneous Carbon steel surfaces to be hot dip galvanized, ASTM 123 Coating Grade 100 minimum
19. Polymer mixer housing: 316 stainless steel housing
 - a. Counterweight: cast iron, galvanized
 - b. Injection Ring: UHMW polyethylene

- c. Splitter manifold: UHMW polyethylene
- 20. Rollers (solid) Carbon steel, 1/2 in. wall, with forged roller shafts
 - a. Drive rollers coated with Buna N rubber, 1/4 in., other solid rollers coated with thermoplastic nylon, 25 mils.
- 21. Rollers (perforated) 316 stainless steel, 1/4" minimum thickness, all internally braced with baffles to remove internal water
- 22. Roller shafts: Forged steel ASTM 572 Grade 50
 - a. Sludge containment barriers: Stainless steel, 14-gauge minimum thickness
- C. Other types of protective coatings shall not be acceptable. All hot dip galvanizing shall be applied in accordance with ASTM-A123 Coating Grade 100 minimum. Zinc flame spray shall not be considered an acceptable substitute to this specification.
- D. The heat setting thermoplastic nylon coating, specified herein, shall have the following properties:

<u>Coating Properties</u>	<u>Test Method</u>	<u>Value</u>
Hardness, Shore D	ASTM D-2240	77
Specific Gravity	ASTM D-792	1.06-1.20
Impact, RT & 45 F	ASTM D-2794	160 in lbs
	Direct Pass	
Tensile Strength	ASTM D-638	6000 PSI
Elongation	ASTM D-638	15%
Melting Point	ASTM D-789	370°F
Abrasion Resistance	ASTM D-4060	8-18 mg. Wt. loss

- E. Buna N rubber coating shall have the following properties:

Tensile strength, ASTM D-412, 2500 psi
 Tear strength, die C, ASTM D-624, 250 psi
 Elongation at break, ASTM D-412, 160%
 Hardness, Shore A, ASTM D - 67690

2.03 – SLUDGE CONDITIONING SYSTEM

- A. Each belt filter press shall be provided with a sludge conditioning system, designed to efficiently mix polymer with the sludge and to adequately condition the sludge, for optimum dewatering.

- B. The sludge conditioning system shall be mounted upstream of the press and shall consist of an in-line, non-clog, static mixer with a variable orifice and a vortex polymer injection ring.
- C. The belt filter press manufacturer shall be required to provide, to the engineer, a proper layout for the system. The sludge conditioning system shall be capable of providing the following performance:
 - 1. Mixing energy must be independently adjustable during operation.
 - 2. The mixer shall be capable of automatically opening to allow solids, which are larger than the preset opening to pass through the mixer without clogging, and then return again to the pre-set position.
- D. The manufacturer shall be required to demonstrate, during the start-up and calibration phase, that flocculation time can be adjusted by one person, within sixty minutes. The sludge conditioning system shall meet the following mechanical specifications:
 - 1. The in-line mixer shall have a flanged, cast housing, an adjustable orifice plate with shaft and o-ring seal connected to an externally mounted lever and counterweight and a removable side plate for inspection and cleaning.
 - 2. The open throat area shall be fully adjustable downward and shall open automatically to prevent clogging.
 - 3. The position of the counterweight on the externally mounted orifice plate lever shall be fully adjustable, within a 360-degree circle, to allow for adjustment of the mixing energy, regardless of the mounting angle, while the unit is in operation.
- E. The polymer mixer shall be designed specifically for its intended use. The use of modified check valves or mixers requiring electrical motors and controls shall not be acceptable to this specification.

2.04 – STRUCTURAL MAIN FRAME

- A. Structural members shall be structural beams with minimum flange thickness of 1/2", a minimum web thickness of 5/16" and a minimum moment of inertia of 59.8 inches to the fourth power. The frame shall have a minimum safety factor under maximum load of 5 times the design yield strength of the member.
- B. Maximum load shall be based on the summation of all forces applied to the frame including, but not limited to, roller and bearing mass forces and tension forces (forces exerted by the tension on

the belts from the belt tensioning devices). Tension forces shall include, but not be limited to, a belt tension of 50 P.L.I.

- C. Certified calculations, showing the frame to be in compliance with the specification, shall be submitted as set forth in the contract documents.
- D. The framework shall be of welded and/or bolted construction. All welding shall conform with the American Welding Society Structural Welding Code. The framework shall be prepared and coated after fabrication with hot-dip galvanizing as specified herein. The structure shall be designed for installation on a prepared concrete foundation and secured with anchor bolts. Permanent lifting lugs shall be provided on the unit, as necessary, to allow installation and removal of the belt filter press. The construction shall allow easy access and visual contact of all internal components.
- E. The manufacturer shall warrant the frame and the coating for a period of three years from the date of start-up, not to exceed three and a half years from the date of delivery. Any defects or corrosion occurring within the warranty period shall be repaired or replaced at no additional cost to the owner.

2.04 – GRAVITY DRAIN SECTION

- A. Each belt filter press shall be furnished with a gravity drainage section to accept sludge from the sludge conditioning system. The gravity drainage section shall be furnished with a sludge feed inlet distributor to evenly distribute the conditioned sludge over the effective width of the moving filter belt.
- B. Conditioned sludge shall be contained on the belt with containment barriers equipped with replaceable rubber seals to prevent leakage. The gravity drainage section shall provide a minimum effective dewatering area of 107 square feet.
- C. The filter belt, while in the gravity drainage section, shall be supported by stainless steel grids with a minimum thickness of 10 gauge, fitted with high density polyethylene wiper bars with a rectangular cross section, spaced at a minimum of 2 1/2 inches, with a nominal wear thickness of one half inch to minimize the frequency of replacement. The belt support grid shall be a minimum of 7 inches wider than the belt and so designed to reduce belt wear. The wiper bars shall be arranged in a chevron pattern with the apex towards the sludge inlet to reduce the possibility of belt creasing. Wiper bars constructed of fiberglass, other high friction materials, round bars, or table rollers which require additional maintenance due to coatings and additional bearings shall not be considered an acceptable substitute to this specification.

- D. The gravity drainage section shall be furnished with chicanes (plows) to adequately furrow the conditioned sludge to facilitate drainage. The chicanes shall be designed to reduce belt wear. Each row of chicanes shall be provided with a single lifting handle, designed to remove the entire row of chicanes at least 6 inches from the belt, out of the sludge flow, to facilitate cleaning. Chicanes shall be designed to be individually moved laterally and to individually pivot horizontally. There shall be a minimum of 10 rows of chicanes and 85 individual chicanes shall be spaced at a minimum distance laterally across the filter belt.
- E. Vacuum assisted, inclined gravity drainage sections or gravity drainage sections that require a separate belt drive motor will not be considered an acceptable substitute to this specification.

2.05 – PRESSURE SECTION

- A. Each belt filter press shall be furnished with a pressure section, following the gravity drainage section. The pressure section shall consist of two stages, the increasing pressure zone and the shear pressure zone.
- B. The first stage of the pressure section shall be the increasing pressure zone, where the upper and lower belts gradually converge in a wedge shaped area, creating a belt/sludge sandwich, and where the sludge cake is prepared for the shear pressure zone by generating continuously increasing pressure on the sludge as it travels through the zone.
- C. For process flexibility, the distance between the two belts, as they enter the increasing pressure zone, shall be infinitely adjustable, between one and six inches, by one man, while the unit is in operation. This adjustment shall be capable of being performed without causing either belt to be pushed from its plane between two rollers and without causing undue wear on the belts or other components.
- D. The minimum effective dewatering area in the increasing pressure zone shall be 80 square feet. The effective dewatering area shall be measured on both belts when the wedge area is mounted vertically and on the lower belt only, when the wedge area is mounted horizontally. The filter belts, while in the increasing pressure zone, shall be supported by stainless steel grid supports, with a minimum thickness of 10-gauge material, and shall be fitted UHMW polyethylene wiper bars. The use of high friction materials such as fiberglass, which cause undue wear on the belts, will not be considered acceptable to this specification.
- E. The second stage of the pressure section shall be the shear pressure zone consisting of a minimum of fourteen (14) rollers, arranged to provide an "S" shaped pattern of belt travel. The sludge, which is sandwiched between the belts, shall be subjected to incremental increases in pressure, without an increase in belt tension, as the belt/sludge sandwich travels over decreasing diameter rollers toward the cake discharge.

- F. The minimum effective dewatering area in the high-pressure zone shall be 216 square feet. The effective dewatering area in the shear pressure zone shall be defined as the area where the belt sludge sandwich is in actual contact with the rollers. The pressure zone configuration shall be such that the filtrate is removed from the sludge cake without re-wetting of the downstream cake.
- G. Rollers shall be constructed as specified under "Rollers". The rollers shall be supported by bearings mounted on the end shafts as specified under "Bearings". The use of impervious belts or nip rollers to apply external pressure to the belt/sludge sandwich shall not be considered acceptable in this specification.

2.06 – ROLLERS

- A. All Solid Rollers shall be constructed using one-piece forge shafts and end plates. The forged stub shaft unit shall eliminate all welding of the roller shafts in the region of highest stress where the shafts join with the end plates. Welded up constructions of round bar and flat plates that create built in stresses and stress concentrations will not be acceptable. The forged stub shaft unit shall be welded to the roller shell with a machine-applied weld using the submerged arc process. The weld depth shall be equal to the wall thickness of the roller shell. The roller shall be machined so that the total indicated runout of the shell relative to the journals is 0.010-inch maximum. Total surface machining is required to provide a smooth surface for the coating of thermoplastic nylon or to prepare the roller for cladding.
- B. The perforated roller, which is the first roller in the pressure section, is designed to allow water to escape out both ends. It shall be constructed with a solid through shaft and at least five (5) radial vanes to support the perforated shell.
- C. The forged stub shaft unit shall be made of ASTM A572 Grade 50 Type 2 or equal. The roller shells may be ASTM A53 or equal. The perforated roller shall have a solid shaft of cold drawn carbon steel, AISC 8620 and the shell and radial vanes shall be ASTM A36 or equal, or stainless steels may be substituted on special order.
- D. Drive rollers shall be coated up to the point of insertion into the bearings by a 1/4-inch minimum thickness of Buna-N rubber. Solid and perforated rollers shall be coated with a 30-mil minimum thickness of thermoplastic nylon. See detail spec for these coatings in Section
- E. Solid rollers may also be clad with 304 or 316 stainless steel. The cladding will be welded to the fully machined roller entirely covering the roller up to the point of insertion into the bearings. Welded stainless steel shafts in lieu of the forging is not acceptable for this application due to the lower strength and higher stress.

- F. All solid roller shells shall have a mill spec minimum wall thickness of 1/2 inch. Heavier walls shall be used where required to meet the maximum stress and deflection limits. The pressure roller bearing journals shall be turned to 100 mm to accept direct mounted 100 mm bore bearings. All other roller journals shall be turned to 75 mm to accept direct mounted 75 mm bore bearings. The minimum thickness of the forged flange that forms the end plates shall be one (1) inch.
- G. The perforated roller shall have punched holes of 1 1/4-inch diameter minimum to prevent bridging of solid material. The punched shell shall be rolled with the smooth side out. The shell shall be a minimum 1/4-inch thick.
- H. The rollers shall be analyzed using finite element stress analyses. Certified calculations, showing the maximum stress to be less than 1/5 the yield strength of the material and the maximum deflection at mid span to be less than 0.050 inch shall be submitted as set forth in the contract documents. The standard load case for the pressure rollers shall be a distributed load in the belt contact area equivalent to 50-pli belt tension, weight loading and drive torque. The standard load case for the other rollers shall be a distributed load in the belt contact area equivalent to 50-pli belt tension and weight loading.

2.07 – BEARINGS

- A. All rollers shall be supported by grease able type, high capacity "E" design roller bearings, equipped with a metal cages, in sealed, splash proof, horizontal split case pillow block housings. The bearings shall be press fit to the roller shaft. Bearings supporting the steering rollers shall be non-self aligning cylindrical roller bearings in pivot mounted pillow block housings. All other rollers shall be supported by self-aligning spherical roller bearings mounted in fixed pillow block housings.
- B. All bearings shall have a minimum L10 bearing life of 675,000 hours, calculated by using the latest ANSI/AFBMA, standard. The L10 life shall be based on the summation of all forces applied to the bearings, including, but not limited to, roller mass forces and belt tension on the rollers. The belt tension forces exerted on the pressure zone rollers shall include a belt tension of 50 pli at a belt speed of 5 meters per minute. Certified calculations, based on the AFBMA/ISO capacity formula, showing that all bearings comply with the specified requirements for minimum L10 bearing life, at maximum loadings, shall be submitted to the engineer as set forth in the contract documents.
- C. Bearing housings shall be class 30 cast iron with four stainless steel mounting bolts and four stainless steel cap bolts. The outer side of the housing shall be solid, without end caps or filler plugs. The housings shall be designed with an integrally cast water trough which, when shrouded

by a shaft mounted water flinger, shall divert water from the bearing seal area. The housings shall be coated as specified herein.

- D. The bearing seal in the pillow block housing shall be of nonmetallic construction with a carrier/flinger which rotates with the roller shaft. A static sealing arrangement between the carrier/flinger and the shaft shall be a triple rubber seal, constructed in a manner that prevents relative rotation between the seal and the shaft. A dynamic sealing arrangement between the carrier/flinger and the bearing housing shall consist of a primary dynamic contact seal of ozone resistant rubber which shall seal by rotational contact with a machined housing surface. A secondary dynamic seal shall be a labyrinth seal between the carrier/flinger and the bearing housing which utilizes a nonmetallic retaining ring to hold the seal assembly in position within the housing.
- E. Bearing lubrication shall be performed through a monel or type 316 stainless steel button head grease fitting mounted on the bearing housing. All bearings shall be outboard (externally mounted) and shall be grease able while the unit is in operation. Lubrication shall not be required more often than once every six months.
- F. The manufacturer of the belt filter press shall warrant the complete bearing assembly, as specified herein, for a period of five years from the date of start-up, or acceptance of the equipment, whichever occurs first. The warranty shall include all parts and labor for repairing or replacing any bearing assembly part that fails during the warranty period.

2.08 – BELT WASH SYSTEM

- A. Each belt filter press shall be equipped with individual belt wash stations for both the upper and lower belts. Each station shall consist of a spray tube, fitted with spray nozzles, contained within a fabricated housing which encapsulates a section of each belt. The housing and nozzle assembly shall be readily removable. Spray showers must be capable of being installed to wash either side of the belts as each application requires.
- B. Nozzle spacing and spray pattern shall be such that the sprays from adjacent nozzles overlap one another at the belt surface. Individual nozzles shall be replaceable.
- C. The housing shall be sealed against the belt with adjustable rubber seals. The seals shall be replaceable/adjustable without disassembly of the wash station.
- D. Each belt wash station shall be furnished with an external hand-wheel that is mounted to a stainless steel cleaning brush located inside the spray pipe. One full turn of the hand-wheel shall cause the brush bristles to enter each spray nozzle, and dislodge any solid particles which have accumulated, open a valve and allow the solids particles to be flushed into the drainage system.

- E. Belt wash stations shall be type manufactured by Appleton Manufacturing, Menasha, Wisconsin or equal.
- F. Each belt wash station shall be positioned such that the washing is performed after the cake has been discharged from the belt. The belt wash station shall extend over the full width of the filter belt by a minimum of two (2) inches. The belt shall be cleaned by the belt wash with no blinding. The belt wash system shall be suitable for use with plant effluent water supplied at a minimum pressure of 85 psig and shall be designed to operate at a flow of 80 gpm.
- G. If wash-water pressure is less than 85 psig, the plant shall furnish a separately mounted in-line booster pump rated at sufficient capacity and discharge head to meet the process requirements. All controls and equipment necessary to provide a complete and operating system shall be provided for the pumps by the belt press manufacturer (less motor starter for wash-water pump), including the controls from the machine control panel as specified hereinafter.
- H. Each belt filter press shall be provided with a 1 1/2 inch female PVC connection for belt wash water.

2.09 – BELT ALIGNMENT SYSTEM

- A. Each belt shall be provided with an automatic belt alignment system to assure proper alignment of both belts at all times.
- B. The belt alignment system shall be provided with sensing devices designed with a spring-loaded arm fitted with a ceramic plate that rides on the edge of the belts to detect their position. The arm shall operate a pilot valve, which in turn affects the position of a hydraulic actuator connected to a pivoted belt alignment roller. The pivoting action of the belt alignment roller shall cause this roller to skew from its transverse position to guide the belts centrally along their path.
- C. The alignment systems shall function as a continuous automatic belt guidance system and shall be an integral part of the press. The alignment system shall operate with smooth and slow motions resulting in a minimum of belt travel from side to side. The use of electrical servos or systems which utilize devices that maintain alignment by a large snap action type alternating movement of the alignment roller shall not be considered acceptable to this specification.
- D. Rollers for the belt aligning system shall be constructed as specified under "Rollers". Support bearings for these rollers shall be as specified under "Bearings".
- E. Back-up proximity limit switches for the belt alignment system shall be provided on the machine with sufficient contacts to de-energize all drives and sound an alarm in case of belt over-travel. All piping, valves, fittings, pumps, motors and controls necessary, to provide a complete and

operational system, shall be included. A hydraulic unit shall be provided, as specified under "Hydraulic system".

2.10 – BELT TENSIONING SYSTEM

- A. Each belt shall be provided with a belt tensioning system. The belt tensioning system shall be hydraulically actuated. The design of the tensioning system shall be such that dewatering pressure is directly proportional to belt tension and adjustments in tension shall result in immediate changes in dewatering pressure.
- B. Each belt tensioning system shall be furnished with individual control such that independent pressure regulation and shut-off for each belt is possible. Pressure gauges shall be calibrated to provide an indication of actual dewatering pressure in pounds per linear inch at various readings of hydraulic pressure and normal operating limits shall be indicated on the face of the gauge. Actual dewatering pressure, as indicated on the gauge, shall be maintained automatically despite process changes, such as, an increase or decrease in feed solids on sludge feed rate. The use of pneumatic bellows that do not have the capability of automatically maintaining a pre-selected belt tension, despite process changes, will not be considered acceptable in this specification. The hydraulic power unit shall be capable of delivering a maximum of 70 P.L.I..
- C. The design of the belt tensioning system shall assure parallel movement of the tensioning rollers. The belt tensioning system shall accommodate a minimum of 4 % increase in belt length. Manual or electric servo tensioning systems are not acceptable.

2.11 – HYDRAULIC SYSTEM

- A. Each belt filter press system shall be provided with a dedicated hydraulic power system to provide pressurized oil for the steering and tensioning. The unit shall consist of a stainless steel, two-gallon reservoir with sight glass and thermometer, variable-displacement pressure compensated hydraulic oil pump and drive motor, hydraulic oil filter (reusable), pressure gauges, piping, valves and cylinders to make a complete operational system.
- B. The pump, motor, reservoir, oil filter and valves shall be mounted directly to the belt press frame to minimize excess piping runs, fittings and hoses. All hydraulic lines shall be properly sized for the pressure and flow of the unit. Pressurized hydraulic lines shall be 316ss tubing and shall be rigidly supported on the structural frame of the press. Flexible lines to cylinders shall be made of the material and construction appropriate to the application. The hydraulic reservoir shall be made of 316L stainless steel, with a sight glass to allow visual inspection of the oil level. The pump motor shall be a 1hp and shall not exceed a noise level of 70 DbA. The motor shall be a cast iron TEFC 1,200 rpm, NEMA B design with a C face mounting for the hydraulic pump adapter.

- C. The maximum system operating pressure shall be 1,000 psi. The operator shall set the pressure in the system, and the system will maintain the desired operating belt tension.
- D. Hydraulic system controls shall be grouped for easy access and ease of operation. There shall be means provided to retract the belt tension cylinders for service. The valves, fittings, manifold and associated parts shall be of non-corroding materials such as FRP, glass filled nylon and stainless steel.
- E. The oil pressure gauge, one for each pair of belt tension cylinders (upper & lower belt) shall indicate oil pressure in PSI. A low-pressure switch shall be provided to sense the absence of belt tension pressure.
- F. Hydraulic cylinders shall have a non-corrosive body and 316 stainless hardware and cylinder rod. The cylinder rod shall be solid stainless with a hardened polished seal contact surface. Chrome or nickel plated rods are not acceptable.
- G. Each belt filter press system shall be provided with a dedicated hydraulic power system to provide pressurized oil for the steering and tensioning.

2.12 – BELT DRIVE

- A. Input power to each of two drive roller shafts is supplied through two A.C., high efficiency motor driven, shaft mounted, torque arm retained, Eurodrive helical gear reducers. Roller rotational speed is controlled through variation in motor frequency, which is regulated by the operator via a potentiometer input to a variable frequency drive controller. Rotational timing of the two drive rollers, which is necessary for proper operation, is achieved by the use of a single variable frequency drive which controls both motors wired in parallel to each other, accomplishing a speed match. This drive system will be comprised of the components listed below.

1. Reducer Data

Quantity per machine:	2
Description:	Helical shaft mounted gear reducer

2. Motor Data

Horsepower:	6.0 hp (3 hp each motor)
Power requirement:	230/460 volt, three phase, 60 hertz.
Maximum speed:	1800 r.p.m.
NEMA design:	B
Ambient temp.:	40 degrees C.
Insulation class:	F
Full load amps:	460 volt at 4.8 amps.
Efficiency:	84%

Service factor:	1.15
Time rating:	Continuous.
Enclosure:	TEFC

2.13 – DEWATERING BELTS

- A. Each belt filter press shall incorporate the use of two dewatering belts. Belts shall be seamed and fabricated of monofilament polyester, wear-resistant plastic materials. The mesh design shall be selected for optimum dewatering of the sludge to be processed with minimum blinding of the filter bed.
- B. Belt selection shall be based on the manufacturers experience obtained from testing the sludge during start-up of the belt filter press (es) and at other installations dewatering similar sludges with similar polyelectrolyte conditioning chemicals. Each belt and connecting splice shall be designed for a minimum tensile strength equal to five times the normal maximum dynamic tension to which the belt shall be subjected. The splice shall be designed to fail before the belt and shall be constructed of Type 316 stainless steel.
- C. Belts shall have a width as herein before specified and shall have a minimum life of 2,000 hours continuous operation at the rated design conditions. This minimum belt life shall also cover belts damaged due to defects in the manufacture of the press or any of its components, and shall also cover the connecting splice. Belts shall be designed for ease of replacement with a minimum of belt filter down time.

2.14 – DISCHARGE BLADES

- A. Discharge blades shall be provided to scrape dewatered sludge from the belt at the final discharge rollers. The blades shall be of ultra high molecular weight polyethylene construction and shall be readily removable.

2.15 – DRAINAGE PANS

- A. Drainage pans shall be provided as necessary to contain filtrate from all dewatering areas within the belt filter press without splashing and to prevent re-wetting of downstream cake. All drainage piping shall be furnished, adequately sized for the intended service, and rigidly attached to the press frame. Drainage piping shall terminate inside the structural frame at the bottom of the press. Drain connection shall be self-venting to prevent overflow. Flushing connections or similar provisions shall be provided for easy access during cleaning. Drainage pans shall be located such that the moving belts do not come into contact with the pans under any conditions.

2.16 – NEW BELT FILTER PRESS CONTROL PANELS (CP-BFP2 & CP-BFP3)

- A. Each belt filter press shall be provided with a control panel that will contain the necessary control devices and equipment for controlling the dewatering process as described herein and in Section 13491 – PROCESS CONTROL DESCRIPTIONS. The control panel shall be U.L. listed and shall be assembled in a U.L. listed facility.
- B. The control panel shall accept a 460 VAC, 60 hertz, 3-phase power input. A main disconnect circuit breaker and operator mechanism shall be included. When the disconnect is in the open position, all power shall be removed from the control system. IEC rated motor starters with short circuit protection shall be provided for the hydraulic unit and the washwater pump. Motor control for the press belt drive motors shall be accomplished via a variable frequency drive (VFD) mounted in the control panel. A control power transformer shall be included that will provide 120 VAC control power to the system. All logic functions for the system shall be performed by an industrial programmable logic controller (PLC) located in the control panel.
- C. Located on the front of the control panel shall be a CONTROL POWER ON/OFF switch. When in the ON position, the CONTROL POWER ON pilot light will be illuminated and control power shall be distributed to the control system. When in the OFF position, the control system shall be held de-energized. Also located on the control panel shall be an illuminated mushroom head style push-pull EMERGENCY STOP operator when depressed shall immediately de-energize all moving equipment in the system. An alarm horn shall be included for audible alarm annunciation.
- D. System Operation:
 - 1. As a minimum, the following control pilot devices shall be located on the front of the control panel for each belt filter press:
 - a. HAND/OFF/AUTO MODE selector switch
 - b. HAND MODE indicator
 - c. AUTO MODE indicator
 - d. AUTO START pushbutton
 - e. AUTO STOP pushbutton
 - f. LAMP TEST pushbutton
 - g. SYSTEM RESET pushbutton

- h. ALARM SILENCE pushbutton
- i. PRE-WASH CYCLE ON indicator
- j. PRESS READY indicator
- k. DEWATERING ON/OFF selector switch
- l. WASHDOWN CYCLE ON indicator
- m. BELT INSTALLATION OFF/ON selector switch
- n. WASHWATER PUMP START pushbutton
- o. WASHWATER PUMP STOP pushbutton
- p. WASHWATER PUMP RUNNING indicator
- q. HYDRAULIC PUMP START pushbutton
- r. HYDRAULIC PUMP STOP pushbutton
- s. HYDRAULIC PUMP RUNNING indicator
- t. BELT DRIVE START pushbutton
- u. BELT DRIVE STOP pushbutton
- v. BELT DRIVE RUNNING indicator
- w. BELT DRIVE SPEED controller (0 -100%)
- x. CONVEYOR START pushbutton
- y. CONVEYOR STOP pushbutton
- z. CONVEYOR RUNNING indicator
- aa. SLUDGE PUMP START pushbutton
- bb. SLUDGE PUMP STOP pushbutton
- cc. SLUDGE PUMP RUNNING indicator

- dd. SLUDGE PUMP SPEED controller (0-100%)
 - ee. POLYMER PUMP START pushbutton
 - ff. POLYMER PUMP STOP pushbutton
 - gg. POLYMER PUMP RUNNING indicator
 - hh. POLYMER PUMP SPEED controller (0-100%)
 - ii. LOW WASHWATER PRESSURE indicator
 - jj. HYDRAULIC PRESSURE FAULT indicator
 - kk. BELT MISALIGNED indicator
 - ll. BELT BROKEN indicator
 - mm. NO CAKE indicator
 - nn. EMERGENCY STOPPED indicator
 - oo. BELT DRIVE FAIL indicator
- E. The control panel shall require the following discrete signal inputs from others. The signals shall be normally open dry contacts and shall close when the equipment is running.
- 1. Conveyor(s) running
 - 2. Sludge pump running
 - 3. Polymer pump running
- F. The control panel shall provide the following discrete signals for use by others. The signals shall be dry contacts.
- 1. Belt Filter Press ready (N.O. close when press has been pre-wet)
 - 2. Belt Filter Press fault (N.O. close on common alarm)
 - 3. Conveyor(s) run (N.O close to run)
 - 4. Sludge Pump (N.O. close to run)

- 5. Polymer Pump run (N.O. close to run)
- G. The control panel shall require the following analog signals from others.
 - 1. Sludge Pump speed or flow (4-20 mA)
 - 2. Polymer Pump speed or flow (4-20 mA)
- H. The control panel shall provide the following analog signals.
 - 1. Sludge Pump speed or flow (4-20 mA)
 - 2. Polymer Pump speed or flow (4-20 mA)

PART 3 - SEQUENCE OF OPERATION

3.01 - AUTOMATIC MODE

- A. Each press may be operated in the automatic mode by selecting the press with the selector switch at CP-01 and place the local HAND/OFF/AUTO selector switch at each belt filter press control panel in the AUTO position. The AUTO MODE indicator will illuminate and the operator will press the AUTO START push-button. At this time the washwater pump, washwater valve, and the hydraulic pump will be energized and a belt tensioning time delay will start.
- B. After the belt tensioning timer times out, the belt drive and PRE-WASH CYCLE ON pilot light will be energized and a belt pre-wet time delay will start. After the pre-wet timer times out, the PRESS READY pilot light will be illuminated, the belt conveyor will energize and, if the DEWATERING ON/OFF selector switch is in the ON position, the selected sludge pump and dedicated polymer pump to the selected press will be energized. The operator may adjust the belt speed and the flows of sludge and polymer via the controllers provided.
- C. Pressing the AUTO STOP push-button will de-energize the sludge and polymer pumps, illuminate the WASHDOWN ON pilot light and start a wash down time delay. After the wash down timer times out, the belt drive, washwater valve, washwater pump, hydraulic pump and conveyor will be de-energized.

3.02 - MANUAL MODE

- A. To operate each press in the manual mode, the operator will select the desired press with the selector switch at CP-01 and place the HAND/OFF/AUTO selector switch in the HAND position. The HAND MODE indicator will be illuminated. The operator will start the washwater pump by pressing the WASHWATER PUMP START push-button, and start the hydraulic pump by pressing

the HYDRAULIC PUMP START push-button. Anytime the washwater pump is running, the washwater valve shall be energized.

- B. The operator should not proceed until the belts are allowed to be fully tensioned. No interlock is provided to prevent the operator from starting the belt drive in the manual mode. Pressing the BELT DRIVE START push-button will energize the belt drive. The operator should not proceed until the belts are fully pre-wetted. At this time, the operator will start the conveyor(s) by pressing the CONVEYOR START push-button, start the selected sludge pump by pressing the SLUDGE PUMP START push-button and start the dedicated polymer pump by pressing the POLYMER PUMP START push-button.
- C. Pressing the respective STOP push-button in the reverse order stated above will stop the system.

3.03 - FAULTS

- A. When any of the following fault conditions occur, in automatic or manual mode, the appropriate fault indicator will be illuminated, the alarm horn will sound and the belt filter press and associated equipment will be de-energized.
 - 1. EMERGENCY STOP
 - 2. LOW WASHWATER PRESSURE (includes time delay for belt wash)
 - 3. HYDRAULIC PRESSURE FAULT
 - 4. BELT MISALIGNED
 - 5. BELT BROKEN
 - 6. BELT DRIVE FAIL
- B. The following fault conditions will cause the wash down cycle to be initiated in the automatic mode (annunciation only in the manual mode):
 - 1. NO CAKE

3.04 - ENCLOSURES

- A. Control panel enclosures shall be fabricated of type 304 stainless steel and shall be suitable for NEMA 4X service. Enclosures shall be manufactured by Hoffman Manufacturing, Steeline or equal.

3.05 - WIRING

- A. All power and control wiring shall be 600 volt, type THHN/THWN or MTW insulation stranded copper and shall be sized for the required load, 14 AWG minimum.

3.06 - CIRCUIT BREAKERS

- A. Circuit breaker for the main disconnect shall be thermal magnetic molded case units. Circuit breakers shall be Allen Bradley type 140U or equal.

3.07 - MOTOR STARTERS

- A. Motor starters shall be full voltage, nonreversing, IEC rated across-the-line units. Coils shall be 120 VAC. The starters shall be Allen Bradley style 140M w/100 contactors.

3.08 - SPEED CONTROLLERS

- A. The speed controllers shall be capable of outputting a 4-20ma DC or 0-10v DC set point control signal and accept a 4-20ma DC or 0-10v DC status signal. The controller shall be capable of PID control. The controller shall be Red Lion P48 or equal.

3.09 - SELECTOR SWITCHES

- A. All selector switches shall be heavy duty, oil tight/watertight, corrosion resistant units rated for NEMA 4X service. Contact blocks shall be rated for 10-ampere continuous service. Selector switches shall be Allen Bradley type 800H or equal.

3.10 - PUSH BUTTONS

- A. All push buttons shall be heavy duty, oil tight/watertight, corrosion resistant units rated for NEMA 4X service. Contact blocks shall be rated for 10-ampere continuous service. Push buttons shall be Allen Bradley type 800H or equal.

3.11 - PILOT LIGHTS

- A. Pilot lights shall be heavy duty, oil tight/watertight, corrosion resistant units rated for NEMA 4X service. Units shall be 120 VAC transformer type. Pilot lights shall be Allen Bradley type 800H or equal.

3.12 - TERMINAL BLOCKS

- A. Terminal blocks shall be high density, spring cage clamp style, with 600-volt rating. Terminal blocks shall be Wago, Class 280, or equal.

3.13 - PROGRAMMABLE LOGIC CONTROLLER (PLC)

- A. The PLC shall be a modular type with discrete and analog capabilities. The CPU shall have 4K minimum RAM for user instructions. The unit shall have battery backed RAM and EEPROM backup. The PLC shall be an Allen Bradley Control Logix, Allen Bradley Compact Logix, GE PAC RX3I, Modicon Premium, Modicon M580 or equal.

3.14 - VARIABLE FREQUENCY DRIVE (VFD)

- A. The VFD shall be UL listed and shall be Allen Bradley Powerflex style or equal.

3.15 - SPARE PARTS

- A. The following spare parts shall be furnished for each new belt filter press by Alfa Laval:
1. One (1) complete set of belts for each belt filter press
 2. One (1) discharge blade for each belt filter press
 3. One (1) set of sludge containment seals for each belt filter press
 4. One (1) set of washwater box seals for each belt filter press
 5. One (1) spare on-the-shelf PLC input card for CP-BFP2 & CP-BFP3.
 6. One (1) spare on-the-shelf PLC analog card
 7. One (1) spare on-the-shelf PLC power supply
 8. One (1) spare on-the-shelf PLC CPU
 9. One (1) spare on-the-shelf level probe indicator/controller
 10. One (1) washwater valve operator (motorized or solenoid) for each belt filter press
 11. One (1) washwater pressure switch for each belt filter press
 12. One (1) thickener roller bearing of each different size used for each belt filter press
 13. Two (2) dozen fuses of each size used in each control panel
 14. One (1) motor starter of each NEMA size

PART 4 - EXECUTION**4.01 - GENERAL**

- A. All components shall be fully tested and verified for service by the manufacturer. The manufacturer shall provide a MSR as specified in Section 01750 - Starting and Adjusting. An amount equal to 0.50% of the scheduled value for the work of this Section shall be retained until the report has been furnished.

4.02 - INSTALLATION

- A. The Contractor shall install all equipment of this Section unless noted on the Drawings or specified herein. All equipment shall be installed in accordance with the manufacturer's written instructions.

4.03 – FIELD QUALITY CONTROL

- A. Acceptance Tests: After the sludge dewatering equipment has been installed and fully connected for service, each belt filter press and its auxiliary equipment shall be tested. The tests shall be conducted on sludge consisting of blended primary and secondary sludge. All testing shall be conducted by factory trained representatives of the manufacturer. The following tests shall be conducted:
1. Mechanical Performance Test: This test shall demonstrate that the units are capable of 24-hour per day, 7 days per week continuous operation. The test shall consist of operation of each belt filter press and the existing belt filter press and its auxiliary equipment for a period of 8 hours per day for two (2) consecutive days without any signs of mechanical defects. Dewatered sludge production must be continuous during all tests.
 2. Performance Test: This test shall demonstrate that the belt filter press achieves the minimum percent solids concentration in the dewatered sludge as specified herein. The belt filter press shall be tested and shall be run satisfactorily for six (6) consecutive hours per test. At the sole discretion of the Engineer, the performance test may be run concurrently with the mechanical performance test.
 - a. The manufacturer, under the observation of the Engineer, shall grab samples of inlet sludge, dewatered sludge, and filtrate to determine the performance of the unit. Grab samples shall be taken at least once every ½ hour throughout the test period.
 - b. Tests shall be conducted and logged for inlet sludge percent solids concentration, dewatered sludge cake percent solids concentration, and percent solids capture. The results of each test shall be arithmetically averaged to

- determine the performance of the unit over the test run period. The manufacturer shall provide split samples when directed by the Engineer. The manufacturer shall perform the tests using laboratory equipment owned by the manufacturer or in a certified lab approved by the Engineer.
- c. The manufacturer shall provide and have delivered to the site three 275 gallon totes of liquid emulsion polymer which shall be utilized during acceptance testing. The manufacturer shall select the polymer such that the performance criteria is achieved. Should the polymer obtain the specified performance, then different polymer will not be required. All polymer remaining after the tests shall then become the property of the Owner the amount of which shall not be less than 275 gallons of liquid emulsion polymer. Should the initial polymer prove incapable of obtaining the specified performance, then the manufacturer shall supply and deliver to the site a different polymer in adequate quantities to demonstrate the specified performance. The manufacturer shall remove the unacceptable polymer from the site. The responsibility shall lie with the manufacturer for obtaining polymer in sufficient quantity until the performance test demonstrates compliance with these specifications.
 - d. All equipment defects detected during the testing periods shall be promptly corrected at the expense of the manufacturer.
 - e. If the tests prove specified performance, the manufacturer shall provide a letter report of the results and conclusions. The test data and polymer recommendations shall be provided.
3. Should the unit fail to obtain all specified performance criteria within fifteen (15) consecutive days of acceptance testing from the date of the initial site mechanical start-up, then the manufacturer's performance bond will be forfeited to the Owner provided that the standard accepted referee testing (bench scale testing, full size- except for width- pilot belt filter press consistent with the details of this specification) shows that the specified performance requirements are achievable. If not, the installed equipment will be deemed acceptable.
4. In the event that the originally supplied belt filter press obtains the specified performance and said performance was obtained in accordance with the testing provisions of the specifications, then the guarantee period shall start. The performance bond will be returned to the belt filter press manufacturer at the end of the guarantee period. A two (2) year maintenance bond shall be posted in the total amount of \$25,000 at this time.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 – SECTION INCLUDES**

- A. Furnishing all labor, materials, equipment and services necessary to furnish and install the three (3) polymer blending units with progressive cavity pump, motors and controls, including all integral piping, valves, fitting, pipe supports, special equipment and appurtenances in accordance with these specifications, including all incidental work necessary to make it complete, satisfactory and ready for operation as it is specified herein and shown on the Contract Drawings.

1.02 – QUALITY ASSURANCE

- A. Prior to shipment the system shall be inspected for quality of construction verifying all fasteners and fittings are tight, all wires are secure and connections whisker-free.
- B. The complete system shall be fully factory tested prior to shipment. Testing shall include: setting and verification of all instrumentation and sensors per the design requirements of the application; pressure testing all plumbing systems for a minimum of one hour at 100 psi. If leaks are found they shall be fixed and a new test shall be conducted for one hour at 100 psi until the plumbing system is verified to be leak free; verification of system design flow rates, and; complete functional simulation of operation.
- C. The polymer dilution and feed system shall be capable of effectively activating and fully blending with water a homogenous polymer solution ranging from 0.1% to 1% concentration of emulsion polymers with active contents up to 75%.
- D. Any proposed substitutions from manufacturers other than that specified will require full compliance with the requirements of Specification Section 01630 – Product Substitution Procedures.
- E. After the bid opening, consideration will only be given to other alternate manufacturers/suppliers who can demonstrate to the Engineer that their equipment complies with these Specifications and has had successful and documented experience with the size, quality, performance and reliability to that specified. Consideration for any other alternate manufacturer shall include the proposed equipment's application and ability to provide equal service and performance as intended by these specifications. All modifications to structures, piping, valves, equipment layout, electrical connections, wiring (runs, wire sizes, service circuit sizes) and coordination with ancillary or interconnected systems or equipment necessitated by a substitution shall be reviewed and approved by the Engineer at the cost of the Contractor.

- F. All systems shall be designed, furnished, and installed to achieve the conditions of service specified herein.
- G. The Supplier shall have at least ten (10) years of experience in the design and manufacturing of top opening inline sludge macerators.
- H. The cost for any construction modifications shall be included in the cost as bid and no additional cost shall be paid by the Owner for acceptance of alternate equipment and any required installation modifications.
- I. The products specified were chosen based on past performance, compatibility and constitute a standard for quality and performance for the specific purpose for which the liquid polymer emulsion systems are intended. Products other than that specified will be considered for use under the provisions set forth as follows:
 - 1. The named products constitute the "Base Bid" liquid polymer emulsion systems. All bidders are advised to provide "Base Bid" pricing since the magnitude of the expenses involved with engineering redesign or modifications may be difficult to determine during the bidding period. Refer to the Contract General Conditions regarding product substitutions.
 - 2. If alternate equipment is proposed, the Supplier shall prepare and submit to the Engineer three (3) copies of the "Evaluation Documentation" as listed below. The information shall be in a form that is neat, clear, precise, legible, and computer drafted and prepared so as to allow the Engineer to evaluate the proposed equipment. The "Evaluation Documentation" shall be hand delivered directly to the Engineer at least ten (10) calendar days prior to the date set for the bid opening. The pre-bid "Evaluation Documentation" shall consist of the following:
 - a. Liquid polymer emulsion systems dimensional data and pump performance curve.
 - b. Descriptive technical information for the proposed product(s) highlighted to show the differences between the proposed unit(s) and the specified unit(s). Descriptive technical information shall include model numbers, type, sizes, weights, performance data, and materials of construction.
 - c. List of facilities showing facility name, active contact name and telephone number, years in service, design conditions and parameters, and design engineer's name and current telephone number of the company.

- d. The Supplier shall state if he/she complies with each and all Sections of the Specifications. Any variance from the specified equipment shall be listed and a description of each variance must be in letter form. Facsimile transmissions will not be accepted.
- J. Failure to submit the above listed information ten (10) calendar days prior to the date set for the bid opening shall be cause for non-evaluation and the product will not be considered for the project.
- K. The Engineer will issue an addendum of approved products prior to the date set for the bid opening.
- L. The acceptance of products prior to the bid date does not relieve the Contractor of his/her responsibility regarding the performance or ability to meet the requirements of the Contract Documents.
- M. After contract execution submit shop drawings in compliance with the requirements contained in Section 01330 - Submittals. The Contractor shall remain fully responsible for all design revisions, including but not limited to, the following: structural, mechanical, electrical, and instrumentation because of the utilization of substitute equipment. Refer to product substitution procedures in the Contract General Conditions, for costs associated with redesigns and/or modifications caused by the use of a substitute product offered by the Contractor.
- N. All costs, including other prime contractor, engineering, and legal costs, associated with accommodating alternate equipment shall be borne by the Contractor.

1.03 – DESIGN REQUIREMENTS

- A. The Contract Drawings have been prepared based on the installation of three (3) liquid emulsion polymer systems manufactured by Velodyne. If other listed manufacturer's or an equal manufacturer's equipment is submitted which requires an arrangement differing from that shown on the plans or if the details of design and construction are different from those specified, the Contractor shall prepare and submit for review the necessary design calculations along with the necessary structural, electrical, instrumentation, mechanical and architectural drawing revisions. All revised design drawings shall be prepared by a NYS licensed Professional Engineer. The manufacturer shall prepare and submit for review along with the required shop drawings, a specific listing of the material, design and construction differences between the proposed equipment and the specified equipment. All work associated with accommodating the submitted equipment shall be at no additional cost to the Owner. All re-design costs associated with

evaluating alternate equipment that does not conform to the requirements specified herein shall be reimbursed to the Engineer by the Contractor.

1.04 – PERFORMANCE CRITERIA

1. Polymer Type: Emulsion
2. Polymer Activity (percent active): 30 to 75
3. Solution Concentration Range: 0.1% to 2% based on neat polymer
4. Solution Concentration Design Point: 0.5% based on neat polymer

Neat Polymer Flow Range (GPH)	Dilution Water Range (GPM)
0.5 – 10	3 - 30

1.05 - WARRANTY

- A. Provide a Warranty Certificate from the manufacturer typed on company letterhead and signed by an authorized officer of the manufacturer. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located. The Warranty Certificate shall be submitted, verbatim and without exception, as follows:

“(Name of Manufacturer)” guarantees all components of the system to be free from defects in design, materials and workmanship for a period of one (1) year commencing on the date the system was permanently placed on-line, and the mechanical equipment functions without flaw.

During the guarantee period, if any part or equipment component is defective or fails to perform when operating at design conditions and if the equipment has been installed and is being operated and maintained in accordance with the written instructions we provided, then we shall repair or exchange such defective part (s).

The warranty shall be a limited warranty against defects in materials and workmanship. The mixing chamber shall be warranted for the life of the system against failure for plugging for any reason. The warranty shall exclude failure due to over pressure or freezing. Non-manufacturer warranty will be unacceptable.

Agreed upon this _____ day
(Date)

by _____ of
(Name of Authorized Agent)

(Name of Manufacturer)

who, by signing this document, affirms that he/she is legally authorized to submit this

warranty on behalf of the Supplier.

AUTHORIZED SIGNATURE

DATE

NOTARY

DATE

1.06 - SUBMITTALS

- A. Comply with the requirements contained in Section 01330 - Submittals. The following documents shall be submitted.
- B. Technical descriptive data for each equipment item in the system showing model number(s), sizes, capacities, weights, horsepower, motor and voltage information, and similar type information. Catalog cuts are acceptable if they contain the necessary information.
- C. Field wiring diagram for each motor operated piece of equipment.
- D. Detailed specifications and data covering materials used, parts, instrumentation devices, and other accessories forming a part of the equipment.
- E. Control panel wiring schematic.
- F. Catalog cuts of every device inside the control panel.
- G. Storage, handling and Manufacturer's installation instruction and certification.
- H. Warranty Certificate prepared in accordance with the requirements contained herein.
- I. Electrical/pneumatic requirements, schematic diagrams, and details of components included.
- J. List of spare parts and miscellaneous equipment to be provided under this Section.
- K. Manufacturer Start-up Report (MSR) in accordance with paragraph 3.01 herein.
- L. Operations and Maintenance Manual prepared in accordance with the requirements contained in Section 01730 - Operations and Maintenance Data.

1.06 – DELIVERY STORAGE AND HANDLING

- A. The unit(s) shall be stored and handled in accordance with the written instructions supplied by the approved Manufacturer.

- B. The equipment will be shipped in a new, high quality completely enclosed weather proof wooden crate constructed of 2" x 4" studs and 3/8" thick ply wood. Access to the crate shall be by a front panel removable by lag bolts. A skid shall be constructed of 4" x 4" or two 2" x 4" each, allowing fork-lifting. The crate shall include a shock sensor to warn of equipment mishandling during shipment.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. The polymer blending and feed equipment:
1. Velodyne, Velocity Dynamics, LLC, VeloBlend model VM-10P-1800-Rp-1-A-2,
 2. Fluid Dynamics Series L6-P model L6-1800
 3. Or approved equal.
 4. Any proposed alternate must be proven to provide at least an equal level of performance, reliability, versatility and quality to the system specified. If, after installation, it is shown that the alternate system does not provide an equal level of performance, reliability, versatility and quality to that specified, the contractor shall replace the system with the specified system at their sole cost.

2.02 - MATERIALS

- A. The following material requirements will be strictly adhered to:
1. System skid: 304 stainless steel
 2. Hardware: Type 18-8 stainless steel
 3. Inlet and Outlet fittings: 304 stainless steel
 4. Piping & pipe fittings: schedule 80 PVC
 5. Tubing and tube fittings: polyethylene, polypropylene, stainless steel and Viton
 6. Water solenoid valve: brass
 7. Pressure gauges: stainless steel, liquid filled
 8. Pressure switches: NEMA 4, brass connection

9. Flow meter: acrylic, stainless steel, PVC and or polypropylene
10. Water control valve: stainless steel with stainless steel seat
11. Mixing chamber body / flanges: stainless steel
12. Mixing chamber cover / chamber: clear polycarbonate
13. Mixing Chamber Discharge: stainless steel
14. Impeller: 304 stainless steel
15. Impeller shaft seal: Viton, stainless steel, ceramic, carbon
16. Mixing chamber pressure relief valve: brass, stainless steel or PVC
17. Metering pump wetted parts: stainless steel & Viton
18. Metering Pump Shaft Seals: Viton, stainless steel ceramic, carbon
19. Control enclosure: FRP

2.03 – POLYMER ACTIVATION & BLENDING CHAMBER

- A. These specifications are based on a multi-stage, multi-zone, Hydro-Mechanical polymer activation & blending technology. Alternate technologies will only be considered if proven to provide an equal level of performance, versatility, reliability and quality, otherwise the following technology will be provided without exception.
- B. In order to provide control and versatility to optimize the performance of the wide range of polymers available and to optimize system reliability, a multi-stage Hydro-Mechanical polymer blending technology shall be provided with both a non-mechanical and mechanical mixing stage:
 1. Non-Mechanical Stage: To optimize reliability, the device shall be capable of activating and blending polymer based on plant water pressure alone at 30 psid or greater. Polymer shall be injected directly into a water jet by means of an injection quill positioned such that the non-mechanical mixing energy is no way diminished prior to polymer and water contact. The non-mechanical zone shall be designed such that the velocity of the mixing energy-producing water jet is maintained or increases as flow decreases.
 2. Hydro-Mechanical mixing Stage: In order to provide optimal polymer performance under all operating conditions and to provide total control over mixing energy, in addition to the

non-mechanical mixing stage the device shall be capable of producing its mixing energy independent of plant water pressure through a variable intensity, controllable stainless steel hydro-mechanical mixer. The mixing impeller shall be fully controllable and capable of inducing ultra high, non-damaging mixing energy at all flow rates. This shall be accomplished by controlling mixing intensity and preventing over exposure to, or damaging recirculation through the impeller. The polymer mixing impeller shall be designed to produce both axial and radial flow to optimize mixing effectiveness and to effectively inducing high, non-damaging mixing energy over the systems full flow range.

3. Alternative technology: a hydro-dynamic, non-mechanical blending device will be acceptable provided that all other specified requirements are met and that the technology is capable of providing control over mixing energy in order to provide the versatility required to handle all emulsion and dispersion type polymers that may be used now and in the future. In order to meet this requirement, the following shall be provided: an integral, multi-stage, stainless steel dilution water booster pump shall be provided to eliminate reliance on plant water pressure for its mixing energy; an integral pressure regulating valve mounted down-stream of the booster pump to provide control over mixing energy; and a pressure gauge up stream of the pressure regulating valve to monitor available plant water pressure. The booster pump system shall be capable of producing 100 psi differential pressure across the hydro-dynamic mixing chamber's water-jet producing orifice which is then controllable down to a minimum of 50 psi differential pressure in order to provide control over mixing energy. If after installation it is shown that the booster pump is incapable of meeting the above criteria the contractor shall be responsible for replacing the booster pump with a pump that does.
 4. Mixers that rely solely on plant water pressure and or flow for mixing energy will not be acceptable. Mixers where performance is affected by flow rate and therefore retention time resulting in under or over exposure to mixing energy, or which rely on constant speed impellers or that rely on close tolerances for blending shall not be acceptable.
- C. In order to prevent polymer build-up, the mixing chamber shall maintain high velocity in the entire chamber - at no time shall there be low velocity within any portion of the mixing chamber.
- D. The mixing impeller shall be controlled by an SCR motor controller and driven by a wash-down duty motor. The motor shall be mounted horizontally or above the mixing chamber. Motors mounted under the mixing chamber where seal failure or leaks can damage the motor shall not be acceptable.
- E. The mixer drive shaft shall be sealed by a mechanical seal which shall have an integrally mounted and factory plumbed seal flush. A drain port behind the seal shall be provided in the

mixing chamber to drain the polymer solution in case of a seal failure. The seal shall be easily accessible for replacement. Systems without a seal flushing system shall not be considered. All bearings shall be external from the mixing chamber. Internal bearings shall not be acceptable.

- F. Both mechanical and non-mechanical mixing zones shall be clear polycarbonate to view the mixing action and blending effectiveness. Acrylic chambers prone to becoming brittle over time and cracking, or opaque pipe shall not be acceptable to meet this requirement. The clear cover shall have a stainless steel reinforced gusseted flange with a stainless steel discharge connection in order to handle maximum operating pressures.
- G. The mixing chamber shall have a maximum rated pressure of 100 psi. Provide a pressure relief on the mixing chamber factory set at 75 psi.
- H. Provide a neat polymer check valve specifically designed to isolate neat polymer from dilution water. The valve shall be designed with an open, unobstructed path to the valve seat. To minimize check valve plugging due to normally occurring polymer agglomerations, the minimum open area up to and including the valve seat shall be 3/16" without exception. The valve body shall be constructed of Teflon with Viton seals. The valve poppet and spring shall be stainless steel. The spring shall be outside of the polymer flow path to prevent build-up and plugging. The locking pin used to hold the valve in place shall be attached to the mixing chamber with a lanyard. The valve shall be readily accessible for cleaning and shall not require tools for removal, cleaning or replacement. Conventional check valves, valves that rely on ball seals, and or check valves that are installed inside the mixing chamber, or which require mixing chamber disassembly for servicing will not be accepted.

2.04 – DILUTION WATER ASSEMBLY

- A. The dilution water flow rate shall be monitored by a paddle type flow meter having the range as specified under paragraph 1.04 above. Unions or flanges shall be provided on the flow meter to allow easy removal for cleaning.
- B. The unit shall have an electric solenoid valve for on/off control of total dilution water flow.
- C. The unit shall have a linear actuated variable rate control valve to automatically proportion water flow to polymer flow for polymer / water ratio control. Valves that diminish mixing energy in the non-mechanical stage shall not be used.
- D. A differential pressure type low water differential pressure alarm shall be provided. The switch shall be adjustable between 25 and 100 psid. Proof pressure shall be 500 psi minimum. The pressure switch shall be as manufactured by Ashcroft.

- E. Provide a 2-1/2" stainless steel liquid filled pressure gauge to monitor dilution water inlet pressure.

2.05 – PROGRESSIVE CAVITY NEAT METERING PUMP

- A. Each unit shall have one (1) neat polymer metering pump(s) integrally mounted on the systems skid. The metering pump(s) shall have a range as specified under paragraph 2.03 above. The pump shall be a positive displacement, progressive cavity type constructed of stainless steel and Viton. The shaft seal shall be a packing type riding on a ceramic sleeve. Mechanical seals shall not be used. A 90 VDC wash-down duty motor shall drive the pump. A gear reducer shall be provided to produce a maximum pump shaft speed of not more than 545 RPM. The motor shall be controlled by an SCR motor controller located in the system control panel.
- B. Provide a calibration column with two full port PVC ball valves having Viton O-rings. The column shall be calibrated for a one-minute draw-down at maximum pump rate and read in GPH and milliliters. The calibration column shall be rigidly mounted to the systems frame with a minimum of two heavy duty brackets. Mounting the calibration to the neat polymer inlet piping shall not be acceptable. Provide a breather plug in the top of the calibration column designed to allow adequate displacement of air during calibration while preventing water or other foreign material from entering the calibration column.
- C. Provide a thermal flow sensor to detect loss of polymer flow.
- D. Provide discharge pressure relief valve plumbed to the pump suction.

2.06 – SOLUTION DISCHARGE ASSEMBLY

- A. Provide a 2-1/2" stainless steel liquid filled pressure gauge to monitor system discharge pressure.

2.07 – CONTROLS

- A. A control panel integral to the systems frame shall be provided. The enclosure shall be rated NEMA 4X and constructed of stainless steel. The control panel shall consist of all controllers, digital displays, potentiometers, switches, lights, relays, and other control devices required for a complete operable system. The control panel and all components shall be industrial duty. All skid mounted electrical components interconnected to the control panel shall terminate at numbered and labeled terminal blocks. The terminal blocks shall be sized for 14 ga. wire. Wires shall be neatly run through wire race-way and numbered with shrink tubing type labels. Adhesive labels shall not be used. The control panel shall be positioned such that there are no obstructions in front of the control panel per related NFPA requirements.

- B. Power: 120 VAC, 1Ph, 60/50 Hz.
- C. A circuit breaker on the main control circuit and on each motor shall be provided as manufactured by Allen Bradley or equal. Fuses shall not be used for circuit protection.
- D. The controller shall be PLC based with a minimum 5.7" TFT touch screen. Systems that rely on microprocessors and or alphanumeric displays shall not be considered.
- E. Operator Interface – 5.7" Minimum TFT touch screen with the following features as a minimum:
 - 1. LOCAL start/stop mode: system shall run on operator input from touch panel start/stop push button.
 - 2. REMOTE start/stop mode: system shall start and stop according to the state of remote dry contacts (closed = run, open = stopped)
 - 3. MANUAL mode: The desired water flow is set manually using increase/decrease push-buttons on touch panel. The desired polymer flow is set manually using increase/decrease push-buttons on touch panel. Solution concentration defined by water and polymer settings.
 - a. MANUAL mode run screen features:
 - 1) Water control increase/decrease push-buttons.
 - 2) Water flow rate (GPH) display.
 - 3) Polymer control increase/decrease push-buttons
 - 4) Polymer flow rate (GPH) display.
 - 5) Solution concentration (% poly) display.
 - 6) Total solution flow rate (GPH)
 - b. WATER MASTER mode:
 - 1) Desired water flow is set manually using increase/decrease push-buttons on the touch panel.
 - 2) Polymer flow adjusts automatically to maintain operator desired solution concentration. Desired solution concentration is adjusted manually using increase/decrease push-buttons on touch panel.

- 3) WATER MASTER mode run screen features:
 - a) Water control increase/decrease push-buttons.
 - b) Water flow rate (GPH) display.
 - c) Polymer flow rate (GPH) display.
 - d) Solution concentration control increase/decrease push-buttons.
 - e) Solution concentration (% poly) display.

c. PACED POLY RATIO mode:

- 1) Water flow adjusts automatically to maintain operator desired solution concentration.
- 2) Polymer flow paced by remote 4-20mA (supplied by others).
- 3) Desired solution concentration adjusted manually using increase/decrease push-buttons on touch panel.
- 4) PACED POLY RATIO mode run screen features:
 - a) Water flow rate (GPH) display.
 - b) Remote pacing signal level (mA)
 - c) Polymer flow rate (GPH) display.
 - d) Solution conc. Control increase/decrease push-buttons.
 - e) Desired solution concentration (% poly) display.
 - f) Solution concentration (% poly) display.
- 5) Help Screens:
 - a) For each mode of operation
- 6) Alarm screen features:
 - a) Indication of alarm

- b) Description of recommended corrective action
- c) Reset
- d) Alarm history
- e) Set-up screen features:
- f) Semi-auto pump calibration
- g) System flush settings
- h) Auxiliary alarm user programming mode
- 7) Discrete Selector Switch & System Indicator:
 - a) Main Power ON /OFF Switch
 - b) Main Power ON indicator
- 8) Inputs (signals by others):
 - a) Remote Start / Stop (discrete dry contact)
 - b) Pacing Signal Based on Process Flow (4-20mA)
- 9) Outputs:
- 10) System Running (discrete dry contact)
- 11) Remote Mode (discrete dry contact)
- 12) Common Alarm (discrete dry contact)
- 13) Polymer Pump Rate (4-20mA)

2.08 – SYSTEM SKID

- A. The system's frame shall be of rugged 304 stainless steel construction. No mild steel shall be used. All piping shall be rigidly supported.
- B. Under no circumstance shall the pump suction exceed 5" from the bottom of the skid for progressive cavity pumps and 12" from the bottom of the skid for diaphragm pumps.

- C. The skid shall have an integral stainless steel drip pan located under the neat polymer metering pump. Provide one dozen absorbent pads designed for oil and sized to fit within the drip pan.
- D. The overall system dimensions shall not exceed 34"W x 30"D X 72"H.

2.09 – ACCESSORIES

A. Tote Accessories

1. Provide a mixer specifically designed to mix neat polymer with viscosities up to 3000 cps in a tote with capacities as high as 300 gallons. The tote mixer shall have a 3/4 HP, 115 VAC, 1750 RPM, TEFC motor with manual resettable thermal overload protection. A gear reducer shall be provided to produce a mixer shaft speed of not more than 240 RPM. The mixer shaft shall be stainless steel and have a thrust bearing external from the motor for support. The bearing frame shall be stainless steel. One (1) 12" collapsible three bladed impeller shall be provided designed to effectively mix a full tote of neat polymer with viscosities up to 3000 cps. Conventional marine propellers shall not be used. The tote mixer controls shall be integral to the motor and include an ON/OFF switch, and 0-60 minute timer and 10' power lead. The mixer frame shall be constructed of stainless steel and have lifting handles. Moveable brackets shall be included to adjust the width of the mixer for the tote being used. A stainless steel wall mounting bracket with drip pan shall be supplied to support the mixer and collect polymer drips while the mixer is not in use.
2. Provide a polymer tote pump suction assembly. The assembly shall include quick disconnect cam-lock fittings, a 1" full port ball valve, and 15 feet of 1" braided PVC hose.
3. Provide a polymer tote truck designed to transport up to 375 gallon totes and tilt the tote when in service to drain entire contents. Polymer totes shall be positioned on tote truck using a fork-lift or overhead crane. Tote truck shall include two fixed wheels and two swivel wheels. Swivel wheels shall be lockable. The tote truck shall be constructed of powder coated steel and rated for #4000 pounds.
4. Provide a tote level sensor. The level sensor shall be the non-intrusive capacitance type. Two level points shall be supplied each fully adjustable. The controls shall include an ON/OFF switch to preclude false alarm signals while probe is being transferred from empty to full tote, a high level indicating light with NO output and a low level indicating light with NO output.

2.10 – SPARE PARTS

- A. Supplier shall provide the following spare parts for each unit:
 - 1. One (1) progressive cavity pump stator
 - 2. One (1) progressive cavity pump packing set
 - 3. Provide one (1) neat polymer check valve, complete
 - 4. Three (2) polymer injection heads
 - 5. One (1) water supply differential pressure switch

PART 3 - EXECUTION**3.01 - GENERAL**

- A. All components of the system shall be installed in accordance with the written and /or verbal instructions provided by the manufacturer.
- B. All components shall be fully tested and verified for service by the manufacturer. The manufacturer shall provide a MSR as specified in Section 01650 - Starting of Systems. An amount equal to 0.50 % of the scheduled value for the work of this Section shall be retained until the report has been furnished.

3.02 - INSTALLATION

- A. Polymer blending and feed equipment shall be installed in accordance with the supplier's installation instructions, and in compliance with all OSHA, local, state, and federal codes and regulations.

3.03 - FIELD QUALITY CONTROL

- A. Supplier shall provide the services of a qualified field service technician to inspect and certify the installation, start-up the equipment, trouble shoot any problems that may arise and providing complete and thorough training of operator personnel. The service technician shall be an employee of the polymer system manufacturer. Start-up and training by a manufacturer's representative shall not be allowed.
- B. Field services shall consist of no less than three (3) days, exclusive of travel time.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 – DESCRIPTION****A. Scope:**

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, start-up and place in satisfactory operation a complete Process Control System (PCS).
2. The process instrumentation and control Work includes, but is not limited to, the following:
 - a. Glen Cove WWTP Belt Filter Press Main Control panel (CP-01) and panel mounted instruments as specified herein.
 - b. Field-mounted instruments and devices.
 - c. Programmable logic controllers (PLC) and licensed software.
 - d. Operator Interface Terminal (OIT) and licensed software.
 - e. Programming and configuration of the PLCs and OITs.
 - f. Uninterruptible power supply.
 - g. SCADA integration requirements

B. PCS shall monitor, store, display, and log process and equipment operating information; perform various process control functions; and generate various reports.

C. The Contract Documents describe the required PCS and PCS functions and operational requirements.

D. Coordination:

1. Process Controls:
 - a. Providing central computer system, instruments, and controls are part of the Work by instrumentation and controls (I&C) Supplier. Programming of control logic and configuration of human machine interface (HMI) software is part of the Work. The I&C Supplier's programmer shall program and configure the software.

Functional description of process system and associated equipment is included in Section 13491, Process Control Descriptions.

- b. Some panels and equipment are furnished under other Specification Sections under this Contract. Coordinate with Suppliers of these panels and equipment to provide fully functional system in accordance with the Contract Documents and that interfaces with central computer system.
 - c. Computer system input/output list identifies inputs and outputs required and is part of this Section. Input/output list is for coordinating signals between equipment provided by other Suppliers and identifying signals to be programmed by I&C Supplier programmer. Provide Work for Contractor-furnished control options not on the input/output list at no additional cost to OWNER.
- 2. To centralize responsibility, I&C materials and equipment provided under this Contract shall be furnished by a single Supplier.
- 3. With Contractor, I&C Supplier shall assume the responsibility for adequacy and performance of materials and equipment provided under this Section.
- 4. To the greatest extent possible, provide I&C materials and equipment from a single manufacturer.
- 5. Supplier's Responsibilities:
 - a. Preparing all process control equipment submittals in accordance with the Contract Documents.
 - b. Proper interfacing of instrumentation and control equipment with field equipment, instruments, devices, and panels, including required interfacing with packaged control systems furnished by other equipment Suppliers, and required interfacing with the Site's electrical system.
 - c. Review and coordination with manufacturers, other Suppliers, and other contracts of Shop Drawings and other Contractor submittals for equipment, valves, piping, and appurtenances for ensuring proper interfacing of hardware, and locations and installation requirements of inline devices and instrument taps.
 - d. Direct, detailed oversight of installation of instruments, panels, consoles, cabinets, wiring and other components, and related wiring and piping connections.

- e. Calibrating, source quality control, field quality control, and start-up of the system.
- f. Responsibility for correction period obligations for the PCS.
- g. Training operations and maintenance personnel in operation and maintenance (including calibration and troubleshooting) of the PCS.

F. Related Sections:

- 1. Section 13491, Process Control Descriptions.

1.02 – REFERENCES

A. Standards referenced in this Section are:

- 1. ANSI/ASQ Z1.4, Sampling Procedures and Tables For Inspection By Attributes.
- 2. ASTM A269, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- 3. ASTM A312, Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- 4. ASTM A403, Specification for Wrought Austenitic Stainless Steel Piping Fittings.
- 7. IEEE 802.1X, Port Based Network Access Control.
- 8. IEEE 802.3, Standards Defining Physical Layer and Data Link Layer Media Access Control (MAC) Sublayer of Wired Ethernet
- 9. ISA 5.1, Instrumentation Symbols and Identification.
- 10. ISA 5.4, Instrument Loop Diagrams.
- 11. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
- 12. NFPA 70 (NEC), Article 770, Optical Fiber Cables and Raceways.
- 13. NFPA 79, Electrical Standard for Industrial Machinery.
- 14. UL 50, Safety Enclosures for Electrical Equipment, Non-Environmental Considerations.
- 15. UL 508A, Industrial Control Panels.

1.03 – QUALITY ASSURANCE**A. Qualifications:****1. I&C Supplier:**

- a. Shall be financially sound with at least five years of continuous experience in designing, implementing, supplying, and supporting process control systems for municipal wastewater treatment facilities comparable to PCS required for the Project, relative to hardware, software, cost, and complexity.
- b. Shall have record of successful process control system equipment installations. Upon Engineer's request, submit record of experience for at least five projects, each with the following information: project name, owner name and contact information, name and contact information for contractor, name and contact information for engineer or architect, approximate and contract value of process control systems Work for which Supplier was responsible.
- c. Shall have at time of Bid experienced engineering and technical staff capable of designing, supplying, implementing, and supporting the instrument and control system and complying with submittal and training requirements of the Contract Documents.
- d. Shall be capable of training operations and maintenance personnel in PCS applications, and in operating, programming, and maintaining the control system and equipment.
- e. Shall have UL-approved panel shop.
- f. Possess a thorough, working knowledge of wastewater treatment processes and control philosophy in accordance with standard practices of the wastewater treatment industry.
- g. Possess and maintain a documented program of failure analysis.

2. Manufacturers:

- a. Manufacturers of instrumentation and control equipment furnished for the PCS shall be experienced producing similar equipment and shall have the following qualifications:

- 1) Shall manufacture instrumentation and control system components that are fully-developed, field-proven, and of standardized designs.
- 2) Shall have system of traceability of manufactured unit through production and testing in accordance with ANSI/ASQ Z1.4.
- 3) Shall have guaranteed availability clause (99.99 percent, minimum for one year) for microprocessor-based components and appurtenances.
- 4) Shall have documented product safety policy relevant to materials and equipment proposed for the Work.

B. Component Supply and Compatibility:

1. PCS components shall be furnished by a single Supplier who shall have responsibility for furnishing a complete and integrated system.
2. Supplier who shall have responsibility for adequacy and performance of all items furnished.
3. Supplier shall prepare, or shall review and approve, all Shop Drawings and other submittals for the PCS.

C. Pre-submittal Conference

1. Schedule and conduct pre-submittal conference for instrumentation and control system within 15 days after acceptance of I&C Subcontractor by OWNER.
2. Required attendance for pre-submittal conference: Contractor, I&C Supplier, Engineer, and OWNER. Pre-submittal conference will be 2 hours. Conference will be held at Glen Cove Water Pollution Control Plant unless otherwise acceptable to the entities attending.
3. Purpose of pre-submittal conference is to review manner in which I&C Subcontractor and I&C Supplier intend to comply with requirements of the Contract Documents relative to PCS submittals before submittals are prepared.
4. Bring to pre-submittal conference list of proposed personnel committed to assignment to the Project. List shall include I&C Supplier project manager, project engineer, field representative, local service representative, and sales representative(s). Indicate addresses of personnel not based at Subcontractor's and Supplier's office nearest to the Site.

5. Prepare items listed below for presentation at pre-submittal conference. Submit information to Engineer two weeks prior to pre-submittal conference.
 - a. List of materials and equipment required for PCS, and manufacturer and model proposed for each item.
 - b. List of currently-known requests for interpretations of which Contractor and I&C Supplier are currently aware.
 - c. List of proposed exceptions to the Contract Documents along with brief explanation of each.
 - d. Proposed PCS network architecture diagram.
 - e. Sample of each type of process control submittal required by the Contract Documents. These may be submittals prepared for other projects.
 - f. Flow chart showing steps to be taken in preparing and coordinating PCS submittals.
 - g. General outline of types of tests to be performed to verify that all sensors and transducers, instruments, and digital processing equipment are functioning properly.

1.04 – SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Field Instruments:
 - 1) Manufacturer's product name and complete model number of devices proposed for use, including manufacturer's name and address.
 - 2) Instrument tag number in accordance with the Contract Documents.
 - 3) Data sheets and manufacturer's catalog literature. Provide data sheets in accordance with ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets using a format similar to ISA 20.
 - 4) Description of construction features.

- 5) Performance and operation data.
 - 6) Installation, mounting, and calibration details; instructions and recommendations.
 - 7) Service requirements.
 - 8) Dimensions of instruments and details of mating flanges and locations of closed tanks, pipe sizes for insertion instruments, and upstream/downstream straight run pipe lengths required.
 - 9) Range of each device and calibration information
 - 10) Descriptions of materials of construction and listing of NEMA ratings for equipment
- b. Panels, Consoles, and Cabinets:
- 1) Layout drawings that include:
 - a) Front, rear, and internal panel views to scale.
 - b) Tag number and functional name of components mounted in and on panel, console, or cabinet, as applicable.
 - c) Product information on panel components.
 - d) Nameplate location and legend including text, letter size and colors to be used.
 - e) Location of anchorage connections.
 - f) Location of external wiring and piping connections.
 - g) Mounting and installation details, coordinated with actual application.
 - h) Proposed layouts and sizes of operator interface graphic display panels and alarm annunciator panels.
 - i) Calculations for heating and cooling of panels

- j) Subpanel layouts and mounting details for items located inside control panels.
- 2) Product information on panel components including:
- a) Manufacturer's product name and complete model number of devices being provided, including manufacturer's name and address.
 - b) Instrument tag number in accordance with the Contract Documents.
 - c) Data sheets and catalog literature. Submit data sheets as shown in ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets with format similar to ISA 20.
 - d) Description of construction features.
 - e) Performance and operation data.
 - f) Installation, mounting, and calibration details; instructions and recommendations.
 - g) Service requirements
- 3) Wiring and piping diagrams, including the following:
- a) Name of each panel, console, or cabinet.
 - b) Wire sizes and types.
 - c) Pipe sizes and types.
 - d) Terminal strip and terminal numbers.
 - e) Wire color coding.
 - f) Functional name and manufacturer's designation for components to which wiring and piping are connected.
 - g) Lightning and surge protection grounding.

- 4) Electrical control schematics in accordance with NFPA 79. Drawings shall be in accordance with convention indicated in Annex D of the NFPA 79. Typical wiring diagrams that do not accurately reflect actual wiring to be furnished are unacceptable. Tables or charts for describing wire numbers are unacceptable.
 - 5) Stock list or bill of materials for each panel including tag number, functional name, manufacturer's name, model number and quantity for components mounted in or on the panel or enclosure.
 - 6) Detail showing anchorage plan of wire bundles between subpanels and front panel mounted devices.
- c. Field wiring and piping diagrams, include the following:
- 1) Wire and pipe sizes and types.
 - 2) Terminal numbers at field devices and in panels.
 - 3) Fiber optic termination designations in the field and in panels.
 - 4) Color coding.
 - 5) Conduit numbers in which wiring will be located.
 - 6) Locations, functional names, and manufacturer's designations of items to which wiring or piping are connected.
- d. Proposed operator interface graphics layouts. Each graphic display and process report layout will be subject to modification from Contractor's submitted format within limits of software package used for development. Implement such modifications in accordance with Engineer's written comments on the submittal.
- e. Process Control System:
- 1) Submit the following general information:
 - a) Detailed block diagram showing system hardware configuration and identifying model numbers of system components.
 - b) Software listings for operating system, applications, and OIT.

- c) Software language and organization.
 - d) OIT interfacing details, licensing structure, and included functions.
 - e) Control and failure modes.
 - f) Online and offline capabilities for programming, system utilities, and diagnostics.
 - g) Input/Output Information:
 - i. Input/output (I/O) point listing with I/O module cross-reference identification.
 - ii. I/O module cross-reference identification based on I/O address list developed by I&C Subcontractor .
 - h) Database listing, including all I/O points.
 - i Suggested detailed format and configuration of log reports, alarm summaries, printer outputs, displays, and graphics.
- 2) Hardware:
- a) Layout drawings showing front, rear, end and plan views to scale of equipment, I/O components, power supplies, and peripheral devices.
 - b) Equipment ventilation requirements.
 - c) Interconnection diagrams, including termination details, cable identification list, and cable length.
 - d) Drawings showing equipment layout.
 - e) Installation requirements, instructions, and recommendations.
- 3) Software:
- a) Licensing agreement with name of licensee, renewal requirements, release and versions, expiration dates (if any) and

upcoming releases scheduled before Project completion. When upcoming releases are expected, provide descriptions, when available, of features that differ from the proposed release.

- b) Standard technical and instructional documentation covering software for utility, system support, system documentation, display, communications, data logging and storage and diagnostic functions. Submit this information on electronic media.
 - c) Standard technical documentation covering all aspects of the computer system software functions and capabilities, including instruction set description and programming procedures related to monitoring, display, logging, reporting and alarming functions.
- 4) Documentation describing memory type, size and structure and listing size of system memory, I/O and Data Table memory and size of memory available for control programs.
- 5) System I/O Loop Wiring Diagrams: Prepare Shop Drawings on a module-by-module basis based on Input/Output list and include the following information:
- a) Rack numbers, module type and slot number, and module terminal point numbers. Include location and identification of intermediate panel and field terminal blocks and terminal numbers to which I/O wiring and power supply wiring is connected. Identify power supply circuits with designation numbers and ratings.
 - b) Wiring types, wire numbers, and color coding.
 - c) Designation of conduits in which field I/O wiring will be installed.
 - d) Location, functional name, tag numbers and manufacturer's module numbers of panel and field devices and instruments to which I/O wiring will be connected.
 - e) Prepare loop wiring diagrams in accordance with ISA 5.4.
- e. Complete point-to-point interconnection wiring diagrams of field wiring associated with the system. Diagrams shall include the following:

- 1) Field wiring between each equipment item, panel, instruments, and other devices, and wiring to control stations, panelboards, and motor starters. Some of this equipment may be specified in other Divisions, Contractor is responsible for providing complete point-to-point interconnection wiring diagrams for control and monitoring of that equipment.
 - 2) Numbered terminal block and terminal identification for each wire termination.
 - 3) Identification of assigned wire numbers for interconnections. Assign each wire a unique number.
 - 4) Schedule showing the wiring numbers and the conduit number in which the numbered wire is installed.
 - 5) Junction and pull boxes through which wiring will be routed.
 - 6) Identification of equipment in accordance with the Contract Documents.
2. Product Data:
- a. Product data for panels, consoles, and cabinets in accordance with requirements for Shop Drawings in this Section.
 - b. Product data for field wiring and piping provided for instrumentation and control service and not included under other Sections or contracts.
 - c. Product data for PCS, including software and hardware. Requirements for software product data are included in requirements for Shop Drawings under this Section.
3. Factory Acceptance Test Procedure: Submit factory testing procedures that will be performed to fulfill requirements of the Contract Documents. Test procedure shall include the following:
- a. Visual inspection of components and assembly.
 - b. Description of hardware operational testing.
 - c. Description of software demonstration.
 - d. Description of testing equipment to be used.

- e. Sign-off sheets to be used at time of testing.

B. Informational Submittals: Submit the following:

1. Documents to be submitted prior to pre-submittal conference, in accordance with Article 1.3 of this specification.
2. System Software Documentation: Submit preliminary software documentation not later than 28 days prior to scheduled start of factory testing. Software documentation shall include the following:
 - a. Complete printed copies of all programming.
 - b. Complete listing of external and internal I/O address assignments, register assignments and preset constant values with function point descriptions. List unused/undefined I/O and data table registers available.
 - c. Copies of all configured HMI screens.
3. PLC Programming and SCADA Integration
 - a. Machine Readable Documentation. The supplier shall provide two sets of documented unprotected as-built Electronic PLC, PC, OIT and all other required software files on CD-ROMs in native machine readable format, final software programs and any passwords or hardware/software required to modify or restore all programs and configurations developed under this Contract. This machine readable documentation shall include all documentation files including logic and annotation files. All changed made during or after factory acceptance tests shall be incorporated at no additional cost to the Owner. Supply of these items shall not require any ongoing support contract or long term relationship with the supplier.
 - b. Submit a memory map of PLC registers for use by the SCADA system programmer no later than 30 days prior to the scheduled shipment of the vendor equipment to the site. Provide a list of all system registers displayed on the control panels provided under this contract OIT's so that control and monitoring of statuses can be replicated on the plant's existing HMI by the SCADA system programmer. The list of registers shall include a register tagname, description, type, range and engineering units/state descriptions. If any security parameters are required, indicate such on the list (i.e. operator, supervisor, administrator).

- c. Control panel supplier shall contact and coordinate with the SCADA system programmer to ensure compatible configuration of the manufacturer-supplied PLCs in order to match the facility network. Control panel supplier shall configure the network addresses in their equipment to match the addresses provided by the SCADA system programmer.
- 4. Manufacturer's Instructions:
 - a. Shipping, handling, storage, installation, and start-up instructions.
 - b. Templates for anchorage devices for materials and equipment that will be anchored to concrete or masonry.
- 5. Source Quality Control Submittals:
 - a. Results of factory testing.
- 6. Special Procedure Submittals:
 - a. Notification to OWNER and Engineer at least 14 days before readiness to begin system checkout at the Site. Schedule system checkout on dates acceptable to OWNER and Engineer.
 - b. Written procedure for system checkout. Submit not less than 90 days prior to starting system checkout.
 - c. Ninety days prior to starting system checkout submit written procedure for start-up.
- 7. Field Quality Control Submittals:
 - a. Submit the following prior to commencing system checkout and start-up.
 - 1) Completed calibration sheets for each installed instrument showing five-point calibration (zero, 25, 50, 75, 100 percent of span), signed by factory-authorized serviceman.
 - b. Field calibration reports
 - c. Field testing reports.
- 8. Supplier's Reports:

- a. Installation inspection and check-out report.
 - b. Submit written report of results of each visit to Site by Supplier's service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
- 9. Qualifications Statements:
 - a. I&C Supplier.
 - b. Manufacturers, when required by Engineer.
- C. Closeout Submittals: Submit the following:
 - 1. Operations and Maintenance Data:
 - a. Submit in accordance with Section 01781, Operation and Maintenance Data.
 - b. Include complete up-to-date system software documentation. Provide hardcopy and electronic copies.
 - c. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.
 - 2. Record Documentation:
 - a. Prepare and submit record documents in accordance with Section 01720, Project Record Documents.
 - b. Revise all system Shop Drawing submittals to reflect as-built conditions in accordance with the following.
 - 1) Two copies of each revised Shop Drawings and documentation to replace out-dated drawings and documentation contained in operation and maintenance manuals. Submit half-size black line drawings for each drawing larger than 11 inches by 17 inches. Include specific instructions for out-dated drawing removal and replacement with record documents submittal.

- 2) Half-size black line prints of wiring diagrams applicable to each control panel shall be placed in clear plastic envelopes and stored in a suitable print pocket or container inside each control panel.
- 3) Submit CADD drawings of the point-to-point interconnection wiring diagrams updated to reflect final as-built equipment information and as-installed field installation information.

D. Maintenance Materials Submittals: Submit the following:

1. Spare Parts and Test Equipment

a. General

- 1) Furnish the spare parts and test equipment as indicated below, identical to and interchangeable with similar equipment provided under this Section.
- 2) Provide source quality control for spare parts as part of factory testing prior to shipment of control equipment.
- 3) For process sensors and other analog instruments, Supplier shall submit a separate quotation for recommended list of spare parts and test equipment. Separately list and price each item recommended. Spare parts quotation shall include a statement that prices quoted are valid for a period of one year from date of equipment installation and that Supplier understands that OWNER reserves the right to purchase none, any, or all parts quoted. Upon request, Supplier shall submit documentation that stock of spare parts and test equipment is obtainable within 48 hours of receipt of OWNER's order.

b. Furnish the following spare parts:

- 1) Five of each type of relay for each quantity of forty or fraction thereof provided under the Contract.
- 2) One of each type of PLC communication cables.
- 3) One of each type of PLC processors.
- 4) One of each type of Communication module.

- 5) One of each type of redundant module and accessories.
 - 6) Two of each type of PLC input/output module or card used with accessories.
 - 7) Two of each type of PLC power supply.
 - 8) One of each type of PLC chassis.
 - 9) One of each type of OIT.
 - 10) Two replacement 24 vdc power supply for each type and size provided under the Contract.
 - 11) One-year supply of all expendable or consumable materials.
 - 12) Twelve of each type and size of fuse used in instruments.
- c. Furnish the following test equipment:
- 1) One Fluke or equal (latest in series) digital Process meter with signal simulators (four to 20 mA DC; zero to ten VDC), test leads, case, and other recommended spares and accessories.
 - 2) One RTD calibrator, including case.

1.05 – DELIVERY, STORAGE, AND HANDLING

- A. Prior to packaging, each manufacturer or Supplier shall securely attach tag number and instructions for proper field handling and installation to each instrument.

PART 2 – PRODUCTS

2.01 – PCS – GENERAL PROVISIONS FOR PRODUCTS

- A. General:

1. All electrically-powered equipment and devices shall be suitable for operation on 115-volt plus-or-minus 10 percent, 60 Hertz plus-or-minus two Hertz power. If different voltage or closer regulation is required, provide suitable regulator or transformer.
2. Provide appropriate power supplies for all two-wire transmitters, loops for monitoring discrete inputs and necessary outputs. Install power supplies mounted in enclosures, and install in appropriate control room or field panel.

3. Power supplies shall be suitable for minimum of 130 percent of the maximum simultaneous current draw.
4. Provide power on-off switch or air circuit breaker for each item requiring electrical power.
5. Provide isolation transformers, line voltage regulators and power distribution panels for the distributed digital portions of the PCS to eliminate electrical noise and/or transients entering on the primary power line.
6. Unless otherwise shown or indicated in the Contract Documents, control system shall be furnished to use 4 to 20 mADC analog signals.
7. Provide signal converters and repeaters where required. Analog inputs to distributed control system shall be through appropriate repeaters to provide signal isolation where series-looped with other devices and to allow loop to maintain integrity even when distributed control system is out of service. Power supplies shall adequate for signal converter and repeater loads.
8. Signals shall be isolated from ground.
9. Signals shall not have a transient DC voltage exceeding 300 volts over one millisecond nor a DC component over 300 volts.
10. PCS and associated input/output wiring will be used in a facility environment where there can be high-energy AC fields, DC control pulses, and varying ground potentials between the sensors/transducers or input contact locations and PCS components. PCS shall be adequate to provide proper protection against interferences from all such possible situations.
11. Instrumentation and PCS components shall be heavy-duty types, suitable for continuous service in a municipal wastewater treatment plant environment. Furnish products that are currently in production at the time products are shipped from the factory. All equipment furnished shall be of modular construction and be capable of field expansion through installation of plug-in circuit cards and additional cabinets as necessary. Logic and control loops shall be fail-safe.
12. Instrumentation and other PCS components shall return automatically to accurate measurement within 15 seconds upon restoration of power after a power failure, and when transferred to standby power supply.

13. Provide surge protection for instruments and all other PCS components that could be damaged by electrical surges.
14. Field-mounted instruments and PCS components shall be suitable for installation in humid and corrosive service conditions. Field-mounted instrument enclosures, junction boxes, and appurtenances shall comply with NEMA 4X requirements, unless otherwise shown or specified.
15. Relays with interconnections to field devices shall be wired through terminal blocks. Terminals as part of the relay base are unacceptable.
16. Panel mounted instruments, switches, and other devices shall be selected and arranged to present a pleasing coordinated appearance. Front-of-panel-mounted devices shall be of the same manufacturer and model line.
17. All components furnished, including field-mounted and rear-of-panel instruments, shall be tagged with the item number and nomenclature as shown and the instrument index in the Contract Documents or, as applicable, the "data sheets" that are part of the Contract Documents.
18. Ranges and scales specified in the Contract Documents shall be coordinated to suit equipment actually furnished. Range, scale, and set point values specified in other Sections of Division 13 are for initial setting and configuration. Coordinate specified values with actual equipment furnished to implement proper and stable process action as systems are placed in operation.
19. Field-mounted devices shall be treated with an anti-fungus spray.
20. Field-mounted devices shall be protected from exposure to freezing temperatures.

B. Environmental Conditions:

1. PCS and its components shall be designed and constructed for continuous operation under the following temperature and humidity conditions:
 - a. Equipment and Devices Installed in Control Rooms:
 - 1) Ambient Temperature: 60 degrees F to 80 degrees F normal range; and 40 degrees F to 105 degrees F occasional maximum extremes.
 - 2) Relative Humidity: 80 percent, normal; 95 percent maximum.

- b. Equipment and devices installed at indoor locations (other than control rooms) for digital processing equipment hardware, control panels, and instruments:
 - 1) Ambient Temperature: 40 degrees F to 120 degrees F.
 - 2) Relative Humidity: 98 percent maximum.
- c. Equipment and Devices Installed Outdoors:
 - 1) Ambient Temperature: -10 degrees F to 120 degrees F.
 - 2) Relative Humidity: 100 percent maximum.

C. Refer to Sections 13400 through 13500 for product requirements for materials and equipment that are part of the PCS.

PART 3 – EXECUTION

3.01 – PCS – GENERAL PROVISIONS FOR EXECUTION

A. Refer to Sections 13400 through 13500 for execution requirements for the PCS.

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 – DESCRIPTION****A. Scope**

1. Contractor shall provide all labor, materials, equipment, and incidentals as specified and required for factory testing at the process control system manufacturer's facility to verify that system components function properly and comply with the functional and performance requirements of the Contract Documents.
2. Perform factory testing on the following types of equipment:
 - a. Glen Cove WWTP Belt Filter Press Main Control panel (CP-01).
3. Contractor shall advise Engineer in writing of the scheduled dates for process control systems factory testing; submit such notice not less than 28 days prior to the scheduled start of factory testing. Owner and Engineer will be present at factory testing facility during operational testing of the process control systems at the factory, either for individual units or for the integrated system. Presence of Owner and Engineer during testing does not relieve Contractor from complying with the Contract Documents and shall does not indicate or imply acceptance of the equipment. When factory tests have been successfully completed, submit a factory test report to Engineer.
4. One Owner representative and one Engineer representative shall attend the witness testing. Expenses and costs for witnessing shall be paid by Contractor, including the following:
 - a. Transportation of Owner and Engineer personnel to the factory test location and return via commercial airline, and ground transportation to and from airports as required.
 - b. Overnight accommodations (two single occupancy rooms) in a hotel in reasonable proximity to the factory testing location. Room quality to be standard business class.
 - c. Ground transportation between the hotel and factory testing location
 - d. Meals for the duration of the testing. Meal allowance shall not be less than U.S. Internal Revenue Service guidelines.

B. Related Sections:

1. 13401, Process Control System General Provisions.

1.02 – SUBMITTALS

A. Action Submittals: Submit the following:

1. Testing Plans:

- a. Submit factory test procedures in accordance with Section 13401, Process Control System General Provisions, for all equipment listed in Paragraph 1.1.A of this Section. Obtain Engineer's acceptance of testing plan not less than 28 days prior to scheduled start of factory test.

B. Informational Submittals: Submit the following:

1. Source Quality Control Submittals:

- a. Written results of factory testing for process control systems. Submit the complete factory test report within two weeks after completion of the factory test.

PART 2 – PRODUCTS

2.01 – SOURCE QUALITY CONTROL

A. Inspections Prior to Factory Testing:

1. Inspect each panel, console, and cabinet to verify compliance with the Contract documents, and approved Shop Drawings and approved other Contractor submittals.
2. Inspection shall include, but not be limited to, the following:
 - a. Nameplates and tags.
 - b. Wire sizes and color coding.
 - c. Terminal block contact ratings and numbers.
 - d. Panel-mounted equipment and identification.
 - e. External and internal panel layout.
 - f. Proper wiring practices and grounding.
 - g. Enclosure flatness, finish and color.

- h. NEMA rating and environmental control equipment.
 - 3. Correct materials and equipment that do not comply with the Contract Documents and submittals approved by Engineer, and re-inspect until compliance is verified.
- B. Factory Tests:
 - 1. System Hardware Operational Testing:
 - a. Test each input/output device and component to verify operability. If panel or device being tested contains pneumatic systems, test the instruments associated with such systems to verify that calibration.
 - b. Test all system hardware components to verify proper operation of the equipment as stand-alone units and as a system. Tests shall include, but are not necessarily limited to, the following:
 - 1) AC/DC power checks.
 - 2) Power fail/restart tests.
 - 3) Verify that quantity of circuits assigned to power field instruments corresponds to approved Shop Drawings and approved other Contractor submittals.
 - c. Criteria for Acceptance: System hardware operational testing shall acceptably demonstrate that specified and required equipment operations capabilities function properly.
 - d. Test remote I/O, operator interface terminals, Modbus or foundation Fieldbus linking devices, and similar devices, to verify that communication between units functions properly.
 - e. Perform an integrated system test, with all control system equipment connected (excluding field sensors and instruments), to verify that equipment performs and functions properly as an integrated system. During the factory test, simulate field sensors and instruments using appropriate signal generators, switches, and jumper cables.
 - 2. System Hardware Demonstration (Programming by Contractor)

- a. Contractor shall perform and be solely responsible for system hardware demonstration factory test.
- b. Preparation:
 - 1) System performance shall be tested using fully-integrated system, including all software and hardware. Entire control system, including one of each type of field device with interconnecting cables, shall be assembled at the factory test location and simulated inputs applied. Signal generators shall be appropriately sized and calibrated for full range of use and shall have a power source to accommodate not less than a full day of testing. Prior to the factory test, provide process I/O simulation panel that includes the following:
 - a) Toggle switches to simulate field or other input contacts.
 - b) Indicating lights to simulate outputs from tested panels.
 - c) Control relays to simulate motor control center coil inputs.
 - d) Time relays to simulate position switches.
 - e) Indications (in milliamps) to indicate every 4 to 20 ma-dc output from tested panel.
 - f) Potentiometers to simulate 4 to 20 ma-dc inputs to tested panel.
 - g) Each device shall have nameplate with description and device's process and instrumentation Drawings (P&ID) tag number. Nameplates shall be removable and interchangeable for multiple use of the panel during the test.
 - 2) Operator Interfaces: Prior to factory testing of the system, configure the display environments in accordance with the display structure agreed upon by Contractor, Engineer, and Owner, and load and link database parameters to the specified fields.
- c. Factory Test:
 - 1) Contractor shall demonstrate system software utility programs and system software security programs incorporated into the control system,

to demonstrate proper functioning of the various functions and capabilities specified.

- 2) Perform complete system test, during which entire system shall operate continuously without failure in accordance with the Contract Documents.
- 3) Demonstrate the monitoring and control information displayed on each HMI screen, based on simulation of each associated point for each screen, in accordance with test procedure approved by Engineer. Simulation through forced values in the PLC programming is acceptable. In addition, Owner or Engineer will randomly select, at the time of the factory test, additional inputs and outputs to be simulated in quantity not less than five percent of total I/O quantity. Demonstrate that monitoring and control application software associated with I/O points performs and functions as intended.
- 4) Demonstrate communications between integrated system elements; include such demonstration in the testing procedure submittal, where applicable.
- 5) Operator Interfaces:
 - a) During factory test, demonstrate overall display structure, including environment configurations, passwords, security, and other parameters and functions.
 - b) Review menu display contents to demonstrate how an operations person will navigate within the overall display structure.
 - c) Demonstrate assignment of displays to annunciator keys.
 - d) Review each graphic display for correctness relative to layout, symbols, color scheme, and other requirements.
 - e) Demonstrate operation of standard alarm management displays (current alarm display, alarm history, and similar alarm displays).
 - f) Perform demonstration of each type of report specified. Printing shall be an integral part of the report demonstration.

3. Factory Test Acceptance Criteria:

- a. In addition to complying with Paragraph 2.1.B.1 of this Section, failure or non-functioning of one or more communication links, failure of more than five percent of the total control functions, more than ten internal panel wiring discrepancies including I/O point cross-wirings, or more than ten I/O point- or database-addressing errors will be unacceptable and constitutes factory test failure.
- b. Do not ship the equipment from the factory until Engineer accepts the factory test results submittal.
- c. Modifications, if any, to documentation as a result of the factory tests shall be completed before shipping the control system.
- d. Should a factory test run fail to comply with the Contract Documents, necessary changes and corrections shall be made and the entire system retested until acceptable results are achieved.
- e. Expenses and costs for Owner and Engineer witnessing such retesting shall be paid by Contractor, in accordance with paragraph 1.1.A.4 above.

PART 3 – EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SYSTEM CHECK-OUT AND START-UP RESPONSIBILITIES**

- A. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all equipment and coordinate all activities necessary to perform check-out and start-up of the equipment.
- B. Contractor shall retain the services of the Instrumentation and Controls (I&C) Supplier to supervise and/or perform check-out and start-up of all system components. As part of these services, the system Supplier shall include for those equipment items not manufactured by him the services of an authorized manufacturers' representative to check the equipment installation and place the equipment in operation. The manufacturers' representative shall be thoroughly knowledgeable about the installation, operation and maintenance of the equipment.

1.02 - SYSTEM CHECKOUT AND START-UP

- A. Contractor, under the supervision of the I&C Supplier, and other instrument suppliers as applicable, shall perform the following:
 - 1. Check and approve the installation of all PCS components and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation.
 - 2. Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in this Work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in start-up of the various unit processes.
- B. Contractor shall provide all test equipment necessary to perform the testing during system checkout and start-up.
- C. Contractor and Supplier shall be responsible for initial operation of monitoring and control system and shall make any required changes, adjustment or replacements for operation, monitoring and control of the various processes and equipment necessary to perform the functions intended.
- D. Contractor shall furnish to the Engineer certified calibration reports for field instruments and devices specified in Section 13420, Primary Sensors and Field Instruments, and panel mounted devices specified in Section 13440, Panel-Mounted Instruments and Devices, as soon as calibration is completed.

- E. Contractor shall furnish Engineer an installation inspection report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of both Contractor and the Supplier.

1.03 - INTEGRATED SYSTEM FIELD TEST

- A. Following the PCS checkout and initial operation, Contractor, under the supervision of the Supplier, shall perform a complete system test to verify that all equipment and programmed software is operating properly as a fully integrated system, and that the intended monitoring and control functions are fully implemented and operational. Any defects or problems found during the test shall be corrected by Contractor and then retested to demonstrate proper operation.
- B. Following demonstration of all system functions, the PCS including field sensors/transducers and instruments shall be running and fully operational for a continuous 48 hour period. The Operational Availability Demonstration specified below shall not begin until the continuous 48 hour integrated system test has been successfully completed and Owner and Engineer agree that the Operation Availability Demonstration can begin.

1.04 - OPERATIONAL AVAILABILITY DEMONSTRATION

- A. Operational Availability Demonstration (OAD) shall begin following completion of the integrated system field test as specified above and shall continue until a time frame has been achieved wherein the system (both hardware and software) availability meets or exceeds 99.7 percent for 60 consecutive days and no system failures have occurred which result in starting the OAD over again. During the OAD the system shall be available to plant operating personnel for use in normal operation of the plant.
- B. For the purpose of the OAD, the system will be defined as consisting of the following systems and components:
 - 1. Cedar Creek Aeration Tanks Odor Control System.
 - 2. Bay Park Aeration Tank Odor Control System.
 - 3. Bay Park Primary Settling Tank Odor Control Polishing System.
- C. The conditions listed below shall constitute system failures which are considered critical to the operability and maintainability of the system. The OAD shall be terminated if one or more of these conditions occur. Following correction of the problem, a new 60 consecutive day OAD shall begin.

1. Failure to repair a hardware or software problem within 120 consecutive hours from the time of notification of a system failure.
 2. Recurrent hardware or software problems: if the same type of problem occurs three times or more.
 3. Software problem causing a processor to halt execution.
- D. The following conditions shall constitute a system failure in determining the system availability based on the equation specified in Paragraph 1.4.E., below:
1. Failure of an isolation damper or Fan.
 2. Loss of communications between devices on the communications network.
 3. Failure of one or more input/output components.
 4. Failures of any type affecting ten or more input/output points simultaneously.
 5. Failure of any type affecting one or more regulatory control loops or sequential control strategies thereby causing a loss of the automatic control of the process variable or process sequence operation.
 6. Failure of power supply. Where redundant power supplies are provided, failure of one power supply shall not constitute a system failure provided the backup power supply operates properly and maintains supply power. Failure of the backup supply to operate properly and maintain supply power shall constitute a system failure.
 7. Failure of three or more primary sensors/transducers or field instruments simultaneously.
- E. The system availability shall be calculated based on the following equation:
- $$A = \frac{TTO}{TTO + TTR} \times 100 \text{ percent}$$
- where, A = system availability in percent
- TTO = total time in operation
- TTR = total time to repair
- F. Time to repair shall be the period between the time that Contractor is notified of a system failure and the time that the system has been restored to proper operation in terms of hours with an

allowance for the following dead times which shall not be counted as part of the time to repair period.

1. Actual travel time for service personnel to get to the Site up to six hours per incident from the time Contractor is notified of a system failure.
 2. Time for receipt of spare parts to the plant site once requested up to 24 hours per incident. No work shall be done on the system while waiting for delivery of spare parts.
 3. Dead time shall not be counted as part of the system available period. The dead time shall be logged and the duration of the OAD extended for an amount of time equal to the total dead time.
- G. Completion of a 60 consecutive day period without any restarts of the OAD and with a system availability in excess of 99.7 percent will constitute acceptance of the PCS by Owner.
- H. All parts and maintenance materials required to repair the system prior to completion of the OAD shall be supplied by Contractor at no additional cost to Owner. If parts are obtained from the required plant spare parts inventory, they shall be replaced to provide a full complement of parts as specified.
- I. A Plant Monitoring and Control System Malfunction/Repair Reporting Form shall be completed by the plant personnel and Engineer to document system failures, to record Contractor notification, arrival and repair times and Contractor repair actions. Format of the form shall be developed and agreed upon prior to the start of the OAD.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - REQUIREMENTS AND RESPONSIBILITIES**

- A. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to perform and coordinate all required training at times acceptable to Owner and Engineer.
- B. Contractor shall retain the services of the Supplier to provide operation and maintenance training for all PCS equipment as specified herein.
- C. For equipment items not manufactured by the Supplier, the Supplier shall provide for on-site training by an authorized representative of the equipment manufacturer as part of the Supplier's services. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of the equipment.
- D. Contractor shall be responsible for all costs, including cost of travel, meals and lodging, if required, associated with training, both on-site and at the suppliers facilities, and shall provide all required materials, texts and required supplies. Engineer approval of quantity and type of material occurs during the submittal process and is described in Paragraph 1.2.A below.
- E. All training shall be conducted in the normal eight-hour working days until conclusion of the training course. For training at the Supplier's facility, the course instructor shall be assigned full time and shall not perform other duties throughout the period of the course.

1.02 - SUBMITTALS

- A. Within 90 days of the effective date of the Notice to Proceed, Contractor shall submit his plan for training conforming to the requirements of Section 01821, Instruction of Operations and Maintenance Personnel. Included in the plan shall be course outlines and schedules for training to be provided at the Supplier's facilities.

1.03 - ON-SITE TRAINING

- A. Primary Sensors/Transducers and Field Instruments:
 - 1. Provide on-site operation and maintenance training by Supplier and the equipment manufacturer representatives prior to placing the equipment in continuous operation, conforming to the requirements of Section 01821, Instruction of Operations and Maintenance Personnel. The services of equipment manufacturer's representative(s) shall be provided for a minimum of eight hours for each type of instrument provided.
 - 2. Training shall accomplish the following:

- a. Provide instruction covering use and operation of the equipment to perform the intended functions.
- b. Provide instruction covering procedures for routine, preventive and troubleshooting maintenance including equipment calibration.
- c. Explain procedures for placing the equipment in and out of operation and explain necessary actions and precautions to be taken regarding the overall plant monitoring and control system.

B. Training covering the control equipment:

- 1. The I&C Supplier shall provide 3 days of operations training covering all system components.
- 2. Training course shall accomplish the following:
 - a. Provide all instructions necessary to operate and utilize all system components.
 - b. Provide all instruction necessary to monitor and control the system processes from the designated control panel.
 - c. Explain procedures for control of the system during scheduled or rescheduled shutdown and the subsequent start-up.
 - d. Provide instructions for regular caretaking operations.

C. PLC Training:

- 1. The I&C Supplier shall provide training that covers PLC related topics as follows:
 - a. Provide an overview of system hardware and software.
 - b. It shall train people in configuration, operation and programming processors.
 - c. The emphasis shall be placed on how to perform set point changes, minor programming changes, range changes, diagnostics and upkeep of documentation.
 - d. Instruction for hardware and software maintenance, trouble shooting and maintenance planning.

D. Training following two months of regular system operations:

1. The I&C Supplier shall provide operation and maintenance covering all system equipment provided.
2. The training shall be of the same format, content and duration as the training described in Paragraph 1.4.A. and Paragraph 1.4.B., above.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust and place into satisfactory operation all primary sensors and field instruments shown and specified herein.
2. Contract Documents illustrate and specify functional and general construction requirements of the sensors and field instruments and do not necessarily show or specify all components, wiring, piping and accessories required to make a completely integrated system. Contractor shall provide all components, piping, wiring, accessories and labor required for a complete, workable, and integrated system.
3. Contractor shall be responsible for installing in-line flow elements (magnetic flow meter flow tubes, insert flow tubes, propeller flow meters) and for providing taps in the process piping systems for installation of other flow, pressure, and temperature sensing instrumentation.

B. Coordination: Coordinate with other suppliers for installation of all items specified herein and required to ensure the complete and proper interfacing of all components and systems.**C. Related Sections:**

1. Section 13401, Process Control System General Provisions
2. Section 13402, Process Control System Factory Testing
3. Section 13403, Process Control System Startup and Field Testing.
4. Section 13404, Process Control System Training.
5. Section 13440, Panel Mounted Instruments and Devices

1.02 - QUALITY ASSURANCE

- A.** Comply with the requirements of Section 13401, General Requirements.
- B.** Acceptable Manufacturers:

1. Furnish primary sensors and field instruments by the named manufacturers or equal equipment by other manufacturers.
2. The named manufacturers have been specified to establish the standard of quality and performance of the equipment to be supplied.
3. Obtain all sensors and field instruments of a given type from the same manufacturer.

C. Responsibilities and Services:

1. Provide primary sensors and field instruments in accordance with the applicable general design requirements specified in Section 13401, General Requirements, and the detailed Specifications herein.
2. Field supervision, inspection, start-up and training in accordance with the requirements of Section 13403, Startup and Field Testing, and Section 13404, Training.

1.03 - DELIVERY, STORAGE AND HANDLING

- A. Comply with the requirements of Section 13401, General Requirements.
- B. Primary sensors and field instruments shall not be delivered to the Site until all product information and system Shop Drawings for the sensors and instruments have been approved by the Engineer.

1.04 - SUBMITTALS

- A. Comply with the requirements of Section 13401, General Requirements.

1.05 - MATERIALS OF CONSTRUCTION FOR WETTABLE PARTS

- A. Provide compatible materials of construction for primary sensors and field instrument (wetted) parts that come in contact with the process fluids.

1.06 - IDENTIFICATION TAGS

- A. Tagging Requirements:
 1. Tag numbers of sensors and field instruments shall be as shown and as specified. For items not shown or specifically tagged, the item tag number shall be established by the system supplier. All instruments, whether field or panel mounted, shall have an identification tag.

2. Information to be permanently engraved onto the tag shall include the identifying tag number, manufacturer, model number, service, and range.
3. Identifying tap number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device with self-tapping stainless steel screws. Where fastening with screws cannot be accomplished the tags shall be permanently attached to the device by a circlet of stranded stainless steel wire rope and clamp.
4. All sensors and field instruments mounted on or within control panels and enclosures shall have the identification tag installed so that the engravings are easily visible to service personnel. Devices mounted on the face of panels shall have the tags attached to the rear of the devices.

PART 2 - PRODUCTS

2.01 - GENERAL DESIGN REQUIREMENTS

A. Power Supplies:

1. All electrically powered equipment and devices shall be suitable for operation on 115 volt, ± 10 percent, 60 Hz, ± 2 Hz power. If a different voltage or closer regulation is required, a suitable regulator or transformer shall be provided at no additional cost to the Owner.
2. Appropriate power supplies shall be furnished by Contractor for any field instrument requiring a power source less than 115 volts. Power supplies shall be mounted in control panels or enclosures installed near the instruments or in field panels.
3. Design all power supplies for a minimum of 130 percent of the maximum simultaneous current draw.

B. Miscellaneous:

1. All instrumentation components shall be heavy-duty types, designed for continuous service. The system shall contain products of a single manufacturer, when possible, and consist of equipment models which are currently in production.
2. All field-mounted instruments and system components shall be designed for installation in humid and corrosive service conditions. All field mounted instrument enclosures, junction boxes and appurtenances shall conform to the NEMA ratings that meet hazardous rating requirements shown on Contract Drawings.

3. Primary sensors and field instruments shall conform to the requirements of the Instrument Data Sheets provided after PART 3 of these specifications.
4. The named manufacturers have been specified to establish the standard of quality and performance of equipment to be supplied.

2.02 - MAGNETIC TYPE FLOW METERS

- A. The magnetic flow meters shall be the magnetic-inductive type that produces a magnetic field by positioning the coils inside the flow tube. The flow meter sizes shall be as specified herein. Flow meters shall be the ABB Instrumentation MagMaster electromagnetic flow meter.
- B. Continuous zero stability shall be an inherent characteristic of the flow meter system. The system shall cancel out interference voltages, thus eliminating the zero-drift by loading the magnetic coils with a pulsed direct current (DC).
- C. Measurement shall not be affected by alternating current (AC) line interference voltages, stratified flow, changes in liquid electrical conductivity (down to 5 micromhos/cm), or non-homogeneity of the fluids electrical conductivity. Zero point shall be stable even with partially fouled electrodes.
- D. The flow meters must meet the following requirements:
 1. General:
 - a. Function: Measure, indicate, and transmit the process flow in a full pipe. Meter must be a full bore meter with the magnetic field traversing the entire cross-section of the flow tube. Insertion magmeters or multiple single point probes inserted into a spool piece are not acceptable.
 - b. Type: Magnetic flowmeter, operating based on Faraday's law, using a pulsed DC type coil excitation with high impedance electrodes.
 - c. Parts: Flow tube, transmitter, interconnection cables, mounting hardware.
 2. Service: FM-1, FM-2 and FM-3 as shown on the Contract Drawings.
 3. Performance:
 - a. Range: 1000 to 1 for 6" and smaller.
 - b. Accuracy: 1/2" to 6" at 0.2% of rate.
 - c. Repeatability: $\pm 0.05\%$ or ± 0.0008 ft/s, whichever is greater.

- d. Calibration: CalMaster Fingerprint with 3-point calibration.
- e. Flow range:
 - i. FM-1: 0 gpm to 250 gpm
 - ii. FM-2: 0 gpm to 250 gpm
 - iii. FM-3: 0 gpm to 250 gpm
- 4. Process Connection:
 - a. Meter Size and Type:
 - i. FM-1: 6-inch
 - ii. FM-2: 6-inch
 - iii. FM-3: 6-inch
 - b. Connection Type: ANSI 150 flanges
 - c. Flange Material: Carbon steel
 - d. Pressure Rating: Meter system must be fully rated to the same design pressure as the flanges.
- 5. Flow Tube:
 - a. Meter Tube Material: 304 stainless steel
 - b. Liner Material: Teflon or chlorobutyl rubber, suitable for wastewater sludge containing 1% solids and replaceable without disturbing the field coils.
 - c. Electrode Type: Conical self-cleaning electrodes.
 - d. Electrode Material: 316 stainless steel
 - e. Enclosure Classification: NEMA 4X, Explosion Proof for Class 1, Div. 2, Group D locations.
 - f. Housing Material: ½" to 6" Epoxy coated cast aluminum
 - g. Grounding: Type 2 corrosion-resistant metallic grounding rings are required.

- h. Submergence: Continuous to 30 feet and direct burial 3 to 16 feet IP68/NEMA6P.
6. Transmitter:
- a. Power: 120VAC 60Hz
 - b. Display: Three-line 16 character back-lit display indicating instantaneous flow and total flow in GPM.
 - c. Integral Keypad: Allows for external configuration without removing covers and compromising the integrity of the electrical and environmental classifications.
 - d. Bi-direction flow: Forward and reverse flow indication and totalization
 - e. Totalizers: Three 9 digit totalizers for forward, reverse and net
 - f. Mounting: Remote mounting, not on the flow meter or railings.
 - g. Enclosure: NEMA 4X Polypropylene with polycarbonate window
 - h. Input Impedance: 1015 ohms.
 - i. Isolation: Galvanic separation to 50V DC between analog, pulse/alarm, earth/ground.
 - j. Current Output: Two standard 4-20 mA into 0-800 ohms minimum.
 - k. Pulse Output: One standard 0-800Hz, <35VDC for forward and one for reverse.
 - l. Contact Outputs: Two programmable as standard.
 - m. Empty Pipe Detection: Required.
 - n. Remote Communications capability: Shall be capable of RS232/485, and HART Protocol, where required.
 - o. Low flow cut off: Adjustable
 - p. Power consumption: < 20VA
 - q. Cable supplied: 30 feet minimum of shielded transmitter cable.

- r. Maximum Cable length: 330 feet with standard cable, longer separation possible.
- 7. Calibration:
 - a. Test Mode: Provide the ability to verify the accuracy of the unit and the integrity of the current loop without any external equipment.
 - b. Self-diagnostics: Internal checks of all outputs and displays.
 - c. In-Situ Calibration Verification: This system shall be used to verify in a quantifiable manner the meter's current conditions versus the meter's condition when originally manufactured. This calibration verification of the meter shall be performed without need for physical access to the meter flow tube. The calibration verification shall meet or exceed the following requirements:
 - i. The original FINGERPRINT values shall be stored on a computer disk given to the owner.
 - ii. The verification process shall consist of at least 52 meter conditions pertaining to the primary coils, electrodes, interconnecting cable and signal converter.
 - iii. The coil verification shall include faults of continuity, impedance, resistance to ground, inductance, and magnetic field strength.
 - iv. The electrode verification shall include faults of continuity, impedance and insulation.
 - v. The cable verification shall include faults of coil, electrode, driven shield, and ground connections, cable cuts, cable damage, and water in the cable.
 - vi. Signal converter verification shall include faults of current supply to coils, zero offset, span forward and reverse, electrode offset, current output, frequency output forward and reverse, driven shield to ground, overall shield to ground and signal ground connection to ground.
 - vii. The calibration verification shall include the following: water ingress into the primary elements, faulty electrodes, dirty electrodes, electrode leakage, corroded electrodes, high process noise, liner failure,

conductive coatings on the liner, insulating coatings on the liner, and primary element damage.

- viii. All tests shall be performed by means of comparison between the absolute values and change in values from the new conditions.
 - ix. Verification standard shall be $\pm 1\%$ of wet calibration for meters produced using the calibration verification service, or $\pm 2\%$ for standard meters.
 - x. The software shall be Windows based. This software shall be capable of generating a report based upon the result of the forgoing described tests. The software shall be capable of creating and storing an audit trail of the meter's conditions and the meter's history.
 - xi. The calibration verification and metering system shall meet or exceed the standards established by the National Testing Laboratories.
- d. Meters to be designed, manufactured, and calibrated in an ISO9001, UKAS/NAMAS, NIST, or NATA certified facility. Flow facility must be certified by volume or weight certified provers. Facility must have the capability to hold the flow rate at the specified calibration points for a minimum of five minutes to allow stabilization for flow and repeatability point checks.

2.03 - PRESSURE SWITCHES

- A. Manufacturers:
 - 1. Mercoird DA Series, or equal.
- B. Bourdon Tube Material: Brass
- C. Stem Mounted
- D. Snubbers
- E. Adjustable Operating Range: 0-100 PSIG – Booster Pump
- F. Snap-action Switch - SPDT, 15A, 120V; one normally closed and one normally open.
- G. Set points shall be adjustable without removing switch cover or shutting down process.
- H. Switch shall have visible on/off indication

- I. Switch shall have calibrated dial and two pointers indicating set and reset points.

2.04 - PRESSURE SENSING RING AND SWITCH

- A. Non-wetted carbon steel body with class 150 flanges
 - B. 0-100psi operating pressure range
 - C. Ethylene glycol & water fill
 - D. EPDM sleeve
 - E. Pressure Switch: Mercoid DA Series with brass boudon tube, stem mounded with 5-150 psi adjustable operating range. Provide snap action SPDT 15A, 120V; one normally closed, one normally open. Set points shall be adjustable and switch shall have on/off indication.
- F. Pressure ring shall be Series 40 as manufactured by RED VALVE or approved equal.

2.05 - PRIMARY SENSORS AND FIELD INSTRUMENTS

- A. General:
 - 1. All primary sensors and field instruments provided under other Sections shall comply with the requirements of this Section.
 - 2. The named manufacturers have been specified to establish the standard of quality and performance of equipment to be supplied.
 - 3. Instruments and devices shall not be assembled in the panels until all product information and system shop drawings for respective components have been approved.

PART 3 – EXECUTION

3.01 - INSTALLATION

- A. Contractor shall require the system supplier to furnish the services of qualified factory-trained servicemen to assist in the installation of the instrumentation and control system equipment.
- B. Install each item in accordance with manufacturer's recommendations and in accordance with the Contract Documents. Transmitters and instruments, which require access for periodic calibration or maintenance, shall be mounted so they are accessible while standing on the floor. Care shall be taken in the installation to ensure sufficient space is provided between instruments and other equipment or piping to allow for easy removal and servicing.

- C. All items shall be mounted and anchored using stainless steel hardware, unless otherwise noted.
- D. All field instruments shall be rigidly secured to walls, stands or brackets as required by the manufacturer and as shown.
- E. Conform to all applicable provisions of the NEMA standards, NEC and local, State and Federal codes when installing the equipment and interconnecting wiring.

3.02 - START-UP, CALIBRATION, TESTING, AND TRAINING

- A. Comply with the requirements of Section 13401, Process Control System General Provisions, Section 13403, Process Control System Startup and Field Testing, and Section 13404, Process Control System Training.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Gas detection system for combustible gas.

1.02 – REFERENCES

- A. NFPA 70 – National Electric Code.
- B. NFPA 820 – Fire Protection in Wastewater Treatment and Collection Facilities.

1.03 – RELATED SECTIONS

- A. Section 16134 – Conduit.

1.04 - SUBMITTALS

- A. Submit under provisions of Section 01330.
- B. Indicate enclosure dimensions, parts lists, wiring diagrams, installation instructions.
- C. Provide operation and maintenance instructions.

1.05 – FIELD SERVICE

- A. Provide services of a factory trained representative to provide calibration and maintenance and operation instruction of the installed equipment. Provide one (1) day of service.

PART 2 - PRODUCTS**2.01 - MANUFACTUREERS**

- A. Mine Safety Appliances (MSA) Company, Instrument Division, Pittsburgh, PA or approved equal.

2.02 – MANUFACTURED UNITS

- A. MSA Ultima XE Gas Monitor in a NEMA 4X enclosure with 4-20 ma output for each sensor with discrete relay outputs for each of the three possible alarm sensors and optional internal power supply for VAC power connection.
- B. MSA Remote Combustible Gas Sensor for Ultima XE Gas Monitors rated for Class 1, Division 1, Groups B, C and D.

1. Combustible Gas Sensor type: Natural Gas & H₂S.
 2. Combustible Gas Sensor Range: 0-100% LEL.
- C. MSA Diffusion Kit with gas for calibration of combustible gas sensor.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Install monitor and sensor in locations indicated on plans.
- B. Install signal, alarm and power wiring in separate dedicated conduit. Provide three conductor shielded cables between sensor and monitor.
- C. Monitor shall relay gas readings back to CP-01 for remote monitoring purposes.
- D. Provide stainless steel hardware for mounting equipment.

3.02 – FIELD QUALITY CONTROL

- A. Calibrate combustible gas sensor with diffusion kit.

3.03 – DEMONSTRATION

- A. Provide services of factory trained manufacturer's representative to demonstrate operation and calibration of gas detection system to Owner.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, start-up and place into satisfactory operation the control panels and enclosures required for a fully functional PCS.
2. Major Panels/Enclosures/Cabinets specified under this Section include:
 - a. Glen Cove WWTP Belt Filter Press Main Control panel (CP-01).

B. Related Sections:

1. Section 03300, Cast-In-Place Concrete.
2. Section 13401, Process Control System General Provisions.
3. Section 13402, Process Control System Factory Testing.
4. Section 13403, Process Control System Start up and Field Testing.
5. Section 13440, Panel Mounted Instruments and Devices.
6. Section 13451, PLC Hardware and Software.
7. Division 16, Electrical.

1.02 - QUALITY ASSURANCE**A. Standards, Codes and Regulations:**

1. Construction of panels and the installation and interconnection of all equipment and devices mounted within shall comply with applicable provisions of the following standards, codes and regulations:
 - a. National Fire Protection Association 79, Annex "D" Standards, (NFPA).
 - b. National Electrical Code, (NEC).
 - c. National Electrical Manufacturer's Association Standards, (NEMA).

- d. American Society for Testing and Materials, (ASTM).
 - e. Operational Safety and Health Administration Regulations, (OSHA).
 - f. Underwriters' Laboratory, Inc., (UL).
 - g. State and Local code requirements.
 - h. Where any conflict arises between codes or standards, the more stringent requirement shall apply.
- 2. All materials and equipment shall be new and all panels shall be built in an Underwriters' Laboratory, Inc. (UL) approved panel shop and bear the UL label.
- B. General Design Requirements:
- 1. Comply with the requirements of Section 13401, Process Control System General Provisions.
- C. Factory Assembly and Testing:
- 1. Comply with the requirements of Section 13402, Process Control System Factory Testing.

1.03 - SUBMITTALS

- A. Comply with the requirements of Section 13401, Process Control System General Provisions.

1.04 - DELIVERY, STORAGE AND HANDLING

- A. Comply with the requirements of Section 13401, Process Control System General Provisions.

PART 2 - PRODUCTS

2.01 - GENERAL CONSTRUCTION REQUIREMENTS

- A. Provide all electrical and/or pneumatic components and devices, support hardware, fasteners, interconnecting wiring and/or piping required to make the control panels and/or enclosures complete and operational.
- B. Locate and install all devices and components so that connections can be easily made and that there is ample room for servicing each item.

- C. Components for installation on panel exterior shall be located generally as shown. Layouts shall be submitted for review in accordance with Section 13401, Process Control System General Provisions.
- D. Panels and enclosures shall have full height front access doors.
- E. Adequately support and restrain all devices and components mounted on or within the panel to prevent any movement.
- F. Provide sub-panels for installation of all relays and other internally mounted components.
- G. All wiring to panel connections from field instruments, devices, and other panels shall be terminated at master numbered terminal strips, unless otherwise specified.
- H. Provide copper grounding studs for all panel equipment.
- I. Provide the following convenience accessories inside of each control panel:
 - 1. One 120 VAC, 20A duplex, DIN-rail mount GFCI type receptacle.
 - 2. One or more 120 VAC fluorescent light fixtures with 40 watt lamp and protective plastic shield to span across the width of the panel but not less than two-thirds the width of the panel, as a minimum. Include snap switch, to turn on the light
 - 3. One 120 VAC, 20A, DIN-rail mount type receptacle for UPS connection.
 - 4. One Make Before Break Switch as UPS bypass switch.
 - 5. Service light with switch and duplex receptacle shall have its own circuit breaker and separate power feed.
- J. The bottom 12-inches of free standing panels shall be free of all devices, including terminal strips, to provide ease of installation and testing.
- K. No device shall be mounted less than 36-inches above the operating floor level, unless otherwise specified.

2.02 - IDENTIFICATION

- A. Provide laminated plastic nameplates for identification of panels and components mounted thereon as follows:

1. Nameplates shall be of 3/32-inch thick laminated phenolic type with white matte finish surface and black letter engraving.
 2. Panel identification nameplates to have 1/2-inch high letter engravings.
 3. Panel mounted component (e.g., control devices, indicating lights, selector switches, etc.) identification nameplates to have 1/4-inch high letter engravings.
 4. Nameplates shall be attached to the panel face with two stainless steel self-tapping screws.
 5. Nameplate engravings shall include the instrument or equipment tag number and descriptive title as shown and specified.
- B. Tag all internally mounted instruments in accordance with the following requirements:
1. Tag numbers shall be as listed in the Instrument Index.
 2. The identifying tag number shall be permanently etched or embossed onto a laminated phenolic tag with white matte finish surface which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.
 3. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch diameter stainless steel wire rope.
 4. Identification tag shall be installed so that the numbers are easily visible to service personnel.
 5. Front of panel mounted instruments shall have the tag attached to rear of device.
- C. Tagging of the following items shall be accomplished with the use of adhesive plastic Brady USA, Inc. labels, or equal.
1. Tag all electrical devices (e.g., relays, timers, power supplies) mounted within control panels and enclosures.
 2. Tag all pneumatic lines.
 3. Numerically tag all terminal blocks on terminal strips.
 4. Color code and numerically tag wiring at each end.
 5. Color coding shall be as per the Panel Wiring Color Code Table below:

DESCRIPTION	COLOR
110 VAC PANEL POWER BEFORE AND FUSES OR BREAKERS	BLACK
CONTROLLED 110VAC POWER (i.e., AFTER RELAY CONTACTS, SELECTOR SWITCH CONTACTS, etc.)	RED
110 VAC POWER SOURCE FROM DEVICES EXTERNAL TTO PANEL	YELLOW
110 VAC NEUTRAL	WHITE
24 VDC POSITIVE POWER FROM POWER SUPPLIES	BROWN
24 VDC NEGATIVE POWER FROM POWER SUPPLIES	Not defined
CONTROLLED 24 VDC POWER (i.e., AFTER PLC OUTPUT CONTACTS, RELAY CONTACTS, etc.)	BLUE
24 VDC POSITIVE POWER FROM DEVICES EXTERNAL TO PANEL	ORANGE
24 VDC NEGATIVE POWER FROM DEVICES EXTERNAL TO PANEL	Not defined
24 VDC 4-20 mADC SIGNAL CABLE	GREY WITH RED POSITIVE, CLEAR NEGATIVE
GROUNDING WIRE	GREEN

2.03 - PANELS AND ENCLOSURES

A. General:

1. Panels and enclosures shall meet the NEMA requirements for the type specified.
2. Sizes shown are estimates. Contractor shall furnish panels and enclosures amply sized to house all equipment, instruments, front panel mounted devices, power supplies, power distribution panels, wiring, tubing and other components installed within, as required.

B. Construction Features:

1. Main Control Panel (CP-01) shall be NEMA 4X rated.
 - a. Panels shall be Type 316L stainless steel construction with a minimum thickness of 12-gage for all surfaces (except those areas requiring reinforcement) having a smooth brushed finish.
 - b. Stainless steel screw clamp assemblies on three sides of each door.
 - c. Rolled lip around three sides of door and along top of enclosure opening.
 - d. Hasp and staple for padlocking.
 - e. Provide a clear plastic, gasketed lockable hinged door to encompass all non-NEMA 4 front of panel instruments.

- f. Provide 3-inch high channel base assembly, with solid bottom, drilled to mate the panel to its floor pad.
- g. Floor Pad: Refer to Part 3 of this Section.

C. Electrical Systems:

1. Control of Environment:

a. Indoor Panels:

- 1) Provide adequately sized, automatically controlled 120 VAC strip heaters to maintain temperature 10°F above ambient for condensation prevention inside panels.
- 2) Provide automatically controlled closed loop ventilation fans or closed loop air conditioners with filtered air louvers if required to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the enclosure.
- 3) Air conditioner shall have a minimum capacity of 4,000 BTU.
- 4) Provide documentation if any of the above is deemed unnecessary.

2. Power Source and Internal Power Distribution:

- a. General: Control panel power supply source, type, voltage, number of circuits and circuit ratings shall be as shown.
- b. Panels shall be provided with an internal 120 VAC power distribution panel with number of circuits and separate circuit breakers sized as required to distribute power to the panel components and field instruments. Distribution panel shall contain two spare breakers, minimum.

3. Wiring:

- a. Internal wiring shall be Type MTW and THW stranded copper wire with thermo-plastic insulation rated for 600 V at 90°C for single conductors, color coded and labeled with wire identification.
- b. For DC panel signal wiring, use No. 18 minimum AWG shielded.

- c. For DC power wiring, use No. 12 minimum AWG. For AC signal and control wiring, use No. 14 minimum AWG. For wiring carrying more than 15 A, use sizes required by NEC standards.
- d. Separate and shield low voltage signal wiring from power and control wiring by a minimum of 6-inches.
- e. Group or bundle parallel runs of wire using covered troughs. Maximum bundle size to be 1-inch. Troughs shall have 40 percent spare capacity.
- f. Install wire troughs as shown on panel layout drawing. Wire trough spacing and layout shall present a neat appearance. Angled runs are not acceptable.
- g. Adequately support and restrain all wiring runs to prevent sagging or other movement.
- h. Terminate all internal panel wiring using screw type terminal blocks mounted on DIN rails. Fused terminal blocks shall have LED blown fuse indication. Terminal blocks for 4-20 mA signals shall be fused and knife disconnect terminal blocks. Terminal strips shall be identified as specified in 2.2.C.3. Identifiers shall be self-stick, plastic tape strips with permanent type, machine printed numbers. Hand-written labels are not acceptable.
- i. All wiring shall be installed such that if wires are removed from any one device, power will not be disrupted to any other device.
- j. Within the enclosure all I/O racks, processor racks, and power supplies shall be grounded and mounted to meet the manufacturer's specifications.
- k. Provide interposing relays for all 24 volt and 120 volt PLC outputs.
- l. Provide individual fuses for all analog and digital inputs and all analog outputs. Fuses shall be capable of being inspected without removal of and replaced without disassembly of the terminal block. Blown fuse LED status indicators shall be provided.
- m. All alarms generated external to the panel, spare alarm, and repeat contacts shall be wired out to terminal blocks.
- n. For internal component-to-component wiring only, compression type terminal blocks are acceptable.

- o. Provide spare terminals equal in number to 20 percent of the terminals used for each type of wiring (e.g., DC signal and AC power).
 - p. Provide a separate terminal for grounding each shielded cable.
 - q. Use separate 5/16-inch diameter copper grounding studs for instrument signal cable shields and AC power.
 - r. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.
 - s. When DC power and/or low voltage AC power is required, provide and install the necessary power supplies and transformers in the panel.
 - t. Provide circuit breakers to protect each circuit, with no more than two instruments on a single circuit.
 - u. Common, push to test circuitry shall be provided for each panel with more than six indicating lights to simultaneously test all indicating lights on the panel using a single pushbutton.
 - v. Provide complete wiring diagram showing "as-built" circuitry. Diagram shall be enclosed in transparent plastic and placed in easily accessible pocket built into panel door.
4. Corrosion Control:
- a. Panels shall be protected from internal corrosion by the use of corrosion-inhibiting vapor capsules as manufactured by Northern Technologies International Corporation, Model Zerust VC; Hoffman Model AHCI; or equal.
5. Surge Protection:
- a. General - Surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines from lightning, utility, or the plant electrical system. The protection systems shall be such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level. Protection shall be maintenance free and self-restoring. Devices shall have a response time of less than 50 nanoseconds and be capable of handling a discharge surge current (at an 8x20 μ s impulse waveform) of at least 8 kA.

Ground wires for all instrumentation device surge protectors shall be connected to a low resistance ground.

- b. Provide protection of all analog signal (4-20 mA) circuits. Circuits shall be protected at both the transmitter and the control system end of the circuit. Protection devices located near the transmitter shall be mounted in the conduit or on the instrument itself, no separate enclosures shall be provided. At the control system end, Units shall be pluggable, din-rail mounted. Units shall include local and remote fail indication. Provide a Phoenix Contact or approved equal.
- c. Provide protection of all 120 vac power feeds at outdoor field mounted devices control panels, instruments, and control room equipment. Protection devices located near the transmitter shall be mounted in the conduit or on the instrument itself, no separate enclosures shall be provided. At the control system end, Units shall be pluggable, din-rail mounted. Units shall include local and remote fail indication. Provide a Phoenix Contact or approved equal.
- d. Non-Fiber Based Data Highway – Provide protection on all data highway circuits (e.g. DeviceNet) that leave a building or are routed external to a building. Circuit protection shall be provided at both ends of the line. Surge protection devices shall be Phoenix Contact PlugTrab Series, Transtector FSP Series, MTL Surge Technologies (Telematic) NP Series, or equal.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Install equipment in conformance with NEC.
- B. Unless otherwise noted, install outdoor NEMA 4X panels on a reinforced concrete pedestal:
 - 1. Minimum Thickness: Eight-inches with No. 4 steel reinforcing bars at 12-inches on centers, each way.
 - 2. Minimum Size: Twelve-inches larger than outer dimensions of base, all sides.
 - 3. Provide excavation and backfill work in conformance with Section 02200, Earthwork.
 - 4. Provide concrete work in conformance with Section 03300, Cast-In-Place Concrete.
- C. Install anchor bolts and anchor in accordance with Section 05051, Anchor Systems.

- D. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into and out of and among the enclosures as indicated on the Drawings.

3.02 - TESTING AND ADJUSTMENTS

- A. Perform system testing and make any adjustments necessary in accordance with this Section, Section 13401, Process Control System General Provisions, Section 13402, Process Control System Factory Testing, and Section 13403, Process Control System Start up and Field Testing.
- B. Perform power supply, voltage adjustments to tolerances required by the appurtenant equipment.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust and place into satisfactory operation panel instruments and devices.
2. Contract Documents illustrate and specify functional and general construction requirements of the panel instruments and do not necessarily show or specify all wiring, piping and accessories required to make a completely integrated system. Contractor shall provide all piping, wiring, accessories and labor required for a complete, workable and integrated system that meets the functional requirements shown and specified.

B. Coordination:

1. Coordinate the installation and interface requirements of all items specified herein and required with the manufacturer of equipment specified in other sections to ensure the complete and proper interfacing of all the components and systems.
2. Comply with the requirements of Section 13401, Process Control System General Provisions.
3. Provide Programmable Logic Controller (PLC), Operator Interface Terminal (OIT) and associated software in accordance with specification Section 13451, PLC Hardware and Software.

1.02 - QUALITY ASSURANCE**A. Comply with the requirements of Section 13401, Process Control System General Provisions.****B. Acceptable Manufacturers:**

1. Furnish instruments and devices by the named manufacturers or equal equipment by other manufacturers.
2. The named manufacturers have been specified to establish the standard of quality and performance of the equipment to be supplied.
3. Obtain all instruments or devices of a given type from the same manufacturer.

C. Manufacturers' Responsibilities and Services:

1. Design and manufacture panels with the instruments and devices installed in accordance with the applicable general design requirements specified in Section 13401, Process Control System General Provisions, and the detailed Specifications herein.
2. Field supervision, inspection, start-up and training in accordance with the requirements of Section 13403, Process Control System Start up and Field Testing, and Section 13404, Process Control System Training.

1.03 - SUBMITTALS

- A. Comply with the requirements of Section 13401, Process Control System General Provisions, and the following:
1. Shop drawings for uninterruptible power system (UPS) shall include the power ratings of all associated equipment the system shall provide power to. Information shall be in list form and include: equipment name and power rating at maximum load, in Watts, for each item. The list shall tally the power ratings and clearly display that the proposed UPS meets the required output capacity, including specified percent spare, for the specified time requirements. A separate list shall be provided for each required UPS.

1.04 - PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Comply with the requirements specified in Section 13401, Process Control System General Provisions.
- B. Instruments and devices shall not be assembled in the panels until all product information and system Shop Drawings for respective components have been approved.

1.05 - IDENTIFICATION TAGS

- A. All panel instruments and devices shall have an identification tag meeting the following requirements:
1. Tag numbers shall be as listed in the Instrument Index.
 2. Identifying tag number shall be permanently etched or embossed onto a plastic tag which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.
 3. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch diameter stainless steel wire rope.

4. All instruments and devices mounted within panels shall have identification tags, which comply with the requirements specified in Section 13430, Process Control Panels and Enclosures, Article 2.2.C.
5. Tags shall be installed so that the numbers are easily visible to service personnel. Front of panel mounted components shall have the tag attached to the rear of the device.
6. Front of panel mounted components shall have nameplates, which comply with the requirements specified in Section 13430, Process Control Panels and Enclosures.

PART 2 - PRODUCTS

2.01 - POWER SUPPLIES

- A. Provide a 24 VDC power supply in the control panel to power field instruments, panel devices, etc., as required. Equip the power supply with a power on/off circuit breaker.
- B. The 24 VDC power supply shall meet the following requirements:
 1. Input power: 115 vac, plus or minus 10 percent, 60 Hz.
 2. Output voltage: 24 vdc.
 3. Output voltage adjustment: 5 percent.
 4. Line regulation: 0.05 percent for 10 V line change.
 5. Load regulation: 0.15 percent no load to full load.
 6. Ripple: 3 mV RMS.
 7. Operating temperature: 32 to 140 degrees Fahrenheit.
 8. DIN rail mounting.
 9. Integrated Selective Fused Breaking
- C. Size the 24 vdc power supply to accommodate the design load plus a minimum 25 percent spare capacity.
- D. Provide output overvoltage and overcurrent protective devices with the power supply to protect instruments from damage due to power supply failure and to protect the power supply from damage due to external failure.

- E. Mount the 24 vdc power supply such that dissipated heat does not adversely affect other panel components.
- F. Provide a Power Supply Diode Redundancy module from the same manufacturer of the power supplies.
- G. Manufacturer(s):
 - 1. Phoenix Contact
 - 2. Allen Bradley.
 - 3. Moxa.
 - 4. Or Equal.

2.02 - MAIN AND BRANCH CIRCUIT BREAKER

- A. General:
 - 1. Circuit breakers shall be furnished and installed in control panels to provide automatically operated switch protection in an electrical circuit from damage caused by an overload or short circuit.
 - 2. Branch circuit breakers shall be approved for branch circuit applications in the United States.
- B. Features:
 - 1. Type: High Density Circuit Breaker.
 - 2. Provide Single Pole 120/240V, 277/480V breakers within the control panels.
 - 3. Rating: Provide breakers with proper amp rating to protect the circuit it serves. Normal operating load of each circuit shall be noted on the panel power distribution wiring drawing. Refer to specification Section 13430, Process Control Panels and Enclosures, for internal panel wiring design requirement.
 - 4. Insulation Resistance: 100M-ohm at 500VDC.
 - 5. Terminal Type: Tubular screw with self-lifting box lug.
 - 6. Push-to-set mechanism for circuit actuation.

7. Manual trip button.
8. DIN rail mounted.
9. Status on/off indicator lights
10. Compliance: UL 1077 Listed, CSA C22.2 No. 235, EN/IEC 60934.

C. Products and Manufacturers: Provide one of the following:

1. Allen Bradley.
2. Or Equal.

2.03 - UNINTERRUPTIBLE POWER SYSTEM (SINGLE PHASE)

A. General:

1. Uninterruptible Power System (UPS) shall be furnished to provide a reliable source of uninterruptible power with no break in AC output power during a complete or partial interruption of incoming line power. UPS shall include audio/visual alarms. UPS shall be UL listed.
2. A UPS shall be provided for each control panel.

B. Description: On line dual track power conditioner and true (0 ms transfer time) uninterruptible power supply providing isolation, line regulation and conditioning, using sealed 48 VDC maintenance free batteries and switch mode power supply for uninterrupted power with 0.5 to 0.7 power factor and 2.7 to 3.5 crest factor.

C. Features:

1. Unit shall provide uninterrupted conditioned power, under fully loaded conditions, for 20 minutes. Unit shall be sized to accommodate power requirements for all equipment it is to power for the required length of time and shall provide ten percent spare output capacity at minimum.
2. Rating: 1.4KVA/1.0KW minimum.
3. Lighting and Surge Protection: Inherent 2000: One spike attenuation.
4. Regulation: One to three percent load regulation with less than 2pF effective coupling capacitance for line to load.

5. Output Waveform: Computer grade sine wave with three percent maximum single harmonic and five percent maximum total harmonic distortion.
 6. Output Frequency: 60 Hz \pm 0.5 Hz.
 7. Operating Temperature: 1°C to 40°C.
 8. Relative Humidity: Five to 90 percent non-condensing.
 9. Normally Closed contact output for Battery Low alarm to be connected to a PLC discrete input.
 10. Input Protection: Independent battery charger fuse and DC fuses.
 11. Output Protection: Inherently current limited ferro-resonant transformer.
 12. Battery Charger: Two-step charger, 8 A and 2 A.
 13. AC Input: 120VAC, 60Hz, single phase, +15 percent, -20 percent.
 14. AC Output: 120VAC, 60Hz, single phase, +3 percent, -3 percent.
- D. Products and Manufacturers: Provide one of the following:
1. Best Power Technology, Ferrups FE Series.
 2. American Power Conversion Corp. (APC)
 3. Eaton.
 4. Or Equal.

2.04 - SELECTOR SWITCHES, PUSHBUTTONS AND INDICATING LIGHTS

- A. General:
1. Selector switches, pushbuttons and indicating lights shall be supplied by one manufacturer and be of the same series or model type.
 2. Type:
 - a. Heavy duty, oil tight.

3. Provide legend plate for indication of switch, pushbutton or light function (e.g., "OPEN-CLOSED", "HAND-OFF-AUTO").
 4. Mounting: Flush mounted on control panel front, unless otherwise noted.
 5. NEMA rated to match panel in which mounted.
- B. Selector Switches:
1. Type: Provide selector switches with number of positions as required to perform intended functions as shown and specified.
 2. Contacts:
 - a. Provide number and arrangement of contacts as required to perform intended functions specified, but not less than two single pole, double throw contact.
 - b. Type: Double break, silver contacts with movable contact blade providing scrubbing action.
 - c. Rating: Compatible with AC or DC current with devices simultaneously operated by the switch contacts, but not less than 10 A resistive at 120 VAC or DC continuous.
 3. Switch Operator: Standard black knob.
- C. Pushbuttons (Standard or Illuminated):
1. Type: Provide momentary lighted and/or unlighted, single and/or dual type pushbuttons as required to perform intended functions specified and shown.
 2. Contacts: Comply with the requirements specified for selector switches.
- D. Indicating Lights:
1. Type: Light-Emitting Diode (LED).
 2. Lamps: 2.2 volt, long life (20,000 hours minimum).
- E. Button and Lens Colors:
1. See table below

INDICATION	COLOR
Open, On, Running	Red
Closed, Off, Stopped	Green
Equipment Malfunction, Process Trouble and alarms (e.g., "HIGH LEVEL", "LOW LEVEL", etc.)	Amber
Power On	White
Informational (e.g. Backwash, Ready, etc.)	Blue

F. Products and Manufacturers: Provide one of the following:

1. Allen Bradley.
2. Eaton Corp.
3. Or equal.

2.05 - DIGITAL INDICATOR

A. General: The digital indicator shall accept an analog input and convert it to scaled numerical characters for digital display and also provide up to two alarm outputs.

B. Required Features:

1. Display Height: 1.2 -inch.
2. Display Capacity: 4½ digits with decimal point position jumper selectable.
3. Display Type: Seven segment, red LED.
4. Accuracy: ± 0.05 percent.
5. Analog Input: 4 to 20 mADC.
6. Excitation Output: 15 VDC for powering transmitter.
7. Analog Output: Proportional 4 to 20 mADC.
8. Temperature Range: 0°C to 60°C.
9. Power: 120 VAC, + 10 to -15 percent.
10. Enclosure: NEMA 4X.

C. Products and Manufacturers: Provide one of the following:

1. Precision Digital.
2. Newport Electronics.
3. Or approved equal.

2.06 - CONTROL RELAY

- A. Type: General purpose, plug-in type rated for continuous duty.
- B. Construction Features:
 1. Coil Voltages: 24 VDC or 120 VAC, as required.
 2. Contacts: DPDT or 4PDT.
 - a. Silver cadmium oxide rated not less than 8 A resistive at 120 VAC or 24 VDC continuous.
 - b. For switching low energy circuits (less than 200 mA) fine silver, gold flashed contacts rated not less than 3 A resistive at 120 VAC or 28 VDC continuous shall be provided.
 3. Relays to have clear plastic dust cover.
 4. Relays to have pilot light to show energized coil.
 5. Relays to be UL recognized.
- C. Products and Manufacturers: Provide one of the following:
 1. Allen Bradley, 700 Series.
 2. Square D Company,
 3. Or equal.

2.07 - ELECTRONIC HORN

- A. General: The horn shall provide an audible warning in the area where a potential alarm may occur.
- B. Features:

1. Decibel Output: 100 at 10 feet, minimum.
2. Enclosure Rating: NEMA 4X or NEMA7 in classified areas.
3. Horn Diaphragm: Stainless steel.
4. Power: 120 VAC.
5. Operating Temperature: 32 to 120°F.

C. Products and Manufacturers:

1. Federal Signal.
2. Or equal.

2.08 - STROBE LIGHT

- A. General: Strobe light shall be a pulsating, illuminating type. The light shall provide a visual warning in the area where a potential hazard may occur.

B. Features:

1. Strobe Light: Rotating 360 degrees; 300 effective candlepower, 80 flashes per minute.
2. Lens Color: Amber.
3. Enclosure Rating: NEMA 4X or NEMA7 in classified areas.
4. Power: 120 VAC.

C. Products and Manufacturers:

1. Federal Signal.
2. Or equal.

2.09 - ETHERNET SWITCH

- A. Ethernet Switches shall have the following features:

1. 10/100/1000 base-TX (auto-sensing).
2. Minimum of sixteen (16) RJ-45 ports.

3. LED for indicating port status.
 4. DIN rail mounted.
 5. Failsafe output relay to indicate malfunction with unit.
 6. FCC Part 15, Class A compliant.
 7. Power transformer as required.
 8. Provide management software for multilevel security, web based configuration and remote monitoring.
- B. Provide Ethernet communication path cable for all required internal panel connections.
- C. Product and Manufacturer:
1. RuggedCom.
 2. Or equal.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Install each item in accordance with manufacturer's recommendations and in accordance with the Contract Documents.
- B. All items shall be mounted and anchored in compliance with Section 13430, Process Control Panels and Enclosures.

3.02 - START-UP, CALIBRATION, TESTING AND TRAINING

- A. Comply with the requirements of Section 13403, Process Control System Start up and Field Testing, and Section 13404, Process Control System Training.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals required to furnish and install Programmable Logic Controllers (PLCs), Operator Interface Terminals (OITs), and associated software in control panels as shown and specified.
2. The hardware and architecture of the system shall be that of a PLC. A Distributed Control System (DCS), hybrid PLC based system, or a PLC and components no longer supported or being removed from support within two years by PLC manufacturer shall not be acceptable.
3. An Input / Output point list with I/O tag, point description, and other related details is provided in Section 13480, Input / Output Point List. The hardware required for the PLC is comprised of the following types of major components:
 - a. Ethernet TCP/IP Communication System.
 - b. Fault tolerant redundant processors configured as Hot Standby.
 - c. I/O drivers to communicate with PLC's.
 - d. Network communication devices.
 - e. Power Supplies.
 - f. I/O Cards.
 - g. I/O Chassis and Cabling.
 - h. Operator Interface Terminals (OIT)
 - i. Peripheral Devices.
4. The PLCs shall be networked as a system and operate as one integrated system. Contractor shall provide all software and drivers required to integrate with other microprocessor based systems into the networked PLC system to form a fully integrated system.

B. Related Sections:

1. Section 13401, Process Control System General Provisions.
2. Section 13402, Process Control System Factory Testing.
3. Section 13404, Process Control System Training.
4. Section 13430, Panels and Enclosure.
5. Section 13480, Input/Output Point List.
6. Division 16, Electrical.

1.02 - TERMS

A. The terms listed below are used throughout this Section and are defined as such:

1. Operator Interface Terminal (OIT): Operator Interface to control system. Allows operator intervention and monitoring of all systems and subsystems connected to the PLC system.
2. Programmable Logic Controller (PLC): The controlling device used to control and monitor hardware connected to it by way of networks or I/O cards. May be identified under different names such as small logic controller, mini or micro.
3. Backplane: Usually will indicate the I/O chassis that the power supply, PLC and I/O cards, and network cards reside in.
4. I/O Cards: Can be either analog or discrete cards that interface between field devices and PLC.
5. Network Hub: Data concentrator where one or more networks are integrated.
6. Server: Computer having one or more CPU's used for a specific task such as data depository, web management. Usually connected to the plant network.
7. Peripheral Devices: Includes, but not limited to, printer(s), display devices and standalone intelligent devices, such as remote HMI stations.
8. PLC System: Includes all parts listed above.

1.03 - QUALITY ASSURANCE

- A. CONTRACTOR shall engage the services of the PLC manufacturer to provide technical support for equipment listed in this Section.

1.04 - WARRANTY

- A. Contractor shall provide warranty that includes labor and parts for 2 year period.

1.05 - TROUBLESHOOTING

- A. The Instrumentation and Controls (I&C) Supplier shall provide trouble-shooting procedures for hardware supplied. The procedures shall be accurate, easy to understand and follow, current, and comprehensive in scope. If links to vendor website or technical support is necessary the vendor shall provide up-to-date phone numbers and links.

PART 2 - PRODUCTS**2.01 - PROGRAMMABLE LOGIC CONTROLLER (PLC)**

- A. The PLC system shall include as a minimum a power supply, network connections, I/O cards and CPU as shown and as required to achieve the specified functionality. The system shall be complete with all necessary processors, I/O modules, backplanes, power supplies, terminals, terminal bases, and cables. The plant control system hardware listed herein is provided for Contractor's convenience and may not include all PLC hardware components that shall be provided.
- B. The final system configuration shall utilize the System Manufacturer's standard hardware and software to meet the functional requirements of these Specifications.
- C. All equipment furnished under this Contract shall be provided to meet the functional requirements of these Specifications plus a 20 percent growth in project requirements, (e.g., graphic displays, alarms, additional instrumentation and equipment). All equipment shall be provided under this Contract, such that the entire 20 percent project growth can be implemented into the PLC, without any additional hardware cost to the OWNER.
- D. The PLC shall have the ability to communicate with multiple remote I/O racks, or devices configured with multiple I/O modules. The PLC shall have the ability to support multiple data communications networks in the same chassis
- E. Assembled System:
1. Within the enclosure all I/O racks, processor racks, and power supplies shall be grounded to meet the manufacturer's specifications.
 2. Provide a dry contact rated at 2 amperes and 120 volts a-c for remote indication of processor failure.

3. PLCs shall be capable of being programmed and updated where installed.
 4. Provide interposing relays for all outputs to motor control centers, solenoids or contactor circuits.
 5. Provide individual fuses for all inputs and outputs. Fuses shall be capable of being inspected without removal of and replaced without disassembly of the terminal block. Blown fuse LED status indicators shall be provided.
- F. The PLC shall perform the following functions:
1. The programming format shall be IEC 1131-3 compliant Ladder Diagram (LD), Function Block Diagram (FBD), Sequential Function Chart (SFC), and Structured Text (ST) languages.
 2. Accept analog input signals (4 to 20 mADC) and dry contact input signals (120 VAC).
 3. All analog inputs shall have 16-bit resolution with 0.025 percent accuracy.
 4. Output analog signals (4 to 20 mADC) and contact output commands as required to meet interface requirements. Contact outputs shall be dry contacts rated for 120 vac, 60 Hz, two amp service or 24 VDC.
 5. Respond to interrogations for data and receive downloaded program changes and operating parameter changes from HMI's or engineering workstation.
 6. Errors and/or failures shall be indicated locally by Light Emitting Diode (LED) and reported at the HMI. Multiple-bit errors shall cause immediate processor halt. Error diagnostic tables shall be user accessible and provide clear and accurate descriptions of PLC system and process level errors.
 7. All I/O boards shall be capable of being removed without powering down any process controller resource.
 8. The unit shall be provided with the following timing elements:
 - a. Real-time clock to provide time reference for processor and system operations.
 - b. Watchdog timer for monitoring system software operations to detect hardware malfunction or a non-productive loop (stall condition).

8. The processor should be able to perform basic arithmetic operations using floating-point data.
 9. A single fault tolerant power supply shall be provided for each CPU, rack and I/O modules. Each power supply shall be capable of being powered from separate 120 Vac and 24 or 125 Vdc sources. The power supplies shall incorporate full power factor correction, AC input filtering, and a 40-millisecond hold up time.
 10. Isolation transformers and other power normalization devices to protect against over voltage and frequency distortion characteristics shall be used where frequent power failures are common.
- G. The PLC should have as a minimum the following features and capabilities:
1. The CPU shall be a microprocessor with onboard dynamic random access memory (DRAM) and flash memory for read/write functions and storage of configured data without battery backup. The microprocessor shall operate:
 - a. Minimum of 8.0 Mbytes of User memory.
 - b. The controller shall be able to operate within the following environmental parameters: Processor and I/O modules shall be capable of withstanding temperatures of 32°F to 122°F at a relative humidity of 5 to 95 percent (non-condensing) in system manufacturer's standard enclosures.
 - c. Provide either of the following:
 - 1) 1756-L73, by Allen Bradley.
 - 2) Or approved equal.
 2. Current Input Module:
 - a. 4-20 mADC.
 - b. Minimum of 8 isolated input channels.
 - c. Provide either of the following:
 - 1) 1756-IF16, by Allen-Bradley.
 - 2) Or approved equal.

3. Current Output Module:
 - a. 4-20 mADC.
 - b. Minimum of 8 isolated output channels.
 - c. Provide either of the following:
 - 1) 1756-OF8, by Allen-Bradley.
 - 2) Or approved equal.
4. Discrete Digital Input Module:
 - a. 120VAC voltage monitor.
 - b. Minimum of 16 individually isolated input channels.
 - c. Provide either of the following:
 - 1) 1756-IA16I, by Allen-Bradley.
 - 2) Or approved equal.
5. Discrete Digital Contact Output Module:
 - a. Relay output (NO contacts, 120VAC 2A minimum).
 - b. Minimum of 16 individually isolated output channels.
 - c. Provide either of the following:
 - 1) 1756-OW16I, by Allen-Bradley.
 - 2) Or approved equal.
6. Ethernet Interface Module:
 - a. Standard Ethernet media (10base2, 10base5, 10baseT, 100baseT, fiber).
 - b. RJ-45 interface.
 - c. Standard TCP/IP communications.

- d. Subnet masking.
 - e. Provide either of the following
 - 1) 1756-ENBT, by Allen-Bradley.
 - 2) Or approved equal.
7. Remote I/O communication Module:
- a. The PLC shall allow the scheduling of data transfers between Peers (Remote I/O chassis, Operator Interface Terminals (OIT) and other PLCs) as a function of the network without the need for programming message instructions in ladder. This transfer shall occur at user selectable and repeatable rates).
 - b. Provide either of the following
 - 1) ControlNet Bridge Module 1756-CNB, by Allen-Bradley.
 - 2) Or approved equal.
8. I/O Chassis:
- a. Number of slots as needed.
 - b. Provide either of the following
 - 1) 1756-Ax, by Allen-Bradley.
 - 2) Or approved equal.
8. Power Supply (PS):
- a. 120VAC input voltage.
 - b. Minimum current output as required to power all local PLC modules.
 - c. Provide either of the following
 - 1) 1756-PA, by Allen-Bradley.
 - 2) Or approved equal.
9. Redundancy System:

- a. The PLC Redundancy System shall provide higher system availability. This shall be realized by switching control to a secondary controller chassis if anything in the primary controller chassis.
- b. The Redundancy System shall allow connecting to other (remotely located) networks using the bridging functionality of other communication modules.
- c. Use fiber optic media to connect the primary and the secondary control system.
- d. The switch over between primary and secondary controller shall happen transparent to the user and to the application.
- e. In event of a switch over, the PLC Redundancy System shall automatically swap communication modules' addresses between primary and secondary chassis. Any external device shall continue to communicate with the new primary controller.
- f. The PLC Redundancy System shall guarantee a bumpless switchover for any outputs point.
- g. The PLC Redundancy System shall provide an automatic program cross-load and synchronization. The program shall be downloaded only to the primary controller. Using this design, it shall eliminate the need for maintaining separate programs for the primary and the secondary controllers. A controller, configured as a secondary controller, shall automatically receive and buffer data changes from the primary controller.
- h. Provide either of the following
 - 1) 1756-SRM, by Allen-Bradley.
 - 2) Or approved equal.

H. PLC Spare Parts:

- 1. See specification Section 13401, Process Control System General Provisions for the complete list of PLC spare parts.

2.02 - PLC PROGRAMMING SOFTWARE

- A. Software shall support the development of the PLC ladder logic derived from process control strategies as specified in Section 13491, Process Control Descriptions. Software shall be IEC

1131-3 compliant Ladder Diagram as well as modular, function block type of control elements, which are familiar to control system programmers and engineers, instrumentation technicians and electricians. The function blocks shall be computational blocks for performing arithmetic, operational blocks for performing such functions as move and convert values, file to file operations, communication blocks for communicating with other PLC's and system resources, special algorithm blocks for advanced control procedures such as shift register, and PID functions. The PID shall use traditional strategies such as Proportional Integral Derivative (PID) controllers, feed forward, cascaded controllers, etc. shall be provided. Tuning constants shall be easily set from operator consoles. For each analog loop, software to allow provision of status of the manual backup control to be monitored and an alarm generated when switch is not in automatic mode.

- B. For each sequence or logic control loop, a disagreement alarm shall be triggered when a command (start-stop, etc.) is initiated and confirmation is not received.
- C. Software shall allow configuration of internal diagnostics alarms for the PLC hardware. Alarms shall be suitable to verify proper and to alert operators when alarm conditions occurs. This includes, but is not limited to annunciation blown fuse indication for all I/O, watchdogs for communications failure with any system processor or I/O address, and communications failure with existing third party equipment.
- D. PLC software shall allow for editing of comments and other PLC documentation using traditional editors such as Notepad.
- E. PLC software shall include as easy to use file and printing management module.
- F. The PLC software shall use intuitive, menu-driver environment and base package platform. These easy-to-use Graphical User Interface (GUI) packages shall perform configuration and maintenance operations.
- G. The PLC software shall be compatible with Windows 7, 64 bits or latest version.
- H. The PLC software shall be fully compatible with all furnished PLC hardware.
- I. Product and Manufacturer:
 - 1. Provide one complete licensed software package of RSLogix 5000 Full Edition, RSLinx Professional, RSNetWorx for ControlNet and all software needed to configure the redundant system, latest version, by Rockwell Automation.
 - 2. Or approved equal.

2.03 - OPERATOR INTERFACE TERMINAL (OIT)

- A. Provide a programmable Operator Interface Terminal (OIT) to enable Operator to control and monitor field equipment. The OIT unit shall be flush panel mounted on the front of the panel. OIT unit shall be provided with all necessary hardware, cables and software to accomplish the interface as specified herein and shown on the Contract Drawings.
- B. Performance Requirements:
 - 1. The OIT shall be designed to display directly connected to the remote I/O or Ethernet network and shall be able to transfer up to twenty-two 64 word blocks each way.
 - 2. The OIT shall be provided with off-line development software which allows development of graphic picture files, touch screen key files, alarm files, trend files, system configurations, variables, and screen definitions. Provision shall be made to store commonly used symbols and screen definitions.
- C. Each OIT shall be provided with the following minimum requirements:
 - 1. Display: 15"-inch Active Matrix Color TFT, 1024 x 768, 18-bit Color, analog touch screen.
 - 2. Field replaceable Backlight.
 - 3. Memory: Available Flash: 512MB; RAM: 512MB.
 - 4. Communication: Ethernet, RS-232,
 - 5. Input Voltage: 18 – 32VDC.
 - 6. Power Consumption: 70 Watts (maximum).
 - 7. Operating Temperature: 0 – 55 degrees Celsius.
 - 8. Humidity: 5 - 90% without condensation.
 - 9. Rating: NEMA 4X, UL-listed.
- D. Manufacturers:
 - 1. Provide operator interface terminals (OIT) of the same manufacturer as the PLC hardware provided. The OIT shall be one of the following:
 - a. Allen-Bradley PanelView Plus Series.

- b. GE Loaded QuickPanel View series.
- c. Modicon Magelis
- d. Or equal.

E. Software:

- 1. Operator Interface Terminal shall be pre-packaged with all configuration and programming software necessary to perform functions as shown on drawings and within the specifications.
- 2. Integrated OIT software shall have the following features configured to apply to this project:
 - a. Trending.
 - b. Data Logging.
 - c. Alarms.
 - d. Graphic Symbols.
 - e. Animations.

F. I/O Ports and Devices:

- 1. OIT shall have a minimum of one Ethernet 10/100 Mbps for connectivity or programming.
- 2. OIT shall have a minimum of one Serial RS232 port.
- 3. Compact flash ports shall be Type 2.
- 4. OIT shall have a minimum of one USB port.

G. Display:

- 1. OIT display size shall be 15" (nominal) as indicated on the system architecture drawings.
- 2. Type of display for the OIT shall be Color Active Matrix TFT.
- 3. Display resolution shall be a minimum 1024 x 768.
- 4. Display shall support touch screen input.

F. Environmental:

1. Rating: OIT shall be rated to maintain the rating of the control panel it will be mounted in.
2. Temperature: Operating temperature range of the OIT shall range 0 - 50 °C.

PART 3 - EXECUTION

3.01 - ENVIRONMENTAL CONDITIONS

- A. The complete monitoring and control system and associated input/output wiring will be used in a wastewater treatment facility environment where there will be high energy AC fields, DC control pulses, and varying ground potentials between the transducers or input contact locations and the system components. The system design shall be adequate to provide proper protection against interferences from all such possible situations.
- B. The PLC components shall be designed and constructed for satisfactory operation and long, low maintenance service under the following environmental conditions:
 1. Temperature range: 32 to 122°F continuous.
 2. Relative humidity: 5 through 95 percent (non-condensing).

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION**

- A. Scope:
 - 1. This Section describes the input/output (I/O) point list, which follows this Section and requirements for configuring the control system database.
- B. Related Sections:
 - 1. Section 13451, PLC Hardware and Software.

1.02 - SUBMITTALS

- A. For each I/O attribute listed in the I/O list that cannot be used exactly as listed, submit an explanation of the reason for the deviation and propose a method to modify the I/O list information. Do not proceed with any configuration until a method of resolving deviations is accepted by the Engineer.
- B. Include the control system I/O database information in the PLC specific submittals for Section 13451, PLC Hardware and Software.

1.03 - I/O POINT LIST DESCRIPTION

- A. The I/O point list contains the information necessary to configure the PLC I/O interface hardware and to indicate range conversion or signal functions.
- B. "TAG" is an alphanumeric character string. For example, the point AE-FI-123A represents:
 - 1. The next alpha character is the functional identifier and follows ANSI/ISA-S5.1. In the example, the "F" represents flow.
 - 2. The next alpha character (I) is the function identifier. In the example, the "I" represents an analog input.
 - 3. (I-8), and loop or field device (13)
 - 4. The four-digit number (0123) identifies the loop or field device.
 - 5. The final character (A) is used, as required, as a suffix to differentiate multiple points in the same loop.

- C. "DESCRIPTION" is an alphanumeric character string that describes the I/O point. Points described as "SPARE" denote pre-wired I/O.
- D. "SIGNAL TYPE" is one of the following:
1. AI designates an analog input.
 2. DI designates a discrete input.
 3. AO designates an analog output.
 4. DO designates a momentary, maintained or latched discrete output.
 5. DNT designates DeviceNet communication.
 6. ENT designates Ethernet communications (All Types of Inputs/Outputs).
- E. "RANGE" is a numeric value denoting the minimum and maximum signal value of the controlled variable. Information in this column is provided only for analog points. Information in this column shall be provided by Contractor. For all instrumentation, RANGE information shall be provided after the associated instrument is calibrated.
- F. "ENGINEERING UNITS" denotes the unit type as it applies to the RANGE. Information in this column shall be provided by Contractor.
- G. "POWER FROM" indicates where power for the instrument/device producing the signal originates from.
- H. "SIGNAL FROM DEVICE" indicates the instrument/device which produces the signal.
- I. "SIGNAL FROM TB" is the terminal block number where the signal wire is terminated. Information in this column shall be provided by Contractor.
- J. "SIGNAL FROM TERMINAL #" is the terminal number where the signal wire is terminated. Information in this column shall be provided by Contractor.
- K. "SIGNAL FROM TERMINAL #" is the terminal number where the signal wire is terminated. Information in this column shall be provided by Contractor.
- L. "SIGNAL TO DEVICE" indicates the instrument/device which receives the signal.
- M. "SIGNAL TO TB." is the terminal block number where the signal wire is terminated. Information in this column shall be provided by Contractor.

- N. "SIGNAL TO TERMINAL #" is the terminal number where the signal wire is terminated. Information in this column shall be provided by Contractor.
- O. "SIGNAL TO TERMINAL #" is the terminal number where the signal wire is terminated. Information in this column shall be provided by Contractor.
- P. "PLC ADDRESS" indicates the device/channel number of the point. Information in this column shall be provided by Contractor.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 - I/O CONFIGURATION

- A. Implement the control system database fields in a consistent manner by using the following procedures:
1. Use abbreviations and acronyms already established in the Contract Documents. In particular, use the information in the I/O Point List.
 2. Use only abbreviation or acronym for a word or group of words, respectively.
 3. Use the same subject and word order within data fields.
 4. Use the same term (either phrase, word or acronym) to denote the same meaning. Do not use multiple terms for a single meaning.
 5. Use the point names, descriptions, logic state descriptions, ranges and units of measurement exactly the same wherever the point is referenced.
 6. Show point names and descriptions for all point references on documentation.
 7. Spell correctly.
 8. Maintain lists of acronyms and abbreviations used.

3.02 - I/O HARDWARE CONFIGURATION

- A. Partition the I/O among cards within an I/O enclosure to provide control loop integrity.
1. Put all inputs of the same I/O type associated with a device (e.g. pump, blower, clarifier or other piece of equipment) on the same card.

2. Put all inputs of the same I/O type for devices arranged in process trains (e.g. a pump, its inlet valve and its outlet valve, or a pump and its associated macerator) on the same card or cards if more than one card is required to accommodate the points.
3. Put all outputs of the same I/O type associated with a device or group of devices in a process train on the same card or cards if more than one card is required to accommodate the points.
4. Where the preceding requirements specified in this paragraph would cause more than 20 percent spare points on a card, points for a device or process train may be split between two consecutive cards.
5. Make unused terminals resulting from partitioning the I/O into pre-wired spares. Provide pre-wired spare points with all cabling and termination internal to the DCU as done for other I/O points.

3.03 - POINT DATA FIELDS

- A. I/O point data fields may be subject to review and modification by the Engineer during the Shop Drawing review phase. Incorporate changes directed by the Engineer completely into the entire system, at no additional cost to Owner, subject to the following limitations:
 1. Limit the total number of modifications to 20 percent of the total number of I/O points.
 2. Each unique change will count as one modification. For example, modifying the description, range, and engineering unit on an analog input count as three modifications.
 3. Analog input alarm limit definition will not be counted as a modification.

3.04 - INPUT/OUTPUT TAGGING

- A. Each tag number shall be written as follows IY-####A where:
 1. I = ISA Identification.
 2. Y = Function Identifier.
 3. 1 Digit P&ID number, followed by a 2 Digit Loop Number.
 4. A = Suffix (to distinguish between similar variables).

+ + END OF SECTION + +

Specification 265011 - Programmable Logic Controller
Appendix A - PLC Inputs/Outputs
Nassa County Department of Public Works
Glen Cove Waste Water Treatment Plant Sludge Dewatering Facility Improvements

						Abbreviations	
						DI:	Digital Input
						DO:	Digital Output
						AI:	Analog Input
						AO:	Analog Output
						MB:	Modbus
						EN:	Ethernet
Sludge Dewatering Facility I/O List							
No.	Description	Signal Type	Quantity	Range	Units	Notes	
1	Sludge Feed Pump P1 H-O-A switch	DI	3	N/A	N/A		
2	Sludge Feed Pump P1 Drive/Bypass Selector Switch	DI	2	N/A	N/A		
3	Sludge Feed Pump P1 Overload	DI	1	N/A	N/A		
4	Sludge Feed Pump P1 Fault	DI	1	N/A	N/A		
5	Sludge Feed Pump P1 Reset	DI	1	N/A	N/A		
6	Sludge Feed Pump P1 Run Aux. Relay	DI	1	N/A	N/A		
7	Sludge Feed Pump P1 High Temperature	DI	1	N/A	N/A		
8	Sludge Feed Pump P1 High Temperature Enable/Disable	DI	2	N/A	N/A		
9	Sludge Feed Pump P1 High Pressure	DI	1	N/A	N/A		
10	Sludge Feed Pump P1 High Pressure Enable/Disable	DI	2	N/A	N/A		
11	Sludge Feed Pump P2 H-O-A switch	DI	3	N/A	N/A		
12	Sludge Feed Pump P2 Drive/Bypass Selector Switch	DI	2	N/A	N/A		
13	Sludge Feed Pump P2 Overload	DI	1	N/A	N/A		
14	Sludge Feed Pump P2 Fault	DI	1	N/A	N/A		
15	Sludge Feed Pump P2 Reset	DI	1	N/A	N/A		
16	Sludge Feed Pump P2 Run Aux. Relay	DI	1	N/A	N/A		
17	Sludge Feed Pump P2 High Temperature	DI	1	N/A	N/A		
18	Sludge Feed Pump P2 High Temperature Enable/Disable	DI	2	N/A	N/A		
19	Sludge Feed Pump P2 High Pressure	DI	1	N/A	N/A		
20	Sludge Feed Pump P2 High Pressure Enable/Disable	DI	2	N/A	N/A		
21	Sludge Feed Pump P3 H-O-A switch	DI	3	N/A	N/A		
22	Sludge Feed Pump P3 Drive/Bypass Selector Switch	DI	2	N/A	N/A		
23	Sludge Feed Pump P3 Overload	DI	1	N/A	N/A		
24	Sludge Feed Pump P3 Fault	DI	1	N/A	N/A		
25	Sludge Feed Pump P3 Reset	DI	1	N/A	N/A		
26	Sludge Feed Pump P3 Run Aux. Relay	DI	1	N/A	N/A		
27	Sludge Feed Pump P3 High Temperature	DI	1	N/A	N/A		
28	Sludge Feed Pump P3 High Temperature Enable/Disable	DI	2	N/A	N/A		
29	Sludge Feed Pump P3 High Pressure	DI	1	N/A	N/A		
30	Sludge Feed Pump P3 High Pressure Enable/Disable	DI	2	N/A	N/A		
31	Sludge Feed Pump P1 Start/Stop	DO	1	N/A	N/A		
32	Sludge Feed Pump P2 Start/Stop	DO	1	N/A	N/A		
33	Sludge Feed Pump P3 Start/Stop	DO	1	N/A	N/A		
34	Sludge Feed Pump P1 Speed Reference	AO	1	4-20	mA	From CP-01 to VFD	
35	Sludge Feed Pump P2 Speed Reference	AO	1	4-20	mA	From CP-01 to VFD	
36	Sludge Feed Pump P3 Speed Reference	AO	1	4-20	mA	From CP-01 to VFD	
37	Sludge Feed Pump P1 Speed Reference	AI	1	4-20	mA	From VFD to CP-01	
38	Sludge Feed Pump P2 Speed Reference	AI	1	4-20	mA	From VFD to CP-01	
39	Sludge Feed Pump P3 Speed Reference	AI	1	4-20	mA	From VFD to CP-01	
40	Plug Valve 1 (PV-1) O-C-S-A Switch	DI	4	N/A	N/A		
41	Plug Valve 1 (PV-1) Open	DI	1	N/A	N/A		
42	Plug Valve 1 (PV-1) Close	DI	1	N/A	N/A		
43	Plug Valve 1 (PV-1) Open/Close Status	DO	1	N/A	N/A		
44	Plug Valve 1 (PV-1) Failure	DO	1	N/A	N/A		
45	Plug Valve 2 (PV-2) O-C-S-A Switch	DI	4	N/A	N/A		
46	Plug Valve 2 (PV-2) Open	DI	1	N/A	N/A		
47	Plug Valve 2 (PV-2) Close	DI	1	N/A	N/A		

Specification 265011 - Programmable Logic Controller
Appendix A - PLC Inputs/Outputs
Nassa County Department of Public Works
Glen Cove Waste Water Treatment Plant Sludge Dewatering Facility Improvements

						Abbreviations	
						DI:	Digital Input
						DO:	Digital Output
						AI:	Analog Input
						AO:	Analog Output
						MB:	Modbus
						EN:	Ethernet
Sludge Dewatering Facility I/O List							
No.	Description	Signal Type	Quantity	Range	Units	Notes	
48	Plug Valve 2 (PV-2) Open/Close Status	DO	1	N/A	N/A		
49	Plug Valve 2 (PV-2) Failure	DO	1	N/A	N/A		
50	Plug Valve 3 (PV-3) O-C-S-A Switch	DI	4	N/A	N/A		
51	Plug Valve 3 (PV-3) Open	DI	1	N/A	N/A		
52	Plug Valve 3 (PV-3) Close	DI	1	N/A	N/A		
53	Plug Valve 3 (PV-3) Open/Close Status	DO	1	N/A	N/A		
54	Plug Valve 3 (PV-3) Failure	DO	1	N/A	N/A		
55	Plug Valve 4 (PV-4) O-C-S-A Switch	DI	4	N/A	N/A		
56	Plug Valve 4 (PV-4) Open	DI	1	N/A	N/A		
57	Plug Valve 4 (PV-4) Close	DI	1	N/A	N/A		
58	Plug Valve 4 (PV-4) Open/Close Status	DO	1	N/A	N/A		
59	Plug Valve 4 (PV-4) Failure	DO	1	N/A	N/A		
60	Plug Valve 5 (PV-5) O-C-S-A Switch	DI	4	N/A	N/A		
61	Plug Valve 5 (PV-5) Open	DI	1	N/A	N/A		
62	Plug Valve 5 (PV-5) Close	DI	1	N/A	N/A		
63	Plug Valve 5 (PV-5) Open/Close Status	DO	1	N/A	N/A		
64	Plug Valve 5 (PV-5) Failure	DO	1	N/A	N/A		
65	Flow Meter 1 (FM-1)	AI	1	4-20	mA		
66	Flow Meter 2 (FM-2)	AI	1	4-20	mA		
67	Flow Meter 3 (FM-3)	AI	1	4-20	mA		
68	CCP1 START/STOP	DO	2	N/A	N/A	Start/Stop Signal when CCP1 is on Remote	
69	CCP1 - Conveyor Run Forward	DO	1	N/A	N/A		
70	CCP1 - Conveyor Run Forward (Feedback)	DI	1	N/A	N/A		
71	CCP1 - Conveyor Run Reverse	DO	1	N/A	N/A		
72	CCP1 - Conveyor Run Reverse (Feedback)	DI	1	N/A	N/A		
73	CCP1 - Conveyor Zero Speed	DI	1	N/A	N/A		
74	CCP1 - Conveyor Failure	DI	1	N/A	N/A		
75	CCP2 START/STOP	DO	2	N/A	N/A	Start/Stop Signal when CCP2 is on Remote	
76	CCP2 - Conveyor Run Forward	DO	1	N/A	N/A		
77	CCP2 - Conveyor Run Forward (Feedback)	DI	1	N/A	N/A		
78	CCP2 - Conveyor Run Reverse	DO	1	N/A	N/A		
79	CCP2 - Conveyor Run Reverse (Feedback)	DI	1	N/A	N/A		
80	CCP2 - Conveyor Zero Speed	DI	1	N/A	N/A		
81	CCP2 - Conveyor Failure	DI	1	N/A	N/A		
82	CCP3 START/STOP	DO	2	N/A	N/A	Start/Stop Signal when CCP3 is on Remote	
83	CCP3 - Conveyor Run Forward	DO	1	N/A	N/A		
84	CCP3 - Conveyor Run Forward (Feedback)	DI	1	N/A	N/A		
85	CCP3 - Conveyor Run Reverse	DO	1	N/A	N/A		
86	CCP3 - Conveyor Run Reverse (Feedback)	DI	1	N/A	N/A		
87	CCP3 - Conveyor Zero Speed	DI	1	N/A	N/A		
88	CCP3 - Conveyor Failure	DI	1	N/A	N/A		
89	CCP4 START/STOP	DO	2	N/A	N/A	Start/Stop Signal when CCP4 is on Remote	
90	CCP4 - Conveyor Run Forward	DO	1	N/A	N/A		
91	CCP4 - Conveyor Run Forward (Feedback)	DI	1	N/A	N/A		
92	CCP4 - Conveyor Run Reverse	DO	1	N/A	N/A		
93	CCP4 - Conveyor Run Reverse (Feedback)	DI	1	N/A	N/A		
94	CCP4 - Conveyor Zero Speed	DI	1	N/A	N/A		

Specification 265011 - Programmable Logic Controller Appendix A - PLC Inputs/Outputs Nassa County Department of Public Works Glen Cove Waste Water Treatment Plant Sludge Dewatering Facility Improvements							Abbreviations	
							DI:	Digital Input
							DO:	Digital Output
							AI:	Analog Input
							AO:	Analog Output
							MB:	Modbus
							EN:	Ethernet
Sludge Dewatering Facility I/O List								
No.	Description	Signal Type	Quantity	Range	Units	Notes		
95	CCP4 - Conveyor Failure	DI	1	N/A	N/A			
96	CCP5 START/STOP	DO	2	N/A	N/A	Start/Stop Signal when CCP5 is on Remote		
97	CCP5 - Conveyor Run Forward	DO	1	N/A	N/A			
98	CCP5 - Conveyor Run Forward (Feedback)	DI	1	N/A	N/A			
99	CCP5 - Conveyor Run Reverse	DO	1	N/A	N/A			
100	CCP5 - Conveyor Run Reverse (Feedback)	DI	1	N/A	N/A			
101	CCP5 - Conveyor Zero Speed	DI	1	N/A	N/A			
102	CCP5 - Conveyor Failure	DI	1	N/A	N/A			
103	Polymer Skid PY-1 System Run	DI	1	N/A	N/A			
104	Polymer Skid PY-1 Remote Mode	DI	1	N/A	N/A			
105	Polymer Skid PY-1 Alarm	DI	1	N/A	N/A			
106	Polymer Skid PY-1 Remote Start/Stop	DO	1	N/A	N/A	Start/Stop Signal when PY-1 is on Remote		
107	Polymer Skid PY-1 Polymer Pump Rate	AI	1	4-20	mA			
108	Polymer Skid PY-1 Pacing Signal (Process Flow)	AO	1	4-20	mA	Process Flow from CP-01 to PY-1		
109	Polymer Skid PY-2 System Run	DI	1	N/A	N/A			
110	Polymer Skid PY-2 Remote Mode	DI	1	N/A	N/A			
111	Polymer Skid PY-2 Alarm	DI	1	N/A	N/A			
112	Polymer Skid PY-2 Remote Start/Stop	DO	1	N/A	N/A	Start/Stop Signal when PY-2 is on Remote		
113	Polymer Skid PY-2 Polymer Pump Rate	AI	1	4-20	mA			
114	Polymer Skid PY-2 Pacing Signal (Process Flow)	AO	1	4-20	mA	Process Flow from CP-01 to PY-2		
115	Polymer Skid PY-3 System Run	DI	1	N/A	N/A			
116	Polymer Skid PY-3 Remote Mode	DI	1	N/A	N/A			
117	Polymer Skid PY-3 Alarm	DI	1	N/A	N/A			
118	Polymer Skid PY-3 Remote Start/Stop	DO	1	N/A	N/A	Start/Stop Signal when PY-3 is on Remote		
119	Polymer Skid PY-3 Polymer Pump Rate	AI	1	4-20	mA			
120	Polymer Skid PY-3 Pacing Signal (Process Flow)	AO	1	4-20	mA	Process Flow from CP-01 to PY-3		
121	Belt Filter Press 1 - BFP1 Ready Status	DI	1	N/A	N/A			
122	Belt Filter Press 1 - BFP1 Common Fault Alarm	DI	1	N/A	N/A			
123	Belt Filter Press 1 - BFP1 Conveyor Running	DI	1	N/A	N/A			
124	Belt Filter Press 1 - BFP1 Conveyor Fail	DI	1	N/A	N/A			
125	Sludge Pump Start/Stop	DI/EN	1	N/A	N/A	Process Sludge Pump start/stop from BFP1		
126	Polymer Pump Start/Stop	DI/EN	1	N/A	N/A	PY-1 start/stop from BFP1		
127	Sludge Pump Running	DO/EN	1	N/A	N/A	Process Sludge Pump Running Status from CP-01 to BFP1		
128	Polymer Pump Running	DO/EN	1	N/A	N/A	Polymer Pump Running Status from CP-01 to BFP1		
129	Sludge Feed Pump Speed Reference	AO/EN	1	4-20	mA	Sludge Feed Pump Speed output from CP-01 to BFP1 panel		
130	Sludge Feed Pump Speed Reference	AI/EN	1	4-20	mA	Sludge Feed Pump Speed output from BFP1 Panel to CP-01		
131	Belt Filter Press 2 - BFP2 Ready Status	DI	1	N/A	N/A			
132	Belt Filter Press 2 - BFP2 Common Fault Alarm	DI	1	N/A	N/A			
133	Belt Filter Press 2 - BFP2 Conveyor Running	DI	1	N/A	N/A			
134	Belt Filter Press 2 - BFP2 Conveyor Fail	DI	1	N/A	N/A			
135	Sludge Pump Start/Stop	DI/EN	1	N/A	N/A	Process Sludge Pump start/stop from BFP2		
136	Polymer Pump Start/Stop	DI/EN	1	N/A	N/A	PY-1 start/stop from BFP2		

Specification 265011 - Programmable Logic Controller Appendix A - PLC Inputs/Outputs Nassa County Department of Public Works Glen Cove Waste Water Treatment Plant Sludge Dewatering Facility Improvements							Abbreviations	
							DI:	Digital Input
							DO:	Digital Output
							AI:	Analog Input
							AO:	Analog Output
							MB:	Modbus
							EN:	Ethernet
Sludge Dewatering Facility I/O List								
No.	Description	Signal Type	Quantity	Range	Units	Notes		
137	Sludge Pump Running	DO/EN	1	N/A	N/A	Process Sludge Pump Running Status from CP-01 to BFP2		
138	Polymer Pump Running	DO/EN	1	N/A	N/A	Polymer Pump Running Status from CP-01 to BFP2		
139	Sludge Feed Pump Speed Reference	AO/EN	1	4-20	mA	Sludge Feed Pump Speed output from CP-01 to BFP2 panel		
140	Sludge Feed Pump Speed Reference	AI/EN	1	4-20	mA	Sludge Feed Feed Pump Speed output from BFP2 Panel to CP-01		
141	Belt Filter Press 3 - BFP3 Ready Status	DI	1	N/A	N/A			
142	Belt Filter Press 3 - BFP3 Common Fault Alarm	DI	1	N/A	N/A			
143	Belt Filter Press 3 - BFP3 Conveyor Running	DI	1	N/A	N/A			
144	Belt Filter Press 3 - BFP3 Conveyor Fail	DI	1	N/A	N/A			
145	Sludge Pump Start/Stop	DI/EN	1	N/A	N/A	Process Sludge Pump start/stop from BFP3		
146	Polymer Pump Start/Stop	DI/EN	1	N/A	N/A	PY-1 start/stop from BFP3		
147	Sludge Pump Running	DO/EN	1	N/A	N/A	Process Sludge Pump Running Status from CP-01 to BFP3		
148	Polymer Pump Running	DO/EN	1	N/A	N/A	Polymer Pump Running Status from CP-01 to BFP3		
149	Sludge Feed Pump Speed Reference	AO/EN	1	4-20	mA	Sludge Feed Feed Pump Speed output from CP-01 to BFP3 panel		
150	Sludge Feed Pump Speed Reference	AI/EN	1	4-20	mA	Sludge Feed Feed Pump Speed output from BFP3 Panel to CP-01		
151	Zeta-Lyte Remote Start/Stop	DO						
152	Zeta-Lyte Pump Rate	AI	1	4-20	mA	Zeta-Lyte Analog feedback to CP-01		
153	Zeta-Lyte Pump Pacing Signal	AO	1	4-20	mA	Zeta-Lyte Analog Speed Reference from CP-01		
154	Zeta-Lyte Pump Remote Speed Control (From BFP-1)	AI	1	4-20	mA	Zeta-Lyte Speed Control on BFP-1 to CP-01		
155	Zeta-Lyte Pump Remote Speed Control (From BFP-2)	AI	1	4-20	mA	Zeta-Lyte Speed Control on BFP-2 to CP-01		
156	Zeta-Lyte Pump Remote Speed Control (From BFP-3)	AI	1	4-20	mA	Zeta-Lyte Speed Control on BFP-3 to CP-01		
157	Polygone Pump Remote Start/Stop	DO						
158	Polygone Pump Rate	AI	1	4-20	mA	Polygone Pump Analog feedback to CP-01		
159	Polygone Pump Pacing Signal	AO	1	4-20	mA	Polygone Pump Analog Speed Reference from CP-01		
160	Polygone Pump Remote Speed Control (From BFP-1)	AI	1	4-20	mA	Polygone Pump Speed Control on BFP-1 to CP-01		
161	Polygone Pump Remote Speed Control (From BFP-2)	AI	1	4-20	mA	Polygone Pump Speed Control on BFP-2 to CP-01		
162	Polygone Pump Remote Speed Control (From BFP-3)	AI	1	4-20	mA	Polygone Pump Speed Control on BFP-3 to CP-01		
163	Zeta-Lyte Injection Solenoid (BFP-1)	DO	1	N/A	N/A			
164	Polygone Injection Solenoid (BFP-1)	DO	1	N/A	N/A			
165	Zeta-Lyte Injection Solenoid (BFP-2)	DO	1	N/A	N/A			
166	Polygone Injection Solenoid (BFP-2)	DO	1	N/A	N/A			
167	Zeta-Lyte Injection Solenoid (BFP-3)	DO	1	N/A	N/A			
168	Polygone Injection Solenoid (BFP-3)	DO	1	N/A	N/A			
169	Sludge Grinder Start/Stop	DO	1	N/A	N/A	Start/Stop Signal from PLC to Grinder Control Panel		
170	Sludge Grinder Run	DI	1	N/A	N/A			
171	Sludge Grinder Fault	DI	1	N/A	N/A			
172	BFP 1 Gas Monitor	DI	1	N/A	N/A			
173	BFP 2 and 3 Gas Monitor	AI	1	4-20	mA	Natural Gas Level		
174	BFP 2 and 3 Gas Monitor	AI	1	4-20	mA	Hydrogene Sulfide (Methane Gas) Level		
175	BFP 2 and 3 Gas Monitor	DI	1	N/A	N/A			
176	BFP 2 and 3 Gas Monitor	AI	1	4-20	mA	Natural Gas Level		
177	BFP 2 and 3 Gas Monitor	AI	1	4-20	mA	Hydrogene Sulfide (Methane Gas) Level		

Specification 265011 - Programmable Logic Controller Appendix A - PLC Inputs/Outputs Nassa County Department of Public Works Glen Cove Waste Water Treatment Plant Sludge Dewatering Facility Improvements							Abbreviations	
							DI:	Digital Input
							DO:	Digital Output
							AI:	Analog Input
							AO:	Analog Output
							MB:	Modbus
							EN:	Ethernet
Sludge Dewatering Facility I/O List								
No.	Description	Signal Type	Quantity	Range	Units	Notes		
178	Existing Mixer 201 H-O-A Switch	DI	3	N/A	N/A			
179	Existing Mixer 201 Overload	DI	1	N/A	N/A			
180	Existing Mixer 201 Start	DI	1	N/A	N/A			
181	Existing Mixer 201 Stop	DI	1	N/A	N/A			
182	Existing Mixer 201 Seal Leak	DI	1	N/A	N/A			
183	Existing Mixer 201 Ovetemp	DI	1	N/A	N/A			
184	Existing Mixer 202 H-O-A Switch	DI	3	N/A	N/A			
185	Existing Mixer 202 Overload	DI	1	N/A	N/A			
186	Existing Mixer 202 Start	DI	1	N/A	N/A			
187	Existing Mixer 202 Stop	DI	1	N/A	N/A			
188	Existing Mixer 202 Seal Leak	DI	1	N/A	N/A			
189	Existing Mixer 202 Ovetemp	DI	1	N/A	N/A			
190	Existing Mixer 203 H-O-A Switch	DI	3	N/A	N/A			
191	Existing Mixer 203 Overload	DI	1	N/A	N/A			
192	Existing Mixer 203 Start	DI	1	N/A	N/A			
193	Existing Mixer 203 Stop	DI	1	N/A	N/A			
194	Existing Mixer 203 Seal Leak	DI	1	N/A	N/A			
195	Existing Mixer 203 Ovetemp	DI	1	N/A	N/A			
196	Existing Mixer 204 H-O-A Switch	DI	3	N/A	N/A			
197	Existing Mixer 204 Overload	DI	1	N/A	N/A			
198	Existing Mixer 204 Start	DI	1	N/A	N/A			
199	Existing Mixer 204 Stop	DI	1	N/A	N/A			
200	Existing Mixer 204 Seal Leak	DI	1	N/A	N/A			
201	Existing Mixer 204 Ovetemp	DI	1	N/A	N/A			
202	Existing Mixer 205 H-O-A Switch	DI	3	N/A	N/A			
203	Existing Mixer 205 Overload	DI	1	N/A	N/A			
204	Existing Mixer 205 Start	DI	1	N/A	N/A			
205	Existing Mixer 205 Stop	DI	1	N/A	N/A			
206	Existing Mixer 205 Seal Leak	DI	1	N/A	N/A			
207	Existing Mixer 205 Ovetemp	DI	1	N/A	N/A			
208	Existing Mixer 401 H-O-A Switch	DI	3	N/A	N/A			
209	Existing Mixer 401 Overload	DI	1	N/A	N/A			
210	Existing Mixer 401 Start	DI	1	N/A	N/A			
211	Existing Mixer 401 Stop	DI	1	N/A	N/A			
212	Existing Mixer 401 Seal Leak	DI	1	N/A	N/A			
213	Existing Mixer 401 Ovetemp	DI	1	N/A	N/A			
214	Existing Mixer 402 H-O-A Switch	DI	3	N/A	N/A			
215	Existing Mixer 402 Overload	DI	1	N/A	N/A			
216	Existing Mixer 402 Start	DI	1	N/A	N/A			
217	Existing Mixer 402 Stop	DI	1	N/A	N/A			
218	Existing Mixer 402 Seal Leak	DI	1	N/A	N/A			
219	Existing Mixer 402 Ovetemp	DI	1	N/A	N/A			
220	Existing Mixer 403 H-O-A Switch	DI	3	N/A	N/A			
221	Existing Mixer 403 Overload	DI	1	N/A	N/A			
222	Existing Mixer 403 Start	DI	1	N/A	N/A			
223	Existing Mixer 403 Stop	DI	1	N/A	N/A			
224	Existing Mixer 403 Seal Leak	DI	1	N/A	N/A			

Specification 265011 - Programmable Logic Controller
Appendix A - PLC Inputs/Outputs
Nassa County Department of Public Works
Glen Cove Waste Water Treatment Plant Sludge Dewatering Facility Improvements

						Abbreviations	
						DI:	Digital Input
						DO:	Digital Output
						AI:	Analog Input
						AO:	Analog Output
						MB:	Modbus
						EN:	Ethernet
Sludge Dewatering Facility I/O List							
No.	Description	Signal Type	Quantity	Range	Units	Notes	
225	Existing Mixer 403 Overtemp	DI	1	N/A	N/A		
226	Existing Mixer 404 H-O-A Switch	DI	3	N/A	N/A		
227	Existing Mixer 404 Overload	DI	1	N/A	N/A		
228	Existing Mixer 404 Start	DI	1	N/A	N/A		
229	Existing Mixer 404 Stop	DI	1	N/A	N/A		
230	Existing Mixer 404 Seal Leak	DI	1	N/A	N/A		
231	Existing Mixer 404 Overtemp	DI	1	N/A	N/A		
232	Existing Mixer 405 H-O-A Switch	DI	3	N/A	N/A		
233	Existing Mixer 405 Overload	DI	1	N/A	N/A		
234	Existing Mixer 405 Start	DI	1	N/A	N/A		
235	Existing Mixer 405 Stop	DI	1	N/A	N/A		
236	Existing Mixer 405 Seal Leak	DI	1	N/A	N/A		
237	Existing Mixer 405 Overtemp	DI	1	N/A	N/A		
238	Existing Mixer 601 H-O-A Switch	DI	3	N/A	N/A		
239	Existing Mixer 601 Overload	DI	1	N/A	N/A		
240	Existing Mixer 601 Start	DI	1	N/A	N/A		
241	Existing Mixer 601 Stop	DI	1	N/A	N/A		
242	Existing Mixer 601 Seal Leak	DI	1	N/A	N/A		
243	Existing Mixer 601 Overtemp	DI	1	N/A	N/A		
244	Existing Mixer 602 H-O-A Switch	DI	3	N/A	N/A		
245	Existing Mixer 602 Overload	DI	1	N/A	N/A		
246	Existing Mixer 602 Start	DI	1	N/A	N/A		
247	Existing Mixer 602 Stop	DI	1	N/A	N/A		
248	Existing Mixer 602 Seal Leak	DI	1	N/A	N/A		
249	Existing Mixer 602 Overtemp	DI	1	N/A	N/A		
250	Existing Mixer 603 H-O-A Switch	DI	3	N/A	N/A		
251	Existing Mixer 603 Overload	DI	1	N/A	N/A		
252	Existing Mixer 603 Start	DI	1	N/A	N/A		
253	Existing Mixer 603 Stop	DI	1	N/A	N/A		
254	Existing Mixer 603 Seal Leak	DI	1	N/A	N/A		
255	Existing Mixer 603 Overtemp	DI	1	N/A	N/A		
256	Existing Mixer 604 H-O-A Switch	DI	3	N/A	N/A		
257	Existing Mixer 604 Overload	DI	1	N/A	N/A		
258	Existing Mixer 604 Start	DI	1	N/A	N/A		
259	Existing Mixer 604 Stop	DI	1	N/A	N/A		
260	Existing Mixer 604 Seal Leak	DI	1	N/A	N/A		
261	Existing Mixer 604 Overtemp	DI	1	N/A	N/A		
262	Existing Mixer 605 H-O-A Switch	DI	3	N/A	N/A		
263	Existing Mixer 605 Overload	DI	1	N/A	N/A		
264	Existing Mixer 605 Start	DI	1	N/A	N/A		
265	Existing Mixer 605 Stop	DI	1	N/A	N/A		
266	Existing Mixer 605 Seal Leak	DI	1	N/A	N/A		
267	Existing Mixer 605 Overtemp	DI	1	N/A	N/A		
268	Existing Mixer 801 H-O-A Switch	DI	3	N/A	N/A		
269	Existing Mixer 801 Overload	DI	1	N/A	N/A		
270	Existing Mixer 801 Start	DI	1	N/A	N/A		
271	Existing Mixer 801 Stop	DI	1	N/A	N/A		

Specification 265011 - Programmable Logic Controller Appendix A - PLC Inputs/Outputs Nassa County Department of Public Works Glen Cove Waste Water Treatment Plant Sludge Dewatering Facility Improvements							Abbreviations	
							DI:	Digital Input
							DO:	Digital Output
							AI:	Analog Input
							AO:	Analog Output
							MB:	Modbus
							EN:	Ethernet
Sludge Dewatering Facility I/O List								
No.	Description	Signal Type	Quantity	Range	Units	Notes		
272	Existing Mixer 801 Seal Leak	DI	1	N/A	N/A			
273	Existing Mixer 801 Ovetemp	DI	1	N/A	N/A			
274	Existing Mixer 802 H-O-A Switch	DI	3	N/A	N/A			
275	Existing Mixer 802 Overload	DI	1	N/A	N/A			
276	Existing Mixer 802 Start	DI	1	N/A	N/A			
277	Existing Mixer 802 Stop	DI	1	N/A	N/A			
278	Existing Mixer 802 Seal Leak	DI	1	N/A	N/A			
279	Existing Mixer 802 Ovetemp	DI	1	N/A	N/A			
280	Existing Mixer 803 H-O-A Switch	DI	3	N/A	N/A			
281	Existing Mixer 803 Overload	DI	1	N/A	N/A			
282	Existing Mixer 803 Start	DI	1	N/A	N/A			
283	Existing Mixer 803 Stop	DI	1	N/A	N/A			
284	Existing Mixer 803 Seal Leak	DI	1	N/A	N/A			
285	Existing Mixer 803 Ovetemp	DI	1	N/A	N/A			
286	Existing Mixer 804 H-O-A Switch	DI	3	N/A	N/A			
287	Existing Mixer 804 Overload	DI	1	N/A	N/A			
288	Existing Mixer 804 Start	DI	1	N/A	N/A			
289	Existing Mixer 804 Stop	DI	1	N/A	N/A			
290	Existing Mixer 804 Seal Leak	DI	1	N/A	N/A			
291	Existing Mixer 804 Ovetemp	DI	1	N/A	N/A			
292	Existing Mixer 805 H-O-A Switch	DI	3	N/A	N/A			
293	Existing Mixer 805 Overload	DI	1	N/A	N/A			
294	Existing Mixer 805 Start	DI	1	N/A	N/A			
295	Existing Mixer 805 Stop	DI	1	N/A	N/A			
296	Existing Mixer 805 Seal Leak	DI	1	N/A	N/A			
297	Existing Mixer 805 Ovetemp	DI	1	N/A	N/A			
298	General Alarm	DO	1	N/A	N/A			
299	General Alarm Reset	DI	1	N/A	N/A			

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - DESCRIPTION****A. Scope:**

1. Programming of the PLCs and configuration of Operator Interface Terminals (OIT) software is part of this Contract. Control strategies provided in this Section are for general information.
2. The PLC programs and configured OIT software will be uploaded to the appropriate PLCs and computers at panel shop before the Factory Test, specified in Section 13402, Process Control System Factory Testing.
3. Programming the required control strategies in processors located within the control panels that are provided with package systems is part of this Contract. Programming the processors, testing, and start-up of the package systems are the responsibility of the package system suppliers and the Contractor.

B. Related Sections:

1. Section 13401, Process Control System General Provisions.
2. Section 13402, Process Control System Factory Testing.

C. This Section describes all of the anticipated control programming under this Contract. The control strategies are generally divided by the responsible supplier and further subdivided by panel.**D. Process Control Functions:**

1. Process control function shall be structured to permit the realization of all control strategy requirements. In addition, each control function shall be designed so that bumpless, balance free transfers are obtained during operating mode changeover and initialization. Where applicable, user-changeable parameters shall be automatically defaulted to a preset value if a specific value is not given during system generation.
2. The P&IDs represent the required process monitoring and control. The required control for the system is a combination of the representation on the P&IDs and the requirements specified herein. The P&IDs do not show all the required internal diagnostic indications. In addition, to the indications shown on the P&IDs the following, at a minimum shall be provided:

- a. Indication of bad quality on any hard wired input/output point (such as less than 3.5 milliamps on a 4 to 20 mA DC circuit).
 - b. Individual PLC fault indications.
 - c. Indication of a communications failure.
 - d. Indication of Input/Output module failure.
 - e. Indication of a Input/Output channel failure.
 - f. For all motor start and stop commands check for run feedback after adjustable time delay (0 to 30 seconds). Provide a "FAIL TO START" and "FAIL TO STOP" alarm if unit fails to run or stop. Use the bad start or stop bit to remove the run command from the control logic.
 - e. For analog control loops, when control of field equipment is not in "COMPUTER," the associated PID controller output shall track the position feedback.
 - f. Runtimes shall be provided for all pieces of equipment. Runtimes shall be seven digits long and reset back to zero when it reaches the maximum number. Runtimes shall maintain the latest values during power outage.
 - g. For all analog signals, provide the following alarm indications:
 - 1) "HIGH-HIGH."
 - 2) "HIGH."
 - 3) "LOW."
 - 4) "LOW-LOW."
 - 5) "HIGH AND LOW RATE OF CHANGE."
3. In addition to the indications shown on the P&IDs, the following shall be provided at a minimum:
- a. Analog Data Scaling: This control function shall scale all analog inputs to a common span and shall normalize the digital representation of each analog input to a percent of the operating span. The processed value shall be expressed as a binary number that specifies the analog input's position on a straight line lying

between zero and full scale as defined for a given input by the zero span values in the data base.

- b. Amplitude Limit Check: This control function shall perform dual level, high/low amplitude limit checking and shall identify a limit violation every time a measured or virtual variable goes out-of-limits and returns back into limits. The control function shall determine the time at which each limit excursion occurred. A deadband shall be provided on each limit and shall be expressed as a percentage of span or in engineering units. Low and high limiting default values will be set-up for each measured or calculated variables used in the process control loops.

- c. Engineering Unit Conversion: This control function shall convert scaled analog data to engineering units by means of the following equation:

$$Y = (H - L) (D/DH) + L$$

where:

Y = Value in engineering units.

H = High value of span, expressed in engineering units.

L = Low value of span, expressed in engineering units.

D = Digitized scaled input value in counts.

DH = Full scale digitized value in counts.

- d. Manual Control: It shall be possible for Operator or Plant Engineer to interrupt any sequence, loop or automatic operation and operate the same manually through the Operator Workstation.
- e. Verification of Digital Outputs: This control function shall verify that the equipment has responded to the digital commands before proceeding to next step during automatic operation. If any discrepancy is detected, an alarm will be annunciated.

E. Hardware: Contractor shall provide all the hardware, as shown, specified or required to implement the control strategies as described.

F. Configuration: All set points, tuning parameters and engineering scales etc. shall be documented

for each control point and each control strategy on configuration sheets or similar documents. These documents shall be updated during Factory Testing and finally during start-up.

- G. Control Strategy Displays: Control strategy displays shall be submitted for review. Displays shall clearly show initial conditions, start, and progression of the control strategies. Each control strategy shall be displayed in a minimum number of displays for ease of monitoring by the Operator.
- H. Plant Power Failure: Plant equipment controlled by the control system shall be programmed to automatically reset upon failure.
- I. Restart: All equipment and motors shall be automatically restarted after power failure by the control system in an orderly fashion approved by the Engineer.
- J. All relays, timing parameters, scales, configuration values, mathematical constants, equations and set points given in the control strategies are adjustable over a wide range. The values given are initial and may change during Shop Drawing review and may have to be readjusted during start-up.

1.02 - SUBMITTALS

- A. The control strategies are written descriptions of the basic configuration and/or programming required to implement regulatory and sequential control of the unit processes as shown on the P&IDs. They do not in all cases describe the process characteristics fully. Finalizing and tuning of strategies, as required, by process characteristic's shall be accomplished during start-up. Control strategies shall fully reside in the memory of the designated DCU. The process inputs/outputs referred to in the Control Strategies are shown on the P&IDs. Any additional I/O (Maximum 20 percent) required shall be added during Shop Drawing review. It shall be provided at no additional cost to the Owner.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 - CONTROL PANEL ALARM NOTIFICATION

- A. When an alarm is generated in the associated control panel and it has not been demoted, the horn shall sound and the strobe light shall flash.
- B. The horn can be silence by pressing the Silence pushbutton on the panel. The strobe light only shall be reenergized if the alarm has been acknowledged on the OIT and the alarm has cleared.

3.02 - BELT FILTER PRESS CONTROL

- A. Control of three (3) belt filter presses and the associated equipment shall be a combination of a Central Control Panel (CP-01) which the operator will select the control protocol, and individual control panels provided by the manufacturer which will control the specific equipment. The main control protocols shall be as following:
1. The CP-01 GUI shall have three protocols for the operator to select via the CP-01 GUI. The operator shall be able to select to send process sludge to be dewatered to either **BFP-1, BFP-2, or BFP-3**. The PLC shall lock-out operation of any other belt filter presses (i.e., only one belt filter press shall operate at any one time).
 2. The CP-01 GUI system shall have a screen with an equipment matrix showing the status and open-close of the motorized valves and various motorized equipment. Refer to Process and Instrumentation diagrams for further details.
 - a. For **BFP-1** operating protocol, the operator shall be able to select which sludge pump will feed the selected belt filter press. All associated motorized actions (including automatic start-stop of equipment and opening-closing of motorized valves) shall be operated by the PLC for this protocol. Via the GUI the operator will have the ability to select any combination of pumps that they would like interlocked with the selected belt filter press. See equipment on-off; open-close table below:

Equipment ID	Pump P-1 to BFP-1	Pump P-2 to BFP-1	Pump P-3 to BFP-1
Inline Grinder G1	O	O	O
Sludge Pump P1	O	C	C
Sludge Pump P2	C	O	O
Sludge Pump P3	C	C	O
Motorized Plug Valve PV-1	O	O	O
Motorized Plug Valve PV-2	C	C	C
Motorized Plug Valve PV-3	C	C	C
Motorized Plug Valve PV-4	C	O	O
Motorized Plug Valve PV-5	C	C	O
Existing Belt Filter Press BFP-1	O	O	O
Belt Filter Press BFP-2	C	C	C
Belt Filter Press BFP-3	C	C	C
Existing Conveyor	O	O	O
Existing Truck Loader	O	O	O
Conveyor C-1	C	C	C
Conveyor C-2	C	C	C
Conveyor C-3	C	C	C
Conveyor C-4	C	C	C
Conveyor C-5	C	C	C
Polymer Skid PY-1	O	O	O

Equipment ID	Pump P-1 to BFP-1	Pump P-2 to BFP-1	Pump P-3 to BFP-1
Polymer Skid PY-2	C	C	C
Polymer Skid PY-3	C	C	C
Polygone Feed Pump PG-1*	C	C	C
Zetalyte Feed Pump ZL-1	O	O	O
*Shall be called to turn on via the BFP control panel via CP-01 O = open/on; C = Closed/off			

- b. For **BFP-2** operating protocol, the operator shall be able to select which sludge pump will feed the selected belt filter press. All associated motorized actions (including automatic start-stop of equipment and opening-closing of motorized valves) shall be operated by the PLC for this protocol. Via the GUI the operator will have the ability to select any combination of pumps that they would like interlocked with the selected belt filter press. See equipment on-off; open-close table below:

Equipment ID	Pump P-1 to BFP-2	Pump P-2 to BFP-2	Pump P-3 to BFP-2
Inline Grinder G1	O	O	O
Sludge Pump P1	O	C	C
Sludge Pump P2	C	O	C
Sludge Pump P3	C	C	O
Motorized Plug Valve PV-1	C	C	C
Motorized Plug Valve PV-2	O	O	O
Motorized Plug Valve PV-3	C	C	C
Motorized Plug Valve PV-4	O	C	C
Motorized Plug Valve PV-5	C	C	O
Existing Belt Filter Press BFP-1	C	C	C
Belt Filter Press BFP-2	O	O	O
Belt Filter Press BFP-3	C	C	C
Existing Conveyor	C	C	C
Existing Truck Loader	O	O	O
Conveyor C-1	O	O	O
Conveyor C-2	C	C	C
Conveyor C-3	O	O	O
Conveyor C-4	O	O	O
Conveyor C-5	O	O	O
Polymer Skid PY-1	C	C	C
Polymer Skid PY-2	O	O	O
Polymer Skid PY-3	C	C	C
Polygone Feed Pump PG-1*	C	C	C
Zetalyte Feed Pump ZL-1	O	O	O
*Shall be called to turn on via the BFP control panel via CP-01 O = open/on; C = Closed/off			

- c. For **BFP-3** operating protocol, the operator shall be able to select which sludge pump will feed the selected belt filter press. All associated motorized actions (including automatic start-stop of equipment and opening-closing of motorized valves) shall be operated by the PLC for this protocol. Via the GUI the operator will have the ability to select any combination of pumps that they would like interlocked with the selected belt filter press. See equipment on-off; open-close table below:

Equipment ID	Pump P-1 to BFP-3	Pump P-2 to BFP-3	Pump P-3 to BFP-3
Inline Grinder G1	O	O	O
Sludge Pump P1	O	C	C
Sludge Pump P2	C	O	C
Sludge Pump P3	C	C	O
Motorized Plug Valve PV-1	C	C	C
Motorized Plug Valve PV-2	C	C	C
Motorized Plug Valve PV-3	O	O	O
Motorized Plug Valve PV-4	O	C	C
Motorized Plug Valve PV-5	O	O	C
Existing Belt Filter Press BFP-1	C	C	C
Belt Filter Press BFP-2	C	C	C
Belt Filter Press BFP-3	O	O	O
Existing Conveyor	C	C	C
Existing Truck Loader	O	O	O
Conveyor C-1	C	C	C
Conveyor C-2	O	O	O
Conveyor C-3	O	O	O
Conveyor C-4	O	O	O
Conveyor C-5	O	O	O
Polymer Skid PY-1	C	C	C
Polymer Skid PY-2	C	C	C
Polymer Skid PY-3	O	O	O
Polygone Feed Pump PG-1*	C	C	C
Zetalyte Feed Pump ZL-1	O	O	O
*Shall be called to turn on via the BFP control panel via CP-01 O = open/on; C = Closed/off			

3. Control of the Sludge Pumps shall be as follows:
- The central PLC (CP-01) shall send a run signal to the sludge pumps to turn on when the selected pump is selected by the operator via the CP-01 GUI.
 - The sludge pump shall have a dry-run protection high temperature safety circuit. When the enable/disable temperature switch on the pump MCC selector is in the enable position, the high temperature which delay shall be incorporated into the control sequence. If a high temperature still exists after time elapses, which shall

be able to be set through the GUI, the sludge pump and associated equipment shall be shut down and manually reset. In the disable position, the high temperature switch shall have no control over the sludge pumps.

- c. The sludge pump shall operate in the same sequence in the 'hand' position as in the automatic position, except that:
 - 1) 'hand' does not need an on signal from the PLC to start the sludge pump.
 - d. In 'hand', the sludge pump speed shall be manually controlled via a speed potentiometer on the respective sludge pump MCC.
 - e. In 'auto', the sludge pump speed shall be manually controlled via the GUI on the respective Belt Filter Press Control Panel.
4. Control of the Belt Filter Presses shall be as follows:
- a. The central PLC (CP-01) shall send a run signal to the respective belt filter press control panel to turn on when the selected belt filter press is selected via the GUI.
 - b. All other faults, alarms, equipment related to the belt filter press, etc. shall be controlled by the belt filter press control panel, as provided by the belt filter press manufacturer. See Specification Section 11350.
 - c. Each belt filter press control panel shall have a pump speed potentiometer that can be manually controlled when the sludge pump is in 'auto' operation to adjust the speed of the selected sludge pump that shall be activated via the PLC and relayed through the PLC to the sludge pump VFD. The speed potentiometer shall be deactivated when the pump is set to 'hand' on the MCC.
5. Control of the Conveyors shall be as follows:
- a. The central PLC (CP-01) shall send a run signal to the respective conveyor control panel to turn on when the selected belt filter press is selected via the GUI.
 - b. All other faults, alarms, equipment related to the conveyor, etc. shall be controlled by the conveyor control panel as provided by the conveyor manufacturer. See Specification Section 14500.
6. Control of the Polymer Skid shall be as follows:

- a. The central PLC (CP-01) shall send a run signal to the respective polymer skid system control panel to turn on when the selected belt filter press is selected via the GUI.
- b. All other faults, alarms, equipment related to the polymer skid, etc. shall be controlled by the polymer skid control panel as provided by the polymer skid manufacturer. See Specification Section 11352.
- c. The polymer skid PLC shall be capable of optimizing flow of polymer into the sludge feed based on flow rate information from the respective electromagnetic flow meter. The flow shall be transmitted back to the central PLC and relayed to the polymer skid control panel as required.

7. Control of Polygone Chemical Feed Pump

- a. The respective belt filter press panel shall send a run signal to CP-01 which will then send a run signal to the polygone chemical feed pump to turn on when the selected belt filter press goes into the wash down cycle.
- b. The respective solenoid for the injection point shall be powered open when the polygone pump is called to power on by the respective belt filter press. The open signal shall come from CP-01.
- c. The polygone pump shall operate in the same sequence in the 'hand' position as in the automatic position, except that:
 - 1) 'hand' does not need an on signal from the PLC to start the chemical feed pump.
- d. In 'hand', the polygone feed pump speed shall be manually controlled via a potentiometer on the chemical pump interface.
- e. In 'auto', the polygone feed pump speed shall be manually controlled via the GUI on the respective Belt Filter Press Control Panel.

8. Control of Zetalyte Chemical Feed Pump

- a. The respective belt filter press panel shall send a run signal to CP-01 which will then send a run signal to the zetalyte chemical feed pump to turn on when the selected belt filter press is in operation.

- b. The respective solenoid for the injection point shall be powered open when the zetalyte pump is called to power on by the respective belt filter press. The open signal shall come from CP-01.
- c. The zetalyte pump shall operate in the same sequence in the 'hand' position as in the automatic position, except that:
 - 1) 'hand' does not need an on signal from the PLC to start the chemical feed pump.
- d. In 'hand', the zetalyte feed pump speed shall be manually controlled via a potentiometer on the chemical pump interface.
- e. In 'auto', the zetalyte feed pump speed shall be manually controlled via the GUI on the respective Belt Filter Press Control Panel.

3.03 - CONTROL FUNCTION DEFINITIONS AND GENERAL CRITERIA

- A. The hardware and/or software functions noted by this paragraph reference are to be implemented by the PLC/OIT control system specified herein. All functions that are specified as being available at (CP-01) OIT.
- B. Any interlocks that are represented, before the local operational descriptions, or are stated as hardwired interlocks, shall interlock all the controls locally OIT.
- C. Any interlocks that are represented in a particular layer of the operational descriptions, shall interlock all the controls in that layer and the layer after it. However the interlock shall not interlock the commands in the layer before it.
- D. Any motor that is requested to start by an operator or an automatic program shall alarm if the run confirm status for that motor does not activate within two seconds. If a motor stops by an interlock or stops without any operator intervention then that motor shall go into alarm. Any motors that are stopped by a program or the operator shall not go into an alarm.
- E. Motors with VFD controls shall be provided with GUI adjustable minimum and maximum speed setpoints. If the VFD is used in a PID control loop, the output of the controller shall not fall below or exceed the minimum and maximum speed setpoints, except where explicitly stated in the detailed control descriptions below.
- F. Motors that have an H/O/A shall indicate to the operator that the motor is being run in the "Hand" position. A motor is being run in "Hand" when the "Auto" position is not true and the run confirm status is true. If not in "Auto" the PLC shall open up its output contact to stop

(shutdown) the pump.

- G. When an analog signal goes outside the 4-20 mA range due to a failure at the instrument or PLC card, the following shall take place:
1. Alarm the signal at any local OITs.
 2. If the analog signal is associated with a control loop or ratio control loop that loop shall go into manual.
 3. If the analog signal is used in a calculation, that calculation shall use the last good analog signal. The computer shall place the control loop in manual if using the calculation.
- H. All interlocks that shutdown (Stop a piece of equipment and prevent it from being restarted or moved) shall be shown on the faceplate pop-up graphic for that piece of equipment.
- I. The run confirms or on status of all motors and lamps shall be accumulated to calculate a run time status of the equipment on the OIT graphic. Each run time accumulation shall come with a reset button on the HMI screen.
1. Current Day's Runtime in XX.XX Hrs
 2. Yesterday's Runtime in XX.XX Hrs
 3. Current Month's Runtime in XXX.X Hrs
 4. Last Month's Runtime in XXX.X Hrs
 5. Total Runtime in XXXXXX Hrs
- J. All flow indications shall be totalized. Do not totalize if the analog signal is outside the 4-20 mA range. Each flow totalization shall come with a reset button on the GUI screen. Do not totalize if the value of the flow input is less than 2% of the full range of the input. The flow totalizer units shall be appropriate for the total volume anticipated for the time period. Totalized flow in million gallons shall be rounded to two decimals (X.XX). Totalized flow shall be rounded to the nearest gallon.
1. Current Day's Flow Totalization
 2. Yesterday's Flow Totalization

3. Current Month's Flow Totalization
 4. Last Month's Flow Totalization
 5. Total Flow Totalization
- K. All chemical feed pump speed feedback indications shall be used to totalize chemical usage. Do not totalize if the analog signal is outside the 4-20 mA range. Each flow totalization shall come with a reset button on the GUI screen. Do not totalize if the value of the speed input is less than 2% of the full range of the input. A GUI adjustable setpoints shall be provided for each chemical pump to allow adjustment of volume per pump rotation and rotations per minute at 100% speed. The PLC shall automatically calculate the volume being pumped based on actual pump speed and the adjustable setpoints previously described. The flow totalizer units shall be presented in gallons per day (GPD). If chemical is pumped to multiple process locations, flow totalization shall also be provided for each location.
1. Current Day's Flow Totalization
 2. Yesterday's Flow Totalization
 3. Current Month's Flow Totalization
 4. Last Month's Flow Totalization
 5. Total Flow Totalization
- L. Motor Failures
1. Supervisor level users shall be able to set a common time setpoint that will be used to generate the following alarms.
 2. All motors being remotely controlled will generate a fail-to-start when the PLC sends the "start" command to the motor and it does not start after a supervisor adjustable time setpoint. When a fail-to-start is generated, the start output command shall be de-energized and the motor shall be prevented from starting until reset is issued from the GUI.
 3. All motors being remotely controlled will generate a fail to stop when the PLC sends the "stop" command to the motor and it continues to run after a supervisor adjustable time setpoint.
 4. All motors with adjustable speed control will generate a "speed deviation" alarm when

the motor is running and PLC sends a speed setpoint to the motor and it does not reach the correct speed (within a deadband initially set to 10%) within a supervisor adjustable timer setpoint. The motor shall remain running.

M. Valve Failures

1. Supervisor level users shall be able to set a common time setpoint that will be used to generate the following alarms.
2. All discrete valves (open-close) being remotely controlled will generate a fail to open alarm when the PLC sends the “open” command to the valve and it does not reach the “opened” limit within a supervisor adjustable time setpoint.
3. All discrete valves (open-close) being remotely controlled will generate a fail to close alarm when the PLC sends the “close” command to the valve and it does not reach the “closed” limit within a supervisor adjustable time setpoint.

N. Analog Alarms

1. Analog alarming capability shall be provided for all analog signals monitored by the PLC as follows.
2. Supervisor level users shall be able to set a common time setpoint that will be used to generate the following alarms after the timer expires. The following alarms (setpoints are supervisor adjustable) will be generated based on the analog feedback value. Each alarm shall include the ability for individual enabling and disabling. High and low analog alarms shall be initially enabled as indicated in the “Alarms/Monitoring” section of each loop.
 - a. High-High
 - b. High
 - c. Low
 - d. Low-Low
 - e. Loss of Signal (Analog signal out of range)
3. A “calibration mode” shall be provided which shall hold the last value prior to calibration mode being activated. When active, calibration mode shall be clearly indicated on any local OITs.

O. Digital Alarms

1. Digital alarms shall be programmed to alarm after a time setpoint expires to eliminate nuisance alarming.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 – SECTION INCLUDES**

- A. Furnish all labor, materials, equipment and services to purchase, receive delivery and start-up one (1) set of heavy duty portable axle scales with weight indicator in accordance with these specifications, including all incidental work necessary to make it complete, satisfactory and ready for operation as it is specified herein.

1.02 – QUALITY ASSURANCE

- A. The portable heavy duty axle scales and weight indicator specified herein, is manufactured by Walz Scale Company. The specified units provide a standard of quality, specification dimensions and performance required for this project.
- B. Prior to shipment the system shall be inspected for quality of construction and be pre-calibrated for immediate use.
- C. The complete system shall be fully factory tested prior to shipment. Testing shall include: setting and verification of all instrumentation and sensors per the design requirements of the application; verification of system design transport rates, and; complete functional simulation of operation.
- D. The heavy duty portable axle scales shall be capable of effectively weighing the dewatered sludge truck axle weights as the truck departs the site for offsite disposal.
- E. Any proposed substitutions from manufacturers other than that specified will require full compliance with the requirements of Specification Section 01630 – Product Substitution Procedures.
- F. After the bid opening, consideration will only be given to other alternate manufacturers/suppliers who can demonstrate to the Engineer that their equipment complies with these Specifications and has had successful and documented experience with the size, quality, performance and reliability to that specified. Consideration for any other alternate manufacturer shall include the proposed equipment's application and ability to provide equal service and performance as intended by these specifications.
- G. All systems shall be designed, furnished, and installed to achieve the conditions of service specified herein.
- H. The Supplier shall have at least ten (10) years of experience in the design and manufacturing of portable axle scales.

- I. The brand name products specified were chosen based on performance, compatibility and constitute a standard for quality and performance for the specific purpose for which the portable axle scales are intended. Products other than that specified will be considered for use under the provisions set forth as follows:
 1. The named products constitute the "Item No. 2 Allowance" portable axle scale item listed on the bid Proposal form of the Contract.
 2. If alternate equipment is proposed, the Supplier shall prepare and submit to the Engineer three (3) copies of the "Evaluation Documentation" as listed below. The information shall be in a form that is neat, clear, precise, legible, and computer drafted and prepared so as to allow the Engineer to evaluate the proposed equipment. The "Evaluation Documentation" shall be hand delivered directly to the Engineer at least ten (10) calendar days prior to the date set for the bid opening. The pre-bid "Evaluation Documentation" shall consist of the following:
 - a. Descriptive technical information for the proposed product(s) highlighted to show the differences between the proposed unit(s) and the specified unit(s). Descriptive technical information shall include model numbers, type, sizes, weights, performance data, and materials of construction.
 - b. List of facilities showing facility name, active contact name and telephone number, years in service, design conditions and parameters, and design engineer's name and current telephone number of the company.
 - c. The Supplier shall state if he/she complies with each and all Sections of the Specifications. Any variance from the specified equipment shall be listed and a description of each variance must be in letter form. Facsimile transmissions will not be accepted.
- J. Failure to submit the above listed information ten (10) calendar days prior to the date set for the bid opening shall be cause for non-evaluation and the product will not be considered for the project.
- K. The Engineer will issue an addendum of approved products prior to the date set for the bid opening.
- L. The acceptance of products prior to the bid date does not relieve the Contractor of his/her responsibility regarding the performance or ability to meet the requirements of the Contract Documents.

- M. After contract execution submit shop drawings in compliance with the requirements contained in Section 01330 - Submittals. Refer to product substitution procedures in the Contract General Conditions, for costs associated with redesigns and/or modifications caused by the use of a substitute product offered by the Contractor.
- N. All costs, including other prime contractor, engineering, and legal costs, associated with accommodating alternate equipment shall be borne by the Contractor.

1.03 – DESIGN REQUIREMENTS

- A. The portable heavy duty axle scales with weigh indicator system shall be designed to meet the following minimum performance and design requirements. The standards for scale selection shall be based on the operational experience of the manufacturer with portable axle scales.

Specification	Description
Weighbridge	7.9 ft x 36 in. W x 6 in. H
With ramp	3 ft x 36 in. W x 6 in. H
Platform Capacity	40,000 lbs
Axle Capacity	80,000 lbs (tandem platforms)
Graduations	60,000 lbs x 50 lb
Platform Construction	I-beam construction with diamond plate top plate

1.04 - WARRANTY

- A. Provide a Warranty Certificate from the manufacturer typed on company letterhead and signed by an authorized officer of the manufacturer. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located. The Warranty Certificate shall be submitted, verbatim and without exception, as follows:

“(Name of Manufacturer) guarantees all components of the system to be free from defects in design, materials and workmanship for a period of one (1) year commencing on the date the system was permanently placed on-line, and the mechanical equipment functions without flaw.

During the guarantee period, if any part or equipment component is defective or fails to perform when operating at design conditions and if the equipment has been installed and is being operated and maintained in accordance with the written instructions we provided, then we shall repair or exchange such defective part (s).

The warranty shall be a limited warranty against defects in materials and workmanship. The warranty shall exclude failure due to over pressure or freezing. Non-manufacturer warranty will be unacceptable.

Agreed upon this _____ day
(Date)

by _____ of

(Name of Authorized Agent)

(Name of Manufacturer)

who, by signing this document, affirms that he/she is legally authorized to submit this warranty on behalf of the Supplier.

AUTHORIZED SIGNATURE

DATE

NOTARY

DATE

1.05 - SUBMITTALS

- A. Submit the following in accordance with the requirements in Section 013300:
 - 1. Technical specifications for the scales and weigh indicator.
 - 2. Dimensional data for scale installation.
 - 3. Detailed specifications and data covering materials used, parts, and other accessories forming a part of the system.
 - 4. Field wiring diagram for each electrically operated piece of equipment.
 - 5. Storage, handling, and installation instructions.
- B. List of spare parts and miscellaneous equipment to be provided under this Section.
- C. Manufacturer Start-up Report (MSR) in accordance with paragraph 3.01 herein.
- D. Operations and Maintenance Manual prepared in accordance with the requirements contained in Section 01730 - Operations and Maintenance Data.

1.06 – DELIVERY STORAGE AND HANDLING

- A. The unit(s) shall be stored and handled in accordance with the written instructions supplied by the Manufacturer.

PART 2 - PRODUCTS**2.01 - MANUFACTURERS**

- A. The heavy duty portable axle scale and weigh terminal shall be Model AXHD-7 by Walz Scale Co., or approved equal.
 - 1. Any proposed alternate must be proven to provide at least an equal level of performance, reliability, versatility and quality to the system specified. If, after installation, it is shown that the alternate system does not provide an equal level of performance, reliability, versatility and quality to that specified, the contractor shall replace the system with the specified system at their sole cost.

2.02 – MATERIALS

- A. Unless otherwise specified or permitted, the materials used in the fabrication of the equipment under this section shall conform to the following:
 - 1. Steel deck
 - 2. Load cells

2.03 – PORTABLE AXLE SCALE WITH WEIGH INDICATOR

- A. The portable axle scale equipment shall include, but not be limited to the following:
 - 1. Two (2) platforms
 - 2. Two (2) ramps for each platform; total of four (4) ramps
 - 3. Load cells
- B. The weigh indicator shall be model AXWT-6 Static by Walz Scale Co., and include but not be limited to the following:

PART 3 - EXECTION**3.01 - GENERAL**

- A. All components of the system shall be furnished to the Owner in accordance with the written and /or verbal instructions provided by the manufacturer.

- B. All components shall be fully tested and verified for service by the manufacturer. The manufacturer shall provide a MSR as specified in Section 01650 - Starting of Systems. An amount equal to 0.50 % of the scheduled value for the work of this Section shall be retained until the report has been furnished.

3.02 - INSTALLATION

- A. The portable scale equipment shall be installed in accordance with the supplier's installation instructions, and in compliance with all OSHA, local, state, and federal codes and regulations. Owner shall identify location for portable truck scales to Contractor prior to delivery and placement.

3.03 - FIELD QUALITY CONTROL

- A. Supplier shall provide the services of a qualified field service technician to inspect and certify the installation, start-up the equipment, trouble shoot any problems that may arise and providing complete and thorough training of operator personnel. The service technician shall be an employee of the polymer system manufacturer. Start-up and training by a manufacturer's representative shall not be allowed.
- B. Field services shall consist of no less than one (1) day, exclusive of travel time.
- C. The supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying that the equipment has been properly installed and has been operated under full load conditions and that it operates satisfactorily.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 – SECTION INCLUDES**

- A. Furnish all labor, materials, equipment and services to furnish and install five (5) shaftless screw conveyors with motors and controls, including all conveyor transitional fittings and open throat connections and appurtenances in accordance with these specifications, including all incidental work necessary to make it complete, satisfactory and ready for operation as it is specified herein and shown on the Contract Drawings.

1.02 – QUALITY ASSURANCE

- A. The specified units provide a standard of quality, specification dimensions and performance required for this project.
- B. Prior to shipment the system shall be inspected for quality of construction verifying all fasteners and fittings are tight, all wires are secure and connections whisker-free.
- C. The complete system shall be fully factory tested prior to shipment. Testing shall include: setting and verification of all instrumentation and sensors per the design requirements of the application; verification of system design transport rates, and; complete functional simulation of operation.
- D. The shaftless screw conveyor system shall be capable of effectively transporting the dewatered sludge at the rate and density specified herein.
- E. Any proposed substitutions from manufacturers other than that specified will require full compliance with the requirements of Specification Section 01630 – Product Substitution Procedures.
- F. After the bid opening, consideration will only be given to other alternate manufacturers/suppliers who can demonstrate to the Engineer that their equipment complies with these Specifications and has had successful and documented experience with the size, quality, performance and reliability to that specified. Consideration for any other alternate manufacturer shall include the proposed equipment's application and ability to provide equal service and performance as intended by these specifications. All modifications to structures, piping, valves, equipment layout, electrical connections, wiring (runs, wire sizes, service circuit sizes) and coordination with ancillary or interconnected systems or equipment necessitated by a substitution shall be reviewed and approved by the Engineer at the cost of the Contractor.
- G. All systems shall be designed, furnished, and installed to achieve the conditions of service specified herein.

- H. The Supplier shall have at least ten (10) years of experience in the design and manufacturing of shaftless screw conveyors.
- I. The cost for any construction modifications shall be included in the cost as bid and no additional cost shall be paid by the Owner for acceptance of alternate equipment and any required installation modifications.
- J. The brand name products specified were chosen based on past performance, compatibility and constitute a standard for quality and performance for the specific purpose for which the top opening inline sludge macerators are intended. Products other than that specified will be considered for use under the provisions set forth as follows:
 - 1. The named products constitute the "Base Bid" shaftless screw conveyors. All bidders are advised to provide "Base Bid" pricing since the magnitude of the expenses involved with engineering redesign or modifications may be difficult to determine during the bidding period. Refer to the Contract General Conditions regarding product substitutions.
 - 2. If alternate equipment is proposed, the Supplier shall prepare and submit to the Engineer three (3) copies of the "Evaluation Documentation" as listed below. The information shall be in a form that is neat, clear, precise, legible, and computer drafted and prepared so as to allow the Engineer to evaluate the proposed equipment. The "Evaluation Documentation" shall be hand delivered directly to the Engineer at least ten (10) calendar days prior to the date set for the bid opening. The pre-bid "Evaluation Documentation" shall consist of the following:
 - a. Shaftless screw conveyors dimensional data and pump performance curve.
 - b. Descriptive technical information for the proposed product(s) highlighted to show the differences between the proposed unit(s) and the specified unit(s). Descriptive technical information shall include model numbers, type, sizes, weights, performance data, and materials of construction.
 - c. List of facilities showing facility name, active contact name and telephone number, years in service, design conditions and parameters, and design engineer's name and current telephone number of the company.
 - d. The Supplier shall state if he/she complies with each and all Sections of the Specifications. Any variance from the specified equipment shall be listed and a description of each variance must be in letter form. Facsimile transmissions will not be accepted.

- K. Failure to submit the above listed information ten (10) calendar days prior to the date set for the bid opening shall be cause for non-evaluation and the product will not be considered for the project.
- L. The Engineer will issue an addendum of approved products prior to the date set for the bid opening.
- M. The acceptance of products prior to the bid date does not relieve the Contractor of his/her responsibility regarding the performance or ability to meet the requirements of the Contract Documents.
- N. After contract execution submit shop drawings in compliance with the requirements contained in Section 01330 - Submittals. The Contractor shall remain fully responsible for all design revisions, including but not limited to, the following: structural, mechanical, electrical, and instrumentation because of the utilization of substitute equipment. Refer to product substitution procedures in the Contract General Conditions, for costs associated with redesigns and/or modifications caused by the use of a substitute product offered by the Contractor.
- O. All costs, including other prime contractor, engineering, and legal costs, associated with accommodating alternate equipment shall be borne by the Contractor.

1.03 – DESIGN REQUIREMENTS

- A. The Contract Drawings have been prepared based on the installation of shaftless screw conveyors manufactured by JDV Equipment Corp. If other listed manufacturer's or an equal manufacturer's equipment is submitted which requires an arrangement differing from that shown on the plans or if the details of design and construction are different from those specified, the Contractor shall prepare and submit for review the necessary design calculations along with the necessary structural, electrical, instrumentation, mechanical and architectural drawing revisions. All revised design drawings shall be prepared by a NYS licensed Professional Engineer. The manufacturer shall prepare and submit for review along with the required shop drawings, a specific listing of the material, design and construction differences between the proposed equipment and the specified equipment. All work associated with accommodating the submitted equipment shall be at no additional cost to the Owner. All re-design costs associated with evaluating alternate equipment that does not conform to the requirements specified herein shall be reimbursed to the Engineer by the Contractor.
- B. The shaftless screw conveyor system shall be designed to meet the following minimum performance and design requirements. The standards for conveyor selection shall be based on

the operational experience of the manufacturer with shaftless screw conveyors, and not standards developed for shafted screw conveyors.

	CONVEYOR (#1 / #2 / #3)	CONVEYOR (#4)	CONVEYOR (#5)
Min. Required Solids Transport Rate (cubic ft per hour)	80	80	80
Material	Dewatered Sludge Cake	Dewatered Sludge Cake	Dewatered Sludge Cake
Material Density (lbs per cubic ft)	60	60	60
Length (#1/#2/#3, #4, #5)	15'-4" / 16'-3" / 20'-8"	17'-7"	43'
Orientation	Horizontal	Vertical	Horizontal
Max. Screw Speed (RPM)	20	20	20
Max. Trough Fill	50%	50%	50%
Min. Flight O.D.	11.2"	11.2"	11.2"
Min. Spiral Weight (lb per ft)	27	27	27
Min. Trough Width	12.5"	12.5"	12.5"
Min. HP	3	5	5
Drive Location	inlet	inlet	inlet
Motor type	TEFC	TEFC	TEFC
Reversing screw	none	none	none

1.04 - WARRANTY

- A. Provide a Warranty Certificate from the manufacturer typed on company letterhead and signed by an authorized officer of the manufacturer. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located. The Warranty Certificate shall be submitted, verbatim and without exception, as follows:

“(Name of Manufacturer) guarantees all components of the system to be free from defects in design, materials and workmanship for a period of one (1) year commencing on the date the system was permanently placed on-line, and the mechanical equipment functions without flaw.

During the guarantee period, if any part or equipment component is defective or fails to perform when operating at design conditions and if the equipment has been installed and is being operated and maintained in accordance with the written instructions we provided, then we shall repair or exchange such defective part (s).

The warranty shall be a limited warranty against defects in materials and workmanship. The warranty shall exclude failure due to over pressure or freezing. Non-manufacturer warranty will be unacceptable.

Agreed upon this _____ day
(Date)

by _____ of
(Name of Authorized Agent)

(Name of Manufacturer)

who, by signing this document, affirms that he/she is legally authorized to submit this warranty on behalf of the Supplier.

AUTHORIZED SIGNATURE

DATE

NOTARY

DATE

1.05 - SUBMITTALS

- A. Submit the following in accordance with the requirements in Section 013300:
1. Technical specifications for the conveyor, motor, and accessories.
 2. Dimensional data for conveyor installation.
 3. Detailed specifications and data covering materials used, parts, and other accessories forming a part of the system.
 4. Field wiring diagram for each electrically operated piece of equipment.
 5. Electrical data sheet for each size pump motor. Provide field-wiring diagram for each size pump motor.
 6. Storage, handling, and installation instructions.
- B. List of spare parts and miscellaneous equipment to be provided under this Section.
- C. Manufacturer Start-up Report (MSR) in accordance with paragraph 3.01 herein.
- D. Operations and Maintenance Manual prepared in accordance with the requirements contained in Section 01730 - Operations and Maintenance Data.

1.06 – DELIVERY STORAGE AND HANDLING

- A. The unit(s) shall be stored and handled in accordance with the written instructions supplied by the Manufacturer.

PART 2 - PRODUCTS**2.01 - MANUFACTURERS**

- A. The shaftless screw conveyor equipment and controls shall be:
- B. JDV Equipment Corporation,
- C. Custom Conveyor Corporation,
- D. Or approved equal.
- E. Any proposed alternate must be proven to provide at least an equal level of performance, reliability, versatility and quality to the system specified. If, after installation, it is shown that the alternate system does not provide an equal level of performance, reliability, versatility and quality to that specified, the contractor shall replace the system with the specified system at their sole cost.

2.02 – MATERIALS

- A. Unless otherwise specified or permitted, the materials used in the fabrication of the equipment under this section shall conform to the following:
 - 1. Chutes 1/8" AISI 304, ASTM A167, 18-8
 - 2. Troughs, End Plates, Covers AISI 304, ASTM A167, 18-8
 - 3. Supports 1/4" AISI 304, ASTM A167, 18-8
 - 4. Hoppers AISI 304, ASTM A167, 18-8
 - 5. Spiral Flighting Cold formed, High Strength Micro Alloy CarbonSteel with a minimum hardness of 220 Brinell
 - 6. Wear Liner Ultrahigh molecular polyethelene (4.02.04A)
 - 7. Bolts, Nuts, and Washers for Conveyor Supports, Trough, Lids, and Drive AISI 316, ASTM A167, 18-8

2.03 – SHAFTLESS SCREW CONVEYORS

- A. The shaftless screw conveyor equipment shall include, but not be limited to the following:

1. Spiral fighting
 2. Troughs and Liners
 3. Chutes
 4. Covers
 5. End Shaft
 6. End Seals
 7. Motor Reducer
 8. Mounting and Support Structure
 9. Electrical Controls
 10. Safety Accessories
- B. Standard screw conveyors with shafts and intermediate bearings will not be acceptable due to their inherent ability to become clogged from the stringy, sticky, gelatinous, thixotropic characteristics of the conveyed material. Conveyor rotational speeds shall not be greater than herein specified.
- C. Shaftless Screw Conveyor Construction
1. Sprial Fighting
 - a. Spiral fighting for the shaftless screw conveyors shall be designed to convey material without a center shaft. The minimum overall spiral weight and surface pressure shall be as specified herein. The conveyor will include an inner flight to increase axial strength and capacity of the conveyor. The minimum spiral weight shall be specified herein.
 - b. Spiral flights shall be cold-formed high strength micro alloy steel with a minimum hardness of 220 Brinell. The spiral flights shall be designed with the stability to prevent distortion and jumping in the trough. The torsional rating of the auger fighting shall be reached at 30% of the Fy value in the extreme fiber of the flight material. Supplier shall demonstrate that, at 250% of the motor nameplate horsepower, the drive unit cannot produce more torque than the torsional rating of the fighting, and that the "spring effect" of the spiral shall not exceed + 0.8 mm per meter of length at maximum load conditions.

- c. Spiral flight material, fabrication technique, strength, hardness, and overall quality are critical to the proper operation of the conveying system as herein designed. Spiral flights that do not meet the characteristics or herein specified are specifically not acceptable. Supplier shall provide certified written documentation that the spiral flights conform to the following:
 - 1) Material: Micro Alloy Steel
 - 2) Hardness: 220 Brinell Minimum
 - 3) Concentricity: 2.0 mm +/-
- d. Supplier shall maintain a certified factory quality control program which shall include certification of spiral fighting as described herein
- e. The spiral fighting shall be formed in sections from one continuous flat bar and shall be concentric to within 2mm +/- . Sectional fighting formed from plate shall not be permitted.
- f. Spiral fighting shall have full penetration welds at all splice connections. The flights shall be aligned to assure true alignment when assembled in the field and shall be made in accordance with the supplier's requirements. The spiral flights shall be coupled to the end shaft by a flanged, bolted connection.
- g. The connection of the spiral to the drive system shall be through a flanged connection plate that is welded to the spiral forming a smooth and continuous transformation from the flange plate to the spiral. The drive shaft shall have a mating flange and shall be bolted to the spiral connection plate.

2. Horizontal and Inclined Troughs

- a. Troughs shall be similar to the dimensional standards of CEMA 300 and enclosure classification IIE. Each conveyor trough shall be U-shaped, fabricated from a minimum 1/8 inch stainless steel plate.
- b. Stiffeners shall be bolted across the top of the trough and fastened to both sides of the trough to maintain trough shape and act as a face seal for the covers; apply a continuous gasket, one half inch width, to the entire top face of the trough top flange and stiffeners.

- c. Each trough shall be equipped with filling and/or discharge openings as required by the contract drawings. If required, each filling and discharge opening shall be flanged suitable for interconnection to other devices. Any interconnecting devices such as chutes and hoppers shall be fabricated from the same material as the troughs.
- d. A flanged covered drain outlet shall be provided with each conveyor to facilitate cleaning.
- e. The portion of each trough that is not covered by the filling chute shall be covered by a bolted cover of a material identical to the trough. The covers shall be manufactured in maximum four foot length section to allow for access to the conveyors. To prevent unsafe access to the conveyors, quick opening covers will not be allowed.

3. Vertical Troughs

- a. Vertical trough conveyors shall be provided where indicated on the contract drawings. Vertical troughs shall be of segmented circular construction made as two halves to allow ready access to the conveyor internal for inspection, service, and cleaning. The trough shall be specifically constructed to prevent "wobble" and/or binding of the spiral during normal operation. Construction must allow free movement of the spiral, to prevent jamming or stalling. Maximum rotational speed shall not exceed 60 RPM and designed to prevent excessive vibration and dynamic imbalance. The seal shall rely on pressure to continually relieve air or grease toward the inside of the conveyor to prevent debris from wearing or scoring the drive shaft and seal. Two drains shall be supplied, one for draining the other for cleaning. In addition, a manually operated flushing connection shall be supplied in the drain area to breakup and clean accumulated debris.

4. Wear Liner (Anti-Wear UHMW)

- a. The wear liner for each conveyor shall be fabricated of ultra high molecular weight polyethylene sintered with an anti-wear filler to reduce wear and synthetic lubricant to reduce friction. The liner shall be provided with a visual (two different color) indicator of excessive wear. The wear liner shall be furnished in maximum four foot sections, 3/8" minimum thickness, to provide ease of replacement. The liner shall be held in place with clips; no fasteners will be allowed.

5. Inlet and Discharge Chutes

- a. Inlet and discharge chutes shall be provided by the conveyor supplier as shown on the drawings. All chutes shall be fabricated from the same material as the conveyor trough.

6. Conveyor Supports

- a. Each conveyor shall be furnished complete with supports suitable for mounting as shown on the contract drawings and as required by the supplier's design. The supports shall be shop fabricated from structural steel shapes and plates, and shall be assembled and fitted to the conveyor prior to its delivery to the jobsite. Supports and conveyor segments shall be match marked and shipped to the jobsite for assembly by the contractor. At a minimum, each conveyor shall be provided with supports at the inlet and discharge end, with intermediate supports as required.
- b. Supports shall be fabricated of AISI 304 stainless steel or equal.
- c. All shop welding shall conform to the latest standards of the American Welding Society (AWS). The supports shall be designed to avoid interference with other equipment or equipment supports.

7. Structural Design

- a. All structural supporting members shall be designed such that the ratio of the unbraced length to least radius of gyration (slenderness ratio) shall not exceed 120 for any compression member and shall not exceed 240 for any tension member (of angles about Z-Z axis). In addition, all structural members and connections shall be designed so that the unit stresses will not exceed the American Institute of Steel Construction allowable stresses by more than 1/3 when subject to loading of twice the maximum design operating torque of the spiral conveyor drive motors.

8. Drive Units

- a. Each spiral conveyor shall be driven by a constant-speed integral gear reducer/motor drive unit mounted to an adapter flange mounted to the end plate of the conveyor. The adapter flange shall allow the leakage of any material from the conveyor trough to atmosphere rather than into the gear reducer/ motor drive unit. Direct coupling of the gear reducer/motor drive unit to the end flange of the conveyor will not be acceptable.

- b. The drive unit shall be rigidly supported so there is no visible "wobble" movement under any operating condition. In the event of a prolonged power failure or emergency system shutdown the drive system shall be designed, at a minimum, to start the conveyor from a dead stop with the trough filled throughout its entire cross sectional area and length with partially dried and hardened dewatered material.
- c. Each motor shall be 460 volt, 60 Hz, 3 phase conforming to the General Equipment specifications, except as modified herein. Each motor shall be high efficiency, 40C ambient rated, 1.15 service factor and shall have Class F insulation. Motor shall have a TEFC enclosure with Design B speed/torque characteristics.

9. Gear Reducers

- a. All gears shall be AGMA Class II, single or double reduction, helical gear units with high capacity roller bearings. Bearings shall be designed for the thrust loads from the fully loaded startup condition and shall have a AFBMA B10 life of 30,000 hours. The reducer will be the standard air cooled unit with no auxiliary cooling. The gear reducer shall be sized with a torque service factor of 1.5 times the absorbed power or 1.1 times the motor nameplate, at the driven shaft speed, whichever is greater.

10. An adjustable greased gland packing ring consisting of two Teflon coated packing rings shall seal the drive shaft at its penetration through the end plate.

11. Motion Failure Alarm Unit

- a. Each conveyor drive unit shall be equipped with a motion failure alarm unit. The location and mounting details shall be as recommended by the conveyor manufacturer. Motion sensors shall be the non-contacting type using a probe with a pre-amplifier and main electronic assembly. The main electronic unit shall operate on 120 volt, single phase, 60 Hz power supply, and shall be housed in a NEMA 4X enclosure. A 0 to 60 second time delay shall be provided for startup of the conveyor.

12. Emergency Shutdown

- a. Each conveyor shall be furnished with an emergency trip cord and safety switch. The cord shall run the full length of each conveyor. The trip switch shall immediately stop all conveyors when the switch is actuated.

- D. Power supply: Power supply to the equipment will be 480 volts, 60 Hz, 3 phase. Power supply for controls shall be 120 volts, 60 Hz, single phase.
- E. Electrical Equipment: All electrical equipment shall conform to applicable standard of the National Electrical Manufacturers Association (NEMA) and the National Electrical Code (NEC). Both power and control equipment shall be insulated for not less than 600 volts even though operating voltages may be lower.
- F. Fabrication: All welds shall be continuous unless otherwise specified. Facing surfaces of bolted joints shall be shop primed. Facing surfaces of field welded components shall be beveled and match marked.
- G. All motors shall be totally enclosed, fan cooled (TEFC). Control panels shall be NEMA 4X, stainless steel.
- H. Edge Grinding: Sharp corners of all cut and sheared edges shall be made smooth by a power grinder.
- I. Fasteners: All bolts, nuts, washers, and other fasteners shall be AISI 316 stainless steel.
- J. Surface Preparation: All iron and mild steel surfaces to be painted shall be dry abrasive grit blasted to "near white metal" in accordance with SSPC-SP6 or SSPC-SP10, and in accordance Section 099100. Grit blasted surfaces shall be painted within 24 hours to prevent rusting and surface discoloration.
- K. Painting: After surface preparation, metal surfaces except for the spiral fighting shall receive a minimum of one coat of Tnemec "66-1211 Epoxoline primer" or equal, and one coat of "46H-413 Hi-Build Tnemec-tar" coal tar epoxy or equal, to provide a total minimum dry film thickness of 15 mils prior to shipment to jobsite. Stainless steel components shall be furnished unpainted.

PART 3 - EXECTION

3.01 - GENERAL

- A. All components of the system shall be installed in accordance with the written and /or verbal instructions provided by the manufacturer.
- B. All components shall be fully tested and verified for service by the manufacturer. The manufacturer shall provide a MSR as specified in Section 01650 - Starting of Systems. An amount equal to 0.50 % of the scheduled value for the work of this Section shall be retained until the report has been furnished.

3.02 - INSTALLATION

- A. Shaftless screw conveyor equipment shall be installed in accordance with the supplier's installation instructions, and in compliance with all OSHA, local, state, and federal codes and regulations.

3.03 - FIELD QUALITY CONTROL

- A. Supplier shall provide the services of a qualified field service technician to inspect and certify the installation, start-up the equipment, trouble shoot any problems that may arise and providing complete and thorough training of operator personnel. The service technician shall be an employee of the polymer system manufacturer. Start-up and training by a manufacturer's representative shall not be allowed.
- B. Field services shall consist of no less than three (3) days, exclusive of travel time.
- C. The supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchorage, and has been operated under full load conditions and that it operates satisfactorily.

3.04 – FACTORY INSPECTION

- A. Conveyors shall be inspected and operated in the shop with the actual drive unit for this project in its entire length. Conveyor longer than the required shipping lengths will have the screws tack welded together and tested in their entire length. Conveyors should be operated for a minimum of 15 minutes and observed for alignment and abnormal operation. Conveyors shall be corrected as necessary. Prior to shipment the tack welds will be broken apart and conveyors suitably prepared for shipment. A video of the test should be supplied on disk to the contractor to be forwarded on to the engineer for record purposes. Video must be received to get paid.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - DESCRIPTION**

- A. This Section covers the requirements for supplying all labor, materials, equipment and services necessary to furnish and install one (1) portable hoist (jib crane).
- B. Related work specified elsewhere includes:
 - 1. Section 01330 - Submittals
 - 2. Section 01650 - Product Delivery, Storage and Handling
 - 3. Section 01750 - Starting and Adjusting
 - 4. Section 09910 - Painting

1.02 - QUALITY ASSURANCE

- A. The jib cranes shall be furnished by one single Supplier (Manufacturer). This requires the Supplier to be responsible for the development, design, fabrication, and delivery of the jib cranes.
- B. Consideration will only be given to Suppliers who can demonstrate that their system complies with these Specifications having had successful and documented experience of the size, quality, performance and reliability to that specified, and who can successfully demonstrate this criteria to the Engineer.
- C. The jib crane shall be designed, furnished and installed to achieve the conditions of service specified herein. The jib crane shall be designed for outdoor operation in a seashore type environment.
- D. The Supplier shall have at least ten (10) years of experience in the design and manufacturing of the specified equipment.
- E. Manufacturers of acceptable jib cranes shall be:
 - 1. THERN
 - 2. Ace Industries, Inc.
 - 3. Or equal.

1.03 - WARRANTY

- A. The Supplier shall provide a Warranty Certificate typed on company letterhead and signed by an authorized officer of the Supplier. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located. The Warranty Certificate shall be submitted, verbatim and without exception, as follows:

“(Name of Manufacturer) guarantees all components of the system to be free from defects in design, materials and workmanship for a period of one (1) year commencing on the date the system was permanently placed on-line, and the mechanical equipment functions without flaw.

During the guarantee period, if any part or equipment component is defective or fails to perform when operating at design conditions and if the equipment has been installed and is being operated and maintained in accordance with the written instructions we provided, then we shall repair or exchange such defective part (s).

The warranty shall be a limited warranty against defects in materials and workmanship. The warranty shall exclude failure due to over pressure or freezing. Non-manufacturer warranty will be unacceptable.

Agreed upon this _____ day
(Date)

by _____ of
(Name of Authorized Agent)

(Name of Manufacturer)

who, by signing this document, affirms that he/she is legally authorized to submit this warranty on behalf of the Supplier.

AUTHORIZED SIGNATURE DATE

NOTARY DATE

1.04 - DELIVERY, STORAGE AND HANDLING

- A. The system supplier and the Contractor shall comply with the requirements contained in Section 01650 - Product Delivery, Storage and Handling.

1.05 - PERFORMANCE AND DESIGN REQUIREMENTS

- A. The hoist parts shall be interchangeable and manufactured to close accuracy. The hoist shall be of balanced design, free from tendency to tip.
- B. The jib crane requirements shall be as follows:

	<u>1 Ton Capacity Unit:</u>
Quantity	1

1.07 - SUBMITTALS

- A. Comply with the requirements contained in Section 01330 - Submittals. The following documents shall be submitted:
5. Design calculations: consisting of a design analysis of the specified jib crane and monorail, conforming to the specified design loading.
 6. Plan and section of jib crane, to scale, showing all components.
 7. Storage, handling and installation instructions.
 8. List of spare parts and miscellaneous equipment for the trolley and hoist to be provided under this Section
 9. Warranty Certificate.
- B. Operations and Maintenance Manual prepared in accordance with the requirements contained in Section 01782 - Operating and Maintenance Data.

PART 2 - PRODUCTS**2.01 - JIB CRANE**

- A. Furnish a 316 stainless steel portable crane assembly by THERN Series 5124, or equal.
- B. Pumps shall be furnished with one (1) stainless steel davit crane and two (2) stainless steel platform sockets. Each crane shall: be rated for a safe load of the specified pump, provide a lift of 10 feet greater than the applicable tank total depth, have 36" minimum reach and 84" maximum reach. Hoist cable shall consist of 316 stainless steel cable, stainless steel lifting hook, and 316 stainless steel snap hook. A secondary stainless steel lifting chain shall also be provided and installed for each pump in the event of hoist cable failure.
- C. Each crane to be provided with a crane winch. Winch shall be stainless steel spur gear hand winch type.
- D. All hoists shall be furnished with a stainless steel platform socket & wire rope keeper for each location shown on Drawings.

PART 3 - EXECUTION**3.01 - GENERAL**

- A. The jib crane shall be installed true and plumb, in accordance with the written instructions provided by the supplier.
- B. All components of each system shall be installed in accordance with the manufacturer's written instructions.
- C. Coordinate the location of the jib crane conductor collector assembly junction box such that the location is acceptable and approved by the Engineer. The Contractor will make final terminal connections.

3.02 - INSTALLATION

- A. The Contractor shall furnish and set all anchor bolts as required by the jib crane manufacturer.
- B. The Contractor shall install all equipment of this Section unless noted on the Drawings. All equipment shall be installed in accordance with the manufacturer's written instructions.
- C. Lubricate as required, and check operation of all movable components.

- D. Clean all grease, grime and dirt from exposed surfaces. Touch up all painted surfaces where scratched or damaged.

END OF SECTION

++ NO TEXT ON THIS PAGE ++

PART 1 - GENERAL**1.01 – DESCRIPTION OF WORK**

- A. This section describes the general requirements for all mechanical items and systems required by the Contract Documents.
- B. Comply with all Contract Requirements, General Conditions, Supplementary Conditions and Division 1 Sections applying to or affecting the Work of Division 15.
- C. Unless specifically dimensioned, the Work shown on the Drawings is in diagrammatic form only to show general arrangement.
- D. Include, in the Work, all accessories and appurtenances, necessary and integral, for the intended operation of any system, component or device, as such systems, components and devices are specified.
- E. Do not install pipe or conduit through ductwork.
- F. If the pipe or duct size shown on the Drawings does not match the connection size of the equipment that it is connected to, provide the necessary transition piece at the piece of equipment.
- G. Do not use or allow to be used asbestos or asbestos-containing materials on this project. Be rigorous in assuring that all materials, equipment, systems and components thereof do not contain asbestos. Any deviations from this requirement shall be remedied at the Contractor's expense without regard to prior submittal approvals.

1.02 - RELATED DOCUMENTS

- A. The General Conditions and General Requirements Division 1 apply to the Work of this Section.

1.03 - REFERENCE STANDARDS

- A. Compliance with the following codes and standards shall be required:
 - 1. Codes, Rules and Regulations of the State of New York
 - 2. USAS USA Standards Institute (Formerly ASA)
 - 3. AMCA Air Moving and Conditioning Association
 - 4. ADC Air Diffusion Council

5.	NEMA	National Electrical Manufacturers Association
6.	FM	Factory Mutual
7.	NFPA	National Fire Protection Association
8.	ASTM	American Society for Testing Materials
9.	UL	Underwriters Laboratories, Inc.
10.	NEC	National Electrical Code
11.	ASME	American Society of Mechanical Engineers
12.	ANSI	American National Standards Institute
13.	OSHA	Occupational Safety and Health Act
14.	BSA	Board of Standards and Appeals
15.	MEA	Materials and Equipment Acceptance
16.	DEC	New York State Department of Environmental Conservation - 6 NYCRR Part 613 Handling and Storage of Petroleum
17.	ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers.
18.	AWWA	American Water Works Association
19.	MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
20.	ARI	American Refrigeration Institute
21.	SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
22.	TEMA	Tubular Exchanger Manufacturers Association
23.	F.S. or FED	Spec. Federal Specification

- | | | |
|-----|---|---|
| 24. | ASA | Acoustical Society of America |
| 25. | NACE | National Association of Corrosion Engineers |
| 26. | ASSE | American Society of Sanitary Engineers |
| 27. | Building Code of New York State | |
| 28. | Fire Code of New York State | |
| 29. | Existing Building Code of New York State | |
| 30. | Fuel Gas Code of New York State | |
| 31. | Plumbing Code of New York State | |
| 32. | Energy Conservation Construction Code of New York State | |
| 33. | Mechanical Code of New York State | |
| 34. | New York State Sanitary Code | |
| 35. | New York State Industrial Code Rules | |
| 36. | IRI | Industrial Risk Insurers |
| 37. | AGA | American Gas Association |
| 38. | AABC | American Air Balance Council |
| 39. | NEBB | National Environmental Balancing Bureau |
| 40. | AWS | American Welding Society |

1.04 - DEFINITIONS

- A. "Provide" means furnish and install, complete the specified material, equipment or other items and perform all required labor to make a finished installation.
- B. "Furnish and install" has the same meaning as given above for "Provide."
- C. Refer to General Conditions for other definitions.

1.05 - ABBREVIATIONS

- A. Reference by abbreviation may be made in the Specifications and the Drawings in accordance with the following list:

HVAC	Heating, Ventilating and Air Conditioning
CM	Construction Manager
AC	Air Conditioning
H & V	Heating and Ventilating
AWG	American Wire Gauge
BWG	Birmingham Wire Gauge
USS	United States Standard
B & S	Brown & Sharpe
OS & Y	Outside Screw and Yoke
IBBM	Iron Body Brass Mounted
WSP	Working Steam Pressure
PSIG	Pounds per Square Inch Gauge
PRV	Pressure Reducing Valve
GPM	Gallons per Minute
MBH	Thousand BTU per hour
BTU	British Thermal Units
WG	Water Gage
LB	Pound (Also shown as: #)
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials

ABMA American Boiler Manufacturers Association

ASA American Standards Associates

MER Mechanical Equipment Room

See Drawings for additional abbreviations

1.06 - REVIEW OF CONTRACT DOCUMENTS AND SITE

- A. Give written notice with the submission of bid to the Architect/Engineer of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules or regulations of Authorities having jurisdiction, and any necessary items of work omitted. In the absence of such written notice it is mutually agreed that the Contractor has included the cost of all required items in his proposal for a complete project.
- B. Contractors shall acknowledge that they have examined the Plans, Specifications and Site, and that from his own investigations he has satisfied himself as to the nature and location of the Work; the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials; availability of labor, utilities, roads and uncertainties of weather; the composition and condition of the ground; the characters quality and quantity of subsurface materials to be encountered; the character of equipment and facilities needed preliminary to and during the execution of the Work; all federal, state, county, township and municipal laws, ordinances and regulations particularly those relating to employment of labor, rates of wages, and construction methods; and all other matters which can in any way affect the Work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with the available information concerning these conditions will not relieve him from the responsibility for successfully performing the Work.
- C. Owner assumes no responsibility for any understanding or representation made during or prior to the negotiation and execution of this Contract unless such understanding or representations are expressly stated in the Contract and the Contract expressly provides that the responsibility, therefore, is assumed by the Owner.

1.07 - MEASUREMENTS

- A. Base all measurements, both horizontal and vertical from established bench marks. Make all Work agree with these established lines and levels. Verify all measurements at site; and check the correctness of same as related to the Work.

1.08 - LABOR AND MATERIALS

- A. Provide all materials and apparatus required for the work of new and first-class quality. Furnish, deliver, arrange, erect, connect and finish all materials and equipment in every detail, so selected and arranged as to fit properly into the building spaces.
- B. Remove all materials delivered, or work erected, which does not comply with Drawings or Specifications, and replace with proper materials, or correct such work as directed, at no additional cost to the Owner.

1.09 - COVERING OF WORK

- A. Do not cover up or hide from view any duct, piping, fitting, or other work of any kind before it has been examined or approved by the Architect/Engineer and/or other authority having jurisdiction over the same. Remove and correct immediately any unacceptable or imperfect work or unauthorized or disapproved materials discovered immediately after being disapproved.

1.10 - PROTECTION

- A. Protect the Work and material of all trades from damage and replace all damaged material with new.
- B. Protect work and equipment until Work is finally inspected, tested, and accepted; protect Work against theft, injury or damage; and carefully store material and equipment received on site which is not immediately installed; close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.
- C. Preserve all public and private property, along and adjacent to the Work, and use every precaution necessary to prevent damage or injury thereto. Use suitable precautions to prevent damage to pipes, conduits and other underground structures or utilities, and carefully protect from disturbance or damage all property marks until an authorized agent has witnessed or otherwise referenced their location, and do not remove them until directed.

1.11 - CUTTING AND PATCHING

- A. Provide all cutting and rough patching required for Work. Perform all finish patching.
- B. Furnish and locate all sleeves and inserts required before the floors and walls are built, pay the cost of cutting and patching required for pipes where sleeves and inserts were not installed in time, or where incorrectly located. Provide all drilling required for the installation of hangers.
- C. Punch or drill all holes cut through concrete slabs or arches from the underside. Do not cut

structural members without the approval of the Architect/Engineer. Perform all cutting in a manner directed by the Architect/Engineer.

- D. Do not do any cutting that may impair strength of building construction. Do not drill any holes, except for small screws, in beams or other structural members without obtaining prior approval. All Work shall be done in a neat manner by mechanics skilled in their trades and as approved.

1.12 - SUBMITTALS

- A. Submit for review, shop drawings for all materials and equipment furnished and installed under this Contract. Submissions shall include but not be limited to:

1. Ductwork layout drawings, air devices and accessories
2. Breeching layout drawings
3. Piping and equipment layout drawings.
4. Piping materials, valves, hangers, supports and accessories
5. Automatic temperature control equipment, diagrams and control sequences
6. Equipment, fixtures, and appurtenances
7. Insulation
8. Rigging Plan - Include the name of the rigging company; a layout drawing that details the crane with its outriggers extended outward. Provide dimensions showing how rigging operations will affect the road and parking lines being used, the type of crane and its specification including crane arm height, lift capacity, crane reach.

- B. Reports

1. Compliance with listings and approvals for equipment and for fire ratings.
2. Acceptance certificates from inspecting agencies.
3. Complete printed and illustrated operating instructions in report format.
4. Manufacturer's performance tests of equipment.
5. Field pipe and duct testing reports.

6. Field operating test results for equipment.
 7. Performance report on the balancing of air and water systems.
 8. Performance reports for vibration isolation equipment.
 9. Manufacturer's reports on motorized equipment alignment and installation.
- C. Specific references to any article, device, product or material, fixture or item of equipment by name, make or catalog number shall be interpreted as establishing a basis of cost and a standard of quality. All devices shall be of the make and type listed by Special Agencies, such as the Underwriters' Laboratories, and where required, approved by the Fire Department.

1.13 – SPACE ALLOTMENTS AND SUBSTITUTIONS

- A. The space allotments and equipment layouts on the Drawings are based on the manufacturer's model indicated or scheduled as the "Basis of Design". Ensure that any equipment that is submitted other than the "Basis of Design" will fit in the space allotment and will provide the necessary maintenance clearances as recommended by the manufacturer. If maintenance clearances are not met, pay for any changes such that maintenance clearances will be met.
- B. Bear all costs associated with re-layout of the equipment, changes to piping/ductwork, and other changes as required if approved equipment other than the "Basis of Design" equipment is purchased. This shall also include any structural steel modifications and structural steel design changes. Submit, at no cost to the Owner, a steel design stamped by a structural engineer licensed in the state in which the Work is to be performed for structural modifications that must be made resulting from the use of equipment other than the "Basis of Design" or not specified.

1.14 – PAINTING

- A. Prime paint all bare supplemental steel, supports and hangers required for the installation of Division 15 Work in accordance with "Painting" Specification Section. Touch up welds of galvanized surfaces with galvanizing primer.

1.15 – MATERIAL SAFETY DATA SHEETS

- A. Submit material safety data sheets (MSDS) for all chemicals, hydraulic fluids, seal oils, lubricating oils, glycols and any other hazardous materials used in the performance of the Work, in accordance with the US Department of Labor, Occupational Safety and Health Administration (OSHA) hazard communication and right-to-know requirements stipulated in 29 CFR 1910.1200 (g).

1.16 – MOTORS AND STARTERS

- A. Provide new NEMA Standard electric motors, sized and designed to operate at full load and full speed continuously without causing noise, vibration, and temperature rise in excess of their rating. Provide motors with a service factor of at least 1.15.
- B. Equip motors for belt driven equipment with rails with adjusting screws for belt tension adjustment. Weather protect motors exposed to the weather.
- C. Install high efficiency electric motors on air handling units, relief fans, and exhaust fans.
- D. Provide high efficiency motors with efficiency and losses determined in accordance with the latest revisions of IEEE Standard 112. Provide polyphase squirrel-cage induction motors rated 1 through 500 horsepower tested by dynamometer method B. Determine the efficiency using segregated losses in which stray load loss is obtained from a linear regression analysis to reduce the effect of random errors in the test measurements. Provide motors that meet or exceed the nominal energy efficiency levels listed below:

HP	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	77.0
1.5	86.5	86.5	84.0
2	87.5	86.5	85.5
3	88.5	89.5	85.5
5	89.5	89.5	86.5
7.5	90.2	91.0	88.5
10	91.7	91.7	89.5
15	91.7	93.0	90.2
20	92.4	93.0	91.0
25	93.0	93.6	91.7
30	93.6	94.1	91.7
40	94.1	94.1	92.4
50	94.1	94.5	93.0
100	95.0	95.4	93.6

- E. Provide all motors for use with Variable Frequency Drives with “high efficiency inverter duty” insulation class “F” with class “B” temperature rise and that conform to or exceed NYSECC or the Federal EP Act of 1992 requirements for efficiency.
- F. Provide stainless steel nameplates, permanently attached to the motor, and having the following information as a minimum:
 - 1. Manufacturer
 - 2. Type

3. Model
 4. Horsepower
 5. Service Factor
 6. RPM
 7. Voltage/Phase/Frequency
 8. Enclosure Type
 9. Frame Size
 10. Full-Load Current
 11. UL Label (where applicable)
 12. Lead Connection Diagram
 13. Bearing Data
 14. Efficiency at Full Load.
- G. Provide motors whose sound power levels do not exceed that recommended in NEMA MG 1-12.49.
- H. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned and balanced.
- I. Protect motor starters on equipment located outdoors in weatherproof NEMA 4X enclosures.
- J. Provide weatherproof NEMA 4X disconnect switches when located outdoors.
- K. Motor Characteristics:
1. 120V/1/60 Hz: Capacitor start, open drip-proof type, ball bearing, rated 40 C. continuous rise.
 2. 460/3/60 Hz: NEMA B, normal starting torque, single speed, squirrel-cage type, open drip-proof, rated 40 C continuous rise, with ball bearings rated for B-10 life of 100,000 hours and fitted with grease fittings and relief ports. Provide motors with aluminum end brackets with steel inserts in bearing cavities.

1.17 - ACOUSTICAL PERFORMANCE OF EQUIPMENT AND SYSTEMS

- A. Install the Work in such a manner that noise levels from operation of motor driven equipment, whether airborne or structure-borne, and noise levels created by or within air handling equipment and air distribution and control media, do not to exceed sound pressure levels determined by the noise criteria curves published in the ASHRAE guide.
- B. Acoustical Tests
 - 1. Owner may direct the Contractor to conduct sound tests for those areas he deems too noisy.
 - 2. If NC level exceeds the requirements of the Contract Documents due to improper installation or operation of mechanical systems, make changes or repairs to bring noise levels to within required levels.
 - 3. Retest until specified criteria have been met.

1.18 - OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Instructions and Demonstration for Owner's Personnel
 - 1. Provide operating and maintenance instruction to the Owner when project is completed and all HVAC equipment serving the building is ready to be turned over to the Owner.
 - 2. Turn over the HVAC equipment to the Owner only after the final testing and proper balancing of HVAC systems.
 - 3. Instruct the Owner's personnel in the use, operation and maintenance of all equipment of each system.
 - 4. The above instruction requirements are in addition to that specified for specific equipment or systems. Conform to specified requirements if more stringent or longer instruction is specified for specific equipment or systems.

1.19 - CODES, RULES, PERMITS & FEES

- A. Give all necessary notices, obtain all permits and pay all government sales taxes, fees, and other costs, in connection with the Work. Unless indicated otherwise, fees for all utility connections, extensions, and tap fees for water, storm, sewer, gas, telephone, and electricity will be paid directly to utility companies and/or agencies by the Owner. File all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having

jurisdiction; obtain all required certificates of inspection for the work and deliver same to the Owner's Representative before request for acceptance and final payment for the Work.

- B. Conform to the requirements of the NFPA, NEC, FM, UL and any other local or State codes which may govern.

1.20 – RECORD DRAWINGS

- A. During the progress of the Work, make a record set of drawings of all changes by which the actual installation differs from the Drawings.
- B. Create all record drawings in AutoCAD version 2002 or later in .dwg format. Upon completion of the Work, submit to the Engineer for approval three complete sets of hard copies of the record drawings, of the same size as the Drawings for approval. Upon approval by the Engineer furnish the Owner a CD copy of the record drawings along with one hard copy for his records.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 - CLEANING AND ADJUSTING

- A. Cleaning
 - 1. Blow out, clean and flush each system of piping and equipment, to thoroughly clean the systems.
 - 2. Clean all materials and equipment; leave in condition ready to operate and ready to receive final finishes where required.
 - 3. Clean the operating equipment and systems to be dust free inside and out.
 - 4. Clean concealed and unoccupied areas such as plenums, pipe and duct spaces and equipment rooms to be free of rubbish and dust.
- B. Adjusting
 - 1. Adjust and align equipment interconnected with couplings or belts.
 - 2. Adjust valves of all types and operating equipment of all types to provide proper operation.

3. Clean all strainers after system cleaning and flushing and again before system startup.
- C. Lubrication
1. Lubricate equipment as recommended by the manufacturer, during temporary construction use.
 2. Provide complete lubrication just prior to acceptance.
- D. Permanent Equipment Operating During Construction
1. Use only in same service as the permanent applications.
 2. Use disposable filters during temporary operation.
 3. Replace expendable media, including belts used for temporary operation and similar materials just prior to acceptance of the Work.
 4. Repack packing in equipment operated during construction just prior to system acceptance, using materials and methods specified by the equipment manufacturer.
- E. Retouch or repaint equipment furnished with factory finish as required to provide same appearance as new.
- F. Tools
1. Provide one set of specialized or non-standard maintenance tools and devices required for servicing the installed equipment.

3.02 - EQUIPMENT BASES, PLATFORMS AND SUPPORTS

- A. Provide supporting platforms, steel supports, anchor bolts, inserts, etc., for all equipment and apparatus provided.
- B. Obtain prior approval for installation method of structural steel required to frame into building structural members for the proper support of equipment, conduit, etc. Welding will be permitted only when approved by the Engineer.
- C. Submit shop drawings of supports to the Engineer for approval before fabricating or constructing.
- D. Provide leveling channels, anchor bolts, complete with nuts and washers, for all apparatus and equipment secured to concrete pads and further supply exact information and dimensions for the location of these leveling channels, anchor bolts, inserts, concrete bases and pads.

- E. Where supports are on concrete construction, take care not to weaken concrete or penetrate waterproofing.

3.03 - ACCESSIBILITY

- A. Install valves, dampers and other items requiring access conveniently and accessibly located with reference to the finished building.

3.04 - USE OF EQUIPMENT

- A. The use of any equipment, or any part thereof, even with the Owner's consent, is not an indication of acceptance of the Work on the part of the Owner, nor shall it be construed to obligate the Owner in any way to accept improper work or defective materials.

3.05 - MODIFICATIONS OF EXISTING WORK

- A. Coordinate the Work with all other contractors and provide necessary dimensions for all openings. Provide all cuts and openings which are necessary for the Work for passage of piping and ductwork
- B. Upon completion, remove all temporary piping and equipment, shoring, scaffolds, etc., and leave all areas clean and free from material and debris resulting from work performed under this Section. Provide rough patching in areas required.

3.06 - EQUIPMENT INSTALLATION

- A. Locate and set equipment anchor bolts, dowels and aligning devices for equipment requiring them.
 - 1. Level and shim the equipment; coordinate and oversee the grouting work.
- B. Perform field assembly, installation and alignment of equipment under direct supervision provided by the manufacturer or with inspections, adjustments and approval by the manufacturer.
- C. Alignment and Lubrication Certification for Motor Driven Apparatus
 - 1. After permanent installation has been made and connections have been completed, but before the equipment is continuously operated, have a qualified representative of the equipment manufacturer inspect the installation and shall report in writing on the manufacturer's letterhead on the following:

- a. Whether shaft, bearing, seal, coupling, and belt drive alignment and doweling is within the manufacturer's required tolerances so that the equipment will remain aligned in the normal service intended by the Contract Documents and that no strain or distortion will occur in normal service.
- b. That all parts of the apparatus are properly lubricated for operation.
- c. That the installation is in accordance with manufacturer's instructions.
- d. That suitable maintenance and operating instructions have been provided for the Owner's use.
- e. Make any corrections to items that are required or recommended based on the manufacturer's inspection and have the equipment re-inspected.

D. Belt Drives

1. V-belt drives - a driving and driven sheave grooved for belts of trapezoidal cross-section. Construct belts of fabric and rubber so designed so as not to touch the bottom of the grooves, the power being transmitted by the contact between the belts and V-shaped groove sides. Design drives for a minimum of 150 percent of motor horsepower. Provide companion type driven sheaves.
2. Select drives to provide for 12-1/2 percent variation in speed, plus or minus, from specified speed. Provide all motors with adjustable sheaves except where indicated otherwise in the Specifications or on the Drawings.
3. Install all fans with adjustable pitch sheaves on their drive motors. Select sheaves to provide air quantities under specified conditions. Put air systems into operation, and determine as a result of the completed air balance the actual size of sheaves required to produce specified air quantities on installed systems. The adjustable pitch sheaves shall then be replaced with the proper size fixed sheaves. Remove adjustable pitch sheaves from premises. Provide fixed motor sheaves manufactured by Wood's.
4. Where indicated on the Drawings or specified, provide spare motor, bearings, and belts.

E. Machinery Guards

1. Protect motor drives by guards furnished by the equipment manufacturer or in accordance with the Sheet Metal and Air Conditioning Contractors National Association's Low Pressure Duct Manual. Provide guards of all types approved as acceptable under

OSHA Standards.

F. Equipment Start-up

1. Require each equipment manufacturer to provide qualified personnel to inspect and approve equipment and installation and to supervise the start-up of the equipment and to supervise the operating tests of the equipment.
2. If a minimum number of hours for start-up and instruction are not stated with the equipment specifications, these shall be 2 full 8-hour working days as a minimum.
3. Advise Owner of start-up at least 72 hours in advance.

3.07 – POSTED OPERATIONS INSTRUCTIONS

- A. Prepare instructions using professionally prepared graphics, printed on full size sheets and in color.
- B. Prepare instructions for posting for all mechanical systems. Include all components. Include the following information as a minimum:
 1. Comprehensive schematics for air distributing and handling systems
 2. Facility floor plans showing location of all equipment with coordinated identification.
 3. Piping diagrams for all systems.
 4. System diagrams, including isometrics of equipment and systems (boiler, pumps, chiller, AHU's, VAV's, exhaust systems, etc)
 5. Valve charts
 6. Equipment Schedules
- C. Include full control diagrams, include the following:
 1. Control sequence of operations diagrams
 2. Point's lists. Include all defined points along with a specific sequence of operations
 3. Schematic HVAC systems and operations diagrams showing piping and ducting systems relative to each major item of equipment.

4. All control termination points permanently labeled and with labeling documented at the panel and in the posted instructions.
- D. Frame all instructions in extruded metal frames, mounted under glass. Permanently mount instructions in the locations designated by the Owner.

3.08 - CLOSEOUT PROCEDURES

- A. General Operating and Maintenance Instructions: Arrange for each installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Owner's personnel to provide necessary basic instructions in the proper operation and maintenance of the entire work. Where installers are not expert in the required procedures, include instruction by the manufacturer's representatives.
- B. Where applicable, provide instruction and training, including application of special coatings systems, at manufacturer's recommendation.
- C. Provide a detailed review of the following items:
 1. Maintenance manuals
 2. Record documents and catalog cuts for each piece of equipment.
 3. Spare parts and materials
 4. Tools
 5. Lubricants
 6. Fuels
 7. Identification systems
 8. Control sequences
 9. Hazards
 10. Cleaning
- D. Warranties, bonds, maintenance agreements, and similar continuing commitments.
- E. Demonstrate the following procedures:

1. Start-up
 2. Shut-down
 3. Emergency operations
 4. Noise and vibration adjustments
 5. Safety procedures
 6. Economy and efficiency adjustments
 7. Effective energy utilization.
- F. Prepare instruction periods to consist of approximately 50% classroom instruction and 50% "hands-on" instruction. Provide minimum instruction periods as follows:
- | Systems or Equipment | Training Time (Hours) |
|----------------------|-----------------------|
| All other equipment | 4 hrs. (each) |
- Note: Consult individual equipment specification sections for additional training requirements.
- G. Prepare a written agenda for each session and submit for review and approval. Include date, location, purpose, specific scope, proposed attendance and session duration.
- H. Videotape training sessions. Turn over video tapes to the owner after training has been completed.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - DESCRIPTION OF WORK**

- A. This Section describes the demolition, removal, relocation, rerouting and reconnection of existing mechanical facilities, as required, shown and specified herein, to accomplish alteration, restoration and to accommodate new construction.
- B. The Work includes but is not limited to, draining, disconnecting, relocating, removing and dismantling, in a neat and workmanlike manner, the items and their accessories as indicated or shown on the Drawings.

1.02 – RELATED WORK

- A. General Mechanical Requirements – Section 15010

1.03 - REFERENCES

- A. BOCA Building Code
- B. NFPA Fire Code
- C. ANSI A10.6 – Safety Requirements for Demolition
- D. National Association of Demolition Contractors (NADC) – Demolition Safety Manual
- E. NFPA 51B – Cutting and Welding Processes
- F. NFPA 70 – National Electrical Code
- G. NFPA 241 – Safeguarding Building Construction and Demolition Operations
- H. OSHA 29 CFR 1910 – Occupational Safety and Health Standards
- I. US EPA – Clean Air Act Amendment of 1990.

1.04 - SUBMITTALS

- A. Demolition Schedule
- B. Fire Watch Procedures
- C. Inspection Report of Underground Piping Systems

- D. Welding/Burning Permit – Obtain a welding/burning permit from the local Fire Official prior to the start of any welding or burning in accordance with the local Fire Code or as required by the Owner.

1.05 - QUALITY ASSURANCE

- A. Only employ workers skilled in the specific trades involved for cutting, patching and removal.
- B. Job Conditions: Prior to start of the Work, make an inspection accompanied by the Architect/Engineer to determine physical condition of adjacent construction that is to remain.

1.06 – SPECIAL PRECAUTIONS

- A. Do not torch cut ductwork.
- B. Torch cutting of other mechanical equipment will be permitted only with the specific written approval of the Architect/Engineer.
- C. Include “Fire Watch” procedures as required by the Fire Code and/or Owner's Fire Insurance Carrier for any cutting work that may produce sparks. Submit fire watch procedures for approval.
- D. Perform draining operations so that damage to existing building components does not occur.

PART 2 - PRODUCTS

- A. Adequately sized rubbish containers for the proper and safe disposal of all debris.

PART 3 - EXECUTION

3.01 - PREPARATION

- A. Construct temporary partitions enclosing respective work prior to any demolition work. Erect temporary fencing and signage around demolished materials.
- B. Protect existing materials and equipment which are not to be demolished.
- C. Prevent movement of structure; provide required bracing and shoring.
- D. Do not begin the work until the time schedules and manner of operations have been approved by the Architect/Engineer and Owner. Include all interruptions of existing services in schedules submitted for approval by the Architect/Engineer and Owner.

3.02 – GENERAL

- A. Provide alteration and demolition of mechanical facilities as required by the Drawings and Specifications. The Drawings are diagrammatic and do not show the exact location of all existing mechanical work. Where existing equipment is to remain in service during construction, provide rerouting and reconnection of mechanical services as required to maintain continuous service.
- B. Review all equipment with the Architect/Engineer and Owner prior to disposal. Completely remove existing ductwork, piping, conduit and similar items to be abandoned that are not embedded in walls or floor slabs unless otherwise shown on the Drawings. Cap open ends at all walls and floors.
- C. Remove, store and protect all equipment or materials designated to be turned over to the Owner. Coordinate exact location of storage with the Owner.
- D. Temporarily cap ends of ductwork, piping and sanitary vent piping to avoid entry of dirt, debris, or discharge of foul odors and gases.
- E. Where existing louvers or ductwork penetrations are to remain, blank-off the opening on the inside with galvanized sheet metal on both sides of 2-inch thick, 6 pcf density rigid fiberglass board insulation. Paint side attached to the opening with weather resistant flat black paint.
- F. Do not close or obstruct egress width to exits.
- G. Do not disable or disrupt building fire or life safety systems without five (5) days' prior written notice to the Architect/Engineer and Owner.
- H. Conform to procedures applicable when discovering hazardous or contaminated materials.
- I. Conduct demolition to minimize interference with adjacent building structures or Owner's operations.
- J. Cease operations immediately if structure appears to be in danger or hazardous materials are encountered. Notify Architect/Engineer. Do not resume operations until directed.
- K. Demolish in an orderly and careful manner. Do not cut or remove more than is necessary to accommodate the new construction or alteration.
- L. Remove demolished materials from site daily. Do not burn or bury materials on site. Dispose of all material at an approved disposal facility.

- M. Protect finished surfaces at all times and repair or replace, if damaged, to match existing construction to the satisfaction of the Architect/Engineer.

3.03 – PIPING REMOVAL

- A. Cut off all welded piping square at the locations indicated on the drawings. No cutting is required where the demolition ends at a flanged valve or equipment. Close off all openings of any remaining valves, piping or fittings with weld caps or blind flanges to prevent debris from entering the existing system.
- B. Disconnect all threaded piping at the location indicated on the drawings. Close off all openings of remaining valves, piping, fittings and equipment with pipe plugs or pipe caps as required to prevent debris from entering the existing systems.
- C. Remove all pipe hangers, supports, miscellaneous steel and anchors with the piping.

3.04 – PROTECTION FROM FREEZING

- A. It is intended that the building remain protected from damage due to freezing temperatures. To that end, keep in place and in operation existing equipment and systems used for heating until scheduling permits shutdown.
- B. Where the removal of equipment, etc. will leave an area unprotected from freezing, notify the Owner and Architect/Engineer at least 72 hours in advance prior to removal so appropriate steps can be taken by the Owner to protect the area. Provide temporary heating equipment sufficient to prevent freezing.
- C. It is the Contractor's responsibility to ensure that piping systems that are being worked on are completely drained from water prior to the start of demolition. If water is not drained and the piping freezes it is the Contractor's responsibility to replace piping at his own expense.

3.05 – DISCONNECTION AND INTERRUPTION OF MECHANICAL SERVICES

- A. When portions of an existing piping system or ductwork system are removed, and this removal causes loss of operation to another piece of equipment due to open or disconnected piping or ductwork, cap piping or ductwork or provide temporary piping or ductwork system to retain operation of the system.

3.06 – MECHANICAL EQUIPMENT REMOVAL

- A. Remove all mechanical equipment as shown on the Drawings. Remove all electrical work, including wiring between equipment, and wiring to power source or point of origin.

- B. Where equipment is supported by steel and/or structural supports, remove these supports.

3.07 – REFRIGERANT REMOVAL

- A. Recover and dispose of all existing refrigerant charges in accordance with EPA regulations. Comply with all regulations applicable to the release of chlorofluorocarbon refrigerants to the atmosphere.

3.08 – DUCTWORK REMOVAL

- A. Disconnect all ductwork which must be removed, at the closest joint and support the remaining ductwork.
- B. Prepare all remaining ductwork joints at the point of disconnection to receive new ducts or blank-off panels.
- C. Remove all ductwork supports and miscellaneous steel with ductwork to be demolished.

3.09 – INSULATION REMOVAL

- A. Remove insulation, together with all piping, fittings, valves and equipment designated for demolition.

3.10 – CONTROL WIRING REMOVAL

- A. Disconnect and remove all control wiring and tubing, including conduit, for the Automatic Temperature Control (ATC) System associated with equipment and systems to be removed.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Work of this Section includes specifications for the adequate support of exposed piping. Pipe hangers shall be meant to include pipe support systems.
- B. Where product specifications are provided they are intended to provide a standard of quality.
- C. The Drawings show the layout, sizes, elevations, and general arrangement of piping, valves, primary instrumentation elements, and process equipment. Pipe support systems shall be selected, configured, and installed by the Contractor in order to comply with the requirements contained herein. The Contractor shall install pipe support systems consisting of hangers, supports, clamps, U-bolts, brackets, bracings, attachments, and structural shapes to adequately support piping from building components, tank walls, decking, walkways, slabs, or fabricated structural assemblies specifically designed for this purpose. All piping supports and hardware shall be fabricated and erected of stainless steel as specified herein.

1.02 - REFERENCES / QUALITY ASSURANCE

- A. Comply with the following in designing and installing pipe support systems:
 - 1. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 - 2. MSS SP69 - Pipe Hangers and Supports - Selection and Application
 - 3. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practice
- B. Terminology used in this Section is defined in MSS SP-90.
- C. All interior and exterior pipe support systems that are located within tanks, reactors, basins, wet wells, channels, pits, chambers, pipe galleries, rooms, buildings, either exposed, submerged, partially submerged, intermittently submerged or never submerged shall be 304L stainless steel as a minimum.
- D. Below grade pipe support systems shall be as specified for underground pipe.

1.03 - SUBMITTALS

- A. Comply with the requirements contained in Section 01330 - Submittals.
- B. Submit the following:

1. Product data and installation instructions.
2. Pipe hanger and support catalog cuts showing manufacturer's figure number, size, materials of construction, and features for each type of support.
3. Provide catalog cuts for all types of stainless steel pipe support.
4. Provide details of each size knee brace and indicate materials of construction and the proposed locations.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Grinnell or equal.

2.02 - MATERIALS

- A. Stainless steel supports and hangers shall be used at locations specified in paragraph 1.02 (C) above.
- B. Grinnell figure 260 MSS Type 1, with adjustable clevis hangers for non-insulated pipe 2 through 24-inch diameter.
- C. Grinnell figure 260 adjustable wrought clevis hangers, with Figure 167, MSS Type 40 galvanized insulation protection shields sized for supporting insulation having a strength of 4 psi, at 8-foot intervals. Support piping on outside of insulation. Size hangers so that pipe insulation passes through them without interruption. Use these for:
 1. Insulated steel pipe $\frac{1}{2}$ through 24-inch diameter.
 2. Insulated galvanized steel pipe $\frac{1}{2}$ through 24-inch diameter.
 3. Insulated copper pipe $\frac{1}{2}$ through 8-inch o.d.
 4. Insulated PVC pipe with no longitudinal movement.
- D. Grinnell Figure 104, MSS Type 6, with adjustable swivel ring, split ring type for:
 1. Non-insulated steel pipe, galvanized steel pipe, and copper pipe $\frac{1}{2}$ through 1-1/2-inch diameter.
 2. Non-insulated cast iron soil pipe up through 8-inch diameter.

- E. Grinnell Figure CT-99C, MSS Type 9, with adjustable wrought tubing ring hanger, either plastic covered for:
1. Non-insulated copper tubing with no longitudinal movement.
 2. Non-insulated PVC pipe, $\frac{1}{2}$ through 4-inch diameter, with no longitudinal movement.
- F. Grinnell Figure 171, MSS Type 41 with pipe roller, and Grinnell Figure 167, MSS Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 psi, at 8-foot intervals). Support piping on outside of insulation. Size hangers so that pipe insulation passes through them without interruption. Use these for:
1. Insulated copper pipe, $\frac{1}{2}$ through 2- $\frac{1}{8}$ -inch diameter, having longitudinal movement.
 2. Insulated steel pipe, 1 through 30-inch diameter, having longitudinal movement.
- G. Grinnell Figure CT-121C, MSS Type 8, riser clamps (at floor slab penetrations) to support:
1. Copper pipe risers.
 2. PVC pipe risers.
- H. Grinnell Figure 261, MSS Type 8, riser clamps (at floor slab penetrations) to support steel pipe risers.
- I. Unistrut Trapeze Hangers: Where three or more lines of pipe run parallel, support them with stainless steel trapeze hangers and stainless steel hardware.
- J. Concrete Inserts: Grinnell Figure 288, MSS Type 18, universal concrete inserts, adequately sized and correctly positioned to support full load, operating systems.
- K. C-Clamps: Grinnell Figure 86, MSS Type 23. Use these for attaching hangers to steel beams. Welding hanger rods to steel members is not permitted. Provide retaining clip for C-Clamps.
- L. Malleable Beam Clamps: Grinnell Figure 229, MSS Type 30. Use these for attaching hangers to bar joists. Provide retaining clip for all beam clamps.
- M. Floor supports: Steel, adjustable pipe support, adjustable height, locknut, nipple, floor flange and baseplate; Standon Model S92 or S89 or equal.
- N. Hanger Rods: Stainless steel threaded both ends or continuous thread. Only stainless steel threaded rod shall be used on the project. Diameter shall be as required to adequately support the

load except where otherwise shown on the Drawings.

PART 3 - EXECUTION

3.01 - EXAMINATION

- A. Examine substrate and conditions under which supports and anchors are to be installed. Do not proceed with the installation until satisfactory conditions have been corrected by reinforcing the substrate.

3.02 - INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps, and attachments to support piping properly from building structure; comply with MSS SP-69 and SP-89. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe as specified above for individual pipe hangers.
- B. Install building attachments to wood joists or to structural steel. Space attachment within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
- C. Install hangers and supports complete with necessary bolts, rods, nuts, washers, and other accessories.
- D. Field-Fabricated, Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS D-1.1.
- E. Install hangers and supports to allow controlled 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.
- F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ASME B31.9 Building Services Piping Code is not exceeded.
- H. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers, to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
3. Shields: Install protective shields MSS Type 40 on cold water piping that has vapor barrier.
4. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

NPS	LENGTH	THICKNESS
1/4 through 3-1/2	12	0.048
4	12	0.060
5 and 6	18	0.060
8 through 14	24	0.075
16 through 24	24	0.105

5. Pipes 8 inches and larger shall have wood inserts.
6. Insert material shall be at least as long as the protective shield.
7. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.03 - INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and with AWS Standards D1.1.
- C. Anchor Spacing: Install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.04 - INSTALLATION OF PIPE ALIGNMENT GUIDES

- A. Install pipe alignment guides on piping that adjoins expansion joints and elsewhere as required.
- B. Anchor to building substrate.

3.05 - EQUIPMENT SUPPORTS

- A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor. Structural steel members shall be used where lateral support is required.
- B. Grouting: Form and place non-shrink grout for piping pier supports, thrust blocking, submersible pump discharge elbows, and equipment base plates. Shim to obtain level and plumb before placing grout.

3.06 - METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.
- 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 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and 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 that no roughness shows after finishing, and so that contours welded surfaces to match adjacent contours.

3.07 - ADJUSTING

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

3.08 - SCHEDULE

PIPE SIZE Inches (mm)	MAX. HANGER SPACING Feet (m)	DIAMETER Inches (mm)
1/2 to 1-1/4 (12 to 32)	6 (1.8)	3/8 (9)
1-1/2 to 2 (38 to 50)	10 (3)	3/8 (9)

PIPE SIZE Inches (mm)	MAX. HANGER SPACING Feet (m)	DIAMETER Inches (mm)
2-1/2 to 3 (62 to 75)	10 (3)	1/2 (13)
4 to 6 (100 to 150)	10 (3)	5/8 (15)

- Hanger spacing based on copper and steel pipe without valves or other equipment. Increased load due to valve and equipment shall require closer spacing of hangers. Maximum hanger spacing shall be 4 feet for PVC pipe.
- Maximum hanger spacing shall be 2 feet, 8 inches for PE and PB pipe.
- Maximum hanger spacing for cast iron pipe less than 10 feet in length shall be 5 feet.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01- SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe Markers.

1.02 - REFERENCES

- A. Division 1- Quality Control: Requirements for references and standards.
- B. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.03 - SUBMITTALS FOR REVIEW

- A. Division 1- Submittals: Procedures for submittals.
- B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.

1.04 - SUBMITTALS FOR INFORMATION

- A. Division 1- Submittals: Procedures for submittals.
- B. Manufacturer's Instructions: Indicate installation instructions, special procedures, and installation.

1.05 - SUBMITTALS AT PROJECT CLOSEOUT

- A. Division 1- Contract Closeout: Procedures for submittals.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.
- C. Valve Tag Chart.

1.06 - REGULATORY REQUIREMENTS

- A. Conform to ASME A13.1 for colors.

PART 2 - PRODUCTS**2.01 - NAMEPLATES**

- A. Manufacturers:
 - 1. Seton Identification Products
 - 2. Bunting.
 - 3. Brady
- B. Description: Laminated three-layer plastic with engraved white letters on dark contrasting background color.

2.02 - TAGS

- A. Plastic Tags:
 - 1. Manufacturers:
 - a. Seton Identification Products
 - b. Bunting.
 - c. Brady.
 - 2. Laminated three-layer plastic with engraved white letters on dark contrasting background color. Tag size minimum 1-1/2 inches diameter, brass S hook.
- B. Metal Tags:
 - 1. Manufacturers:
 - a. Seton Identification Products Model M4506.
 - b. Bunting
 - c. Brady.

2. Brass with stamped letters and service designation tag size minimum 1-1/2 inches diameter with smooth edges, brass S hooks.
- C. Tag Chart: Typewritten letter size list in anodized aluminum frame with plastic window.

2.03 - STENCILS

- A. Manufacturer:
1. Seton Identification Products, ANSI Letter Size Pipe Stencils
 2. Bunting.
 3. Brady.
- B. Stencils: With clean cut symbols and letters of following size:
1. Up to 2 inch Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
 2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1 inch high letters.
 3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
- C. Stencil Paint: Semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.04 - PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
1. Manufacturers:
 - a. Seton Identification Products, Model SETMARK.
 - b. Bunting
 - c. Brady
 2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Spring fasteners for large sizes.
- C. Plastic Tape Pipe Markers:

1. Manufacturers:
 - a. Seton Identification Products
 - b. Bunting
 - c. Brady
2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 - EXECUTION

3.01 - PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces for stencil painting.

3.02 - INSTALLATION

- A. Division 1 - Quality Control: Manufacturer's instructions.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Identify pumps tanks and other equipment with stencil painting. Identify small devices, such as in-line pumps, with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Tag automatic controls, instruments, and relays. Key to control schematic.
- J. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs

including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

3.03 - SCHEDULES

A. Pipe Markers:

Outside Diameter of Insulation or Pipe Inches	Letter Height Inches	Color Field Inches
3/4 to 1-1/4	1/2	8
1-1/2 to 2	3/4	8
2-1/2 to 6	1	12
8 to 10	2	24
Over 10	2	24
Equipment	2	24

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. This Section includes all labor, materials, and equipment necessary to install pipe insulation where indicated on the Drawings.
- B. In addition, all exposed ductile iron air piping used for process aeration, regardless of location, shall be insulated.

1.02 - REFERENCES

- A. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
- B. ASTM C533 - Specification for Calcium Silicate Block and Pipe Thermal Insulation.
- C. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- D. ASTM C547 - Mineral Fiber Preformed Pipe Insulation.
- E. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. ASTM E96 - Test Method for Water Vapor Transmission of Materials.

1.03 - SUBMITTALS

- A. Submit the following in accordance with the requirements contained in Section 01330:
 - 1. Product Data: Provide product description, list of materials and thickness for each service, and location.
 - 2. Manufacturer's Installation Instructions: Indicate procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 - DELIVERY, STORAGE AND HANDLING

- A. Comply with the requirements contained in Section 01650.
- B. Deliver, store and protect products in accordance with manufacturer's instructions.

- C. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- D. Store insulation in original wrapping and protect from weather and construction activities.
- E. Protect insulation against dirt, water, chemical, and mechanical damage.

1.05 - ENVIRONMENTAL REQUIREMENTS

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

1.06 - QUALITY ASSURANCE

- A. Persons experienced in the installation of the specified system shall perform work of this Section.
- B. If requested by the Engineer, submit documentation relative to the installer's qualifications. The Owner and Engineer may elect to visit the installer's previous work.
- C. Submit at least three references who may be contacted regarding the installer's qualifications.

PART 2 - PRODUCTS**2.01 - GLASS FIBER**

- A. Manufacturers: Owens Corning or equal.
- B. Insulation:
 - 1. High density all service jacket with double adhesive lap seal, two-component, butt strip, closure system.
 - 2. ASTM C547; rigid noncombustible molded type
 - 3. K-Value: ASTM C335, 0.24 at 75° F.
 - 4. Minimum Service Temperature: 0° F.
 - 5. Maximum Service Temperature: 850° F.
 - 6. Maximum Moisture Absorption: 0.2% by volume.

C. Vapor Barrier Jacket (Interior and Exterior Service):

1. Fiberglass SSL II by Owens Corning or equal.
2. ASTM C 1136
3. Secure with self-sealing longitudinal laps and butt strips.
4. Secure with outward clinch expanding staples and vapor barrier mastic.
5. Shall be color-coded to identify piping as per Ten States Standards.

D. Tie Wire: 18-gage stainless steel with twisted ends on maximum 12-inch (300 mm) centers.

E. Fire and Smoke Hazard Ratings: Class 1 and 2 jacketing materials, mastics, sealants and adhesives shall have a maximum flamespread rating of 25 and a maximum fuel contributed and smoke developed rating of 50 or less, when tested in accordance with ASTM E84 and UL723.

F. For Exterior Use Only:

1. PVC Cover for Pipe and Fittings:

- a. High impact, self-extinguishing PVC and suitable for outdoor service.
- b. Fed. Spec. L-P-535E
- c. Physical Property Data:

Property	Test Method	Specification
Specific Gravity	ASTM D792	1.46
Water Sorption		.05
Moisture Vapor Transmission		<0.05
Tensile Strength, psi	ASTM D638	7000

PART 3 - EXECUTION**3.01 - EXAMINATION**

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed and dry.
- C. Paint piping before insulation is installed. Painting shall be work of Section 09910.

3.02 - INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Minimum pipe insulation thickness shall be in accordance with New York State Energy Code requirements.
- C. Inserts and Shields:
 - 1. Application: All piping regardless of size.
 - 2. Shields: 304L Stainless steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping, and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Cork or other heavy density insulating material suitable for the planned temperature range.
 - 6. Neatly finish insulation at supports, protrusions, and interruptions.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Small piping, valves and accessories

1.02 – RELATED SECTIONS

- A. Section 11318 – Vertical Multi-Stage Centrifugal Pump Station
- B. Section 15142 – Backflow Prevention Device

1.03 - SUBMITTALS

- A. Submit under provisions of Section 01330. Provide the following:
 - 1. Product literature.
 - 2. Dimensional data.
 - 3. Materials of construction specifications.

PART 2 - PRODUCTS**2.01 - COPPER PIPING & ACCESSORIES**

- A. Small Copper Piping: for potable water shall be Type "K" hard drawn copper tubing, conforming to ASTM B42, with fittings per ANSI B-16.22. All underground sampling piping shall be soft annealed Type "K" ANSI H-23.1, fittings ANSI A-40.2.
- B. Check Valves: Swing check renewable BUNA-N disc, all bronze, Stockham Figure B-319 or equal threaded end or Figure B-309 solder end, rated 250 to 300 psi non-shock water.
- C. Ball Valves: Renewable reinforced Teflon seats, adjustable packing gland, non-blowout stem with run port opening. Ball valves shall be Stockham Figure S-216 or equal, with threaded ends.
- D. Dielectric Connections: EPCO Sales, Inc. or "V:Line" Lochinvar Co. or equal dielectric couplers. Use couplers at junction of dissimilar metal piping systems. Do not use steel or cast iron fittings in copper piping systems. Brass fittings may be used for dielectric locations.
- E. Pressure connections to flow and pressure transmitters, switches, recorders and indicating gauges shall be equipped with snubbers.

2.02 - PVC PIPING & ACCESSORIES

- A. PVC Piping: Polyvinyl chloride, Class 1245-B, Schedule 80, and shall conform to ASTM D2241, D1784, and D1785. Pipe shall be as manufactured by A.M. Beyers Company or equal. Fittings for PVC piping shall be solvent welded and shall be of the same schedule approved for use by the pipe manufacturer. Pipe shall bear the trademark of the manufacturer.
- B. Ball Valves: True union PVC, Type 1, Grade 1, cell classification conforming to ASTM D1784. Valve shall allow for disassembly on the downstream side of the piping system while maintaining a watertight condition on the upstream-pressurized line. PVC ball valves shall be Tru-Block True Union as manufactured by Chemtrol; Safe Block True Union as manufactured by Hayward Industrial Products, Inc. or equal.
- C. Check valves: Ball type true union, PVC, Type 1, Grade 1, cell classification conforming to ASTM D1784. Free oscillation of ball in guide ribs shall facilitate full port flow with minimum turbulence and chatter. Valves shall operate in the horizontal or vertical position. PVC check valves shall be True Check as manufactured by Hayward Industrial Products, Inc., True Union as manufactured by Chemtrol or equal.
- D. Strainers: Y type, of size indicated, PVC body with 40 mesh cylindrical stainless steel screen, as manufactured by Hayward Co., Wallace & Tiernan or equal.
- E. Unions shall be UL listed O-ring unions with Teflon gaskets by Hayward Co. or equal.
- F. Wetted parts of PVC piping, valves and accessories shall be compatible with treatment chemicals.

2.03 - STEEL PIPE AND ACCESSORIES

- A. Butt-welded, electric resistance welded, or seamless black steel pipe, ANSI 836.10, ASTM A120, Grade "B" or "A" or ASTM A53, A106, or A134 Schedule 40.
- B. Flanges, fittings, unions and similar items: Commercially available products marked in accordance with MSS-SP-25 marking on small size of odd shaped products may be omitted provided they are listed in the sequence so allowed by MSS-SP-25, but such products shall bear the manufacturer's name and trademark.
- C. Valves and strainers: Iron body with all wetted parts compatible with 50% caustic solution. Ball valves shall have lockable features.
- D. Fittings 2 inches and smaller: Threaded, standard cast iron.

- E. Galvanized steel pipe fittings: Same as above, except galvanized coated. Provide drainage patten type fittings for exterior gas service piping.
- F. Unions: Cast iron with bronze to iron ground joint rated at 150 lbs.
- G. Threads and dimensions: ANSI B1.1 and B18.2
- H. Thread lubricant: Crane "Formula 425", or equal. Teflon tape may be used.
- I. Gaskets: Full face, 1/8-inch thick neoprene rubber.

2.04 - ACCESSORIES

- A. Sleeves: Schedule 10 or 40 steel pipe or 26 gauge galvanized sheet metal.2.05 - HOSE BIBS
- B. Hose Bibs: Non-freeze as manufactured by Jay R. Smith or equal Figure No. 5609-PB or equal "Line-Gard" antisiphon non-freeze wall hydrant, cast polished brass face, with vacuum breaker.

2.05 - CORPORATION STOPS

- A. Mueller Company, Model No. H-15000 or equal. Water service bronze body with AWWA standard thread inlet and copper AWWA outlet, complete with straight coupling nuts.

2.06 – YARD HYDRANTS

- A. Exposed head, non-freeze type, model Z-1385 by Zurn or equal.
- B. Shall be complete with bronze casting and cast aluminum casing guard, all bronze interior parts, bronze seat, and replaceable seat washer. Unit shall be provided with 1/4" drain port in valve housing.
- C. Unit shall be for a 1-inch hose connection. Provide operating wheel for each hydrant. Provide a 1-inch to 3/4-inch brass reducing fitting for each hydrant.

2.07 – FOOT VALVES

- A. Foot valves shall be combination ball check single poppet with foot valve screen, with machined seats by Hayward, Wallace & Tiernan or equal.
- B. Construction materials for foot valves shall be PVC for hypochlorite solution and 316 stainless steel for caustic solution.

2.08 – TANK VENT CAPS

- A. Tank vent caps shall conform to the requirements of NFPA 30, full pipe size galvanized cast iron construction as manufactured by Preferred Utilities Manufacturing Corp. or approved equal.

2.09 – QUICK CONNECT COUPLING

- A. Male coupler end with female dust cap, stainless steel body and cam arm pins.
- B. Attach dust cap to hose coupling with stainless steel cable. Provide 2 feet of cable per installation.
- C. Manufacturer: Dixon or equal.

PART 3 - EXECUTION**3.01 - INSTALLATION**

- A. Joints between PVC and iron pipe shall be made with screwed fittings or screwed companion flanges.
- B. Install pipes so that expansion and contraction will not cause undue stress or strain to pipes or equipment. Provide offsets and expansion joints.
- C. Provide flanges and unions throughout the pipe systems to make installation and removal of piping and equipment convenient. Make provisions for servicing and removal of equipment without dismantling piping.
- D. Small PVC Piping Installation: Pipe and fittings in vicinity of treatment equipment and at ends of runs shall have screw type joints. In all other locations, solvent welded slip type joints will be acceptable.
- E. Threaded joints where specified shall be made using standard hand or machine pipe threaded tools. Dies must be sharp and in good condition to assure a clean and smooth threading operation from start to finish. Threads shall be full cut and perfect.
- F. Protective pads or leather, rubber or felt shall be employed to prevent damage to pipe walls by chuck and/or vise jaws. A slightly tapered wood plug shall be tapped snugly into the pipe for the length of thread to prevent distortion of the pipe wall by the die.
- G. Joints shall be made up using Teflon base compounds placed on the pipe threads. Do not place compound on threads of fittings.

- H. Wicking will not be permitted.
- I. Install PVC pipe in such a manner that it is not forced out of line by pipe supports, hangers, or other supporting members.
- J. Pipe hangers shall be clevis or strap type as specified in Section 15060.
- K. For anchoring pipe, use metal compression type hangers padded with a compressible insert band. All fittings, except couplings, shall be supported and valves shall be braced to resist torque during valve manipulation. All piping shall be free of traps and graded to permit complete drainage.
- L. Copper piping: All piping shall be cut square, burrs removed and reamed after cutting. Fitting sockets and tube ends shall be thoroughly cleaned to a bright finish. All solder joints shall be fluxed and soldered using 95-5 tin and antimony solder.
- M. Install corporation stops at locations where branch yard hydrants or water services are being tapped from existing water lines.
- N. Locate shutoff and control valves for easy access and operation. Where valves are located in enclosed spaces, provide access doors.

3.02 - FIELD QUALITY CONTROL

- A. Test small piping for pressure and leakage, in accordance with AWWA C600. Check joints for leakage while under air pressure by swabbing, utilizing soap and water solution, and leaks found shall be repaired and rechecked.
- B. Pressure of air during testing shall be at least 50% higher than normal working pressure. Furnish all labor, materials, and equipment necessary to accomplish all testing and repairs.
- C. Before piping is concealed, recheck it for leaks.
- D. Rework or replace defective and leaking joints, and joints that are otherwise unsatisfactory. Peening, caulking and doping are not permitted.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Pipe, pipe fittings, valves, and connections for piping systems.
 - 1. Black iron piping, valves and accessories
 - 2. Copper piping, valves and accessories
 - 3. Galvanized piping and accessories
 - 4. PVC piping, valves and accessories
 - 5. Reinforced flexible tubing and accessories
 - 6. Caps
 - 7. Corporation stops
 - 8. Curb stops
 - 9. Escutcheons
 - 10. Pressure gauges
 - 11. Pressure regulating valves
 - 12. Relief valves
 - 13. Solenoid valves
 - 14. Vacuum breakers
 - 15. Natural Gas Piping, Above Grade
 - 16. Natural Gas Piping, Below Grade
 - 17. Gas Cocks
 - 18. Sample Pumps

1.02 - RELATED SECTIONS

- A. Section 15060 – Pipe Hangers and Supports
- B. Section 15075 - Mechanical Identification
- C. Section 15080 - Insulation

1.03 - REFERENCES

- A. Section 01450 - Quality Control: Requirements for references and standards.
- B. ASME B16.3 - Malleable Iron Threaded Fittings.
- C. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- D. ASME B16.23 - Cast Copper Alloy Solder - Joint Drainage Fittings -DWV.
- E. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- F. ASME B31.3 - Process Piping.
- G. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- H. ASTM A120 - Pipe, steel, black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses
- I. ASTM B42 - Seamless Copper Pipe
- J. ASTM B88 - Seamless Copper Tube
- K. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications
- L. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
- M. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- N. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

- O. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- P. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
- Q. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- R. ASTM D2737 - Standard Specification for Polyethylene (PE) Plastic Tubing.
- S. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- T. AWWA C800 - Underground Service Line Valves and Fittings
- U. AWWA C901 - Polyethylene Pressure Pipe and Tubing, 1/3" to 3", for Water Service.

1.04 - SUBMITTALS FOR REVIEW

- A. Section 01330 - Submittals: Procedures for submittals.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 - QUALITY ASSURANCE

- A. Perform Work in accordance with State of New York and Town code.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 - REGULATORY REQUIREMENTS

- A. Perform Work in accordance with the State of New York and local code.

1.07 - DELIVERY, STORAGE, AND PROTECTION

- A. Section 01650 – Product Delivery, Storage and Handling: Transport, handle, store, and protect products.

- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- F. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.08 - ENVIRONMENTAL REQUIREMENTS

- A. Section 01650 - Product Delivery, Storage and Handling: Environmental conditions affecting products on site.
- B. Do not install underground piping when bedding is wet or frozen.

PART 2 – PRODUCTS

2.01 - BLACK IRON PIPING, VALVES AND ACCESSORIES

- A. Standard weight, Schedule 80, threaded ends, conforming to ASTM A120. Fittings shall be malleable iron, screwed type conforming to ASME B16.3.
- B. Transitions from black iron to poly-tubing shall be made with compression fittings, or approved equal.
- C. Ball Valves: All 316 stainless steel body, ball and retainer, reinforced TFE stem, seat and retainer seal, 304 stainless steel lever with vinyl grip, rated for 125 psi minimum working pressure, threaded connections, Series 7F-100 by CONBRACO INDUSTRIES, INC.
- D. Check Valves: All 316 stainless steel construction, including body, tail piece, guide and spring, glass filled TFE ball check, rated for 125 psi minimum working pressure, threaded connections, Series 62-100 by CONBRACO INDUSTRIES, INC.
- E. All valve materials shall be compatible with material transported in piping, which includes but is not limited to the following: seats, gaskets, O-rings, etc.

- F. Pressure relief/backpressure valves shall be molded in-line valves with PVC body construction. Valves shall have a setting range from 5 to 100 psi and be compatible with chemicals in application. Valves shall be as manufactured by PLAST-O-MATIC VALVES, INC., Griffco Valves Inc., or approved equal.

2.02 - COPPER PIPING, VALVES AND ACCESSORIES

- A. All exposed small copper piping shall be Type "K" hard drawn copper tubing. All underground piping shall be soft annealed Type "K" copper tubing with compression fittings.
- B. All brass valves and fittings installed on potable water supply piping shall be made of "low-lead" materials (UNS Copper Alloy C89833 or C89520) and have a maximum lead content of 0.25 percent by weight. All low lead brass fittings shall be stamped or embossed with a mark indicating that the product is manufactured from low-lead alloys.
- C. Check valves shall be swing check renewable BUNA-N disc, all bronze, STOCKHAM Figure B-319Y (threaded end) or Figure B-309Y (solder end) - 250 to 300 psi non-shock water.
- D. Ball valves for copper piping/tubing and galvanized piping shall be renewable reinforced Teflon seats, adjustable packing gland, non-blowout stem with run port opening. Ball valves shall be STOCKHAM Figure T or S-285 (threaded or soldered ends).

2.03 - GALVANIZED PIPING AND ACCESSORIES

- A. Galvanized piping shall be standard weight, Schedule 40, seamless, with threaded ends, conforming to ASTM A120. Fittings shall be galvanized cast iron, threaded, conforming to ASME B16.12.

2.04 - PVC PIPING, VALVES AND ACCESSORIES

- A. PVC piping for all interior and exterior applications shall be polyvinyl chloride, Class 1245-B, Schedule 80, and shall conform to ASTM Specifications D2267, D2241, D1784 and D1785. All PVC piping shall conform to NSF-61 and be approved for potable water applications. Pipe shall be as manufactured by A.M. BEYERS or CHARLOTTE PIPE COMPANY or approved equal. Fittings for PVC piping shall conform to ASTM D2467 and be slip type and shall be of the same schedule approved for use by the pipe manufacturer. Pipe shall bear the trademark of the manufacturer.
- B. Transitions from PVC to poly-tubing shall be made with compression fittings, or approved equal.

- C. Ball valves shall be double union/double block with PVC body, ball, insert and stainless steel rod and stem with Teflon seats, Tru-Bloc by NIBCO CHEMTROL, SPEARS or approved equal.
- D. Check valves shall be of the true union ball check type with a PVC body construction. The valves shall be rated at 150 psi. The valves shall be manufactured by HAYWARD CO., SPEARS or approved equal.
- E. Strainers shall be Y type, true union, of size indicated, transparent PVC body with 20 mesh cylindrical PVC screen and FKM o-rings, and shall be as manufactured by ASAHI. or approved equal.
- F. Unions shall be UL listed, Oring unions with Teflon gaskets by HAYWARD CO. or approved equal.
- G. Threads and dimensions: ANSI B1.1 and B18.2.
- H. All wetted parts of PVC piping, valves and accessories shall be compatible with treatment chemicals.
- I. Threads and dimensions: ANSI B1.1 and B18.2
- J. Thread lubricant: Crane "Formula 425", or equal. (NOTE: Approved Teflon tape may be used).
- K. Gaskets: Full face, 1/8-inch thick neoprene rubber.
- L. Solvent welded joints for chemical piping shall be made using solvent cement that meets or exceeds ASTM F493, compatible with PVC pipe and fittings. Solvent cement shall be Low V.O.C., Heavy Duty Gray Industrial solvent cement by Oatey; Model EP42 or specifically approved equal.
- M. Pressure relief/backpressure valves shall be molded in-line valves with PVC body construction. Valves shall have a setting range from 5 to 100 psi and be compatible with chemicals in application. Valves shall be as manufactured by PLAST-O-MATIC VALVES, INC., Griffco Valves Inc., or approved equal.

2.05 - REINFORCED FLEXIBLE TUBING

- A. HDPE translucent tubing, compatible with chemical transported, minimum 190 psi working pressure at 70F for 1/2" to 3/4" O.D. Install high pressure PVC compression fittings all connections to tubing.

- B. S.S. corrugated braided hose, compatible with chemical being transported, minimum 792 psi working pressure for 3/4" O.D., threaded NPT or compression fittings

2.06 - CAPS

- A. Vent caps
 - 1. Mushroom style, pipe size, galvanized cast iron construction with stainless steel no. 24 mesh screen as manufactured by PREFERRED UTILITIES MANUFACTURING CORP. or approved equal.
 - 2. Mushroom style, pipe size, PVC construction with 10 x 10 polypropylene mesh screen
 - 3. Dual outlet, cast iron air relief vent, 2" NPT, with 16 mesh brass screen by McMaster-Carr Model No. 4815K15

2.07 - CORPORATION STOPS

- A. Manufacturers:
 - 1. MUELLER COMPANY, Model No. H-15000.
 - 2. FORD METER BOX COMPANY, Model No. FB600
- B. Ball valve type, water service bronze body with AWWA standard thread inlet and copper AWWA outlet, complete with straight coupling nuts.
- C. All connections greater than 1" shall utilize a threaded saddle with stainless steel bands.

2.08 - CURB STOPS

- A. Ball Valve Type
 - 1. All metal parts shall be constructed of water service lead free bronze.
 - 2. All ball valve curb stops shall be by FORD METER BOX COMPANY, No. B44-333M-NL or specifically approved equal.
 - 3. All curb stops shall be provided with an extension type curb box with Owner's standard cap and an arch pattern base.
 - 4. Extension of type curb box shall be by FORD METER BOX COMPANY, No. EA2 and provided without a rod.

2.09 - ESCUTCHEONS

- A. Provide chrome plated escutcheons where uninsulated pipes penetrate walls of finished spaces.

2.10 - PRESSURE GAUGES

- A. Pumps: Pressure gauges shall be manufactured by ASHCROFT, all stainless steel construction, with pressure range from 0 to 160 psi, stem mounted 3-1/2" diameter, glycerin liquid filled, provided with snubber and block and bleed needle valve by WIKA Type 910.11.200 or equal.
- B. Chemical Systems: Pressure gauges shall be manufactured by ASHCROFT, all stainless steel construction, with pressure range from 0 to 160 psi, stem mounted 2-1/2" diameter, glycerin liquid filled, provided with welded diaphragm seal by Ashcroft Type 500.
 - 1. Caustic and Zinc Orthophosphate: Diaphragm and housing shall be constructed of 316L stainless steel and filled with halocarbon fluid
 - 2. Sodium Hypochlorite: Diaphragm shall be constructed of tantalum, housing shall be constructed of titanium and filled with halocarbon fluid

2.11 - PRESSURE REGULATING VALVES

- A. Manufacturer:
 - 1. WATTS, Series 263A (3-way).
 - 2. Approved equal.
- B. Valves shall be of brass construction with Buna-N disc/diaphragm, inlets/outlet size to match piping, maximum working pressure 300 psi, adjustable range 3 psi to 50 psi.
- C. Provide with pressure gauge and slotted adjusting screw.

2.12 - RELIEF VALVES

- A. Air Release/Vacuum Valves
 - 1. Manufacturer:
 - a. CRISPIN, "AL" series
 - b. VALMATIC, Series 22 & 38
 - c. Approved equal

1. Valve shall comply with ANSI/AWWA C512 Standards.
2. The body and valve shall be constructed of cast iron conforming to ASTM A126, Class B.
3. Spherical Type 316 stainless steel float shall seal against a renewable Buna-N resilient seat.
4. Orifice and linage mechanism shall be constructed of Type 316 stainless steel

B. Pressure relief & Backpressure / Anti-siphon valves

1. Manufacturer:
 - d. PLAST-O-MATIC VALVES, INC.
 - e. GRIFFCO, PRG2050P & BPV05OP
 - f. Approved equal
2. Valves shall be molded in-line type with PVC body construction.
3. Valves shall have a setting range from 5 to 120 psi and be compatible with chemicals in application. Size in accordance with the Plans.

2.13 - SOLENOID VALVES

- A. Manufacturer:**
1. Red Hat II, Series 8210.
 2. Approved equal.
- B. Provide normally closed valves, 120 volt AC, 304 stainless steel body. The construction material of all wetted parts shall be compatible with the product contained.**

2.14 - VACUUM BREAKERS

- A. Vacuum breaker check valves shall be constructed of PVDF (Kynar), normally-closed, with self-sealing diaphragm. Connectors to match pipe and fittings. As manufactured by PLAST-O-MATIC VALVES, INC., Series VBM, or approved equal.**

PART 3 - EXECUTION**3.01 - INSTALLATION**

- A. Clean inside of piping and tubing before installation. Keep installed piping clean and protect ends from foreign matter by capping or plugging.
- B. Install piping and tubing so that it does not interfere with opening of doors or apparatus, access to equipment or any portion of electrical equipment.
- C. Run piping and tubing in straight lines and square with building. Install rise plumb. Make offsets only where indicated and where necessary.
- D. Install pipes so that expansion and contraction will not cause undue stress or strain to pipes or equipment. Provide offsets and expansion joints as shown on drawings.
- E. Provide flanges and unions throughout the piping systems to make installation and removal of piping and equipment convenient. Make provisions for servicing and removal of equipment without dismantling piping.
- F. Support pipe in accordance with provisions of Section 220529.
- G. Install non-conducting dielectric connections wherever joining dissimilar metals.
- H. Install valves with stems upright or horizontal.
- I. Install water service lines in accordance with water utility standards.
- J. All copper piping shall be cut square, burrs removed and reamed after cutting. Fitting sockets and tube ends shall be thoroughly cleaned to a bright finish. All solder joints shall be fluxed and soldered using 95-5 tin and antimony solder and water soluble flux.
- K. All copper tubing connections shall be compression type.
- L. Joints between PVC and Black Iron/Galvanized Pipe (wherever necessary), shall be made with screwed fittings or screwed companion flanges.
- M. PVC piping and fittings connections to treatment equipment and at ends of runs shall have screw type joints. In all other locations, solvent welded slip type joints shall be used.
- N. Install PVC pipe in such a manner that it is not forced out of line by pipe supports, hangers or other supporting members. Pipe hangers shall be clevis or strap type.

- O. Threaded joints where specified shall be made using standard hand or machine pipe threading tools. Dies must be sharp and in good condition to assure a clean and smooth threading operation from start to finish. Threads shall be full cut and perfect. Protective pads of leather, rubber or felt shall be employed to prevent damage to pipe walls by chuck and/or vise jaws. A slightly tapered wood plug shall be tapped snugly into the pipe for the length of thread to prevent distortion of the pipe wall by the die.
- P. Threaded pipe joints shall be made up using Teflon base compounds placed on the pipe threads. Do not place compound on threads of fittings. NO WICKING WILL BE PERMITTED.
- Q. All fittings, except couplings, shall be supported and valves shall be braced to resist torque during valve manipulation.
- R. All piping shall be free of traps and graded to permit complete drainage.

3.02 - SERVICE CONNECTIONS AND TAPPING

- A. Maintain a 10 foot (3 m) horizontal separation and an 18 inch (460 mm) vertical separation of water main from sewer piping.
- B. Thoroughly clean water main to be tapped to remove all dirt and scale.
- C. Tap main on the side toward the line to be connected to the tap.
- D. Equipment utilized for tapping shall be as recommended by the manufacturer of the corporation stop.
- E. Maintain a minimum of 4'-6" (1.4 m) cover over the copper service pipe.
- F. Install new copper service pipe in one continuous piece. Splicing will not be permitted.
- G. Install parallel lines in neat fashion maintaining a minimum of 8" wall to wall separation. Each service line shall penetrate foundation separate from all other utility penetrations. Record origin of all service lines penetrating foundation.
- H. Cuts made in copper service tubing for installation of valves or connection to the building shall be square, reamed and all burrs removed.
- I. Solder used for service line fittings shall be lead-free, with a maximum lead content of 0.2 percent.

- J. Install curb stop at locations specified and install curb box directly above the curb stop with the cover at or slightly above grade.
- K. Connect copper service piping to building service piping with compression fitting.

3.03 - FIELD QUALITY CONTROL

- A. Flush piping prior to conducting pressure testing.
- B. Piping shall be pressure tested with air before piping is concealed. All joints shall be checked for leakage while under air pressure by swabbing, utilizing a soap and water solution, and leaks found shall be repaired and rechecked. Pressure of air during testing shall be at least 50 percent higher than normal working pressure. Piping shall be tested for pressure and leakage in accordance with Section 017550.
- C. Before piping and valves are concealed, recheck it for leaks.
- D. Rework or replace defective and leaking joints, and joints which are otherwise unsatisfactory. Peening, caulking and doping are not permitted.
- E. The Contractor shall furnish all labor, materials and equipment necessary to accomplish all testing and repairs.

3.04 - VALVE ACCESS

- A. Locate shutoff and control valves for easy access and operation. Where valves are located in enclosed spaces provide and install access doors.

3.05 - TESTING

- A. All small piping shall be tested for pressure and leakage, in accordance with AWWA Specification C600.

3.06 - SPARE PARTS

- A. Provide District with three (3) 100-foot sections of poly-tubing. Size appropriately, as indicated on the drawings.
- B. Provide District with three (3) spare sections of braided stainless steel hose used to connect caustic piping from 15E to new treatment building. Size appropriately, as indicated on the drawings.

END OF SECTION 221116

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Work of this Section includes all labor, materials, and equipment necessary to furnish and install process piping under pressure.
- B. Work includes exposed and underground piping as shown on the Drawings.

1.02 - REFERENCES

- A. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
- B. ANSI/AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.
- C. ANSI/AWWA - C115/A21.15 - American National Standard for Flanged Ductile Iron Pipe with Threaded Flanges.
- D. ANSI/AWWA C150/A21.50 - American National Standard for Thickness Design of Ductile Iron Pipe.
- E. ANSI/AWWA C600-93 - Installation of Ductile Iron Water Mains and Appurtenances.
- F. ANSI B18.2.1 - Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws.
- G. ANSI B18.2.2 - Square and Hex Nuts (Inch Series).
- H. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- I. AWWA C900 - DR-18, Class 150 PVC

1.03 - SUBMITTALS

- A. Submit information in accordance with Section 01330.
- B. Prepare a schedule for each service classification specified herein listing the pipe, fitting, lining, coating if applicable and joint type proposed for the project.
- C. Provide data on pipe material, coatings, linings, pipe fittings, dimensions and accessories. Provide manufacturer's catalog information.

- D. Piping shop drawings shall be provided. Field measurement then fabrication of pipe will not be permitted. All exposed pipe shall be delivered to the site cut to exact layout dimensions.
- E. Manufacturer's installation instructions for each pipe type.
- F. Foundry Records and Tests: Written transcripts of the test results shall be delivered directly to the Engineer within one week of the shipment of pipe with the date of the tests as close to the date of manufacture as practical. For ductile iron pipe, written transcripts shall be furnished directly to the Engineer in accordance with applicable sections of AWWA C151 and ANSI A21.51:

Transcripts & Certification:	51-5.2
Group Tests Required:	Hydrostatic Test (51-9)
	Tensile Test (51-12.1)
	Impact Test (51-12.2)
	Low Temperature Impact Test (51-13)
Number of Specific Group Tests Required in Addition to General Certification:	One (1) per pipe size per 2,000 linear feet of pipe.

1.04 - QUALITY ASSURANCE

- A. PVC pipe shall be marked with manufacturer's name, classification, or nominal thickness and "PVC" or "Poly Vinyl Chloride".
- B. Ductile iron pipe manufacturer shall be a member of the Ductile Iron Pipe Research Association.
- C. Pipe shall be marked with the manufacturer's name, classification, or nominal thickness and "DI" or "Ductile Iron".

1.05 - DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect, and handle products in accordance with manufacturer's instructions.
- B. Protect products from entry of foreign materials.

1.06 - ENVIRONMENTAL REQUIREMENTS

- A. Do not install piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.01 - PVC PIPE AND FITTINGS – BURIED AND EXPOSED

- A. Pipe shall be DR-18, Class 150 PVC with cell classification of 12454B as defined in Specifications ASTM D1784..

- B. All buried and exposed (dry and submerged service) shall be DR-18 Class 150 PVC in locations indicated on Drawings.
- C. All buried and exposed fittings shall be cement lined in accordance with AWWA C104, double thickness, minimum $\frac{3}{16}$ " for pipe and standard thickness for fittings.
- D. All buried fittings shall be provided with bituminous seal coat in accordance with AWWA C106, inside and out.
- E. All exposed (dry and immersion service) fittings shall be provided with an interior seal coat in accordance with AWWA C106. The exterior of all exposed fittings shall be factory primed using a high solids epoxy system with a shop coat thickness of 3.0-8.0 mils DFT. The primer shall be manufactured by Tnemec Company or equal and be red oxide in color. Field paint exposed pipe (dry and immersion service) as specified in Section 09910.
- F. Fittings: Comply with AWWA C110 for center-to-center end dimensions.
 - 1. Buried and Exposed: All buried and exposed fittings and buried and exposed valve joints shall be mechanically restrained and be provided with thrust blocking as detailed on the Drawings. Mechanical joint restraint shall be incorporated into the design of the follower gland. The restraining mechanism shall consist of individually actuated wedges. The joint restraint ring shall be made of 60-42-10 ductile iron conforming to ASTM A536-84. The restraint shall be series 1100 Megalug by Ebba Iron or equal.
 - a. Connection to flanges on equipment: Flanged fittings shall match those of Class 125 flanges in accordance with ANSI B16.1 with $\frac{1}{8}$ -inch full-face plain rubber SBR (Styrene Butadiene Copolymer) gaskets for sewage and water service. Gaskets for air service shall be EPDM (Ethylene Propylene Diene Monomer) with a temperature capability of 250 deg. F.
- G. Joints:
 - 1. Exposed Piping:
 - a. Flanged – As specified above for connection to flanges on equipment.
 - b. Mechanically Restrained Joint: as specified above.
- H. Exposed and Buried Service Bolts and Nuts: Nuts and bolts shall be alloy steel conforming to the physical properties of ASTM A563. Bolts shall conform to ANSI B18.2.1. Nuts shall conform to ANSI B18.2.2. Bolts and nuts for grooved pipe shall be heat-treated plated carbon steel, track

head, conforming to the physical properties of ASTM A183. Paint exposed and buried bolts and nuts in accordance with Section 09910.

- I. Submerged Service Bolts and Nuts: Type 304 stainless steel conforming to ASTM A-193. All piping bolts and nuts located in any tank, vault, well, chamber, or any other structure that treats, stores or conveys water or sewage shall be considered a submerged (immersion) service even if it is not physically located below the water level. The Contractor shall not paint these nuts and bolts. Mask the exposed threads prior to pipe painting. All bolts and nuts in any process tank, regardless if it is located above water level shall meet the requirements of this paragraph.
- J. Lubricant for Joints: Shall have no deteriorating effects on gasket or pipe material and shall be supplied by the pipe manufacturer or joint manufacturer in sufficient quantity.
- K. Manufacturer: JM Manufacturing Company Inc., or equal.
- L. Flanged Adapters: Dismantling joint Smith Blair, Inc., Model 975 or equal for plain end steel or cast iron pipe with all bolts, rings, gaskets and accessories.
- M. Couplings: Smith Blair, Inc., Model 411 or equal for plain end steel or cast iron pipe with all bolts, rings, gaskets and accessories.
- N. Restrained Joint Fittings: Ford Meter Box Co., Inc., UNI-FLANGE "BlockBuster" series 13100, 1400 & 1500 for PVC, ductile iron and steel piping.

2.02 – DUCTILE IRON PIPE AND FITTINGS – BURIED AND EXPOSED

- A. Pipe shall be centrifugally cast with primary graphite in nodular form or spherulitic and conform to AWWA C151.
- B. All buried and exposed (dry and submerged service) shall be thickness Class 53 in locations indicated on Drawings.
- C. Grooved end ductile iron pipe shall conform to AWWA C606. All pipe shall be manufactured to rigid groove dimensions.
- D. All buried and exposed pipe and fittings shall be cement lined in accordance with AWWA C104, double thickness, minimum 3/16" for pipe and standard thickness for fittings.
- E. All buried pipe and fittings shall be provided with bituminous seal coat in accordance with AWWA C106, inside and out.

- F. All exposed (dry and immersion service) pipe and fittings shall be provided with an interior seal coat in accordance with AWWA C106. The exterior of all exposed pipe and fittings shall be factory primed using a high solids epoxy system with a shop coat thickness of 3.0-8.0 mils DFT. The primer shall be manufactured by Tnemec Company or equal and be red oxide in color. Field paint exposed pipe (dry and immersion service) as specified in Section 09910.
- G. Fittings: Comply with AWWA C110 for center-to-center end dimensions.
1. Buried: All buried fitting and buried valve joints shall be mechanically restrained and be provided with thrust blocking as detailed on the Drawings. Mechanical joint restraint shall be incorporated into the design of the follower gland. The restraining mechanism shall consist of individually actuated wedges. The joint restraint ring shall be made of 60-42-10 ductile iron conforming to ASTM A536. The restraint shall be series 1100 Megalug by Ebba Iron or equal.
 2. Exposed:
 - a. Flanged fittings shall match those of Class 125 flanges in accordance with ANSI B16.1 with 1/8-inch full-face plain rubber SBR (Styrene Butadiene Copolymer) gaskets for sewage and water service.
 - b. Grooved fittings shall comply with AWWA C606 rigid radius grooving dimensions. Fittings shall be ductile conforming to ASTM A-536.
- H. Joints:
1. Exposed Piping:
 - a. Flanged – As specified above for fittings.
 - b. Grooved – Couplings shall be Victaulic Style 31 or equal, cast of ductile iron conforming to ASTM A-536 with alkyd-phenolic primer coating with a synthetic rubber gasket suitable for the intended service. Gasket shall be specially compounded to conform to ductile iron pipe surfaces with a short center leg that shall bridge the pipe ends offering an initial seal on the leading edge of the pipe ends.
 2. Buried Piping: AWWA C111 push on joint with stainless steel locking segments vulcanized into rubber ring gasket, Flex-Ring ® by American Ductile Iron Pipe or FieldLok ® by U.S. Pipe or equal.

- I. Exposed and Buried Service Bolts and Nuts: Nuts and bolts shall be alloy steel conforming to the physical properties of ASTM A563. Bolts shall conform to ANSI B18.2.1. Nuts shall conform to ANSI B18.2.2. Bolts and nuts for grooved pipe shall be heat-treated plated carbon steel, track head, conforming to the physical properties of ASTM A183. Paint exposed and buried bolts and nuts in accordance with Section 09910.
- J. Submerged Service Bolts and Nuts: Type 304 stainless steel conforming to ASTM A-193. All piping bolts and nuts located in any tank, vault, well, chamber, or any other structure that treats, stores or conveys water or sewage shall be considered a submerged (immersion) service even if it is not physically located below the water level. The Contractor shall not paint these nuts and bolts. Mask the exposed threads prior to pipe painting. All bolts and nuts in any process tank, regardless if it is located above water level shall meet the requirements of this paragraph.
- K. Lubricant for Joints: Shall have no deteriorating effects on gasket or pipe material and shall be supplied by the pipe manufacturer or joint manufacturer in sufficient quantity.
- L. Manufacturer: American Ductile Iron Pipe, U.S. Pipe & Foundry Co. or equal.
- M. Flanged Adapters: Dismantling joint Smith Blair, Inc., Model 975 or equal for plain end steel or cast iron pipe with all bolts, rings, gaskets and accessories.
- N. Couplings: Smith Blair, Inc., Model 411 or equal for plain end steel or cast iron pipe with all bolts, rings, gaskets and accessories.
- O. Restrained Joint Fittings: Ford Meter Box Co., Inc., UNI-FLANGE "BlockBuster" series 13100, 1400 & 1500 for PVC, ductile iron and steel piping.

PART 3 - EXECUTION

3.01 - BURIED PIPE INSTALLATION – GENERAL

- A. Install pipe in accordance with the manufacturer's written instructions and in accordance with applicable AWWA and ANSI standards.
- B. Comply with the excavation, backfill, compaction, and dewatering requirements contained in Division 2 of these specifications for installation of buried pipe.
- C. Keep buried piping clean as it is being installed by plugging the open end. Do not allow foreign material, such as soil and groundwater, from entering the pipe. If directed by the Engineer, the Contractor shall water flush installed pipe to remove foreign material. Water used to flush pipe

shall be trucked to the site by the Contractor. Use of site water will not be allowed. The Owner will not pay for water usage in this regard.

- D. Maintain the excavation free of water during the progress of the work. No pipes shall be installed in water nor shall any joints be made in water. All slides or cave-ins of trenches or cuts shall be remedied prior to the work continuing.
- E. Commence pipe laying at the lowest point, with the bell or socket end pointing in the direction of flow.
- F. Use the manufacturer's approved equipment for cutting pipe to length.
- G. Thoroughly clean pipe and fitting interiors, joint surfaces, and gaskets prior to them being placed in the trench for installation. Maintain all materials clean during the prosecution of the work.
- H. Carefully lower pipes and fittings into the trench using industry recognized rigging standards and techniques. Every joint shall be made in the trench.
- I. All adjustments to the line and grade of pipe laid in earth foundation shall be done by scraping away or filling in the earth under the barrel of the pipe, and not by blocking or wedging. Where the excavation has been carried too deep, but not in excess of six (6) inches, the Contractor may replace with suitable material and mechanically compact to provide a firm foundation. Wherever, the excavations have been carried to a depth in excess of six (6) inches, the Engineer may order stone or gravel refill without additional compensation. In all cases, the trench under the joint shall be excavated to permit an even bearing for the barrel of the pipe.
- J. When unsuitable materials are encountered, the Engineer may direct the Contractor to continue the excavation below the required elevation and the trench filled with suitable material. This work will be paid for as "Extra Work".

3.02 - BURIED AND EXPOSED PIPE/FITTING INSTALLATION – MECHANICAL/RESTRAINED JOINT

- A. Comply with the manufacturer's written instructions for installing pipe, fittings and retainer.
- B. Clean the socket and plain end. All surfaces with which the gasket comes in contact shall be thoroughly wired brushed just prior to assembly. All loose rust, mud, frozen material, sand, gravel, and other foreign material shall be removed.

- C. Wipe the gasket clean and install the gasket. Take care that no gasket loops or bulges protrude into the path of the entering pipe spigot. In temperatures below 32 degrees F, warm gaskets before installation.
- D. Using a clean brush, apply a liberal amount of lubricant completely over the end of the pipe, the spigot radius, and the outer surface of the pipe up to the assembly stripe. Also, apply lubricant completely over the exposed surface of the gasket.
- E. Install the bevel end of the pipe into the socket. Take care that the plain end is centrally located in the socket and push the pipe home. The joint deflection may then be set.
- F. When tightening bolts on mechanical joint fittings, the gland shall be brought up to the fitting flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around. This shall be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and last the remaining bolts. Repeat this process until the proper joint tightness is achieved and the nut is sheared off. Overstressing the bolts to compensate for the poor installation will not be permitted.
- G. Complete the installation by applying a single coat of bitumastic to the entire surface of the retainer.

3.03 - EXPOSED PIPING – FLANGED JOINT

- A. Flanged: Clean face of flange of all sand, grease, grit or other foreign matter. Center gasket before assembling joints. After alignment has been completed insert bolts and hand tighten nuts. Keep gap between flanges approximately uniform while tightening. Tighten bolts to required torque in several steps, alternating from one side to the other.
- B. Install flanged adapters and couplings in accordance with manufacturer's installation instructions.

3.04 - RECHECKING AND REPAIRING

- A. Pressure test all exposed and underground pipe in accordance with the requirements contained in Division 1. Before piping is concealed, recheck for leaks.
- B. Rework or replace defective and leaking joints, and joints that are otherwise unsatisfactory. Peening, caulking and doping are not permitted.

3.05 - FIELD QUALITY CONTROL

- A. Conduct pressure testing in accordance with AWWA C600 and Division 1 requirements.

- B. Blow out all dirt, debris and foreign material in all aeration process piping before placing the aeration system diffusers on-line. Do not use water to flush out material. The use of the supplied air compressors may be used if approved by the Engineer.

+ + END OF SECTION + +

++ NO TEXT ON THIS PAGE ++

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Pipe penetration seals.

PART 2 - PRODUCTS**2.01 - MANUFACTURERS**

- A. Thunderline Corp. LINK-SEAL or equal.

2.02 - MATERIALS

- A. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. Bolts and nuts shall be Type 18-8 stainless steel.
- B. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and wall opening under 40 feet of head. Seal shall be suitable for a temperature range of -40°F to 250°F and submergence in groundwater.

PART 3 - EXECUTION**3.01 - EXAMINATION**

- A. Determine the required inside diameter of each individual wall opening or sleeve. The inside diameter of each wall opening shall be sized as recommended by the manufacturer to fit the pipe and pipe penetration seal to assure a watertight joint. Sizing for correct pipe penetration seal model and number of links per seal may be obtained through manufacturer's catalog.
- B. If pipe outer diameter is nonstandard due to coating or insulation, consult manufacturer for engineering assistance and recommendation before proceeding with wall opening detail.

3.02 - INSTALLATION

- A. Install and tighten seal to provide a watertight pipe penetration in accordance with manufacturer's instructions.
- B. Install non-shrink grout on both sides of the wall as detailed on the Drawings.

+ + END OF SECTION + +

PART 1 – GENERAL**1.01 – DESCRIPTION OF WORK**

- A. Horizontal Delivery Electric Unit Heaters.

1.02 - REFERENCES

- A. Electric unit heaters shall meet the requirements of the National Electric Code (NEC) and shall be UL listed.

1.03 - SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Submit manufacturer's product data and installation instructions to Engineer.
- C. Submittal data shall include capacity and size of each heater and wiring instructions.

PART 2 - PRODUCTS**2.01 – HORIZONTAL DELIVERY ELECTRIC UNIT HEATER**

- A. Horizontal electric unit heater shall be manufactured by QMARK or approved equal.
- B. Heater to be of the KW rating, voltage and phase specified in the schedule.
- C. Unit Casing: Unit shall have heavy gauge die-formed steel casing with a corrosion resistant finish. Top of casing shall have two threaded holes for threaded rod suspension. Bottom of casing shall have a hinged panel for service access to wiring and controls.
- D. Heating Elements: Aluminum-finned, copper clad steel sheath heating element. Elements shall have kilowatt rating as specified. Provide automatic reset linear thermal cut-out, capillary type, to provide protection over entire length of element areas.
- E. Motor and Fan: The motor shall be totally enclosed, continuous duty, with automatic resetting, thermal-overload protection. Propeller fan shall be directly connected to the motor shaft and be statically balanced. Motor mounted with rubber vibration absorbing material.
- F. Electrical: All units shall have built-in contactors and low voltage control circuit transformers to provide single-source power connection. Built-in fuse blocks and factory supplied fuses shall be installed on all models with a 208-volt single-phase power supply. Factory mounted disconnect switches shall be provided. A wiring diagram and grounding lug shall be included in each control

compartment.

- G. Air Deflectors: Removable and adjustable horizontal air deflectors shall be furnished on all models.
- H. Thermostat: Each unit shall be furnished with a remote wall mounted, low voltage thermostat, range 40°F to 80°F. Thermostat shall be UL listed.
- I. Supports: Stainless steel hanger rods, double nuts, and ceiling/wall bracket.
- J. Provide other accessories as described on the contract drawings.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Install unit in accordance with manufacturer's published installation instructions.
- B. Do not install horizontal unit heaters closer than 12 inches to combustible materials in any direction.

Do not install vertical unit heaters closer than 18 inches from ceiling and 24 inches horizontally from combustible materials in any direction. The bottom of the unit must be a minimum of 8 feet above the floor.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 – DESCRIPTION OF WORK**

- A. Provide centrifugal exhaust fans, as specified herein, of sizes and capacities scheduled and in locations shown on drawings.
- B. Product listed in Part 2 of this Section include:
 - 1. Utility Exhaust Sets.

1.02 – REFERENCE CODES AND STANDARDS

- A. AMCA 99 – Standards Handbook
- B. AMCA 210 – Laboratory Methods of testing Fans for Rating
- C. AMCA 300 – Reverberant Room Method for Sound Testing of Fans
- D. ASHRAE Handbook, HVAC Applications Volume “Sound and Vibration Control”
- E. UL listed and labeled.

1.03 - RELATED WORK

- A. Section 15890 – Sheet Metal Work
- B. Section 15990 – Balancing of Air and Hydronic Systems

1.04 - SUBMITTALS

- A. Shop Drawings – Show fan layout, housing, materials, gauges, dimensions, weights and installation details
- B. Product data – Manufacturer’s fan performance (data includes cfm, rpm, bhp, motor nameplate data, tip speed, outlet velocity and static pressure) and sound performance (data includes sound power level ratings by octave bands) as tested in accordance with AMCA Standards 210 and 300.
- C. Fan performance curves – Submit curves for all fans with system performance shown, and for plus or minus 10 percent and plus or minus 20 percent change in fan rpm. Curves shall include plotted rpm, horsepower, cfm, static pressure, and fan surge line and operating point.

- D. Certified AMCA Ratings – Submit ratings for air and sound performance.
- E. UL Listing – Submit listing if specified.

1.05 – QUALITY ASSURANCE

- A. Factory balance each fan statically and dynamically, test run before shipment, and key fan wheel to fan shaft. Fans shall operate quietly and without pulsation or vibration. Conduct sound power level tests for each type fan at the factory in accordance with AMCA 300.
- B. Fans shall operate in the stable range of their performance curves.
- C. The fan external static pressures shown in the schedules are those required by the ductwork and apparatus, and do not include the internal and intake fan losses, inlet vanes or integral outlet dampers, inlet screens, outlet velocity heads or drive losses.
- D. Factory performance test each fan assembled in or as part of apparatus specified to be performance tested. Test shall display scheduled performance characteristics, using certified, calibrated testing instruments provided by the manufacturer of the apparatus.
- E. All fan performance ratings shall be based up on factory tests performed in accordance with AMCA 210. One fan of each type specified shall have actual factory performance tests performed prior to shipment. All fans shall be certified by AMCA and carry its seal.

PART 2 - PRODUCTS

2.01 - ACCEPTABLE MANUFACTURERS

- A. Greenheck , or approved equal.

2.02 - UTILITY EXHAUST SETS

- A. Supply, exhaust or return air fans shall be of the belt drive utility fan type in AMCA Arrangement 10 with a single width, single inlet housing in CW or CCW rotation.
- B. The housing shall be constructed of heavy gauge galvanized steel with lock formed seams permitting no air leakage. The housing shall be field rotatable to any of the eight standard discharge positions. Housing and bearing supports shall be constructed of welded steel members to prevent vibration and rigidly support the shaft and bearings.
- C. The fan wheel shall be of the forward curved type and shall be constructed of heavy gauge steel with uniform stamped blades. Wheels shall be statically and dynamically balanced. The wheel

cone and fan inlet cone shall be carefully matched for maximum performance and operating efficiency. Motors shall be permanently lubricated, heavy duty ball bearing type carefully matched to the fan load and furnished at the specified voltage, phase and enclosure.

- D. The fan shaft shall be ground and polished solid steel mounted in heavy duty, permanently sealed, pillow block ball bearings. Bearings shall be selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed, and securely attached to the wheel and motor shafts. The motor pulley shall be adjustable for final system balancing.
- E. Fan performance shall be based on tests conducted in accordance with AMCA Standard 210 test code for air moving devices, and fans shall be licensed to bear the AMCA Certified Ratings Seal for air performance.
- F. Utility fans shall be Model SFB (with forward curved wheels) as manufactured by Greenheck.

PART 3 - EXECUTION

3.01 – GENERAL

- A. Install fans, including all necessary structural supports and bracings as scheduled and located on the contract drawings in accordance with manufacturer's instructions and approved submittals.
- B. Connect duct to fans to allow for straight and smooth air flow.
- C. Provide flexible connections (minimum of 4") between fan and duct.
- D. Install fan level: +/- 5 degrees vertical. Final installation shall be free of all leaks from both fan and associated ductwork.

3.02 - START-UP, TESTING, DEMONSTRATION

- A. Start-up fans after checkout to insure proper alignment and phased electrical connections.
- B. Test fans individually and as part of system.
- C. Insure fans are properly interlocked with supply fans and with control system.
- D. Demonstrate operation to Owner and instruct maintenance personnel in operation of equipment.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Ductwork
- B. Supports
- C. Dampers
- D. Accessories

1.02 - REFERENCES

- A. ASHRAE - Handbook Fundamentals.
- B. SMACNA - HVAC Duct Construction Standards.
- C. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
- E. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- F. UL 555 S - Fire Dampers & Smoke Dampers.

1.03 - REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A standards.

1.04 - SUBMITTALS

- A. Submit ductwork shop drawings for approval:
 - 1. Coordinate layout duct drawings that differ from ductwork shown on contract drawings.
 - 2. Plans and section showing all equipment and accessories.
 - 3. Minimum 3/8-inch scale, double line, showing sizes, transverse joints, transitions, elevations, clearances and accessories; sections where required.
- B. Submit shop details and catalog cuts of:

1. Ductwork construction, including gauge and bracing schedule.
2. Supports.
3. Dampers.
4. Turning vanes.
5. Fire damper.
6. Access doors.
7. Flexible connections.
8. Other accessories.

1.05 - EXTRA MATERIALS

- A. Provide one (1) spare set of filters for each unit.

PART 2 - PRODUCTS

2.01 - MATERIALS

- A. General: Non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.
- B. Steel Duct: ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz. per sq. ft. for each side in conformance with ASTM A90.
- C. Fasteners: Rivets, bolts, or sheet metal screws of same material as ductwork.
- D. Flexible Duct: shall be of aluminum only, and it shall be used only when rectangular ductwork cannot be used. Maximum length of the flexible duct shall be 5 feet.
- E. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
- F. Hangers: Steel, galvanized.
- G. 2-hour rated wall penetration: Where small size duct up to 6-inch x 6-inch is penetrating a 2-hour wall, the duct shall be constructed of 16 gauge galvanized sheet metal.

2.02 - DUCT CONSTRUCTION

- A. Fabricate and support all ductwork in accordance with SMACNA Standards for 2-inch w.c. pressure classification unless otherwise noted on the drawings. Provide ductwork with the flange type joints and Pittsburgh lock longitudinal seam. Provide duct gauges, transverse, for the pressure classification as indicated in the corresponding SMACNA Tables of Rectangular Duct Reinforcement. All ductwork shall be sealed with SMACNA Class B seal.
- B. Construct Tees and bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes.
- C. Increases duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
- D. Connect flexible ducts to metal ducts with adhesive plus stainless steel clamps.
- E. Use double nuts and lock washers on threaded rod supports.
- F. All ductwork located on the top of the roof shall be of stainless steel sheet metal of minimum 20 gauge with the flange type joints and Pittsburgh lock longitudinal seam.
- G. Where flexible duct is used, the connection to the diffuser shall be with a rigid galvanized steel elbow.

2.03 - STAINLESS STEEL RECTANGULAR DUCTS AND FITTINGS

- A. Construct ducts of minimum 20 gage AISI Type 316 stainless steel sheet metal, and in accordance with the latest SMACNA HVAC Duct Construction Standards and pressure classifications as stated on the contract drawings (minimum 2" w.c. pressure classification).
- B. Piping, conduit and structure shall not penetrate ductwork. Where this condition cannot be avoided and with the written permission of the Engineer, follow Figure 2-8 of SMACNA HVAC Duct Construction Standards-Metal and Flexible, except that sides of transition sections shall slope a maximum of 15 degrees.
- C. Provide 90-degree full-radius elbows with a centerline radius 1.5 times the duct width in the plane of the bend.
- D. For elbows with centerline radius less than 1.5 times the width of the duct in the plane of the bend, provide turning vanes.

- E. Provide square throat elbows with manufactured turning vanes.
- F. All dissimilar metals shall be connected with flanged joints made up with fiber or neoprene gaskets to prevent contact between dissimilar metals. Flanges shall be fastened with bolts protected by ferrules and washers made of the same materials as the gaskets.
- G. For split fittings, the split shall be proportional to the air flow. See Figure 2-5 of SMACNA HVAC Duct Construction Standards- Metal and Flexible.
- H. Transitions and Offsets shall follow Figure 2-7 of SMACNA HVAC Duct Construction Standards – Metal and Flexible, except that sides of transitions shall slope a maximum of 15 degrees.
- I. All branch take-offs perpendicular to the main shall be a 45 degree entry.
- J. Longitudinal seams shall be of the Pittsburgh Lock type outlined in the SMACNA HVAC Duct Construction Standards – Metal and Flexible, Figure 1-5.
- K. Duct transverse joints shall be selected and used consistent with the static pressure class, applicable sealing requirements, materials involved, duct support intervals and other provisions for proper assembly of ductwork outlined in the SMACNA HVAC Duct Construction Standards – Metal and Flexible. Transverse joints T-25a, T-25b (Ductmate) shall only be used. Metal clips will only be allowed (NO PVC). Ductmate shall not be used for the following (use transverse joints T-15 through T-24 in these cases):
 - 1. The Ductmate '45' system shall not be used for applications with duct gauges heavier than 10 or lighter than 22.
 - 2. The Ductmate '35' system shall not be used for applications with duct gauges heavier than 16 GA. or lighter than 26 GA.
 - 3. The Ductmate '25' system shall not be used for application with duct gauges heavier than 20 GA. or lighter than 26 GA.

2.04 - TURNING VANES

- A. Galvanized steel ductwork: galvanized steel.
- B. Other ductwork: same materials as ductwork.
- C. Pressure Class 2-inch w.c.: SMACNA HVAC Duct Construction Standards.
- D. Install at square duct elbows and as noted on drawings.

2.05 - FLEXIBLE CONNECTIONS

- A. SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- B. With metal collars.
- C. 2-inch slack in fabric.
- D. Installed to allow minimum movement of 1-inch.
- E. Install at duct connections to all gas fired AC units and to all fans.
- F. Materials: Neoprene coated glass fabric, 30 oz. per sq. yd. with sewn and cemented seams, similar to Vent Fabrics, Inc.

2.06 - VOLUME DAMPERS

- A. MANUFACTURERS
 - 1. Ruskin Mfr. Co. Type IBD 23
 - 2. Arrow Damper & Louver.
 - 3. Imperial Damper Co.
- B. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.
- C. Fabricate single blade dampers for duct sizes up to 6 inches in height.
- D. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes of 4 inches for ducts above 6 inches in height. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- E. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- F. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches, provide regulator at both ends.
- G. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- H. Provide volume damper at each duct branch and also where is shown on the drawing. Install volume damper at each branch even if damper is not shown on the drawing.

2.07 - ACCESS DOORS

- A. Fabricate in accordance with SMACNA Duct Construction Standards and as indicated.
- B. For HVAC duct systems, construct doors of the same material as the ductwork. Minimum size of access doors shall be 8 inches by 8 inches, unless shown otherwise.
- C. Access doors shall be insulated same as duct.
- D. Provide with continuous neoprene gaskets around perimeter of access doors for airtight seal.
- E. Provide all access doors with cam lock latches.
- F. Provide access door with fireproof gaskets in exhaust ductwork. Doors shall be of extra-heavy black iron construction and grease-tight when in place. Locate doors on 20-foot centers on straight runs of ductwork and at each change of direction. Position doors on the side of duct a minimum of 1.5 inches above the bottom of the duct.
- G. All access doors serving a fire damper shall be painted red and shall have a label with white letters not less than ½ inch high reading "FIRE DAMPER". No external ductwork insulation shall conceal a fire damper access door unless there is a label attached to the insulation indicating the exact location of the access door.
- H. Provide access doors in following locations:
 - 1. Fire damper, on both sides of ducts.
 - 2. Automatic dampers: linkage side
 - 3. Smoke detection heads.
 - 4. On both sides of ducts where necessary to provide maintenance accessibility to equipment on either side.
 - 5. Fan Plenums.
 - a. In-Line Fans (suction and discharge sides)
 - b. Other items requiring access for service/maintenance
- I. Where duct access doors are concealed the Contractor shall furnish and pay for installation of access doors to be mounted in the fire rated walls and ductwork enclosures. The access doors

must be fire resistive and minimum 6" larger on each side then the duct access door for the above mentioned applications.

2.08 - MANUAL VOLUME DAMPER

- A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.
- B. Fabricate single blade dampers for duct sizes up to 6 inches in height.
- C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes of 4 inches for ducts above 6 inches in height. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- E. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches, provide regulator at both ends.
- F. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- G. Volume damper shall be provided at each duct branch and also where shown on the drawings. Volume dampers must be installed at each branch even if they are not shown on the drawing.
- H. Approved Manufacturers:
 - 1. Ruskin Mfr. Co.
 - 2. Arrow Damper & Louver.
 - 3. Imperial Damper Co.

2.09 - BACKDRAFT DAMPERS

- A. Dampers shall be low-leakage, parallel-blade type. Damper sizes shall be suitable for duct sizes noted on the contract drawings. The dampers shall be suitable for a minimum 4000 fpm velocity.
- B. Damper frames shall be minimum No. 12 gauge galvanized steel blades shall be minimum No. 16 gauge galvanized steel or Type 6063T5 aluminum with press-fit ball bearings.
- C. Dampers shall be complete with adjustable counterweights and linkage for duty at .20 inches w.g. and 3500 fpm.

- D. Provide neoprene or silicone rubber blade seals.
- E. Approved manufacturers – Ruskin Manufacturing Company.

2.10 - DUCT TEST HOLES

- A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.11 - DUCT HANGERS AND SUPPORTS

- A. Provide trapeze, strap or angle iron hangers meeting SMACNA HVAC Duct Construction standards – Metal and Flexible.
- B. Materials of hangers, supports and fasteners shall conform to the manufacturer's load ratings.
- C. Hangers, supports, upper attachments and inserts shall be hot-dip galvanized steel or stainless steel.
- D. Fasteners for HVAC duct systems shall be hot-dip galvanized steel, cadmium-plated steel or stainless steel.
- E. Secure ductwork hangers attached to concrete structures and slabs with embedded inserts, anchor bolts or concrete fasteners. A safety factor of 5 should be used in selection of all inserts and expansion bolts (if applicable safety factor shall be determined by analysis of seismic loads and the greater safety factor shall be used).
- F. Provide hangers and supports not more than 12 inches from each face of a horizontal elbow.
- G. Plenums shall be supported to permit personnel to enter the plenum. If no structural steel design is shown on the drawings, it is the responsibility of the Contractor to provide the services of a licensed structural engineer in the State of New York to submit a structural design for review.

2.12 - SEALANTS

- A. Where ducts are not continuously welded or soldered, provide sealants and gaskets as required to meet the specified duct leakage allowance.
- B. Provide Gaskets, Sealers, Mastics and Tapes as manufactured by Ductmate.

2.13 - STANDARD FLEXIBLE CONNECTIONS

- A. Provide fabric flexible duct connections.
- B. Fabric shall be UL approved, fire-retardant, closely-woven glass, doublecoated with neoprene, and a minimum of 4 inches wide.
- C. Shall be installed at duct connections to all ceiling hung fans and where vibration will be transmitted through ductwork.
- D. Approved Manufacturers:
 - 1. "Ventglas" by Vent Fabrics, Inc.

2.14 - HEAVY DUTY FLEXIBLE CONNECTIONS

- A. Heavy Duty Flexible Connections shall be used in high pressure (greater than 2 in. w.c.), high temperature (greater than 150 degree F) air applications or where the gas is highly corrosive and the duct connector must be leak proof.
- B. Flexible Connectors shall be flanged. If installed outdoors, all metallic components shall be stainless steel construction. Provide flexible connector materials of construction as recommended by the manufacturer for the pressure, temperature, and gas that is being used in air handler system.
- C. Approved Manufacturers:
 - 1. Mercer Rubber Company

2.15 - HOODED GRAVITY INTAKE (GVI-1, 2, 3)

- A. Gravity hoods shall be manufactured by Greenheck or approved equal. See drawings to verify size and performance.
- B. Gravity roof ventilators shall be constructed of heavy gauge aluminum.
- C. Hoods shall be constructed of precision formed, arched panels with interlocking seams. Support members shall be constructed of galvanized steel and fastened so that the hood can be either removed completely from the base or hinged open.

2.16 - ACCESSORIES

- A. Connection to louvers furnished under this work.

- B. Duct-mounted automatic controls and monitoring devices.
- C. Mount on mechanical equipment all devices related to automatic controls.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Support ductwork with suitable sheared strips of galvanized metals or 1-inch by 1/8-inch galvanized steel band iron hangers, on each side of the duct.
- B. Attach hangers to the duct work using sheet metal screws.
- C. Space hangers approximately eight feet along the duct except as noted below.
- D. Obstructions may be located within ducts, but only with the permission of the Engineer for each instance.
- E. Ease obstructions in accordance with the recommendations of the SMACNA "Duct Manual".
- F. Do not exceed 45 for easement transition angle.
- G. Seal transverse joints with approved sealer in accordance with manufacturer's directions.
- H. Insulation: Where drawings and insulation specifications indicate that ducts are to be insulated make provisions for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. Metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be finished to be mounted on duct.

3.02 - DUCT CONSTRUCTION

- A. General:
 - 1. In accordance with SMACNA HVAC Duct Construction Standards, except as noted.
 - 2. All duct joints shall be made with companion bolted angles with 1/8-inch neoprene gaskets which are shop fabricated and machine attached to ductwork.
 - a. Installation in accordance with manufacturer's recommendations, except as noted.
 - b. Metal clips only; PVC not permitted.

- c. Ductmate or similar joint system.
- 3. Hangers
 - a. Galvanized steel hangers.
 - b. Follow the SMACNA manual for sizing and fabrication of duct hangers.
- B. Provide flexible connections immediately adjacent to equipment in ducts associated with motorized equipment. Cover connections to medium pressure fans with leaded vinyl sheet, held in place with metal straps.
- C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- D. All patching and repairing shall be performed under this Contract.

3.03 - DUCTWORK SCHEDULE

AIR SYSTEM	MATERIAL
Supply	Stainless Steel
Return	Stainless Steel
Exhaust	Stainless Steel

3.04 - ADJUSTING, TESTING AND CLEANING

- A. Air Filters
 - 1. Air filters shall be used during the construction period. Remove filters used during the construction period and replace with clean filters upon final completion of project.
 - 2. Operation of system fan(s) without filters in place shall not be permitted.
 - 3. Filters shall be UL Class I and their installation shall conform to NFPA 90A and 90B.

3.05 - FIELD QUALITY CONTROL

- A. Total system leakage shall not exceed 10 percent of the scheduled design capacity of the system.
- B. Test leakage shall include all ductwork from fan outlet to the last air outlets.

+ + END OF SECTION + +

++ NO TEXT ON THIS PAGE ++

PART 1 - GENERAL**1.01 - WORK INCLUDED**

- A. Cleaning and testing of mechanical systems furnished under this contract.

1.02 - RELATED WORK SPECIFIED ELSEWHERE

- A. Section 15993: Balancing of Systems

1.03 - QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 - 1. Perform factory testing of factory fabricated equipment in complete accordance with the agencies having jurisdiction.
 - 2. Perform field testing of piping systems in complete accordance with the local utilities and other agencies having jurisdiction and as specified.

1.04 - JOB CONDITIONS

- A. Protection: During test Work, protect controls, gages and accessories which are not designed to withstand test pressures. Do not utilize permanently installed gages for field testing of systems.
- B. Scheduling, Sequencing:
 - 1. Transmit written notification of proposed data and time of operational tests to the Engineer at least 5 days in advance of such tests.
 - 2. Perform cleaning and testing Work in the presence of the Engineer.
 - 3. Pressure test piping systems inside buildings, at the roughing-in stage of installation, before piping is insulated and at other times as directed. Perform test operations in sections as required and directed, to progress the Work in a satisfactory manner. Valve or cap-off sections to be installed in the permanent piping systems, or temporary valves or caps as required to perform the Work.

PART 2 - PRODUCTS**2.01 - MATERIALS**

- A. Test Equipment and Instruments: Type and kind as required for the particular system under test.

- B. Test Media: As specified for the particular piping or system under test.
- C. Cleaning Agent (water): As specified for the particular piping, apparatus or system being cleaned.

2.02 - VACUUM CLEANING OF NEW DUCTWORK

- A. Vacuum clean all new ductwork used for this project.
- B. Provide set of spare air filters for each AC unit.

PART 3 - EXECUTION

3.01 - PRELIMINARY WORK

- A. Thoroughly clean pipe and tubing prior to installation. This work shall be performed under this Contract. During installation, prevent foreign matter from entering system. Prevent if possible and remove stoppages or obstructions from piping and systems.

3.02 - PRESSURE TESTS - PIPING

- A. Piping shall be tight under test and shall not show loss in pressure or visible leaks, during test operations or after the minimum duration of time as specified. Remove piping which is not tight under test; remake joints and repeat test until no leaks occur.
- B. Water Systems:
 - 1. Circulating Water Systems: Hot water systems, including cold water makeup piping connections to hot water system.
 - a. Before final connections are made perform hydrostatic test at 1-1/2 times the maximum working pressure, but not less than 125 psig, for 4 hours.

3.03 - TESTING OF EQUIPMENT, APPARATUS AND APPURTENANCES

- A. Relief Valves: Increase pressure in equipment or apparatus to relief valve setting, to test opening of valves at required relief pressures.

3.04 - HOT WATER SYSTEM CLEANING AND OPERATIONAL TESTING

- A. Circulating Water Systems:

1. **Cleaning:** Flush system and apparatus, upon completion of pressure and miscellaneous tests. Completely open valves and flush each system with clean water, prior to chemical cleaning. Repeatedly flush at short intervals until twice the system water capacity has been flushed through. Chemically clean systems immediately following flushing operations. Circulate a solution consisting of trisodium phosphate, in a proportion of one pound of chemical to every 50 gallons of water in the system. Completely fill system with cleaning solution: vent system and place in operation, with automatic controls operating temperature or an operating temperature designated by the Engineer. Circulate the solution through the system for a minimum of 4 consecutive hours. Immediately drain system and flush with clean water until the pH at the farthest drain matches the clean water input. Keep strainers unplugged during the cleaning operations. Remove and clean strainer screens prior to operational test. Refill system with clean water.
2. **Operational Test:** Run system in an automatic mode for a minimum of 120 consecutive hours, with final connections made to apparatus, equipment and accessories. Make final adjustments.

3.05 - VENTILATING AND AIR CONDITIONING SYSTEMS LEAKAGE TESTING

- A. **Testing:** Air testing during erection shall include separate leakage air tests of air riser, horizontal distribution system, and, after all ductwork is installed and the central stations apparatus is erected, leakage testing of the whole system.
- B. Tests shall be made prior to insulation of system being tested using suitable test equipment for seal class "C" (SMACNA), including test blower, "U" tube, orifice, tubing and cocks, arranged to indicate the amount of air leakage.
- C. The leakage tests of the ductwork shall be made with pressure in the header maintained at approximately 4 inches, obtained by operation of the test blower.
- D. All joints shall be inspected and checked for audible leakage, repaired, if necessary, and retested. Duct leakage shall be limited to the following:

Average Size of Run Diameter or Equivalent	*A/100 ft. Run
12 inches or less	10
20 inches or less	15
30 inches or less	25
40 inches or less	30
50 inches or less	30
* (A) = Permissible loss in cfm	

Total system leakage shall not exceed 1 percent of the scheduled design capacity of the system when tested as per SMACNA testing methods.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. General electrical requirements shall be provided in accordance with the requirements specified under this section, the Specifications and the Contract Drawings.
- B. The Contractor shall provide all labor, materials and equipment required to perform the work as specified in the Specifications and as shown on the Contract Drawings. The work shall also include the following:
 - 1. Inserts and other electrical items which shall be installed embedded in concrete, or built into walls, partitions, ceilings or panels.
 - 2. Installation procedures and schedules under other contracts shall be reviewed and coordinated with other Subcontractors regarding the installation of electrical items that must be installed.
 - 3. Keep informed of the construction so the electrical work shall be installed within such time periods as will not delay the work of the other Subcontractors.
 - 4. Notify other Subcontractors in advance of the installation of the work included, so they shall have sufficient time for coordination and installation of interrelated items that are included in their contracts and that must be installed in conjunction with the work included under this Contract.
- C. The existing plant will be maintained in continuous operation during the entire construction period of all contracts. Work under each contract shall be so scheduled and conducted by each Contractor that such work will not impede any treatment process, reduce the quality of the plant effluent or cause odor or other nuisance. In performing the work shown and specified, the Contractor shall plan and schedule his work to meet the plant and collection system operating requirements.
- D. The Contractor has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done at no additional cost and provided that all requirements of these specifications are fulfilled. No plant personnel will be available to supervise, operate or maintain any temporary facilities. Work not specifically covered in the following paragraphs may, in general, be done at any time during the contract period, subject to the operating requirements outlined hereinafter. All references to days in this section are to consecutive calendar days, except where noted. All references to schedule completion dates shall mean the date noted in the latest revision of the CPM schedule.

- E. It shall be the responsibility of the Contractor to move all equipment, desks, stored materials, etc. from one building to another. All moves shall be scheduled and coordinated with the Engineer.

1.02 - RELATED SPECIFICATIONS

- A. Specification 01310 – Maintenance of Plant Operations
- B. Specification 09900 – Painting.
- C. Specification 16292 – Power Distribution System Coordination
- D. Specification 16036 – Testing

1.03 - PAYMENT

- A. Payment for general electrical requirements shall be made as provided for in the Specifications.

1.04 - REFERENCES

- A. General electrical requirements shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70, National Electrical Code.
 - 2. NEMA, National Electrical Manufacturers Association.
 - 3. UL, Underwriters Laboratories Incorporated.

1.05 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:
 - 1. Point-to-point field wiring diagrams.
 - 2. Qualifications of proposed wiring coordinator who shall prepare the point-to-point field wiring diagrams.
- C. Reports: Demonstration of equipment report shall be submitted.

1.06 - QUALITY ASSURANCE**A. General:**

1. All equipment and devices, provided under each Contract, shall be properly connected and interconnected with other equipment and devices so as to render the installations complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Specifications or shown on the Contract Drawings.
2. Similar products shall be by the same manufacturer for uniformity on the Contract.
3. Electrical material and equipment shall be new and shall bear the label of UL, or other nationally recognized, independent testing laboratory, wherever standards have been established and label service regularly applies.
4. Where execution of the work under this Contract requires certain systems and equipment to be modified, the Contractor shall perform the work with due regard to maintenance of operations and construction staging in accordance with the Specifications.
5. The modification work shall be coordinated in advance with the plant superintendent and existing conditions. Contractor shall field determine and make such investigations as required to determine the functionality of each circuit and identify circuit terminations as required for the modifications intended to ensure the proper interface of all components for a complete functional system.
6. The Contractor shall retain the services of a wiring coordinator, to prepare the point-to-point field wiring diagrams. The wiring coordinator shall have experience in the development of the diagrams of the type specified and shall have served in a similar role on a project of similar size and complexity.

B. Area Classifications:

1. Materials and equipment for all indoor areas shall conform to the area classifications shown on the Contract Drawings or stated in the Specifications.
2. Materials and equipment for all outdoor areas shall conform to corrosive requirements, unless shown otherwise on the Contract Drawings or stated in the Specifications.
3. The locations and requirements shall be in accordance with the following:

- a. Materials, equipment and incidentals installed in corrosive areas shall meet NEC and NEMA requirements for corrosive locations. Enclosures installed in corrosive locations shall meet NEMA 4X requirements. All exterior areas for this Contract are noted as NEMA 4X.
- b. Materials, equipment and incidentals installed in hazardous locations shall meet NEC requirements for the Class and Division designated. Enclosures installed in hazardous locations shall be provided with stainless steel hardware and watertight gasketing.
- c. Materials, equipment and incidentals installed in dusty locations shall meet NEC and NEMA 12 requirements. The interiors of all unit substation buildings are noted as NEMA 12.

1.07 - GENERAL CONSTRAINTS

- A. General: Under Paragraph 1.09, Sequence of Construction and Operation, herein, the sequence for units which are to be taken out of service for renovation and remedial work is outlined for each area. The operational status of completed or existing units other than the designated units shall not be interrupted by the Contractor. New units may only be used after the specified testing and acceptance of the units.
- B. Accidental Shutdown: In the event of accidental shutdown of plant equipment the Contractor shall notify plant personnel immediately to allow for an orderly restart of affected equipment.
- C. Access to Plant Site: An unobstructed traffic route through the plant must be maintained at all times for the plant equipment and personnel.
- D. Access on Internal Roads: Vehicular access to the treatment units and buildings must be maintained at all times.
- E. Personnel Access: Treatment plant personnel must have access to all areas which remain in operation throughout the construction period. The construction work must be phased, and access for plant workers must be maintained during construction.
- F. Power, Light and Communication Systems: Electric power, lighting service and communications systems shall be maintained in uninterrupted operation in all areas which remain in operation. Individual units may be disconnected as required for replacement.

- G. Sump Pumps and Sumps: All existing pumps shall be maintained in an operable condition with either existing pumps or temporary pumps. Interim piping, power and controls shall be provided as required by the staged construction sequence.
- H. Service Interruptions:
1. When a construction task requires a suspension of normal operations of a plant utility system for a period of less than twenty-four (24) continuous hours, the suspension shall be considered a service interruption.
 2. The contractor shall compile an inventory of the labor and materials required to perform the tasks, an estimate of the time required and a written description of the steps required to complete the task resulting in a service interruption. The inventory, time estimate and written procedure shall be submitted to the Engineer for review sixty (60) days prior to the start date of the task as defined in the CPM schedule. If the proposed procedure submitted by the Contractor is acceptable, the Engineer shall authorize in writing, the service interruption pending the verification of materials and labor and the final notification specified therein.
 3. No service interruption shall be initiated until the list of materials and labor is verified by the Engineer as on site at least one week prior to the proposed start date. After verification of the list of materials and labor, the Contractor shall notify the Engineer of the exact date that he wishes to perform the work in writing two (2) normal working days, excluding Saturdays, Sundays and holidays, prior to the proposed date.
 4. When the normal operations of a plant utility system unit are suspended longer than twenty-four (24) hours, then the procedures for a shutdown, specified hereinafter, shall be enforced.

1.08 - PRIOR, CURRENT AND FUTURE CONSTRUCTION CONTRACTS

- A. Refer to Specification 01120- Contract Summary

1.09 - SEQUENCE OF CONSTRUCTION AND OPERATION

- A. In order to maintain continuous plant operation during construction, a phased removal, construction and operational sequence will be required as described herein. The order in which the principal structures or work areas are presented herein is for convenience of presentation and is not intended as a sequence of work or a listing of priorities. The Contractor is advised that work in multiple areas of the plant must be performed simultaneously in order to complete the entire scope of the contract within the allotted time. The Contractor is advised that the presentation is

not organized in accordance with specific trades. The work sequence described herein as being required to complete a building, an area or a process shall be considered all-encompassing for all trades.

- B. Refer to Specification 01310 – Maintenance of Plant Operations for Electrical work phasing and sequencing requirements.

1.10 - TEMPORARY FACILITIES

- A. Temporary facilities shall be provided in accordance with the requirements of Division 1, Maintenance of Plant Operations.
- B. Temporary facilities shall be any equipment, materials, controls, services and accessories temporarily needed for access to and for protection of all existing structures and equipment, and to maintain an operating system, all in accordance with the provisions of these Specifications.
- C. The size or capacity of the temporary facility shall generally be equal to the size or capacity of the facility replaced, unless otherwise directed by the Engineer.

1.11 - INTERIM AND TEMPORARY MATERIAL AND EQUIPMENT

- A. The Contractor shall furnish, install and remove the interim material and equipment in accordance with the Contract Documents.
- B. The Contractor is responsible for the removal from the site of all interim material and equipment and disposal thereof in accordance with the Specifications.
- C. Temporary material and equipment is material and equipment which must be furnished by the Contractor based on his method of construction for maintaining a treatment process for a specific period, or the utility or service systems during the installation or connection of new equipment or material. For specific cases, the location and general routing of temporary equipment and material has been shown for the convenience of the Contractor and to ensure minimal disruption of plant operations during the equipment installation. The Contractor is advised that temporary connection between the existing and new service shall be necessary to comply with the General Constraints specified herein.

1.12 - ADDITIONAL PROVISIONS

- A. Shutdowns:
 - 1. Before commencing work on any of the existing equipment which requires a shutdown or suspension of normal operations, the Contractor shall request permission from the

Engineer, in writing, at least sixty (60) days in advance of the date he proposes to commence such work. A date in a CPM schedule shall not constitute proper notification. In the request, the Contractor shall explain what construction procedures shall be used during the shutdown.

2. The Contractor is prohibited from shutting down any treatment units or equipment before obtaining written authorization from the Engineer to proceed with such operations; such authorization shall, however, not be construed as a waiver of the requirements for the uninterrupted operation of the plant. A final notification in writing shall be submitted by the Contractor two (2) normal working days excluding Saturdays, Sundays and holidays, in advance of the actual shutdown.
- B. Protection of Underground and Covered Facilities: The location and extent of these facilities are not guaranteed, and the Contractor is cautioned to proceed with care, in the construction of new work in order to prevent damage to any existing structures, piping, or facilities. Protection and support for all underground facilities shall be provided to insure that the service provided for all existing facilities will not be interrupted. Any rerouting of the existing facilities to facilitate construction operation shall be only with written permission of the Engineer and then in the manner and at the time approved by the Engineer. The rerouting shall be made at no additional cost. Contractor shall pay for all damage to existing underground facilities that he causes and compensate the County for any service interruption caused by such damages.
- C. Special Protection of Machinery and Equipment:
1. The Contractor shall take all protective measures to the satisfaction of the Engineer necessary to insure that inclement weather or dust and debris from demolition does not enter any of the mechanical or electrical equipment enclosures. Enclosures shall be provided where necessary to prevent contamination of the air. All protective measures shall be furnished, installed, lighted, ventilated, maintained and removed at the Contractor's own cost. The Contractor shall pay for all damage to machinery and equipment caused by his failure to adequately protect it.
 2. Interior dustproof covers shall be a heavy reinforced polyethylene film curtain, minimum thickness 6 mils, supported by wood framing. All seams and penetrations shall be sealed with duct tape on two sides. Junctions with existing walls, floors and ceilings shall be made with a double fold secured with a backing strip anchored to the existing wall, floor and ceiling.

3. Exterior weather tight enclosures shall be provided whenever a section of a roof or exterior wall on an existing building is removed or equipment is installed in a new building.
- D. Site Visit: The Contractor, before submitting his proposal, shall visit the site and shall be responsible for having ascertained local conditions, such as location, accessibility and general character of the site, the character and extent of any existing work within or adjacent to the site, and any other work being performed on the site at the time of submitting his proposal. The Contractor shall fully examine all the drawings relating to the work and shall become completely informed as to the extent and character of the work required and prevailing existing condition. No allowances will be made for the Contractor's failure to avail himself of such information.
- E. Existing Cables and Conduits
1. It is anticipated that several branch circuit conduits and/or lights may have to be routed, extended, relocated or temporarily removed and replaced, to permit the installation or removal of equipment by other trades under this Scope of Work. Review all drawings and allow for the rerouting or relocation of wiring systems and devices to remain which must be relocated or rerouted. This Contractor shall include these costs in his bid price, and accomplish these rework items to suit field requirements and conditions.
 2. When working with existing equipment or wiring systems, care shall be taken to avoid damage, and shutdown of process equipment. Prior to working in an area, Contractor shall examine existing conditions and file an inspection report with the Engineer. Any additional defects which result from the Contractor's work, will result in the Contractor being held liable for damage to existing equipment.
 3. Where new construction involves connecting to or using existing equipment, the Contractor shall include in his bid price, all cost, work and materials required to adapt, extend or rework the prevailing existing "As Is" condition, to the new work. Should an existing condition prove to be grossly deteriorated or inadequate for modification, such condition shall be reported to the Engineer for a remedy.
 4. Where existing empty conduits are to be used for new wiring systems, they shall be assumed to be in poor condition requiring prior "make ready" work before using. A wire brush reamer shall be pulled through prior to wiring and, if necessary, water accumulations shall be pumped or blown out.
 5. Contractor shall trace and tag all wires before these are relocated and reconnected from the equipment. Contractor shall coordinate removal of wires with the Field Engineer.

6. The Contractor's attention is directed to the requirement that he shall work on an existing Sewage Treatment Plant which shall remain in operation.
 7. As indicated on the plans, certain equipment and/or wiring systems are being taken out of active service permanently and the Contractor shall perform all work required to remove or safely abandon existing systems.
 8. The following describes the intended work scope for removals:
 - a. The Contractor shall arrange for the safe de-energization of all electrical equipment.
 - b. Feeder and branch wiring, conduits and boxes routed exposed shall be removed in their entirety by the Contractor.
 - c. Feeder and branch wiring and conduits in earth, concrete slabs or masonry shall be abandoned in place, except that wiring ends shall be cut off (or removed) at the conduit mouth by the Contractor. When feeder and branch wiring and conduits interfere with the installation of any new project work they shall be removed in their entirety by the Contractor. Conduits which exit floor slabs, and walls, shall be cut or hammered down, flush with floor level or wall and filled with epoxy concrete by the Contractor.
 9. Generally all equipment, boxes, fixtures, etc. shall be removed from the site and disposed of at Contractor's expense, or delivered to an on-site storage area when the Engineer directs.
 10. The Contractor shall be responsible for all damage to existing structures, equipment, and facilities caused by his construction operations and must repair all such damage when and as ordered at no additional cost.
- F. Emergency Repair Crews: In case the Contractor's operations disrupt the treatment process or the minimum operating facilities herein before described, at any time, he shall at his own cost immediately make all repairs or replacements and do all work necessary to restore the plant to operation to the satisfaction of the Engineer. Such work shall progress continuously to completion on a 24-hour day, seven work-day week basis. The Contractor shall provide the services of emergency repair crews, available on call 24 hours per day.

PART 2 - PRODUCTS**2.01 - POINT-TO-POINT FIELD WIRING DIAGRAMS**

- A. The Contractor shall provide point-to-point field wiring diagrams for all equipment, including equipment provided by other Contractors.
- B. The diagrams shall be developed for performance of the work and to document terminations. The diagrams shall be prepared based upon approved shop drawings of related Contracts, working drawings and inspections as necessary to complete the diagrams. The diagrams shall include:
 - 1. External wiring for each piece of equipment, panel, instrument and other devices to control stations, lighting panels and motor controllers. The diagrams shall include control, status, signal and power wiring. Power diagrams shall include connections to switchgear, motor control centers, panelboards, panels and field devices.
 - 2. Numbered terminal block identification for each wire termination.
 - 3. Identification of the assigned wire numbers and color coding for all interconnections.
 - 4. Identification of all wiring by the conduit tag in which the wire is installed.
 - 5. Terminal, junction, and pull boxes through which wiring is routed.
 - 6. Identification of equipment with functional name and number to which wiring is to be connected.

2.2 - SHOP FINISHES

- A. Electrical equipment shall be shop painted in accordance with the requirements of Specification 09900.
- B. Exposed ferrous metal surfaces except aluminum, bronze, brass and stainless steel components shall be cleaned with a commercial blast and primed with one coat of rust inhibitive primer.
- C. Manufactured assemblies such as switchgear, substations, motor control centers, panelboards and motor controllers shall be shop painted in accordance with the requirements of Specification 09900.
- D. Other equipment shall be painted with the manufacturer's best grade finish paint system compatible with the finish coatings specified in Specification 09900.

PART 3 - EXECUTION**3.01 - MAINTENANCE OF OPERATIONS**

- A. Where execution of the work under this Contract requires certain equipment to be taken out of service, the Contractor shall perform the work with due regard to maintenance of operations and construction staging in accordance with the Specification Section 01310 Maintenance of Plant Operations.
- B. The Contractor shall schedule the work in advance with the Engineer so as not to affect proper plant operations. When the work is scheduled, the Engineer shall be notified 48 hours prior to proceeding with the work to allow time for the plant superintendent to perform load switching and alternation of equipment.
- C. To the maximum extent possible at the end of the workday, all equipment shall be back in place and ready for its normal service use should a plant emergency arise. In addition, should an emergency condition occur during execution of the work, at the request of the plant engineer, the equipment shall be placed back in service immediately and turned over to plant personnel.
- D. In the event of accidental shutdown of plant equipment the Contractor shall notify plant personnel immediately to allow for an orderly restart of affected equipment.

3.02 - DEMONSTRATION OF EQUIPMENT

- A. The Contractor shall demonstrate, in the presence of the Engineer that all electrical systems and electrically operated equipment operates as specified, designed and as required.
- B. The Contractor shall coordinate the demonstration of the electrical systems which are part of other Contracts with the other Subcontractors.
- C. The demonstration of equipment shall include the following:
 - 1. All power circuits shall be operated to verify proper connection to equipment. Mechanical key-interlocks for circuit breakers shall be operated to verify their proper operation. Power shall be removed and reapplied to automatic transfer switches to verify their operation.
 - 2. Emergency power systems shall be activated to verify their automatic start-up, proper operation while running and proper deenergization and cool down upon availability of normal power.

3. All pushbuttons, indicating lights and similar devices shall be operated to verify proper connection and function. All devices, such as pressure and flow switches and similar devices shall be operated to verify that shut-downs and control sequences operate as required.
4. The Contractor, with coordination of the other Subcontractors, shall operate the systems to verify wiring and adjust the controls, as required, to achieve proper operation. This shall include wiring, timing and switching functions.
5. Lighting and Receptacle Systems
 - a. All lighting systems shall be operated to verify proper switching and proper circuit wiring. Emergency lighting systems shall be operated to verify proper switching, circuit wiring and response to loss of primary power.
 - b. Receptacle circuit wiring shall be verified to agree with panelboard schedules.
6. Protective relaying and breaker protection systems/settings shall be set and operated and detailed in Specification 16292 - Power Distribution System Coordination.
7. All instrumentation systems shall be operated to verify that wiring and data transmission is correct.
8. The Contractor shall coordinate the demonstration of the electrical systems which are part of other systems (HVAC, plumbing, mechanical, instrumentation) with the other Subcontractors. The Contractor shall operate the systems to verify that the wiring is correct and that all controls operate as required.

3.03 - RESTORATION

- A. The Contractor shall field paint after installation marred or scratched surfaces. All scratches, abrasions and other damage to equipment shall be touch-up painted in accordance with the requirements of Specification 09900.

+ + END OF SECTION ++

PART 1 - GENERAL**1.01 – SECTION INCLUDES**

- A. Requirements for providing demolition work. This section also includes equipment relocation. The demolition and relocation work shall be performed in accordance with the requirements specified under this Section, the Specifications and the Contract Drawings.
- B. The Contractor shall remove and dispose of all electrical equipment and items as a result of the demolition Work. Where demolished equipment is so identified, it shall become the property of the County and disposal shall not occur.
- C. The Contractor shall also relocate electrical equipment. The extent of the demolition and relocation work is shown on the Contract Drawings.

1.02 – PAYMENT

- A. Payment for demolition work shall be made as provided for in the Specifications.

1.03 – REFERENCES

- A. Demolition work shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70, National Electrical Code.
 - 2. Local Codes and Ordinances

1.04 – SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:
 - 1. Techniques and details proposed to accomplish the demolition work.

1.05 – QUALITY ASSURANCE

- A. All demolition and removal work shall be in accordance with the Nassau County Building Code and NFPA 70 National Electrical Code.

- B. In performance of the demolition work, the Contractor shall provide protection of adjacent plant areas, existing equipment and on-going construction. No electrical equipment shall be disposed off-site without the written approval of the County and Engineer.
- C. The Contractor shall execute the work in a careful and safe manner with the least possible disturbance to the public and to the operation of the facility. All work shall be performed with due regard to maintenance of plant operations and construction staging in accordance with the Specifications.
- D. Demolition and removal work shall be executed with care and performed by competent experienced workmen for the various types of demolition and removal work. All patching, replacing and refinishing of work shall be done by skilled workmen. The work shall be carried out through to completion with due regard to the safety of County employees, workmen on site and the public.
- E. The Contractor shall make such investigations, explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. The Contractor shall give particular attention to shoring, bracing and shielding requirements so as to prevent any damage to new or existing construction. The Contractor shall be responsible for any damage which may be caused by demolition and removal work to any part or parts of existing structures or equipment designated for reuse or to remain.
- F. All demolished equipment becomes the property of the Contractor, except where identified by the County. All equipment marked by the County to remain shall be carefully removed by the Contractor, so as not to be damaged, cleaned and stored on or adjacent to the site in a protected place or loaded onto trucks provided by the County.
- G. The Contractor shall coordinate with other Prime Contractors to disconnect or remove sources of power to equipment being removed or relocated under other Contracts.

1.06 – SITE CONDITIONS

- A. The County assumes no responsibility for the actual condition of structures to be demolished and removed. Conditions existing at the time of inspection for bidding purposes shall be noted by the Contractor and shall be used by him in preparing his bid.
- B. The Contractor shall perform the work with due regard that certain equipment, tanks, and piping contain gases which are potentially hazardous and may be toxic, contain insufficient oxygen for human survival and are combustible in the presence of oxygen. All work regarding hazardous materials shall be performed in accordance with the Specifications.

- C. The Contractor shall perform the work with due regard that in some areas only certain systems and equipment shall be demolished while other systems and equipment shall remain operational. Contractor shall field determine and make such investigations as required to determine the source and function of each circuit, to allow for the disconnection and removal each circuit not required as result of the demolition and to retain all active circuits for areas unaffected by the demolition work.

1.07 – SCHEDULING

- A. The Contractor shall proceed with the demolition and removal of equipment in a sequence designed to maintain the existing facility in operation. The Contractor shall notify the Engineer 48 hours before proceeding and meet with plant personnel to review removals and demolition work. Work shall begin only after approval of the County and Engineer.
- B. Any equipment and appurtenances removed without proper authorization, which are necessary for the operation of the existing facility, shall be replaced to the satisfaction of the Engineer at no cost to the County.
- C. The Contractor shall familiarize himself with the work of all contracts and coordinate and schedule demolition activities with the other Prime Contractors for proper sequencing of the work and the removal of equipment.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 – PREPARATION

- A. The Contractor shall provide protection and restoration of structures in accordance with the Specifications. Catch platforms, lights, barriers, weather protection, warning signs and other items shall be provided as required for proper protection of the public, occupants of the building, workmen engaged in demolition operations, and adjacent construction.
- B. The Contractor shall provide weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.
- C. The Contractor shall provide temporary protection of the existing structure designated to remain where demolition, removal and new work is being done, connections made, materials handled or equipment moved.

- D. The Contractor shall provide dustproof partitions to prevent dust from rising by wetting demolished masonry, concrete, plaster and similar debris. Unaltered portions of the existing equipment affected by the demolition shall be protected. Such enclosures will be required in areas of major demolition work and for protection of existing equipment and personnel. Insulating barriers shall also be provided where necessary for protection.
 - 1. Dust proof partitions shall be constructed of wood studs with plywood on both sides. Partitions shall extend from floor to ceiling with a closure plate at the floor and ceiling and a dust- tight door in each enclosure complete with hardware, attached and keyed.
 - 2. Insulation barriers shall be provided to cover exposed, energized terminals, wires and busses.
 - 3. Adequate ventilation shall be provided for a safe working environment.
- E. The Contractor shall provide adequate fire protection during demolition in accordance with East Rockaway Fire Department requirements.
- F. The Contractor shall not close or obstruct roadways, walkways, passageways, or stairways and shall not store or place materials in passageways, stairs or other means of egress. The Contractor shall conduct operations with minimum traffic interference.
- G. The Contractor shall repair any damage to the existing structure or contents by reason of the insufficiency of protection provided.

3.02 – REMOVALS

- A. The Contractor shall demolish or relocate electrical equipment as shown on the Contract Drawings. All motors shall be disconnected by the Contractor, but removed with the driven equipment by the other Subcontractors.
- B. All wiring shall be removed, salvaged and stored. Direct burial cable shall be abandoned, but disconnected at both ends, insulated and identified. Where cable enters a structure, the cable shall be cut back to the point of entrance.
- C. All exposed conduits shall be removed and disposed. Conduits underground or concealed shall be abandoned. Abandoned conduits shall be cut flush with the slab or wall at the point of entrance and plugged.
- D. Recessed equipment to be demolished shall be abandoned, unless otherwise noted on the Contract Drawings. Demolished recessed panelboards and boxes enclosure fronts and internals shall be completely removed. The enclosure fronts shall be covered with new blank cover plates.

- E. Wherever cable and conduit are to be removed for disposition, the circuit shall be de-energized by the Contractor and adjacent circuits that are to remain in service shall be blanked off and then isolated.
- F. All supports, pedestals and anchors for conduits, lighting fixtures and other equipment shall be removed with the equipment unless otherwise noted on the Contract Drawings. Concrete bases, anchor bolts and other supports shall be removed to approximately one inch below the surrounding finished area and the recesses shall be patched to match the adjacent areas.
- G. The Contractor shall dispose of all demolition equipment, debris and other items, not marked by the County to remain, off the site and in conformance with all applicable codes and regulations.
- H. The Contractor shall perform patching, restoration, finishing and new work in accordance with the Specifications. All openings in structures as a result of the work, shall be patched and exterior openings made watertight. Where alterations occur, or new and old work join, the Contractor shall cut, remove, redrill or refinish the adjacent surfaces to the extent required by the conditions, so to leave the altered work in a condition as existed prior to the start of the work.
- I. Superstructure wall and roof openings shall be closed, and damaged surfaces shall be restored to match the adjacent areas. Wall sleeves and castings shall be plugged or blanked off, all conduit openings in equipment shall be closed.
- J. Where equipment is indicated to be removed, relocated and reused, the equipment shall be operated in the presence of representatives of the Contractor, and the Engineer. Such items shall be removed or relocated with care to prevent unnecessary damage, under the supervision of the trade responsible for reinstallation and protected and stored until required. Material or items damaged during removal shall be replaced with similar new material or items.

3.03 – CLEANING AND MAINTENANCE

- A. The Contractor shall maintain the existing electrical power system to operate without interruption. Any interruption of electrical power to the existing facility and equipment shall be with the approval and permission of the County and the Engineer.
- B. The Contractor shall maintain all protection facilities installed in preparation of the demolition work.
- C. The Contractor shall provide on-site dump containers for collection of waste materials, debris and rubbish.
- D. All existing surfaces shall be cleaned of dirt, grease, loose paint before refinishing.

- E. The Contractor shall clean the site and properties of dust, dirt and debris caused by the demolition and removal work in accordance with the Specifications. Waste materials, debris and rubbish shall be disposed of and the areas shall be returned to conditions prior to start of the work.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. The Contractor shall perform all tests as specified in these specifications, and as required.
- B. Individual testing requirements are detailed in the individual equipment specifications.

1.02 - RELATED SPECIFICATIONS

- A. Specification 16292 - Power Distribution System Coordination

1.03 - REFERENCES

- A. NETA - International Electrical Testing Association.
- B. IEEE - Institute of Electrical and Electronics Engineers.
- C. ANSI - American National Standards Institute.

1.04 - DESIGN REQUIREMENTS

- A. General
 - 1. The Contractor shall furnish all instruments and qualified personnel for all tests.
 - 2. Written notice of all tests shall be given to the Engineer at least two (2) weeks in advance.
 - 3. Unless waived in writing by the Engineer, all tests shall be made in the presence of a duly authorized representative of the Engineer. When the presence of such representative is so waived, sworn statements, in duplicate, of the tests made and the results thereof, shall be furnished to the Engineer by the Contractor.
 - 4. Necessary adjustments and testing shall be made in cooperation with the respective manufacturers and other Contractors when necessary.
 - 5. The Contractor shall make available, the electrical system and personnel when required by other Contractors to test their respective equipment. The Contractor shall coordinate their resources with the other Contractors.
- B. Factory and witness shop testing requirements shall be as detailed in the individual equipment specifications.

- C. Field Testing: All electrical equipment furnished, installed or modified under this Contract shall be field tested by this Contractor as detailed in the individual equipment specifications.
- D. Schedules and Plant Operations
1. When testing requires that certain pieces of equipment be taken out of service, all testing procedures and schedules must be submitted to the County's engineer for review and approval one month prior to any work beginning. When testing has been scheduled as above, the plant must be notified 48 hours prior to any work to allow time for load switching and/or alternation of equipment. In addition, all testing that requires temporary shutdown of plant equipment must be coordinated with plant personnel so as not to affect proper plant operations.
 2. At the end of the workday, all equipment shall be back in place and ready for immediate use should a plant emergency arise. In addition, should an emergency condition occur during testing, at the request of the plant engineer, the equipment shall be placed back in service immediately and turned over to plant personnel.
 3. In the event of accidental shutdown of plant equipment the contractor shall notify plant personnel immediately to allow for an orderly restart of affected equipment.
- E. Independent Testing: In addition to the independent testing for the short circuit and relay coordination studies and relay setting and protective device settings (as described in Specification 16292 - Power Distribution System Coordination), all medium voltage equipment testing, including medium voltage cable tests, shall be performed by a qualified testing company using NETA certified technicians.
- F. Final Field Testing
1. The Contractor shall complete the installation and testing of the electrical installation at least two (2) months prior to the start-up and testing of all other contracts. During the period between the completion of electrical installation and the start-up and testing of all other contracts, the contractor shall make all components of the Electrical Work available to the other contractors as it is completed for their use in performing Preliminary and Final Field Tests.
 2. Before each test commences, the Contractor shall submit a detailed test procedure, and also provide manpower and scheduling for the approval of the Engineer. In addition the Contractor shall furnish detailed test procedures for any of his equipment required as part of the field tests of systems by other contractors.

1.05 - SUBMITTALS

- A. Submit the following in accordance with Article GC-14 of the General Conditions and Division 1.
- B. Certificate of Compliance
 - 1. Qualifications of independent testing firm and technicians.
- C. Reports
 - 1. Proposed testing methods and schedules.
 - 2. All field test reports.

1.06 - QUALITY ASSURANCE AND QUALIFICATIONS

- A. As detailed above, the independent testing firm shall be a qualified firm employing NETA certified technicians.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Requirements for providing grounding. Grounding shall be provided in accordance with the requirements specified under this section, the Specifications and the Contract Drawings.
- B. The grounding work shall be a complete system for the electrical and instrumentation systems, structures and equipment. The work shall include grounding of all electrical equipment, transformer neutrals, equipment enclosures, grounding electrodes, fences and gates.

1.02 - RELATED SPECIFICATIONS

- A. Specification 16121 - Electric Wires and Cables
- B. Specification 16131 - Electric Conduit System

1.03 - PAYMENT

- A. Payment for grounding shall be made as provided for in the Specifications.

1.04 - REFERENCES

- A. Grounding shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70, National Electrical Code.
 - 2. Long Island Power Authority.
 - 3. UL Standard No. 467, Electrical Grounding and Bonding Equipment.

1.05 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:
 - 1. Prior to equipment submission, submit a list of proposed manufacturers with the products they produce proposed for the contract.

2. Manufacturer's catalog cuts for the grounding materials proposed for use.
 3. Scaled working drawings showing proposed routing and layout of the grounding system.
- C. Field test report shall be submitted.

1.06 - QUALITY ASSURANCE

- A. The grounding system maximum resistance shall not exceed 5 ohms under normally dry conditions. All structures and metal equipment containing electrical apparatus shall be connected to ground.
- B. All grounding associated with the Long Island Power Authority service feeders shall be in accordance with the requirements of Long Island Power Authority.

1.07 - DELIVERY, STORAGE AND HANDLING

- A. The grounding equipment shall be delivered, stored and handled in accordance with the Specifications and the manufacturer's recommendations.

PART 2 - PRODUCTS**2.01 - GROUND CABLE**

- A. The ground cable shall be soft drawn bare stranded copper conforming to ASTM B8 and B189. Size shall be as stated in 16900 Cable and Conduit Schedule and as shown on the Contract Drawings.
- B. The insulated cable for equipment grounding shall conform to the requirements of Specification 16121 - Electric Wires and Cables.
- C. Ground cable shall be General Cable Corporation, Okonite Cable Company or equal to be approved by the Engineer.

2.02 - GROUND RODS

- A. Ground rods shall be copper-clad steel, 5/8-inch diameter and 10 feet long.
- B. Ground rods shall have a drive point at the lower ends. The upper end of each rod shall be equipped with bronze, clamp type connectors with not less than four bolts.
- C. Ground rods shall be Heary Brothers Lightning Protection Company, Fushi Copperweld, or equal to be approved by the Engineer.

2.03 - GROUNDING CONNECTORS

- A. Compression connectors shall be heavy duty copper. Bolted connectors shall be copper alloy castings, designed specifically for the items to be connected, and assembled with Durium or silicone bronze bolts, nuts and washers.
- B. Welded connections shall be by exothermic process utilizing molds, cartridges and hardware designed specifically for the connection to be made.
- C. Bolted or compression grounding connectors shall be Burndy, Thomas and Betts or equal to be approved by the Engineer. Welded grounding connections shall be Cadwell or equal to be approved by the Engineer.

PART 3 - EXECUTION**3.01 - INSTALLATION**

- A. A complete ground grid system shall be installed as shown on the Contract Drawings.
- B. Ground cable shall be installed around perimeter of structures at a minimum of 2 feet-6-inches below grade.
- C. Ground rods shall be installed 2 feet below grade, 2 feet from foundation walls and shall extend 10 feet vertically into the earth.
- D. Test points shall be installed at locations and in accordance with the details shown on the Contract Drawings.
- E. Equipment shall be connected in accordance with the details shown on the Contract Drawings. All steel column and underground connections shall be welded except for test points.
- F. Metal casings or supporting frames of electrical equipment, such as transformers, panel boards, control panels, unit substations, and individual motor controllers shall be grounded. The equipment shall be thoroughly grounded to the facility grounding system. All metal conduits leaving all electrical equipment shall be grounded. Grounding type fittings shall be installed on flexible conduits.
- G. An insulated cable for equipment grounding shall be installed with the phase conductors within the conduit for the nominal 120 volt and higher power, lighting and control circuits.

3.02 - FIELD TESTING

- A. After installation, the completed ground system shall be field tested for operation and conformance. The field tests shall be witnessed by the Engineer and certified by the Contractor. The Contractor shall provide testing consisting of the following:
1. Resistance testing shall be made using a Biddle, Null Balance Earth Tester or Associated Research Vibro-ground, not less than 48 hours after rainfall. Resistance shall be no more than 5 ohms. If resistance is greater than 5 ohms, the Contractor shall continue to drive ground rods up to a maximum of three to reduce the resistance to 5 ohms. Resistance values above 5 ohms after three ground rods have been driven in the same area shall be brought to the Engineer's attention.
 2. Grounded cables and metal parts shall be continuity tested. The conduit system shall be ground tested in accordance with the requirements of Specification 16131 - Electric Conduit System
- B. The Contractor shall provide a Field Test Report, the report shall identify the testing performed and the results obtained

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Requirements for providing supporting devices. Supporting devices shall be provided in accordance with the requirements specified under this section, the Specifications and the Contract Drawings.
- B. The supporting devices shall be a complete system for the equipment. The work shall include providing all required support devices to properly mount and secure all equipment furnished under this Contract.
- C. This section also includes equipment anchorage and restraints suitable to meet the specified seismic requirements.

1.02 - RELATED SPECIFICATIONS

- A. Specification 16131 - Electric Conduit System

1.03 - PAYMENT

- A. Payment for supporting devices shall be made as provided for in the Specifications.

1.04 - REFERENCES

- A. Supporting devices shall comply with the latest applicable provisions and recommendations of the following:
 - 1. ASTM A569, Specification for Steel, Carbon, Hot-Rolled Sheet and Strip Commercial Quality.
 - 2. ASTM A570, Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
 - 3. ASTM B633, Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 - 4. AISI, Standard for Stainless Steel.
 - 5. MFMA-1, Standard Publication for Metal Framing.

1.05 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:
 - 1. Manufacturer's catalog cuts for the supporting devices proposed for use with specifications and other data required to demonstrate compliance with the specified requirements.
 - 2. Scaled working drawings showing dimensions and locations of all items and clearance requirements.
 - 3. Support design details and equipment seismic anchorage and restraint details, stamped by a licensed Engineer as required.

1.06 - QUALITY ASSURANCE

- A. General:
 - 1. All channels, fittings and hardware used in the supporting system shall be in accordance with MFMA-1, Standard Publication.
 - 2. The design of the support system shall be the responsibility of the Contractor. The Contractor shall provide the proper sized rods, channels, fittings, brackets and appurtenances necessary to adequately support the equipment.
 - 3. The Contractor shall retain the services of a Licensed Engineer, registered in the State of New York, to prepare support details for equipment exceeding 50 pounds in weight. The Engineer shall stamp the support system design details.
- B. Seismic Requirements:
 - 1. Equipment assemblies such as secondary unit substations, switchgear, motor control centers and panelboards shall be certified to meet seismic requirements in accordance with the requirements specified in the applicable sections of the Specifications.
 - 2. The Contractor shall be provide equipment anchorage details for all equipment certified to meet seismic requirements. The details shall be coordinated with the manufacturer's equipment mounting provisions.

3. Electric conduit shall include seismic restraints in accordance with the requirements of Specification 16131 - Electric Conduit System.
4. The Contractor shall retain the services of a Licensed Engineer, registered in the State of New York, to prepare the seismic anchorage and restraint details. The Engineer shall stamp the seismic anchorage and restraint details.

1.07 - DELIVERY, STORAGE AND HANDLING

- A. The supporting devices shall be delivered, stored and handled in accordance with the Specifications and the manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Supporting devices shall be by B-Line (Eaton), Kindorf (Thomas & Betts/ ABB Group) or equal to be approved by the Engineer.

2.02 - CHANNELS, FITTINGS AND BRACKETS

- A. The Contractor shall provide channels, fittings, brackets and related hardware for mounting and supporting the electrical equipment. Anchor bolts, concrete inserts and related hardware for proper support of equipment shall also be provided. All equipment necessary to meet the seismic requirements specified shall be provided.
- B. Channels shall conform to ASTM A569 or A570. Channels shall have a minimum thickness of 12 gauge. The cross sectional width dimension shall be 1-1/2 inch minimum. The depth shall be as required to satisfy load requirements.
- C. Attachment holes, when required, shall be factory punched on hole centers approximately equal to the cross sectional width and shall be 9/16 inch diameter.
- D. Fittings and brackets shall have 9/16 inch diameter holes on centers identical to the channel or as required to align with the channel holes. Fittings and brackets shall have the same width as the channel and shall be 1/4 inch thick minimum. Fittings and brackets shall mate properly with the channel.
- E. All channels, fittings, brackets and related hardware shall be steel and have an electro-plated zinc finish according to ASTM B633.
- F. In corrosive areas, channels, fittings, brackets and related hardware shall be type 316 stainless steel or PVC coated.

2.03 - CONDUIT HANGERS, SUPPORTS AND INSERTS

- A. The Contractor shall provide channels, rods, straps, anchors and related hardware for support of the exposed electric conduit system.
- B. The Contractor shall also provide anchor bolts, concrete inserts and related hardware for proper support of equipment. All equipment necessary to meet the seismic requirements specified shall be provided.
- C. Conduit hangers, supports and inserts shall be in accordance with Specification 16131 - Electric Conduit System.

PART 3 - EXECUTION**3.01 - INSTALLATION**

- A. All supporting devices shall be installed level, parallel and perpendicular to building walls and floors, such that the support system is installed in a neat and professional manner.
- B. All holes in hung ceilings for support rods and other equipment shall be made adjacent to bars where possible, to facilitate removal of ceiling panels.
- C. The channels, fittings and brackets shall be rigidly bolted together and braced to make a substantial supporting framework support system.
- D. Where motor control centers, switchgear, unit substations and other electrical equipment is being installed on concrete pads, the Contractor shall furnish leveling channels. The Contractor shall install the leveling channel in the concrete pads. Seismic certified equipment shall be anchored in accordance with the seismic anchorage details.
- E. All equipment fastenings to steel columns, beams and trusses shall be by beam clamps. In lieu of beam clamps, equipment may be welded to steel structures, subject to Engineer approval.
- F. No holes shall be drilled in any steel columns, beams and trusses.
- G. Hanger rod supports shall be installed such that threaded rod is parallel and perpendicular to building walls and floors.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Requirements for providing labeling and identification. Labeling and identification shall be provided in accordance with the requirements specified under this section, the Specifications and the Contract Drawings.
- B. The labeling and identification shall be provided for the identification of equipment. The work shall include providing all high voltage signs, equipment nameplates, markers and tags for all equipment furnished under this Contract.
- C. The Contractor is advised that the equipment identification shown on the Contract Drawings is temporary and will be finalized during construction.
- D. Temporary identification will be required as to information specified, but only final identification needs to conform to materials and mounting methods specified herein.
- E. All switchgear, unit substation, motor control center nameplates shall have both the equipment name and tag identification number.
- F. All pullboxes, junction boxes, terminal boxes, etc. shall be tagged with its own unique system related tag number.
- G. All conduits shall be tagged with its own unique system related tag number. The conduit systems include, but are not limited to, power, lighting, telephone, instrumentation, process/mechanical, fire alarm, low voltage power, security, CCTV, and Fiber Optic Network.
- H. In addition to tagging and labeling the pullbox exterior, the pullbox interior shall also be tagged and labeled. All conduit bushings on the pullbox interior shall be tagged and labeled.

1.02 - RELATED SPECIFICATIONS

- A. Specification 16121 - Electric Wire and Cable
- B. Specification 16131 - Electric Conduit System

1.03 - PAYMENT

- A. Payment for labeling and identification shall be made as provided for in Division 1 of the Specifications.

1.04 - REFERENCES

- A. Labeling and identification shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70, National Electrical Code.
 - 2. OSHA, Occupational Safety and Health Act.

1.05 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:
 - 1. Prior to equipment submission, submit a list of proposed manufacturers with the products they produce proposed for the contract.
 - 2. Submit signs, nameplates and other labeling and identification devices proposed for use with specifications and other data required to demonstrate compliance with the specified requirements.

1.06 - QUALITY ASSURANCE

- A. All labeling and identification signs and nameplates shall be provided in accordance with the NFPA 70 and OSHA.

1.07 - DELIVERY, STORAGE AND HANDLING

- A. The labeling and identification devices shall be delivered, stored and handled in accordance with the Specifications and the manufacturer's recommendations.

PART 2 – PRODUCTS**2.01 - HIGH VOLTAGE SIGNS**

- A. High voltage signs shall be provided for equipment operating over 600 volts.
- B. High voltage signs shall be fiberglass reinforced polyester, rigid acrylic or aluminum plate 1/16-inch thick. Finish shall be industry standard of red, white and black graphics. Signs shall be 10 inches by 14 inches with the following exceptions:

1. Use 7-inch by 10-inch signs where this is the largest size that can be applied.
 2. Use 14-inch by 20-inch signs where needed for adequate vision.
- C. High voltage signs shall read; "DANGER - HIGH VOLTAGE KEEP OUT".
- D. High voltage sign mounting screws shall be 3/16 inch diameter, round head, stainless steel, self-tapping type.

2.02 - EQUIPMENT NAMEPLATES

- A. Equipment nameplates shall be provided in addition to the manufacturer's nameplate, to identify the equipment number and the item's function and the equipment to which it serves.
- B. Equipment nameplates shall be provided in accordance with the requirements specified under Article 2.02 and Specification 15076 - Piping and Equipment Identification.
- C. Equipment nameplates shall be laminated plastic with black letters on a white background. Nameplates for equipment identification shall have 1/2-inch high letter engravings. Nameplates for pilot device identification shall have 1/4-inch high letter engravings.
- D. Nameplates for distribution equipment shall have the following information:
1. Equipment name and number.
 2. Voltage.
 3. Phases and number of wires.
- E. Pullboxes, junction boxes and control stations shall have a nameplate identifying the equipment name and number.
- F. All feeders and branch circuit devices shall have nameplates identifying the served equipment name and number. Where execution of the work under this Contract requires certain feeders and branch circuit devices to be modified, the Contractor shall provide new nameplates reflecting the modifications. The nameplates shall identify the served equipment name and number.
- G. All control and indicating devices shall have individual nameplates identifying device function.
- H. Nameplate mounting screws shall be 3/16 inch diameter, round-head, stainless steel self-tapping type. Adhesives shall not be used.

2.03 - CONDUIT MARKERS AND TAGS

- A. Conduit markers and tags shall be provided for the identification of the electric conduit system.
- B. Conduit markers and tags shall be in accordance with Specification 16131 - Electric Conduit System.

2.04 - CABLE AND WIRE MARKERS

- A. Cable and wire markers shall be provided for the identification of the electric wire and cable.
- B. Cable and wire markers shall be fiberglass based. Teflon coated stainless steel line/wire shall be used to attach the markers to the cables.
- C. Cable and wire markers shall be in accordance with Specification 16121 - Electric Wire and Cable.

PART 3 - EXECUTION**3.01 - INSTALLATION**

- A. All signs, nameplates and tags shall be installed neatly, properly and as recommended by the manufacturers.
- B. Signs and nameplates shall be mounted with screws. Where mounting of signs or nameplates with screws is impractical, the Contractor shall alert the Engineer.
- C. High voltage signs shall be installed on equipment operating at over 600 volts. High voltage signs shall also be installed on sides of fences or walls which enclose outdoor equipment operating at over 600 volts.
- D. Control, signal and status wire and cable shall be identified by a unique number. The numbering system shall reflect the actual identification used in the work and shall be documented on the point-to-point wiring diagrams.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Requirements for providing electric wires and cables. Electric wires and cables shall be provided in accordance with the requirements specified under this section, the Specifications and the Contract Drawings.
- B. The electric wires and cables to be provided shall include all accessories.
- C. The cables and wires proposed for all instrumentation cables and wires shall be approved by the Contractor before Engineer approval can be given. The Contractor shall submit the approvals from the Contractor along with the cable and wire shop drawings for Engineer approval. The cable and wires shall include those used for all equipment and devices specified in Division 15.

1.02 - PAYMENT

- A. Payment for electric wires and cables shall be made as provided for in Division 1 of the Specifications.

1.03 - REFERENCES

- A. Electric wires and cables shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70, National Electrical Code.
 - 2. National Electrical Safety Code.
 - 3. ASTM B5, High Conductivity Tough-Pitch Copper Refinery Shapes.
 - 4. ASTM B8, Concentric-Lay-Stranded Copper Conductors, Hard, Medium-hard or Soft.
 - 5. ASTM B33, Tin Coated Conductors.
 - 6. ASTM D69, Test Methods for Friction Tape
 - 7. ICEA S-66-524 Cross-linked-thermosetting - polyethylene-insulated Wire and Cable for the Transmission and Distribution of Electrical energy.
 - 8. ICEA S-68-516, Ethylene-Propylene-Rubber-Insulated Wire and Cable for Transmission and Distribution of Electrical Energy.

9. UL Standard No. 44, Wires and Cables, Rubber-Insulated.
10. UL Standard No. 83, Wires and Cables, Thermoplastic-Insulated.
11. UL Standard 486A - Wire Connectors and Soldering Lugs for Use With Copper Conductors.
12. UL 1072, Medium Voltage Power Cables.
13. AEIC CS6-87, Ethylene-Propylene-Rubber-Insulated Shielded Power Cable.
14. NETA, International Electrical Testing Association.
15. IEEE 48, Test Procedures and Requirements for High Voltage Alternating-Current Cable Terminations.

1.04 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:
 1. Prior to equipment submission, a list of proposed manufacturers shall be submitted with the products they produce proposed for the contract.
 2. Manufacturer's Literature, specifications and engineering data for the electric wires and cables and accessories.
 3. For medium voltage wires and cables the following information shall be submitted:
 - a. Manufacturer and type of cable.
 - b. Minimum insulation resistance in megohms per 1,000 ft. At 15.5 degrees C.
 - c. Material, number and size of strands composing each conductor.
 - d. Conductor insulation in thickness inches or 64th of an inch with material and voltage rating.
 - e. Sheath thickness in inches or 64th of an inch.

- f. Average outside diameter of bare conductor.
 - g. Average outside diameter of finished cable and jacket material.
 - h. Weight per 1,000 ft. of finished cable.
 - i. Material and thickness in inches or 64th of an inch of each shield system.
 - j. Minimum bending radius, in inches.
 - k. Minimum pulling temperatures at which cable may be pulled without damage.
 - l. Maximum pulling tensions which may be applied to the cable without damage.
 - m. Literature identifying the methods and materials which Contractor proposes to use to make splices and terminations. Submittal shall consist of manufacturer's literature evidencing compatibility of the conductor insulation, shield and jacket of the cable with the splicing or terminating materials and methods which Contractor proposes to use.
 - n. Manufacturer's recommended pulling lubricants.
 - o. Qualifications of splicing and termination personnel.
- 4. Description of shop and field testing methods, procedures and apparatus with calibration dates shall be submitted. Testing methods and procedures shall be submitted at least 45 days in advance prior to conformation of witness testing dates and actual testing.
 - 5. Qualifications of proposed testing firm to perform acceptance testing shall be submitted. Submit firm experience records at least 45 days in advance to actual testing, five recent references with phone numbers shall be submitted.
 - 6. Qualifications of proposed mineral-insulated metal sheath cable installer shall be submitted. Submit installer experience records with five recent completed installations with names and phone numbers.
 - 7. Certification from the mineral-insulated metal sheath cable manufacturer's representative that the cable installation is in accordance with the manufacturer's requirements.

C. Reports:

- 1. Shop and field test reports shall be submitted.

2. Acceptance testing report shall be submitted.

D. MATERIAL SAFETY DATA SHEETS

- E. Material Safety and Data Sheets (MSDS) shall be submitted for all cables and wires supplied. MSDS shall be submitted with the equipment shop drawings.

1.05 - QUALITY ASSURANCE

A. General:

1. All cables and wires shall be made by an approved manufacturer, and in their construction shall be employed the most improved commercial materials and processes of manufacture.
2. Only electrical wiring manufactured under high standards of production and meeting the approval of the Engineer shall be used. Friction tape shall be in accordance with ASTM Des. D69.
3. All medium voltage cable splicing and terminations shall be done by experienced cable splicers who have worked with similar cable for a period of at least 10 years, using materials and procedures recommended by the cable manufacturer. All splicing and terminations of medium voltage cable shall be in accordance with the instructions of the cable manufacturer.
4. The wire and cable manufacturer shall use a shop test facility that has recently calibrated testing apparatus and qualified, experienced technicians, for all shop tests. Calibration of testing apparatus shall be within one year.
5. All test equipment and instrument calibration shall be in accordance with the latest edition of the accuracy standard of the U.S. National Institute of Standards and Technology and the NETA acceptance testing specification.
6. The mineral-insulated metal sheath cable installation shall be performed by experienced mineral-insulated metal sheath cable installers who shall have been regularly engaged in the installation of mineral-insulated metal sheath cable for a minimum of the past three years.
7. The Contractor shall retain the services of the mineral-insulated metal sheath cable manufacturer's representative to certify the cable installation is in accordance with the manufacturer's requirements.

B. Field Tests:

1. Electric wires and cables shall be field tested. Field testing for 600 volt and below wires and cables shall be in accordance with the requirements specified under Article 3.04.
2. The Contractor shall retain the services of an independent testing firm who shall perform acceptance testing on the medium voltage wire and cable installation. The testing firm shall have experience in the inspection and testing of cables of the type specified and shall be a member company of NETA. Provide proof of membership or demonstrate that the standards and experience required for membership are possessed, all to the satisfaction of the Engineer. The testing shall be performed in accordance with the requirements specified under Article 3.05.

1.06 - DELIVERY, STORAGE AND HANDLING

- A. Electric wires and cables shall be delivered, stored and handled in accordance with the Specifications and the manufacturer's instructions.

PART 2 - PRODUCTS**2.01 - 300 VOLT INSULATED CABLE**

- A. 300 volt insulated cable shall be used for all instrumentation and communication circuits. The size and quantity of 300 volt insulated cable shall be as indicated in the conduit and cable schedule.
- B. Instrumentation cable shall be in accordance with the following:
 1. Conductors shall be stranded, tinned coated copper, No. 16 AWG minimum size. All conductors shall be polyethylene insulated and twisted in pairs with an aluminum-mylar shield overlapped.
 2. The cable shall include an outer jacket. Jacketing shall be neoprene, chlorosulfonated polyethylene (hypalon), chlorinated polyethylene or flame retardant 105 degree C polyvinyl chloride.
 3. Instrumentation cable shall be by Okonite Company, General Cable Corporation, Belden Company or equal to be approved by the Engineer.
- C. Communication and Fire Alarm Cable shall be in accordance with the following:
 1. Conductors shall be stranded, tinned coated copper, No. 18 AWG minimum size for fire alarm cable and No. 24 AWG for communication cable. Insulation shall be polyethylene.

Where specifically shown on the Contract Drawings or stated in the Specifications, communication system conductors shall be twisted shielded cable.

2. The cable shall include an outer jacket. Jacketing shall be neoprene, chlorosulfonated polyethylene (hypalon), chlorinated polyethylene or flame retardant 105 degree C or polyvinyl chloride.
3. Fire Alarm Cable shall be UL listed, made of Teflon and approved by the East Rockaway Building Department, Material and Equipment Acceptance Division.
4. Communication and Fire Alarm Cable shall be by General Cable Corporation, Belden Company with Beldfoil shielding or equal to be approved by the Engineer

2.03 - 600 VOLT INSULATED WIRE AND CABLE

- A. 600 volt insulated wire and cable shall be used for all 600 volt and below power, lighting, control and alarm circuits. The size and quantity of 600 volt insulated wire and cable shall be as indicated in the conduit and cable schedule. The conductor jacket shall be in accordance with color identification requirements specified under Article 3.03.
- B. 600 volt single conductor wire and cable for installation in conduit shall be in accordance with the following:
 1. Conductors shall be stranded, tinned coated copper, single conductor cable conforming to ASTM B8, and B33, No. 12 AWG minimum size.
 2. Insulation shall be flame-retardant EPR (FREP), moisture and heat resistant thermoset rated 90 degrees C in dry locations and 90 degrees C in wet locations and listed by UL as type XHHW-2 or RHW-2.
 3. XHHW-2 shall be used for all indoor circuits and RHW-2 for all underground and outdoor circuits.
 4. 600 volt insulated wire and cable for installation in conduit shall be by Okonite Company, General Cable Corporation or equal to be approved by the Engineer.
- C. When identified in the conduit and cable schedule 600 volt multiple conductor cable shall be used for control and alarm circuits in the quantities indicated. 600 volt multiple conductor control cable for installation in conduit shall be in accordance with the following:
 1. Conductors shall be stranded, tinned coated copper conforming to ASTM B8 and B33, No. 12 AWG minimum size.

2. Insulation shall be moisture and flame resistant cross-linked polyethylene rated 90 degrees C in wet and dry locations and listed by UL as type XHHW-2.
 3. Cable conductors shall be assembled together with flame and moisture resistant filters and tape to make round.
 4. Cable shall include an overall protective jacket of polyethylene compound, 45 mils minimum thickness.
 5. 600 volt multiple conductor control cable shall be Okonite Company, General Cable Corporation or equal to be approved by the Engineer.
- D. When identified in the conduit and cable schedule mineral-insulated metal sheath cable shall be used for the fire pump circuit. The mineral-insulated metal sheath cable shall be in accordance with the following:
1. The mineral-insulated metal sheath cable shall be NFPA 70, type MI. The cable assembly shall be UL listed including supports for a 2 hour fire rating.
 2. Conductors shall be solid copper conforming to ASTM B5.
 3. Cable insulation shall be magnesium oxide mineral rated 600 volts, 90 degrees C. The cable shall include a metal-sheath consisting of seamless softdrawn copper.
 4. The cable shall be provided with all fittings and hardware necessary for proper installation.
 5. The mineral-insulated metal sheath cable shall be by BICC Pyrotenax, AFC Cable Systems or equal to be approved by the Engineer.
- E. Security system cables shall be 600 Volt insulated. Minimum size conductors for the security system shall be No.22 AWG. Where specifically shown on the Contract Drawings or stated in the Specifications, security system shall use twisted shielded cable or coaxial type cable.

2.04 - 600 VOLT AND BELOW WIRE AND CABLE ACCESSORIES

- A. Cable connectors shall be provided for terminating 600 volt and lower voltage wire and cable. Connectors for wire and cable up to 600 volt shall be solder less type and properly sized to fit fastening device and wire size. Connectors shall be in accordance with the following:
1. For wire sizes up to and including No. 6 AWG, compression type with UL 486A listing shall be used. All cable terminations for conductors No. 10 AWG and smaller shall be

terminated using UL listed ring tongue type, nylon insulated connectors, at each terminal board.

2. For wire sizes No. 4 AWG and above, either compression type or bolted type with tin-plated contact faces shall be used.
 3. For wire sizes No. 250 kcmil and larger, connectors with at least 2 cable clamping elements or compression indents and provision for at least 2 bolts for joining to apparatus terminal shall be used.
 4. Compression connectors shall be Power-Connect, ring tongue shall be Series 83 as manufactured by Ideal Industries. Connectors shall also be by Thomas and Betts, Burndy or equal approved by the Engineer.
- B. Cable splicing for 600 volt and below wire and cable shall be performed when terminals are not provided. Splicing shall be in accordance with the following:
1. For wire sizes No. 8 AWG and larger, splices shall be made up with compression type copper splice fittings with UL 486A listing. Splices shall be taped and covered with materials recommended by the cable manufacturers, to provide insulation equal to that on the conductors.
 2. For wire sizes No. 10 AWG and smaller, splices shall be made up with pre-insulated spring connectors. Connectors shall be flame retardant with UL listing.
 3. For wet locations, splices shall be submersible rated for underwater use. Underwater splices shall be rated for 10,000 psig. The splices shall be precision precast polyurethane compression dams, waterblock solder pins and an amber polyurethane overmold to prevent all water from entering the cable and keeping seawater outside the cable from passing through the splice to the electrical connection. Underwater splices shall be UL listed. All underwater splices shall be manufactured by PMI Industries or approved equal.
 4. Compression splices shall be by Ideal Industries, Thomas and Betts, Burndy, or equal to be approved by the Engineer. Waterproof compression splices shall be thermo-shrink as manufactured by Ideal Industries. Waterproof compression splices shall also be by Thomas and Betts, Burndy, Buchanan or equal approved by the Engineer.
 5. Spring connector splices shall be Twister type and Twister DB type for waterproof, as manufactured by Ideal Industries. Spring connectors shall also be by Thomas and Betts, Burndy, or equal approved by the Engineer.

- C. Cable markers shall be provided for the identification of 600 volt and below wire and cable. Markers for 600 volt and below wire and cable shall be in accordance with the following:
1. Markers shall be vinyl type, moisture, heat and abrasion resistant with adhesive back. Cable identification shall be clearly marked.
 2. Markers shall be by Ideal Industries, Thomas and Betts or equal to be approved by the Engineer.
- D. Pulling compound shall be provided to facilitate wire pulling. Pulling compound shall be in accordance with the following:
1. Pulling compound shall be waxed based, with a .17 average coefficient of friction and a temperature range of 30 to 190 degrees F. The compound shall be compatible with all cable types.
 2. Pulling compound shall be Ideal Industries, Greenlee or equal to be approved by the Engineer.

2.06 - SHOP TESTS

- A. Certified Shop Tests:
1. Shop testing shall be performed on the wire and cable at the manufacturer's plant prior to shipment. Shop test shall be in accordance with the latest revisions of ICEA and UL and shall demonstrate that the wire and cable tested conforms to the requirements specified.
 2. The Contractor shall provide a shop test report. The report shall identify the tests performed and the results obtained.
 3. All low voltage wire and cable shall be shop tested in accordance with the requirements of Underwriters' Laboratories.
 4. All medium voltage wires and cables shall be shop tested in accordance with the following:
 - a. Conductors shall meet the electrical resistance requirements of ICEA-S-68-516, Part 2.5.
 - b. Insulation Resistance test shall be performed in accordance with the requirements of ICEA S-68-516, Part 6.28. Each cable shall have an insulation

resistance not less than that corresponding to the insulation resistance constant of 20,000 megohms - 1000 ft. at 15.6 degrees C.

- c. A high voltage AC and DC test shall be performed in accordance with the requirements of ICEA S-68-516, Part 6.27. The AC and DC test voltages shall be in accordance with Section B of AEIC CS6.
- d. Shield resistance shall be measured and recorded from end to end on the completed cable.
- e. Each reel of completed shielded power cable shall be partial discharge tested in accordance with Section E and F of AEIC CS6.

B. Witnessed Shop Tests:

- 1. The Contractor shall perform witnessed shop tests in accordance with the Specifications.
- 2. The Engineer shall have access during working hours for inspection purposes to all parts of the works where material and cable are being manufactured, and all reasonable inspection and testing facilities shall be provided to him without increase in price. The Engineer may request that dielectric strength tests and measurements be made to verify the cable data furnished by the Contractor. For this purpose the Contractor shall furnish without increase in price, a length of cable, not to exceed 3 feet for each size to be cut from one or more reels as directed by the Engineer. Each sample shall be marked with a tag bearing full description of cable insulation and number of reel from which it is cut.

2.07 - PROCESS NETWORK CABLE

- A. Process network cable shall be utilized for interior data highway systems and circuits where shown on the Contract Drawings or in Section 16900, Cable and Conduit Schedule.
- B. All process network cable provided under this Contract shall be furnished by a single manufacturer.
- C. The process network cable shall have the following specifications:
 - 1. Category 6 plenum cable.
 - 2. 4 Pair - AWG 24 solid copper conductors.
 - 3. FEP insulation with PVC overall jacket.

4. Meets ANSI/TIA/EIA-568-A performance specifications.
 5. Characteristic impedance: 100+/-15 ohms.
 6. DC resistance: 7 ohms (maximum).
 7. DC resistance unbalance: 2.5% (maximum).
 8. Mutual capacitance: 5.6 nF/100 meters (maximum).
 9. Pair-to-pair capacitance unbalance: 100 pF/100 meters (maximum).
 10. Manufactured to UL444 and flame tested to UL910.
 11. UL rated Type CMP and MMP.
- D. Cable shall be equal to Southwire Cyber Technologies, "Cyber LAN Category 6 plenum."

PART 3 - EXECUTION

3.01 - GENERAL

- A. All cables and wires shall be installed within the raceways as shown on the Contract Drawings. They shall be carefully handled so as to avoid twists or kinks in the conductors or damage to the insulation.
- B. The Contractor shall ensure that the manufacturer's recommended cable bending radii and pulling are not exceeded and that the number of conductors permitted in a conduit are in accordance with the latest applicable section of NFPA 70 National Electrical Code.
- C. No splices shall be permitted between terminals except at approved junction or terminal boxes. Boxes shall be provided as shown on the Contract Drawings or as required by Code for the pull lengths. No more than two terminations shall be made at each terminal point. Cable and wire runs shall be looped through pull boxes without cutting and splicing where possible. All splices below grade, in manholes, hand holes and wet locations shall be water proofed.
- D. No splicing of instrument wiring shall be permitted. Instrument wiring shall be extended by use of field termination boxes employing labeled terminal strips. Shield continuity shall be maintained. Ultimate shield termination (ground) shall be at one end only.

- E. The mineral-insulated metal sheath cable manufacturer's representative shall review the cable installation to certify that the cables are installed in accordance with the manufacturer's requirements.

3.02 - INSTALLATION OF WIRING

- A. Cables shall be installed complete with proper terminations at both ends. For each motor circuit, Contractor shall ensure proper phase sequence and motor rotation.
- B. Wire and cable contained within a single conduit shall be pulled simultaneously using insulating pulling compounds containing no mineral oil.
- C. Pulling tension on medium voltage cables shall be continuously monitored using a calibrated Dynamometer type device, having a calibration label within six months of its use.
- D. Cables shall be installed with maximum slack at all terminal points, boxes, handholes and manholes.
- E. Medium voltage cables located within manholes, handholes and boxes shall be wrapped with fireproofing tape for their entire length on an individual cable basis. Tape shall be 30 mills thick of self-extinguishing material which will not support combustion. Tape shall not deteriorate when subjected to water, salt, sewage or fungus and shall be secured with glass cloth tape. Medium voltage cables shall be fireproofed in accordance with the cable manufacturer's recommendations and then covered with tape extending at least one inch into any duct.

3.03 - CONDUCTOR IDENTIFICATION

- A. Each wire shall be labeled at each termination points and all splice locations. Carry individual conductor or circuit identification throughout, with circuit numbers or other identification stamped on terminal boards when provided or the cable so it is visible around the cable's circumference.
- B. Each wire shall be identified in junction boxes, cabinets, and terminal boxes. Where no termination is made, use a plastic-coated, self-adhesive, wire marker. Where termination is made, use a plastic, pre-printed sleeve wire marker. Paper, self-adhesive wire markers shall not be used.
- C. In manholes and handholes, each power wire shall be identified by a laminated plastic tag located so that it can be seen from center of manhole without moving adjoining wires. Bundle and mark control wires as listed in conduit and cable schedule.

- D. Multi-conductor control cables shall be color coded in accordance with ICEA S-61-402, Method 1, Table K.
- E. The following identification scheme shall be used for all 600 volt and below power circuits:

System Voltage	Neutral	Phase A	Phase B	Phase C	Ground
208/120V	White	Black	Red	Light Blue	Green
240/120V	White-Gray Strip	Black-Blue Strip	Red-Blue Strip	None	Green
480/277V	Gray	Brown	Orange	Yellow	Green

3.04 - 600 VOLT AND BELOW WIRE AND CABLE FIELD TESTING

- A. After installation, all 600 volt and below wire and cable shall be field tested. The field tests shall be performed by the Contractor who shall furnish all testing equipment. The field tests shall be witnessed by the Engineer and certified by the Contractor. The Contractor shall provide a report identifying the tests performed and the results obtained.
- B. Each electrical circuit shall be tested after permanent cables are in place to demonstrate that the circuit and equipment are connected properly and will perform satisfactorily and that they are free from improper grounds and short circuits. The tests shall consist of the following:
- 600 volt wire and cable mechanical connections shall be individually tested after installation and before they are put in service with a calibrated torque wrench. Values shall be in accordance with manufacturer's recommendations.
 - 600 volt and below wire and cables shall be individually tested for insulation resistance between phase and from each phase to ground. Test after cables are installed and before they are put in service with a Megger for one minute at a voltage rating recommended by the cable manufacturer or in accordance with NEMA and ICEA standards.
 - The insulation resistance for any given conductor shall not be less than the value recommended by the cable manufacturer or in accordance with NEMA and ICEA standards. Any cable not meeting the recommended value or which fails when tested under full load conditions shall be replaced with a new cable for the full length.
 - Shielded instrumentation cable shields shall be tested with an ohmmeter for continuity along the full length of the cable and for shield continuity to ground.

5. Connect Shielded instrumentation cables shall be connected to a calibrated 4-20 milliamp DC signal transmitter and receiver. Test at 4, 12, and 20 milliamp transmitter settings.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Requirements for providing conduit system. The conduit system shall be provided in accordance with the requirements specified under this section, the Specifications and the Contract Drawings.
- B. The conduit system required shall be provided with all rigid and flexible conduits, boxes, fittings, supports, hangers and inserts and other conduit accessories as required for the installation of the electric wire and cable.
- C. The following index of this Specification is presented for convenience.

PART 1 - GENERAL		
Article	Title	Page
1.1	Section Includes	1
1.2	Related Specifications	2
1.3	Payment	2
1.4	References	2
1.5	Submittals	3
1.6	Delivery, Storage and Handling	4

PART 2 - PRODUCTS		
Article	Title	Page
2.1	Rigid Steel Conduit	4
2.2	Hangers, Supports and Inserts	5
2.3	Flexible Metallic Conduit	5
2.4	Outlet Boxes and Fittings	6
2.5	Conduit Accessories	7
2.6	Terminal, Junction and Pull Boxes	11

PART 3 - EXECUTION		
Article	Title	Page
3.1	General	13
3.2	Installation of Raceways	14
3.3	Conduit Connections to Equipment	17
3.4	Installation of Boxes and Fittings	18
3.5	Installation within Hazardous Areas	19
3.6	Field Tests	20

- D. The conduit system proposed for all instrumentation circuits shall be approved by the General Contractor before Engineer approval can be given. The Contractor shall submit the approvals from the General Contractor along with the conduit layout submittals for Engineer approval. The

circuits shall include all equipment and devices specified in Division 15 and their associated conduit runs.

- E. The conduit system proposed for all of the HVAC instrumentation circuits shall be approved by the HVAC Contractor before Engineer approval can be given. The Contractor shall submit the approvals from the HVAC Contractor along with the conduit layout submittals for Engineer approval. The circuits shall include all instrumentation equipment and devices specified in Division 15, such as transmitters, analyzers, monitors, PLC's, CPU's, workstations, etc. Fans, air conditioners, heaters and other mechanical equipment circuits will not require the above approvals.
- F. All PVC coated conduit installed shall be the same uniform gray color. No other color variations will be accepted. All RGS conduit shall be painted to match the same uniform gray color of the PVC coated conduit delivered to the site.
- G. Every conduit shall be tagged to define its system served: power, process/mechanical, instrumentation, telephone, fire alarm, communications and lighting.
- H. Where conduit enters and exits pull boxes, junction boxes, terminal boxes, etc. the labels for conduit tags shall be placed on the interior of the box on the conduit bushings.

1.02 - RELATED SPECIFICATIONS

- A. Specification 09900 - Painting.
- B. Specification 16071 – Supporting Devices.

1.03 - PAYMENT

- A. Payment for Electric Conduit System shall be made as provided in Division 1 of the Specifications.

1.04 - REFERENCES

- A. Electric conduit system shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70, National Electrical Code.
 - 2. IEEE 142, Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - 3. UL Standard No. 6, Rigid Metal Electrical Conduit.

4. UL Standard No. 50, Electrical Cabinets and Boxes.
5. UL Standard No. 360, Liquid-Tight Flexible Steel Conduit.
6. UL Standard No. 514A, Metallic Outlet Boxes.
7. UL Standard No. 514B, Fittings for Conduit and Outlet Boxes.
8. UL Standard No. 886, Electrical Outlet Boxes and Fittings for Use in Hazardous Locations.
9. ANSI C80.1, Specification for Zinc Coated Rigid Steel Conduit.
10. ANSI C80.4, Specification for Fittings for Rigid Metal Conduit and Electrical Metallic Tubing.
11. NEMA Standard No. RN-1, PVC Externally Coated Galvanized Rigid Steel Conduit.

1.05 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:
 1. Prior to equipment submission, submit a list of proposed manufacturers with the products they produce proposed for the contract.
 2. Manufacturer's catalog cuts for the conduit, boxes, fittings and supports proposed for use.
 3. Construction details of conduit racks and other conduit support systems with seismic restraint details and calculations signed by a licensed Engineer.
 4. Scaled working drawings showing proposed routing of all conduits, inclusive of conduits embedded in structural concrete and conduits directly buried in earth. Drawings shall show locations of pull and junction boxes and all penetrations in walls and floor slabs.
- C. Field test report shall be submitted.

1.06 - DELIVERY, STORAGE AND HANDLING

- A. Electric conduit system shall be delivered, stored and handled in accordance with the Specifications, the manufacturer's instructions and the following:
 - 1. Conduit shall be delivered to the work in standard bundles having each length suitably marked with the manufacturer's name or trademark and bearing the label of the Underwriters' Laboratories, Incorporated, inspection service.

PART 2 - PRODUCTS**2.01 - RIGID STEEL CONDUIT**

- A. The Contractor shall provide rigid steel conduit. All steel conduit shall comply with the requirements of ANSI C80.1, and the Underwriters' Laboratories, Incorporated, Standard for No. 6.
- B. Both the inside and outside surfaces of the rigid steel conduit shall be protected against corrosion by a coating of zinc applied by the hot-dip galvanizing process.
- C. Conduits, elbows and couplings shall be rigid, heavy wall, mild steel, hot dip galvanized. Conduits, elbows and couplings shall have a smooth interior with tapered threads and carefully reamed ends. Conduit size shall be 3/4-inch minimum and shall conform to UL-6.
- D. Conduits, elbows and couplings shall include a PVC coating for all areas. For conduits located indoors in dry, dusty areas the use of rigid steel conduit without PVC coating shall be permitted.
- E. PVC coated conduit shall be factory applied and shall include a smooth 2 mil thick urethane interior coating and 40 mil thick polyvinyl chloride exterior coating. The exterior PVC coating color shall be gray. The threads of conduits that have been cut to size shall have the same PVC coating applied in the field. PVC coated conduit shall conform to NEMA Standard RN-1.
- F. Rigid steel conduit shall be by Allied Tube and Conduit Corporation, Wheatland Tube Company or approved equal. PVC coated rigid steel conduit shall be by Perma-Cote Industries, OCAL Incorporated, Robroy Industries or equal to be approved by the Engineer.

2.02 - HANGERS, SUPPORTS AND INSERTS

- A. The Contractor shall provide hangers, supports and inserts for support of the electric conduit system. The supports shall securely attach the electric conduit system to the channel and structure.

- B. The electric conduit system shall be designed, constructed and installed suitable for earthquake regulations in accordance with the seismic requirements of the Nassau County Building Code and the Uniform Building Code for Zone 2A application.
- C. Transverse and longitudinal bracing shall be provided as required to brace the electric conduit for the seismic requirements specified.
- D. All drilled in type concrete inserts shall be expansion shields or anchors conforming to Specification 05092 - Metal Fastening and 15060 - Hangers and Supports. In corrosive locations, concrete inserts shall be 316 stainless steel.
- E. Hangers and supports shall be in accordance with the requirements of Specification 15060 - Hangers and Supports except beam clamps, hanger rods and hardware shall be steel with electro-plated zinc finish. This shall also include bolts, nuts and washers. In corrosive locations, hangers and support hardware shall be type 316 stainless steel or factory applied 40 mil thick PVC coated.
- F. Hangers, Supports and Inserts shall be by B-Line, Kindorf or equal to be approved by the Engineer.

2.03 - FLEXIBLE METALLIC CONDUIT

- A. The Contractor shall provide flexible metallic conduit where required to permit movement of connected devices and where it is impracticable to complete runs with rigid conduit.
- B. Liquid-tight flexible metallic conduit shall be used for all indoor non-hazardous areas.
- C. Liquid-tight flexible metallic conduit shall be used for all outdoor non-hazardous areas.
- D. For hazardous areas flexible conduit shall include a brass inner core with a bronze outer braid and protective neoprene plastic coating. End fittings shall be steel, brass or bronze.
- E. Flexible conduit shall be by Anaconda American Brass Company, Electric-Flex Company or approved equal. Hazardous area flexible conduit shall be by Crouse Hinds Company, Appleton Electric Company or equal to be approved by the Engineer.

2.04 - OUTLET BOXES AND FITTINGS

- A. The Contractor shall provide outlet boxes and fittings for rigid and flexible conduit. The outlet boxes and fittings required for the work which constitutes a part of the conduit system, shall be of approved types.

- B. For outdoor, wet and corrosive areas, conduit fittings and outlet bodies shall be cast gray iron alloy, cast malleable iron bodies and covers. All units shall be gasketed, watertight, and threaded with five full threads and shall have rust-proofing in accordance with the requirements of Article 2.06. Fittings and bodies installed on PVC coated conduits shall also include interior and exterior coatings equivalent to the conduit.
- C. Threaded cast ferrous metal, hub type outlet boxes shall be used throughout, except in the interior walls of superstructures and in roof slabs protected by built-up roofing where pressed steel boxes shall be installed. Cast iron or alloy outlet boxes of the proper size and depths for the application, complete with watertight gaskets and covers secured by brass screws, shall be furnished and installed as indicated on the Contract Drawings or as required by the conduit run. Outlet boxes, furnished and installed for the installation of lighting fixtures, switches and receptacles in a future contract, shall be furnished with watertight gaskets and blank covers.
- D. For non-hazardous, indoor dry dusty areas pressed steel boxes of the proper size and depths for the application shall be provided. Boxes shall be rated NEMA 12, not less than No. 14 U.S. Standard Gauge (0.078 inch). The conduit openings shall be provided with oil-resistant gaskets. Conduits shall be fastened to these boxes with locknuts and bushings, and all unused outlets or holes shall be left sealed.
- E. All outlet boxes intended for fixtures shall be provided with approved fixture studs.
- F. For concealed conduit runs in outside walls and all exposed conduit work, connections to boxes and fittings shall be made through threaded holes, unless otherwise approved by the Engineer. For concealed conduit work in non-hazardous areas in other than outside walls, connections between conduit and boxes may be made with drilled holes, using locknuts and bushings. Where necessary unions may be used. Unions in hazardous locations shall be Crouse Hinds type UNF, UNL, UNY conduit fittings or equal to be approved by the Engineer. Unions in non-hazardous areas shall be Universal or Erickson conduit couplings or equal to be approved by the Engineer.
- G. All boxes installed for concealed conduit, shall be provided with extension rings or plaster rings and covers as required. For non-hazardous, dry indoor areas stainless 302/304, satin beveled steel cover and device plates for surface mounted boxes shall be used. For corrosive locations, galvanized ferrous and galvanized cast ferrous metal cover and device plates with neoprene gaskets shall be used.
- H. Outlet boxes and fittings installed on PVC coated conduit shall also include interior and exterior coatings equivalent to the conduit.

- I. For receptacle, switch, fixture, and other device outlet boxes recessed in walls, or exposed within hung ceiling spaces, in non-hazardous, indoor, dry areas above grade, standard galvanized pressed steel outlet boxes with partially pre-punched conduit connection cutouts, of the proper size and depth for the application, shall be provided. Conduits shall be fastened to these boxes with locknuts and bushings. Similar pressed steel boxes with blank covers may be used for junction and pull boxes in conduit runs where pressed steel device boxes are permitted.

2.05 - CONDUIT ACCESSORIES

- A. The Contractor shall provide conduit accessories for use with the conduit system. The conduit accessories shall be of approved types.
- B. Expansion and Deflection Fittings:
 1. Expansion and deflection fittings shall be made up of non-corrodible parts and shall provide for ample longitudinal and lateral movement. A suitable bond shall provide a low resistance, continuous longitudinal path for ground currents.
 2. Expansion and deflection fittings shall be watertight cast iron, malleable iron or hot dipped galvanized. Fittings shall be corrosion-resistant, UL listed and compatible with the conduit system.
 3. Expansion /deflection fittings shall provide both expansion and deflection in a single fitting in accordance with the following:
 - a. Axial expansion or contraction up to 3/4-inch.
 - b. Angular misalignment up to 30 degrees.
 - c. Parallel misalignment up to 3/4-inch.
 4. Expansion fittings shall provide expansion /contraction with eight inch total movement.
 5. Expansion and deflection fittings shall be by Crouse Hinds, Appleton Electric or equal to be approved by the Engineer.
- C. Sealing Fittings:
 1. Sealing fittings shall be cast gray iron alloy or cast malleable iron or copper free aluminum with zinc electroplate and lacquer or enamel finish.

2. Sealing fittings shall have an ample opening with threaded closure for access to conduit hub for making dam. Sealing fiber and compound shall be suitable for use with the fitting and shall be the products of the fitting manufacturer.
3. For corrosive locations, seal fittings shall include interior and exterior coatings equivalent to the PVC conduit coating specified under Article 2.01.
4. Sealing fittings shall be by Crouse Hinds, Appleton Electric or equal to be approved by the Engineer.

D. Drain Fittings:

1. Drain fittings shall be a combination device designed to provide ventilation to minimize condensation and drains accumulated condensate.
2. The combination drain/breather fitting shall be 3/8 inch male thread size with stainless steel body.
3. Drain fittings shall be by Crouse Hinds, Appleton Electric or equal to be approved by the Engineer.

E. Conduit Hubs:

1. Conduit hubs shall be threaded, insulated throat type with bonding screw locknut.
2. The conduit hub and locknut shall be malleable iron or zinc and shall include a 90 degree C insulating surface and a sealing ring for a water tight and dust tight connection.
3. Conduit hubs shall be by O-Z Gedney, Thomas and Betts or equal to be approved by Engineer.

F. Conduit Bushings:

1. Conduit bushings shall be insulated, grounding type with lay-in-lug connection. Two locknuts shall be provided for each bushing.
2. The conduit bushing and locknuts shall be steel, malleable iron or zinc. The bushing shall include a 90 degree C insulating surface.
3. Conduit bushings and locknuts shall be by O-Z Gedney, Thomas and Betts or equal to be approved by the Engineer.

G. Duct Seal:

1. Duct seal shall be a soft, fibrous non-hardening sealing compound for sealing between cables and conduits.
2. Duct seal shall be by O-Z Gedney, Ideal Industries or equal to be approved by the Engineer.

H. Thruwall Seals and Bushings:

1. Thruwall seals and bushings shall be in accordance with the following:
 - a. For conduits and cables in new construction and passing through exterior subsurface walls and exterior concrete walls, thruwall seals shall be used. Thruwall seals shall be Type WSK and WSCS manufactured by O-Z/Gedney or equal to be approved by the Engineer.
 - b. For conduits and cables in new construction and passing through concrete floors and floor slabs, floor seals shall be used. Floor seals shall be type SK and FSCS manufactured by O-Z/Gedney or equal to be approved by the Engineer.
 - c. For conduits passing through exterior block walls or installed in existing construction passing through exterior subsurface walls, exterior concrete walls, floor slabs and roof slabs for use in core bit-drilled holes sealing bushings shall be used. Sealing bushings shall be Type CSMI at the inside of the structure and Type CSMC at the outside of the structure, within the same core drilled hole. Sealing bushings shall be manufactured by O-Z/Gedney or equal to be approved by the Engineer.
 - d. For conduits passing through existing interior concrete walls or floors and interior block walls sealing bushings shall also be used. Sealing bushings shall be CSMC or CSMI type as manufactured by O-Z/Gedney or equal to be approved by the Engineer.
 - e. For conduits passing through fire rated floors and walls fire stop fittings shall be used. Fire stop fittings shall be CFS and/or CFSI type as manufactured by O-Z/Gedney or equal to be approved by the Engineer.
 - f. For multiple conduit runs passing through interior or exterior and fire rated walls thru- wall barriers shall be used. Thru- wall barriers shall be TW series by Crouse-Hinds or equal to be approved by the Engineer.

I. Conduit Tags:

1. Conduit tags shall be Setmark snap around conduit markers which shall be secured to the conduit with annealed brass wire.
2. Conduit tags shall be clearly stamped with the conduit number in conformity with the conduit and cable schedule or as directed by the Engineer.
3. Conduit tags shall be by Seton Nameplate Corporation or equal to be approved by the Engineer.

J. Conduit Markers:

1. Conduit identification markers shall be self-sticking color-coded tape. Identification tape shall be two inches wide and colored in accordance with the color banding specified under this section.
2. Conduit markers shall be by Thomas and Betts or equal to be approved by the Engineer.

2.06 - TERMINAL, JUNCTION AND PULL BOXES

- A. The Contractor shall provide terminal, junction and pull boxes as shown on the Contract Drawings and where otherwise required, or as directed by the Engineer.
- B. Boxes located indoor in dry, dusty areas shall be NEMA Type 12, constructed of welded and galvanized sheet steel. Boxes 24 inches and less shall be 14 USS standard gauge metal. 12 USS standard gauge metal on boxes greater than 24 inches, except 10 USS standard gauge shall be used for boxes with any dimension of 36 inches or more.
- C. Boxes located in other areas shall conform to the following area classifications:
1. For wet locations boxes shall be watertight NEMA Type 4. Boxes shall be constructed of galvanized cast iron and shall include gasketed, bolt on covers, with tapped holes in bosses or hubs for conduit entrance. Boxes shall be provided with cast mounting lugs for installation in concrete.
 2. For hazardous locations boxes shall be explosion proof NEMA Type 7. Boxes shall be constructed of cast iron and shall include threaded connections and ground joint surfaces.
 3. For corrosive locations boxes shall be corrosion resistant, NEMA Type 4X. Boxes shall be constructed of 316 stainless steel material with sealed seams.

- D. Pull and junction boxes shall be provided with covers held in place by brass screws. Terminal boxes shall be provided with terminal block supports and approved hinged covers fitted tightly against a gasket and secured by lug bolts and wing nuts. Hinges, lug bolts, wing nuts and other fittings shall be made of an approved, non-ferrous, non-corrodible metal. All boxes shall be provided with rabbeted gaskets or flange gaskets securely held in place.
- E. Tapping for threaded connections to outlet boxes, junction boxes, pull boxes and conduit fittings in non-explosion proof construction shall conform to the following:
1. All threads shall be tapered.
 2. If threads for connection of conduit are tapped all the way through a hole in an enclosure, or if an equivalent construction is employed, there shall be not less than 3-1/2 threads in the metal and the construction of the enclosure shall be such that a suitable conduit bushing can be properly attached.
 3. If threads for connections of conduit are not all the way through a hole in a boxwall, conduit hub or the like, there shall be not less than five full threads in the metal and there shall be a smooth, well rounded inlet hole for the conductors, which shall afford protection to the conductors equivalent to that provided by a standard conduit bushing and which shall have an internal diameter approximately the same as that of the corresponding trade size of rigid conduit. The threaded hole shall be provided with a conduit end stop.
 4. Tapping for threaded connections for explosion proof construction shall conform to the requirements of the National Electrical Code for construction in Class I, Division 1, hazardous locations.
- F. Cast iron or cast ferrous alloy outlet boxes, junction boxes, pull boxes, conduit fittings and conduit accessories such as box covers shall be rust-proofed by zinc coating applied by the "hot-dip" process or shall be given a rust protective coating applied by either of the following methods:
1. Method A:
 - a. Castings shall be given a mechanical and chemical cleaning.
 - b. Castings shall be given a phosphoric acid type dip.
 - c. Then a coating of zinc chromate primer shall be applied, and finally
 - d. A coating of baked enamel finish shall be applied over the outside and inside surfaces of the castings.

2. Method B:
 - a. Castings shall be given a mechanical and chemical cleaning.
 - b. Then a coating of cadmium shall be deposited electrolytic ally.
 - c. Then a coating of zinc shall be applied by electroplating.
 - d. Then a vinyl resin base aluminum lacquer shall be applied.
- G. Stamped steel outlet boxes, junction boxes and box covers shall be rust-proofed by a zinc coating applied by an electro-galvanizing or sherardizing process. Fabricated sheet steel boxes shall be formed from galvanized sheet steel. Welded joints shall be touched up with aluminum lacquer and boxes and covers shall be given a shop priming coat of zinc chromate rust inhibiting paint.
- H. Terminal blocks shall be used within terminal boxes for termination of prepared conductors No. 10 AWG and smaller. Terminal blocks shall be in accordance with the following:
 1. Terminal blocks shall be high density, screw terminal type suitable for rail mounting with quantities sufficient for the conductors to be terminated plus 20 percent spare.
 2. Terminal blocks shall be NEMA rated, 600 volt, 35 ampere suitable for 85 degrees C.
 3. Terminal block components shall have stainless steel and tin plated copper alloy components, backed out captive screws and marking surface.
 4. Terminal blocks shall be Allen-Bradley Company, General Electric Company or equal to be approved by the Engineer.

PART 3 - EXECUTION

3.01 - GENERAL

- A. All conduits shall be installed in accordance with the requirements specified under this section and in conformity with the sizes stated in the Specifications or shown on the Contract Drawings. They shall be installed complete with all accessories, fittings and boxes, in an approved and workmanlike manner so as to provide proper raceways for electrical conductors.
- B. The Contractor's attention is called to the fact that all conduit runs indicated on the Contract Drawings are shown diagrammatically for the purpose of outlining the general method of routing the conduits to avoid interference. Where conduit runs are not shown, it shall be the responsibility of the Contractor to establish the runs required based upon the various systems shown on the Contract Drawings.

- C. Should any structural difficulties prevent the setting of cabinets, boxes, conduits, etc., at points shown on the plans, deviations therefrom as determined by the Engineer will be permitted and shall be made without additional cost.
- D. All exposed steel conduits, fittings, boxes, straps, racks and hangers shall be painted in conformity with Specifications 09900 - Painting. PVC coated conduit systems shall not be painted. Paint shall match the gray color of the PVC coated conduits.
- E. Conduits shall be tagged using conduit tags. Conduit tags shall be installed where conduits terminate in equipment and enclosures.
- F. Exposed conduits shall be color banded using conduit markers. Markers shall also include operating voltage when over 600 volts. Conduit markers shall be installed 360 degrees, double wrap around conduit exterior. Conduit markers shall be installed where conduits enter equipment, boxes, within each room, at wall penetrations and 50 feet on centers in each area. When exposed conduits are to be painted, markers shall be installed after the conduits are painted. Color banding shall be in accordance with the following:
 - 1. 120/208 volt AC: Gray.
 - 2. 277/480 volt or 480 volt AC: Sand.
 - 3. 2400 volt or 4160 volt AC: Silver.
 - 4. 13800 volt AC: Brown.
 - 5. Fire Detection and Alarm: Red.
 - 6. Telephone: Blue.
 - 7. Intercommunication: Yellow.
 - 8. Security System: Rust.
 - 9. Low Voltage Switching, Instrumentation and Controls System: Black.

3.02 - INSTALLATION OF RACEWAYS

- A. The Contractor shall install all exposed raceways parallel or at right angles to walls and ceiling beams. Changes in directions shall be made with bends, elbows and pull boxes. All parallel runs shall be spaced uniformly throughout and secured in place with hangers and fasteners. Brace raceways to satisfy the specified seismic requirements in accordance with the restraint details.

- B. Conduits, where exposed, shall in all cases be substantially supported in an approved manner, but they shall not be fastened to or come in contact with any other pipes, ducts or other work of a similar nature. In all exposed work, approved channel or angle iron hangers, racks, one-hole straps or a combination thereof shall be provided to support the conduits. Where conduits are supported with one-hole straps, spacers shall be used to provide 1/4-inch minimum clearance between the conduits and walls or ceilings.
- C. Hanger rods for trapeze type hangers shall not be less than 5/8 inch diameter. Conduit supports shall be located at intervals not exceeding 8 feet. Conduits shall be securely fastened to each support with U-bolts, straps or clamps. All hanger types (trapeze and others) shall be furnished and installed in accordance with Specification 15060, Hangers and Supports. All items that are hung and supported shall be submitted as a separate shop drawing complete with licensed structural engineer P.E. seal.
- D. All concealed conduits shall be placed in walls, floors, ceilings or slabs at the proper time in accordance with the progress of the structural work. The Contractor shall cooperate in every respect in meeting schedules and shall not delay the structural work unnecessarily.
- E. Conduits embedded in concrete shall be blocked and braced in place by use of adequate conduit separators to prevent displacement during the pouring of concrete. The Contractor will be held responsible for proper position of conduits and shall rearrange any conduit that may be displaced while concrete is poured, without additional cost.
- F. Where conduit runs are to be concealed and the Contractor fails to place such conduit in sufficient time to be included in the structures and the structures are completed without such conduit, the Contractor shall install such runs either concealed or exposed as directed by the Engineer, with no extra payment for additional work or for more conduit than the original lengths.
- G. Embedded conduit shall be run in structural concrete in the center of slabs and walls and above waterstops. Conduit connections shall be made watertight. Contractor shall confirm that concrete thickness is sufficient for embedding the quantity of conduits intended. Unless specifically shown otherwise on the Contract Drawings or stated in the Specifications, embedded conduits shall be in accordance with the following criteria:
 - 1. Minimum concrete thickness shall be as follows:
 - a. For concrete 16 inches thick and less, the minimum concrete thickness shall be 11.5 inches plus the depth of the largest conduit assembly. The conduit assembly depth shall be from the top of the uppermost conduit to the bottom of the lowest conduit.

- b. For concrete greater than 16 inches thick, the minimum concrete thickness shall be 13.5 inches plus the depth of the largest conduit assembly.
 - c. For concrete at foundation slabs, an additional inch shall be added to the minimum concrete thicknesses previously stated.
 - 2. Conduit spacing shall be as follows:
 - a. Conduits shall be separated three times outer diameter of larger conduit center to center.
 - b. For multiple conduit layer assemblies, conduits shall be separated vertically three times outer diameter of larger conduit center to center.
 - c. When conduits cross at a given point, the conduits may be in direct contact and the angle of cross shall be 45 degrees or greater. Conduits may also cross within the vertical spacing of a multi-conduit layer assembly.
 - d. When conduits cross a structural expansion joint, conduits shall be separated three times outer diameter of larger conduit fitting center to center.
- H. A run of conduit between outlet and outlet, between fitting and fitting or between outlet and fitting shall not contain more than the equivalent of three quarter bends, including those bends located immediately at the outlet or fitting. The equivalent number of 90° bends in a single conduit run are limited to the following:

1.	Runs in excess of 300 feet	0
2.	Runs of 300 feet to 201 feet	1
3.	Runs of 200 feet to 101 feet	2
4.	Runs of 100 feet and less	3
- Factory bent elbows or field bent elbows with approved tools may be used. Heating of conduit to facilitate bending is prohibited.
- I. Factory-made conduit bends or elbows shall be used wherever possible in making necessary changes in direction. Field bends shall be carefully made so as to prevent conduit damage or reduction in the internal areas. The radius shall not be less than six times the nominal diameters for the conduit with carefully matched bends on parallel runs so as to present a neat appearance.

- J. All conduits, where cut, shall be carefully reamed to remove burrs. No running threads will be permitted. All screw joints shall be watertight. Conduits shall be fitted in an approved manner to all devices and boxes. The ends of all conduits shall be equipped with suitable approved conduit fittings. The ends of all empty conduits shall stub up six inches above the slab and shall be capped.
- K. All conduits shall be carefully cleaned before and after installation and all inside surfaces shall be free from all imperfections likely to injure the cable. Conduits shall be cleaned in accordance with the following:
1. After erection of complete conduit runs, conduits shall be snaked with a suitable swap to which shall be attached an approved tube cleaner equipped with an approved cylindrical mandrel of a diameter not less than 85 percent of the nominal diameter of the conduit.
 2. All conduits through which the mandrel will not pass shall be removed and replaced by the Contractor at his own expense. After snaking, the ends of the dead-ended conduits shall be protected with standard malleable iron caps to prevent the entrance of water or other foreign matter.
 3. Conduit ends shall be protected after cleaning with caps to prevent entrance of water, concrete, debris or other foreign substance.
- L. As far as practicable, conduits shall be pitched to drain to outlet boxes or otherwise so installed as to avoid trapping moisture. Trapped conduits in concealed construction shall be provided with outlet boxes for drainage. Where necessary drainage in outlet boxes or where dips are unavoidable in exposed conduits, a drain fitting shall be installed at the low point.
- M. Thruwall type seals and conduit sealing bushings shall be installed for all conduits passing through concrete slabs, floors, walls or block walls.
- N. Conduit runs shall be installed so as to avoid flues, heat sources, steam or hot water pipes. A minimum separation of 12 inches shall be maintained where conduit crosses or parallels hot water, steam pipes or heat sources.
- O. Where conduit enter or leave equipment located within electrical and control rooms the conduit shall be sealed and packed with duct seal compound.
- P. A 250 pound tested polyethylene pull tape shall be provided in all empty conduits, with a minimum 8 inch of slack, double backed into the conduit. Conduit shall be protected immediately after installation by installing flat non-corrosive metallic discs and steel bushings designed for this purpose at each end. Discs shall not be removed until it is necessary to clean the conduit.

- Q. All conduit that is cut on the job shall be cut square and taper reamed to remove burrs before installation. Where steel conduit is cut and threaded on the site, it shall be coated before and after making connections.
- R. Conduits embedded in concrete shall stub up 6 inches above the slab. A three inch high curb extending three inches from the outer surface of the conduit penetrating the floor shall be provided to prevent corrosion. Conduit stub-ups shall be terminated in couplings, slightly above the finished concrete curb.

3.03 - CONDUIT CONNECTIONS TO EQUIPMENT

- A. At each motor, limit switch, solenoid valve, electrical control device or other electrically controlled or operated equipment, the Contractor shall install a complete conduit connection between the conduit system and the terminal box of the motor or the conduit connection point of the equipment.
- B. Conduits installed in the conduit system shall be terminated in such locations as to permit direct connections to motors, devices or equipment.
- C. Connections shall be made with rigid conduit if equipment is fixed and not subject to adjustment, mechanical movement or vibration. Rigid connections shall be provided with union fittings to permit removal of equipment without cutting, breaking or burning conduit.
- D. Motors, transformers and equipment subject to adjustment, mechanical movement or vibration shall be connected with flexible metallic conduit.
- E. Devices such as solenoid valves, small limit switches, etc., shall be connected with flexible metallic conduit arranged to prevent strain and distortion.
- F. Flexible conduit connections shall be watertight unless the area of installation requires explosion-proof construction.

3.04 - INSTALLATION OF BOXES AND FITTINGS

- A. All concealed outlet boxes shall be set in such a manner that they will be plumb and flush with the finished surface.
- B. Boxes shall be installed rigidly and securely to the structure. Independent supports shall be provided where no walls or other structural surface exists.
- C. Expansion and expansion/deflection fittings shall be installed where conduits cross structural expansion joints and at locations shown on the Contract Drawings. Fittings shall be installed on

each conduit and incorporated into the expansion joints of structures, at right angles to the joint, to insure their proper functioning and preservation.

- D. Expansion fittings shall be installed on exposed conduit runs exceeding 200 feet. Unless specifically shown otherwise on the Contract Drawings or stated in the Specifications, when crossing structural expansion joints larger than one inch, an expansion fitting shall also be installed together with an expansion/deflection fitting. The fittings shall be installed on each conduit run in accordance with manufacture's recommendations to provide the additional movement necessary.
- E. All conduit connections in wet and corrosive locations shall be made up watertight and shall terminate at enclosures with an approved conduit hubs.
- F. All conduit connections in dry and dusty locations shall terminate at enclosures with bushings and lock nuts. Terminations shall include one bushing and two lock nuts at each location. Lock nuts shall be installed one inside and one lock nut outside the enclosure. All conduit shall be bonded to the safety ground.
- G. At pull and junction boxes having any box dimension in excess of 18 inches, jumper type grounding bushings shall be installed on conduit ends and jumper wires shall be installed to bond all conduits and to bond conduits to boxes.
- H. All insulated grounding bushings shall be bonded together and to the structure of the enclosure by a continuous, copper bonding wire.
- I. Removable, flame-retardant, insulating cable supports shall be provided in all boxes with any dimension exceeding 3 feet.
- J. Scratched PVC boxes damaged as a result of installation shall be touched up by field applying PVC. All touch up work shall be in strict conformance with manufacturer's recommendations.

3.05 - INSTALLATION WITHIN HAZARDOUS AREAS

- A. Explosion-proof boxes and fittings shall be of a type approved by the Engineer. Boxes and fittings shall be of cast iron with finish as specified hereinbefore or of an aluminum alloy specially developed for use in hazardous areas.
- B. Explosion-proof boxes shall be suitable for the installation of explosion-proof switches, receptacles, lighting fixtures or other devices as indicated. All conduit connections to such boxes shall be made with threaded fittings. Bushings and locknut connections shall not be used.

- C. Conduits terminating at explosion-proof boxes, enclosing circuit opening equipment, shall be sealed at the entrance to the box with an approved compound-filled sealing fitting to prevent passage of explosive or combustible gases through the conduit. Where construction prevents the use of sealing fittings, the ends of the conduits shall be properly sealed with sealing compound.
- D. Sealing fittings shall be installed to seal each conduit leading from or entering into hazardous locations. Exposed conduits passing through hazardous locations shall be sealed at point of exit and entrance.
- E. The installation of explosion-proof boxes, fittings and all conduits in connection therewith shall conform to the requirements of the National Electrical Code for Class I, Division 1 Group D hazardous location unless specifically noted otherwise.

3.06 - FIELD TESTS

- A. After installation, the electric conduit system shall be field tested. The field tests shall be witnessed by the Engineer and certified by the Contractor. The Contractor shall provide testing consisting of the following:
 - 1. Each conduit shall be tested by pulling through a cylindrical mandrel as specified under paragraph 3.02 K. Maintain a record of all conduits testing clear.
 - 2. Conduit systems shall be ground tested in the presence of the Engineer, who will inspect all enclosures, pull and junction boxes for bonding to the safety green conductor pulled with the nominal 120 volt and higher power and control circuits, and for bonding of the conduit grounding bushing to this safety ground.
 - 3. The separation of above safety grounding system from the instrumentation signal grounding shall be verified.
- B. The Contractor shall provide a Field Test Report. The Report shall identify the testing performed and the results obtained.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Requirements for providing dry type transformers. Dry type transformers shall be provided in accordance with the requirements specified under this section, the Specifications and the Contract Drawings.

1.02 - RELATED SPECIFICATIONS

- A. Specification 16076 - Labeling and Identification

1.03 - PAYMENT

- A. Payment for dry type transformers shall be made as provided for in the Specifications.

1.04 - REFERENCES

- A. Dry type transformers shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70, National Electrical Code.
 - 2. ANSI C89.1, Specialty Transformers.
 - 3. ANSI C89.2, Dry-Type Transformers for General Applications.
 - 4. UL Standard No. 506, Specialty Transformers.
 - 5. UL Standard No. 1561, Dry-Type General Purpose and Power Transformers.
 - 6. NEMA ST-20, Sound Levels.

1.05 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:
 - 1. Manufacturer's catalog cuts for the transformers proposed for use.
 - 2. Dimensional drawings showing transformer details with diagrammatic nameplate.

3. Description of shop and field testing methods, procedures and apparatus with calibration dates shall be submitted. Testing methods and procedures shall be submitted at least 45 days in advance prior to conformation of witness testing dates and actual testing.
- C. Shop test and field test reports shall be submitted.
- D. Operations and Maintenance Manuals shall be submitted in accordance with the Specifications.

1.06 - QUALITY ASSURANCE

- A. General:
 1. All transformers shall conform to the applicable NEMA, ANSI and IEEE Standards and shall be built by one approved manufacturer who shall use only best commercial materials and processes of manufacture. Transformer enclosures shall have ample room for primary and secondary wiring connections.
 2. All transformers shall be UL listed and certified to ANSI/NEMA sound levels.
 3. The transformer manufacturer shall use a shop test facility that has recently calibrated testing apparatus and qualified, experienced technicians, for all shop tests. Calibration of testing apparatus shall be within one year.
 4. All test equipment and instrument calibration shall be in accordance with the latest edition of the accuracy standard of the U.S. National Institute of Standards and Technology.
- B. Field testing of the transformers shall be performed in accordance with the requirements specified under Article 3.02.

1.07 - DELIVERY, STORAGE AND HANDLING

- A. Dry type transformers shall be delivered, stored and handled in accordance with the Specifications and the manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Dry type transformers shall be manufactured by Cutler-Hammer, General Electric Company, Square D or approved equal.

2.02 - GENERAL PURPOSE TRANSFORMERS

- A. General purpose transformers shall be of the dry, commercially quiet, low temperature rise type consisting of two copper windings per phase. Transformers shall be suitable for indoor or outdoor installation in accordance with the locations shown on the Contract Drawings.
- B. Transformers shall have KVA rating, primary voltage and connection, secondary voltage and connection and number of phases as shown on the Contract Drawings.
- C. Transformer insulation shall be rated 220 degrees C, 80 degrees C rise.
- D. Transformers shall be equipped with six 2-1/2 percent fully rated taps, two above and four below the rated voltage tap on the primary winding. The arrangement, assembly, and laminations of the core shall be such as to facilitate repair to the windings. The design, shape, and arrangement of windings shall allow free flow of air for insulation and cooling.

2.03 - SHOP TESTS

- A. Shop tests shall be performed at the transformer's manufacturer's plant prior to shipment. Shop tests shall demonstrate that the equipment tested conforms to the requirements specified.
- B. Each transformer shall be given a routine test in accordance with the latest requirements of UL, ANSI and NEMA standards.
- C. The Contractor shall provide a shop test report. The report shall identify the tests performed and the results obtained.
- D. Transformer shop tests shall be performed consisting of the following:
 - 1. Applied potential shall be performed.
 - 2. Induced potential shall be performed.
 - 3. No load losses shall be performed.
 - 4. Voltage ratio shall be performed.
 - 5. Polarity shall be performed.

PART 3 - EXECUTION**3.01 - INSTALLATION**

- A. Transformers shall be installed in the Motor Control Center by the Motor Control Center Manufacturer as shown on the Contract Drawings. Sufficient access and working space shall be provided for ready and safe operation and maintenance.
- B. The transformer leads shall be provided with solderless, clamp type cable connectors. Conduit runs shall be arranged for easy removal of the transformers.
- C. Transformer nameplates shall be Install for identification of equipment. Nameplates shall be provided in accordance with the requirements of Specification 16076 - Labeling and Identification.

3.02 - FIELD TESTS

- A. Insulation resistance tests shall be performed on the transformers after installation. The tests shall be witnessed by the Engineer and certified by the Contractor. The tests shall be performed by the Contractor who shall furnish all testing equipment.
- B. The Contractor shall provide a field test report. The report shall identify the tests performed and the results obtained.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Requirements for providing panelboards. Panelboards shall be provided in accordance with the requirements specified under this section, the Specifications and the Contract Drawings.
- B. The panelboards shall include all power distribution, lighting, appliance and instrument panels.

1.02 - RELATED SPECIFICATIONS

- A. Specification 16076 - Labeling and Identification

1.03 - PAYMENT

- A. Payment for panelboards shall be made as provided for in the Specifications.

1.04 - REFERENCES

- A. Panelboards shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70, National Electrical Code.
 - 2. UL Standard No. 50, Enclosures for Electrical Equipment.
 - 3. UL Standard No. 67, Panelboards.
 - 4. UL Standard No. 489, Molded Case Circuit Breakers.
 - 5. UL Standard No. 943, Ground Fault Circuit Interrupters.
 - 6. NEMA PB1, Panelboards.
 - 7. NEMA AB1, Molded Case Circuit Breakers.

1.05 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:
 - 1. Manufacturer's technical information for the panelboards proposed for use including all components.

2. A listing of the panelboards with the number and size of circuit breakers identified.
 3. Dimensional drawings showing panelboard enclosure details.
 4. Panelboard anchorage details with design calculations signed by licensed Engineer.
- C. Certificates of Compliance: Seismic qualification certification from the manufacturer including mounting recommendations.
- D. Reports: Shop test reports shall be submitted.
- E. Operations and Maintenance Manuals shall be submitted in accordance with the Specifications.

1.06 - QUALITY ASSURANCE

- A. General:
1. All panelboards shall conform to the applicable NEMA and UL Standards and shall be built by one approved manufacturer who shall use only best commercial materials and processes of manufacture.
 2. All panelboards shall be UL listed.
 3. The panelboards manufacturer shall use a shop test facility that has recently calibrated testing apparatus and qualified, experienced technicians, for all shop tests. Calibration of testing apparatus shall be within one year.
 4. All test equipment and instrument calibration shall be in accordance with the latest edition of the accuracy standard of the U.S. National Institute of Standards and Technology.
- B. The panelboards shall be designed, constructed and installed suitable for earthquake regulations in accordance with the seismic requirements of the Nassau County Building Code and the Uniform Building Code for zone 2A application.

1.07 - DELIVERY, STORAGE AND HANDLING

- A. Panelboards shall be delivered, stored and handled in accordance with the Specifications and the manufacturer's recommendations.

PART 2 - PRODUCTS**2.01 - MANUFACTURERS**

- A. Panelboards shall be manufactured by Cutler-Hammer, General Electric Company or approved equal.

2.02 - PANELBOARDS

A. General:

1. The panelboards shall be dead-front type with automatic trip-free, bolt-on, molded case circuit breakers.
2. The panelboards shall be equipped with main breakers or main lugs, branch circuit breakers, 1-pole, 2-pole and 3-pole, as shown on the Contract Drawings.
3. The panelboards shall be enclosed in flush or surface mounted cabinets as shown on the Contract Drawings.

B. Ratings:

1. Panelboard ampacities, voltage, number of phases and wires shall be as shown on the Contract Drawings. Panelboard frequency shall be 60 Hz.
2. Panelboards shall be labeled with a UL short circuit rating. All panelboards shall be fully rated.
3. Panelboards rated 240VAC or less shall have a short circuit rating of 22,000A RMS symmetrical, unless shown otherwise on the Contract Drawings.
4. Panelboards rated 480VAC shall have a short circuit rating of 65,000A RMS symmetrical, unless shown otherwise on the Contract Drawings.

C. Bus Bars:

1. Bus bars shall be copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.
2. Bus bar taps for single-pole branches shall be arranged for sequence phasing of the branch circuit devices.
3. A bonded ground bus shall be included in all panels.

4. Full-size neutral bars shall be provided for panelboards, unless noted otherwise on the Contract Drawings.
5. Where specifically shown on the Contract Drawings or stated in the Specifications, panelboards shall be provided with a 200 percent rated neutral bus suitable for use with non linear loads. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

D. Cabinets:

1. Cabinets shall be constructed of 12 gauge galvanized steel with stainless steel hardware. Fronts shall have doors over circuit breakers and trims of proper width. Doors shall be fastened to the trims with concealed hinges and shall be equipped with flush-type catches and locks. All locks shall be keyed alike.
2. Cabinets shall have wiring gutters on the sides. Cabinets shall be at least 5-3/4 inches deep and 20 inches wide for panelboards with maximum branch circuit breakers of 100A. When branch circuit breakers are above 100A, cabinets shall be at least 9-1/2 inches deep and 31 inches wide.
3. Cabinets shall be NEMA 12 for dry, indoor areas and NEMA 4X for corrosive areas. In hazardous locations, panelboards shall have a NEMA 7 rating.
4. Cabinets shall have identifying nameplates in accordance with the requirements of Specification 16076 - Labeling and Identification.
5. All panelboard directories shall have both the equipment name and the tag identification number. Where this will not physically fit in the standard panelboard directory, an additional expanded directory mounted behind the standard directory shall be supplied containing the above information.

E. Circuit Breakers:

1. Circuit breakers shall be the molded case type conforming to NEMA Standard AB-1.
2. Breakers shall be the bolt-on type with quick-make, quick-break, toggle mechanism for manual as well as automatic operation. Breakers shall have 100 amp frames, with 15 amp trip elements as minimum, unless otherwise shown on the Contract Drawings. All 100 amp frame breakers shall be fixed thermal magnetic trip units. Frame sizes above 100 amp shall have interchangeable thermal magnetic trip units.

3. Where specifically shown on the Contract Drawings or stated in the Specifications, breakers shall be provided with electronic trip units. Electronic trip units shall provide long time, short time, instantaneous and ground fault settings and time adjustments as minimum.
4. Where specifically shown on the Contract Drawings or stated in the Specifications, ground fault circuit interrupters shall be provided. Ground fault breakers shall be equipped with solid state sensing and 5 milliamp sensitivity.
5. Breakers used for lighting circuit switching shall be suitable for the purpose and shall be marked "SWD". Breakers requiring continuous operation shall be provided with a lock-on device.
6. Where specifically shown on the Contract Drawings or stated in the Specifications, shunt trips, bell alarms, and auxiliary devices shall be provided.

F. Directories:

1. Each panel shall be provided with a directory. Panel directories shall be typewritten, and shall have designations of each branch circuit. The directory shall be protected by a glass or noncombustible plastic cover.
2. The Contractor shall maintain in each panel, during the duration of the Contract, a handwritten directory clearly indicating the circuit breakers in service and the number of spares. This directory shall be updated as work progresses, and final, typewritten directories shall be provided at the end of the Contract.
3. Where execution of the work under this Contract requires certain circuits to be modified, the Contractor shall update the panelboard directories if available to reflect the modifications. Final typewritten directories shall be provided at the end of the Contract.

2.03 - PAINTING

- A. All metal surfaces of the panelboard enclosures shall be thoroughly cleaned and given one coat of zinc chromate primer. All interior surfaces shall then be given one shop finishing coat of a nitro-cellulose enamel lacquer.
- B. All exterior surfaces shall be given three coats of the same lacquer. The color of finishing coats shall be light gray ANSI No. 61.

2.04 - SHOP TESTS

- A. Shop tests shall be performed at the panelboard's manufacturer's plant prior to shipment. Shop tests shall demonstrate that the equipment tested conforms to the requirements specified.
- B. Each panelboard shall be given a 60 Hertz, AC, Hi-Pot test, phase to phase and phase to ground, at twice rated voltage plus 1000 volts for one minute, 1500 volts minimum.

PART 3 - EXECUTION**3.01 - INSTALLATION**

- A. Panelboard shall be mounted rigidly and securely to the building structure or to supporting devices which are rigidly and securely supported to the building structure. Anchor panelboards to satisfy seismic requirements in accordance with the anchorage details.
- B. Panelboards shall be fastened with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on metal.
- C. Mount all panelboards parallel or perpendicular to walls, such that panelboards are installed in a neat and professional manner.
- D. All wiring shall be neat within the panelboards. Wires shall be run vertically in the wire gutter and then terminate horizontally at a breaker.
- E. The Contractor shall install blanking devices within panelboard spaces so bus bars are not exposed.
- F. Install panelboard nameplates for identification of equipment.
- G. Panelboard circuits shall be installed so to balance the loads on each of the panelboards.

+ + END OF SECTION + +

PART 1 - GENERAL

1.01 - SECTION INCLUDES

- A. Requirements for providing electric control equipment. Electric control equipment shall be provided in accordance with the requirements specified under this section, the Specifications and the Contract Drawings.

1.02 - PAYMENT

- A. Payment for electric control equipment shall be made as provided in the Specifications.

1.03 - REFERENCES

- A. Electric control equipment shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70, National Electrical Code.
 - 2. UL Standard No. 98, Enclosed Switches.
 - 3. UL Standard No. 508, Industrial Control Equipment.
 - 4. NEMA Standard KS-1, Enclosed Switches.
 - 5. NEMA Standard ICS, Industrial Control and Systems, General Requirements.
 - 6. NEMA Standard ICS 2, Industrial Control and Systems, Controllers, Contactors and Overload Relays.
 - 7. NEMA Standard ICS 5, Industrial Control and Systems, Control Circuit and Pilot Devices.
 - 8. NEMA Standard ICS 6, Industrial Control and Systems, Enclosures.

1.04 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:
 - 1. Prior to equipment submission, submit a list of proposed manufacturers with products they produce proposed for the contract.

2. Manufacturer's catalog cuts, technical information and enclosure details for the electric control equipment.
- C. Operations and Maintenance Manuals shall be submitted in accordance with the Specifications.

1.05 - QUALITY ASSURANCE

- A. Unless otherwise shown on the Contract Drawings, stated in the Specifications or directed by the standards and codes referenced under this section, the Contractor shall provide for each low voltage motor or other power device, complete equipment for starting and control.
- B. The starting and control equipment shall be provided with features of protection, current limitation and functioning and be complete with all accessories, appurtenances and supporting structures.
- C. Control equipment shall be UL listed and properly designed with relation to the characteristics of operation of the motor and device controlled.
- D. Unless otherwise shown on the Contract Drawings or stated in the Specifications, each motor shall be provided with control equipment consisting of apparatus as follows:
 1. Motors of 1/4 HP or less may, in the absence of other requirements, shall be controlled by a manual motor starter having thermal overload protection at all times.
 2. Motors larger than 1/4 HP shall be controlled by a magnetic motor starter.
 3. For wound rotor motors of all horsepower ratings, the primary shall be controlled by a magnetic motor starter. Secondary control shall be magnetic or manual as stated in the Specifications.
 4. Multiple speed squirrel cage motors, shall be controlled by a magnetic motor starter. The magnetic motor starter shall provide adequate protection of the motor at each speed. A line establishing contactor shall be provided for each motor speed.
- E. Each motor shall include overload protection based on latest standards.

1.06 - DELIVERY, STORAGE AND HANDLING

- A. Electric control equipment shall be delivered, stored and handled in accordance with the Specifications and the manufacturer's instructions.

1.07 - SPARE PARTS

- A. The Contractor shall furnish and deliver to the Engineer, at that part of the site and at such time as the Engineer may direct, spare parts for the electric control equipment in accordance with the Specifications.
- B. The spare parts shall be listed in an index and packed in containers suitable for long term storage, bearing labels clearly designating the manufacturer's part number with complete information for use and reordering.
- C. The following spare parts shall be furnished:
 - 1. One (1) set of contact tips, shunts and coils shall be provided for each 6 or less of each size motor starter.
 - 2. One (1) auxiliary contact unit or one set of auxiliary contact tips shall be provided for each 6 or less motor starter.
 - 3. Two (2) sets of arc chutes shall be provided for each type and rating of magnetic contactor.
 - 4. One (1) timing relay shall be provided of each type installed as part of control equipment installation.
 - 5. One (1) complete auxiliary relay shall be provided of each type installed as part of control equipment installation.
 - 6. One (1) control transformer shall be provided of each rating and type installed as part of control equipment installation.
 - 7. Two (2) complete fuse replacements shall be provided of each rating and type installed as part of control equipment installation.

PART 2 - PRODUCTS

2.01 - SWITCHING DEVICES

- A. Switching devices shall be provided in accordance with the details shown on the Contract Drawings. The switching devices required under this section shall be the disconnect switch and circuit breaker types.
- B. Switching devices shall be enclosed in NEMA type enclosures in accordance with the requirements specified under Article 2.05.

C. Disconnect switch type switching devices shall be in accordance with the following:

1. Switches shall be heavy duty type with number of poles, voltage and current ratings as shown on the Contract Drawings.
2. Switches shall be capable of interrupting the full rated current at full rated voltage. Where specifically shown on the Contract Drawings, disconnect switches shall be complete with fuses.
3. Switches shall be the quick make and quick break type covered with an arc resisting barrier. The switch shall be provided with provision for locking in either open or closed position. The ratings shall be as follows:

MOTOR HORSEPOWER		
Switch Rating in Amperes	208-240v.	480v.
60	Over 5 to 15	Over 5 to 30
100	Over 15 to 25	Over 30 to 60
200	Over 30 to 50	Over 60 to 125
400	Over 50 to 75	Over 125 to 200

D. Circuit breaker type switching devices shall be in accordance with the following:

1. Circuit breakers shall be the molded case type with number of poles, voltage and current ratings as shown on the Contract Drawings.
2. Breakers shall be manually operated thermal magnetic type, including inverse-time overload and instantaneous short-circuit protection. Contacts shall be nonwelding silver alloy and arc extinction shall be accomplished by means of arc chutes.
3. Breakers shall have 100 amp frames as a minimum. Overload protection shall be provided on all poles, with trip settings as shown on the Contract Drawings. Breakers with frame sizes 225 amp or larger shall have interchangeable trip units and adjustable magnetic trip elements.
4. Breakers shall be operated by a toggle-type handle and shall have a quick-make/quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Breaker enclosure shall be equipped with an external lockable handle with provision for locking in the closed or open position.

5. Where specifically shown on the Contract Drawings or stated in the Specifications, breakers shall be provided with electronic trip units. Electronic trip units shall include long time, short time, instantaneous and ground fault settings as minimum.
 6. Where specifically shown on the Contract Drawings or stated in the Specifications, breakers shall be provided with shunt trips, bell alarms and auxiliary devices.
- E. Switching devices shall be by Cutler-Hammer, General Electric Company or approved equal.

2.02 - MAGNETIC MOTOR STARTERS

- A. Magnetic motor starters shall be provided complete with fused control power transformer, pilot devices, auxiliary contacts and accessories as shown on the Contract Drawings or stated in the Specifications.
- B. Magnetic motor starters shall be enclosed in NEMA type enclosures in accordance with the requirements specified under Article 2.05. The starter shall be combination type. The enclosure shall be equipped with an external operable, pad lockable handle, arranged so that it is impossible to open the door unless the breaker is open.
- C. The starter shall be magnetic coil operated, and shall include a magnetic only motor circuit protector with trip unit range adjustable from 700 to 1300 percent of full load. The combination starters shall be suitable for interrupting 65,000 amps through 480 volts.
- D. Magnetic contactors shall be 3 pole, single throw, 110-550 volt, ac, 60 cycles with auxiliary contacts for under-voltage protection. Contactors shall be mounted upon steel bases with insulated mountings or upon bases of insulating material. Contactors shall be provided with necessary barriers and arc chutes.
- E. Contactors shall be NEMA rated as follows:

MOTOR HORSEPOWER		
NEMA Size of Contactor	208-240v.	480v.
1	1/4 to 7-1/2	1/4 to 10
2	over 7-1/2 to 10	over 10 to 25
3	over 15 to 25	over 25 to 50
4	over 30 to 40	over 50 to 100
5	over 50 to 75	over 100 to 200

- F. Contactors in Sizes 1 through 4 shall have double break, silver to silver main contacts. Contactors in Size 5 shall have silver plated tips which close with rolling action and which have self-aligning and self cleaning features. Auxiliary and interlocking contacts for all sizes shall be of

the silver button type. All contact tips shall be easily renewable. Flexible shunts shall be tinned copper braid or tinned extra flexible copper cable.

- G. Thermal overload relays shall be of the ambient compensated bi-metallic type with separate interchangeable heaters and manual reset feature. Relay shall include a normally open auxiliary contact for remote alarm purposes. Heaters for overload relays shall be selected to match full load currents of the motors to allow motor operation at maximum safe loads without damage to equipment. Full load current data shall be obtained from nameplates of motors actually installed.
- H. Pilot devices shall be heavy duty type, rated 10 amp continuous. Pushbuttons, selector switches, indicating lights, and other devices shall be located on the starter enclosure. Indicating lights shall be push-to-test, transformer type with 12 volt secondaries.
- I. Relays shall be standard, latching type and pneumatic or solid state time delay type. Relays shall be provided with contacts rated 10 amp with number as required.
- J. Special overload protection shall be provided where definite purpose motors cannot be protected by standard thermal overload relay applications.
- K. Magnetic motor starters shall be by Cutler-Hammer, General Electric Company, Furnas Electric Company or approved equal.

2.03 - MANUAL MOTOR STARTERS

- A. Manual motor starters shall be provided complete with pilot devices as shown on the Contract Drawings or stated in the Specifications.
- B. Manual motor starters shall be enclosed in NEMA type enclosures in accordance with the requirements specified under Article 2.05.
- C. Manual motor starters shall be toggle operated, NEMA horsepower rated, single phase type with thermal overload protection unless shown otherwise on the Contract Drawings or stated in the Specifications. Pilot devices when required shall be in accordance with the requirements specified under Article 2.02.
- D. Where shown on the Contract Drawings, manual motor starters shall be 600 volt, three phase type without overload protection for use as manual starting disconnect switches. The switches shall be NEMA size 0 or 1 horsepower rated, as required for the application intended.
- E. Manual motor starters shall be by Cutler-Hammer, General Electric Company, Furnas Electric Company or approved equal.

2.04 - CONTROL STATIONS

- A. Control Stations shall be provided in accordance with the details on the Contract Drawings.
- B. Control Stations shall be enclosed in NEMA type enclosures in accordance with the requirements specified under Article 2.05.
- C. Control stations shall be industrial, heavy duty, oil tight construction with clearly marked legend plates. Stations shall have operating devices as shown on the Contract Drawings.
- D. Contact ratings shall be 10 amp minimum. All indicating lights shall be transformer type with 6 volt lamp, lens color shall be as shown on the Contract Drawings.
- E. Control stations shall be by General Electric Company, Furnas Electric Company, Cutler-Hammer, or equal to be approved by the Engineer.
- F. All control stations associated with electric motor powered equipment shall be provided with both red "running" and green "stopped" indicating lights. Additional indicating lights shall be provided as shown on the Contract Drawings.

2.05 - ENCLOSURES

- A. Enclosures shall be provided for the electric control equipment. Enclosures located indoors in dry, dusty areas shall be gasketed and shall be constructed of 14 gauge sheet steel. Cabinet type enclosures shall include hinged and gasketed front doors.
- B. Enclosures shall be provided in accordance with NEMA requirements as required for the area classifications indicated on the Contract Drawings.
- C. For dry, dusty locations, enclosures shall meet NEMA 12 requirements. For wet and corrosive locations, enclosures shall meet NEMA 4X requirements. NEMA 4X enclosures shall be fabricated from 316 stainless steel.
- D. Unless specifically noted otherwise on the Contract Drawings or stated in the Specifications, enclosures within hazardous locations shall meet Class 1, Division 1, Group D requirements. Hazardous enclosures shall be fabricated from cast metal.

2.06 - EMERGENCY GENERATOR CONNECTION BOX

- A. Contractor shall furnish and install a submersible emergency generator connection box and disconnect switch for remote connection of portable emergency generator.

- B. Disconnect switch shall be rated 480 volts, 3 phase, 60Hz, 2000 amperes mounted in a watertight submersible enclosure.
- C. Emergency generator connection box shall be rated 480 volts, 3 phase, 60Hz, 2000 amperes mounted in a watertight submersible enclosure.
- D. Emergency generator connection box busbar shall be rated 480 volts, 3 phase, 60Hz, 2000 amperes tin-plated copper. The bus system shall in accordance with the following:
 - 1. The main and vertical buses shall be phase and ground isolated and insulated from each other. Bus sizing and insulation shall be in accordance with NFPA 70 National Electrical Code. Bus rating current density shall not be greater than 1000 amps per square inch.
 - 2. The busbar shall consist of the necessary bus connections between the section bus and fixed mounted emergency generator connector and contain the mechanical lugs required to accept the fixed load side cables.
 - 3. The ground bus shall be tin-plated copper with current capacity equal to 1/2 capacity of main power bus and drilled with lugs of appropriate capacity.
- E. Emergency generator connectors shall be E1016 series male camlock panelmounts with flip covers for portable generator connection as manufactured by Meltric, Cooper, or approved equal.
- F. Emergency generator connection box shall be equipped with phase rotation meter.
- G. Emergency generator connection box shall be manufactured by Trystar Inc or approved equal.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Equipment shall be mounted so that sufficient access and working space is provided for ready and safe operation and maintenance.
- B. Equipment shall be securely fasten to walls or other surfaces on which they are mounted. Independent supports shall be provided where no wall or other surface exists.
- C. Electric control equipment shall be installed in conformance with and the National Electrical Code.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Work Included: The Contractor shall furnish, installed, test, and place into satisfactory operation the motor control centers (MCCs) as shown on the Contract Drawings and specified herein.
- B. The following index of this Specification is presented for convenience.

PART 1	GENERAL	1
Article	Title	16482-Page
1.1	Section Includes	1
1.2	Related Specifications	2
1.3	References	2
1.4	Submittals	2
1.5	Quality Assurance	3
1.6	Delivery, Storage and Handling	.4
1.7	Spare Parts	5
1.8	System Description	5
1.9	Design Requirements	5

PART 2	PRODUCTS	6
2.1	Manufacturers	6
2.2	General	6
2.3	Structure	7
2.4	Bus Arrangement and Materials	7
2.5	Unit Compartments	8
2.6	Wiring	21
2.7	Key Interlock Systems	22
2.8	Painting	22
2.9	Shop Tests	22

PART 3	EXECUTION	23
3.1	Installation	23
3.2	Field Tests	23
3.3	Grounding	24
3.4	Identification	24
3.5	Rubber Mats	24
Article	Title	16482-Page
3.6	Manufacturer's Field Services	24
3.7	Acceptance Testing	25

1.02 - RELATED SPECIFICATIONS

- A. Specification 16036 - Testing
- B. Specification 16071 - Supporting Devices

- C. Specification 16076 - Labeling and Identification
- D. Specification 16292 - Power Distribution System Coordination

1.03 - REFERENCES

- A. Motor control centers shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70 - National Electrical Code
 - 2. ANSI C37.90.1 - Surge Withstand
 - 3. NEMA ICS 3-1 - Motor control centers
 - 4. National Electrical Manufacturers Association (NEMA) - No. ICS-1, General Standards for Industrial Control and Systems; No. ICS-2, Industrial Control Devices, Controllers and Assemblies; No. ICS-6, Enclosures for Industrial Control and Systems.
 - 5. UL 845 - Motor control centers
 - 6. NETA - International Electrical Testing Association

1.04 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article 4 - Contractor's Working Drawings, Design and Shop Drawings; and as specified under Specifications.
- B. Working Drawings
 - 1. Equipment specifications and product data sheets identifying all materials used and methods of fabrication.
 - 2. Complete assembly, layout, and installation drawings with clearly marked dimensions.
 - 3. Equipment cross section drawings.
 - 4. Weights of all component parts, assembled weight of units and approximate total shipping weight.
 - 5. Interconnection Wiring Diagrams.

6. Circuit breaker and fuse time-current curves.
7. Complete motor data and performance characteristics including nameplate data sheet.
8. List of Spare Parts.
9. List of Special Tools.
10. List of recommended lubricants.
11. Painting procedures.
12. Installation instructions.
13. Single line diagram.
14. Internal wiring diagrams for each unit compartment.
15. Motor control center anchorage details with design calculations signed by licensed engineer.

C. Testing Methods

1. Contractor shall submit a description of shop and field testing methods, procedures and apparatus with calibration dates. Testing methods and procedures shall be submitted at least 45 days in advance prior to conformation of witness testing dates and actual testing.
2. Qualifications of proposed testing firm to perform acceptance testing shall be submitted. Submit firm experience records at least 45 days in advance to actual testing, five recent references with phone numbers shall be submitted.

D. Certificates of Compliance

1. Submit seismic qualification certificate from the manufacturer including mounting recommendations.
2. Submit data and results of witness tests accompanied by a certificate of authenticity sworn to before a notary public by an officer of the manufacturing company. Upon approval, release for shipment to site shall proceed.

E. Reports

1. Submit shop test and field test reports shall be submitted.

- 2. Submit manufacturer's site visit and acceptance testing reports shall be submitted.
- F. Operation and maintenance manuals shall be submitted in accordance with the Specifications.
- G. Prior to completion and final acceptance of the project, the Contractor shall furnish and install "as-built" wiring diagrams for each MCC unit of each motor control center. These final drawings shall be plastic laminated and securely placed inside each MCC unit door and included in the O&M manuals.

1.05 - QUALITY ASSURANCE

A. General

- 1. Motor control centers shall be designed, built and tested in accordance with the latest applicable editions of ANSI/IEEE, NEMA, UL and NFPA
- 2. All structures shall be fabricated of code gauge steel. Steel surfaces shall be chemically cleaned, treated and finished with ANSI No. 61 indoor light grey paint.
- 3. The motor control center manufacturer shall use a shop test facility that has recently calibrated testing apparatus and qualified, experienced technicians, for all factory tests. Calibration of testing apparatus shall be within one year.
- 4. All test equipment and instrument calibration shall be in accordance with the latest edition of the accuracy standard of the U.S. National Institute of Standards and Technology and the NETA acceptance testing specification.
- 5. The motor control centers shall be designed, constructed and installed suitable for earthquake regulations in accordance with the seismic requirements of the Uniform Building Code for zone 2A application.
- 6. Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacturing, installing and servicing of similar items with a history of successful production acceptable to the Engineer as specified herein and in accordance with Article 5 of the General Conditions.

- B. The Contractor shall submit certification that manufacturer has been producing motor control centers for a minimum of five (5) years.

C. Field Tests

1. The motor control centers shall be field tested. Field testing shall be performed in accordance with the requirements specified under Article 3.2.
2. The services of the motor control center manufacturer shall be retained for field service. Field service shall be in accordance with the requirements specified under Article 3.3.
3. Retain the service of an independent testing firm who shall perform field acceptance testing of the motor control centers. The testing firm shall have experience in the inspection and testing of the equipment and shall be a member company of NETA. Provide proof of membership, or demonstrate that the standards and experience required for membership are possessed, all to the satisfaction of the Engineer. Acceptance testing shall be in accordance with the requirements specified under Article 3.4.

1.06 - DELIVERY, STORAGE AND HANDLING

- A. Motor control center equipment shall be delivered, stored and handled in accordance with the Specifications, the manufacturer's instructions and the following.
 1. Motor control center equipment shall be inspected for shipping damage or loose parts when received. Evidence of water which may have entered equipment during transit shall be checked.
 2. Motor control center equipment shall be lifted, rolled or jacked into locations shown on the Contract Drawings.
 3. Motor control center equipment shall be stored in a clean, dry location in which a uniform temperature is maintained. Equipment shall be protected with coverings and maintain air circulation.
 4. Where dampness or condensation may be encountered, heaters shall be provided for equipment to prevent moisture damage.

1.07 - SPARE PARTS

- A. The Contractor shall furnish and deliver to the Engineer, at that part of the site and at such time as the Engineer may direct, spare parts for the motor control centers in accordance with the Specifications.
- B. The spare parts shall be listed in an index and packed in containers suitable for long term storage, bearing labels clearly designating the manufacturer's part number with complete information for use and reordering.

- C. Spare parts shall be furnished in accordance with the manufacturer's recommendations. Spare parts for each motor control center shall include at a minimum the following:
1. One (1) of each circuit breaker size for each ten (10) provided, minimum of one (1) if less than ten (10).
 2. Three (3) of each fuse size provided.
 3. One (1) of each meter or monitor for each five (5) provided, minimum of one (1) if less than five (5).
 4. One (1) of each starter size for each ten (10) provided, minimum of one (1) if less than ten (10).
 5. All manufacturer recommended spare parts.

1.08 - SYSTEM DESCRIPTION

- A. In general, the motor control centers included under this Section shall include, but not be limited to, the following:
1. Main disconnecting devices.
 2. Motor starters and controls.
 3. Feeder disconnecting devices.
 4. Control wiring and interlocking.
 5. Metering, monitoring and communication equipment.

1.09 - DESIGN REQUIREMENTS

- A. The Contractor shall review installation procedures under other Sections and Contracts and coordinate them with the work specified herein.
- B. The Contractor shall notify other Contractors in advance of the installation of the work included to provide them with sufficient time for installation and coordination of interrelated items that are included in their Contracts and that must be installed in conjunction with the work included in this Section.

- C. In all cases where a device or part of the equipment is referred to in this Section in the singular (such as motor starter), it is intended that such references shall apply to as many such devices as are required to complete the installation.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Motor control center manufacturers and their particular products shall be as follows:
1. Square D, "Model 6"
 2. Cutler-Hammer, "Freedom"
 3. General Electric, "Spectra Series"
 4. Or approved equal.

2.02 - GENERAL

- A. The motor control centers shall be 600 volt class suitable for operation on a three phase, 60 hertz system. The system operating voltage shall be 480V. Number of wires, bus ampacity, and short circuit withstand capability shall be as shown on the Contract Drawings.
- B. In addition, refer to Contract Drawings for actual layout and location of equipment and components, electrical ratings of devices, components and assemblies, and other details.
- C. Motor control centers shall contain wiring similar to NEMA Class II, Type B. All inputs and outputs shall be wired to I/O terminal blocks.
- D. The circuit breakers, motor circuit protectors, disconnect switches and motor starters shall have a short circuit withstand rating equal to the bus short circuit withstand rating.
- E. The Contractor shall obtain the new motor control centers from one manufacturer who shall also manufacture the enclosure and major equipment components, which includes, but is not limited to, starters, variable frequency drives, reduced voltage soft starters, branch circuit breakers, main circuit breaker, power monitoring equipment, and other components of the equipment assembly. Subcontracting of wiring is not acceptable.
- F. The motor control center shall be assembled/modified using NEMA rated components. Components designed and built to International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured and labeled in compliance with IEC standards is not acceptable.

2.03 - STRUCTURE

- A. Structures shall be totally enclosed dead-front, free-standing assemblies. They shall be 90 inches high and 20 through 22 inches wide. Larger widths of 24, 30 or more inches shall be utilized for oversized starters, automatic transfer switches, programmable logic controllers, variable frequency drives, main breakers, and other components as required. Minimum depth shall be 20 inches.
- B. Each MCC shall consist of vertical sections of heavy gauge steel bolted together forming a rigid unit assembly. Removable lifting angles or tabs shall be mounted on top of MCC sections. Removable bottom channel sills shall be mounted front and rear of each vertical section and shall extend the full width of line-up.
- C. MCC enclosures shall be NEMA Type 12 dust-tight and drip-proof.
- D. Each vertical section shall contain a top and bottom horizontal wireway for incoming lines and wiring between sections. A vertical wireway shall be adjacent to each vertical unit and shall be covered by a hinged door. Vertical wireways shall contain cable tie supports. Each individual device compartment shall have a side barrier to permit pulling wire from vertical wireway without disturbing adjacent device compartments.
- E. Compartments for mounting control units shall be incrementally arranged such that not more than six (6) NEMA Size 1 starters can be mounted within any vertical structure. Guide rails shall be provided.
- F. Motor control centers shown "back-to-back" on the Contract Drawings shall be complete motor control assemblies placed back-to-back in the location shown. Motor control center sections with common horizontal and/or vertical bus systems are unacceptable.

2.04 - BUS ARRANGEMENT AND MATERIALS

- A. Each structure, including the I/O compartment sections, shall contain a main horizontal tin-plated copper bus. Vertical busses supplying unit compartments shall be tin-plated copper, shall be 300A minimum or fully rated for larger equipment, and shall be securely bolted to the horizontal main bus. All joints shall be front accessible for ease of maintenance.
- B. Main bus shall be isolated from wireways, starters and other areas by insulated barriers. Bus bars shall be supported on polyester reinforced insulators.
- C. Vertical busses shall be completely isolated and insulated by means of a labyrinth design barrier. It shall effectively isolate the vertical busses to prevent any fault generated gases to pass from one phase to another. Small openings in bus sandwich shall permit unit stabs to plug into vertical

bus bars, rather than onto them. An automatic shutter mechanism shall be furnished to completely isolate vertical bus, including stab area opening, when plug-in device is removed.

- D. Each MCC shall contain a tin-plated copper ground bus which extends the full width of the MCC. The ground bus shall be rated 300A, unless shown otherwise on the Contract Drawings. Pressure type ground lugs shall be mounted on the ground bus in the incoming line sections.
- E. A vertical plug-in ground bus shall be tin-plated copper and linked to the horizontal ground bus. This tin-plated copper vertical plug-in ground bus, in combination with the unit ground bus stab, shall establish unit insert grounding before the plug-in power stabs engage the power bus, and conversely, as the unit is withdrawn, grounding is maintained until after the plug-in power stabs are disengaged.
- F. A vertical load ground bus shall be tin-plated copper and linked to the horizontal ground bus. The bus assembly shall provide a termination point for the load equipment grounding conductor(s) at the unit. The fixed connection shall not have to be removed when the unit is withdrawn from the MCC.
- G. For 3-phase, 4-wire systems, a tin-plated copper neutral bus shall be furnished when shown on the Contract Drawings. The neutral bus shall extend the full width of the MCC and shall be fully rated unless shown otherwise on the Contract Drawings.

2.05 - UNIT COMPARTMENTS

- A. General
 - 1. Each unit compartment shall be provided with an individual front door. Each front door shall have a drawing holder mounted on the inside of the door for holding final, "as-built" wiring diagrams. Each plug-in unit shall be supported and guided by a removable unit support pan, so that the unit rearrangement is easily accomplished. The rearrangement of the unit support pan from one location to the other shall be accomplished without use of tools. After insertion, each plug-in unit shall be held in place by at least one multi-turn latch, located on the front of the unit. The latch shall be located for front accessibility and inspection convenience.
 - 2. Unit compartments shall contain circuit breakers, combination motor starters, fused disconnects, and related equipment such as overload relays, control power transformers, terminal blocks, and other components as shown and as specified and required.
 - 3. Full voltage, non-reversing starter units NEMA Size 1 through NEMA Size 5 shall be of the draw out type. Draw out provisions shall include a positive guide rail system and stab

shrouds to absolutely ensure alignment of stabs with the vertical bus. Draw out units shall have a stab assembly for connection to the vertical bus. Cables shall be connected to stabs with maintenance free crimp connectors. No wiring to these stabs shall extend into the bus compartment.

4. All unit compartment interiors shall be painted white.
 5. All units shall be isolated from one another, above and below, by unit support pans or steel barriers which can remain in place when the units are withdrawn.
 6. Incoming line compartments shall be isolated from horizontal and vertical wireways by steel barriers.
 7. Each incoming line unit shall contain buswork and fittings as required with cable lugs for cables of sizes and quantities shown on the Drawings. Cable lugs shall be suitable for their respective conductors.
 8. For 3-phase, 4-wire systems, a neutral landing pad shall be furnished in the incoming line or main circuit breaker sections.
- B. Operating Mechanisms: An operating mechanism shall be mounted on the primary disconnect of each feeder or starter unit. It shall be mechanically interlocked with the unit door to prevent access unless the disconnect is in the OFF position. A defeater shall be provided to bypass this interlock. With the door open, an interlock shall be provided to prevent inadvertent closing of the disconnect. A second interlock shall be provided to prevent removal or reinsertion of the unit while in the ON position. Padlocking facilities shall be provided to positively lock the disconnect in the OFF position with from one (1) to three (3) padlocks with the door open or closed. In addition, means shall be provided to padlock the unit in a partially withdrawn position with the stabs free of the vertical bus.
- C. Main and Tie Circuit Breakers
1. Main and tie circuit breakers shall be the molded case type. All main and tie circuit breakers shall contain electronic trip units for device coordination curve adjustments. As a minimum, adjustments shall include:
 - a long-time pick-up and delay
 - b short-time pick-up
 - c ground fault pick-up and delay

d instantaneous pick-up

2. The Contractor shall be responsible for determining and setting all required breaker parameters for proper system operation.
3. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make/quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
4. The main and tie circuit breakers shall contain properly sized rating plugs, as shown on the Contract Drawings. Rating plugs shall be removable.
5. Main and tie circuit breakers shall have operating mechanisms as described above.
6. Where shown on the Contract Drawings, main circuit breakers shall have internal or external auxiliary devices capable of monitoring and transmitting electrical quantities to remote locations. See Articles 2.6 and 2.7 for details.

D. Feeder Circuit Breakers

1. Feeder circuit breakers shall be the molded case type (as described above). Breakers shall be manually operated and shall provide thermal magnetic, inverse-time overload, and instantaneous short-circuit protection. Provide electronic trip units for 225 AF circuit breakers and larger. Provide electronic trip units for smaller frame size circuit breakers if available.
2. Feeder circuit breakers shall have 100A frames as a minimum. Overload protection shall be provided on all poles, with trip settings as indicated on the Contract Drawings. Circuit breakers with 225A or larger frames shall have interchangeable trip units and adjustable magnetic trip elements.
3. Feeder breakers shall have operating mechanisms as described above.
4. Feeder breakers shall have internal or external auxiliary devices capable of monitoring and transmitting electrical quantities to remote locations. See Articles 2.6 and 2.7 for details.

- E. Combination Motor Control Units shall consist of a main disconnect device, a motor starter, a control power transformer, an overload relay, control relays, pilot devices, and terminal blocks. Additional control relays or other devices shall be included as required and as shown on the Contract Drawings.
- F. Disconnect Device
1. The disconnect device shall be either a circuit breaker (as described above), motor circuit protector, or fused disconnect as shown on the Contract Drawings.
 2. Motor circuit protectors (MCP) shall be molded case devices similar to circuit breakers (as described above) with a current sensing coil in each of the 3-poles and shall have an adjustable magnetic trip setting by means of a single dial, mounted on the front of the MCP. The MCP shall be designed to meet the NEC requirements concerning motor full load and locked-rotor current.
 3. The settings of the MCPs shall be based on actual motor nameplate data.
 4. The MCPs shall have operating mechanisms as described above.
 5. Disconnect switches shall be heavy duty, single-throw fused type.
 6. Switches shall be rated 600V and shall have ampere ratings and number of poles as shown on the Contract Drawings.
 7. Switches shall be quick-make/quick-break and shall accept Class R dimension fuses.
 8. Disconnect switches shall have operating mechanisms as described above.
- G. Motor Starters and Overload Relays
1. Motor starters shall be electrically operated, electrically held, threepole assemblies with arc extinguishing characteristics and shall have silver-to-silver renewable contacts. They shall have provisions for a total of eight (8) normally open (NO) or eight (8) normally closed (NC) auxiliary contacts. The overload protection shall consist of one (1) current sensor located in each phase monitored by the microprocessor that yields a time current curve closely paralleling that of motor heating damage boundary, accurate to 2%. Running overload protection shall be DIP switch selectable for the specific motor full load amperes within the starter range. Provide DIP switch selectable overload trip class of 10, 20 and 30.

2. Motor starters shall monitor current in each phase to provide phase loss and phase unbalance protection, such that if the unbalance on any of two phases is greater than 30% of the DIP switch selected trip rating, a phase loss/unbalance trip occurs. Provide phase loss/unbalance protection which requires no time delay for reset.
3. Motor starters shall provide ground fault protection. Ground fault protection shall be set at 20% of maximum continuous ampere rating and have a start delay of 20 seconds, and a run delay of 1 second to prevent nuisance trip on starting.
4. The microprocessor shall measure control circuit voltage and prevent closing of the coil on low-voltage (78 volts AC) and/or high-voltage (135 volts AC) conditions which are outside of the coil ratings.
5. The microprocessor shall apply voltage to the coil such that a guaranteed maximum of two (2) milliseconds of main contact bounce occurs on contactor closure.
6. The microprocessor shall continuously measure coil circuit voltage and current so as to maintain constant coil power at a level to maintain main contact closure and minimize coil power consumption.
7. Provide Control Modules to perform the indicated input/output control functions shown on the Contract Drawings. Module to incorporate faceplates having membrane type pushbuttons and LEDs. All pushbutton and LED functions to be furnished with clearly written identification. Modules to be provided with the ability to replace conventional start, stop, hand, auto, and control functions, and when utilized in starter applications, overload reset function.
8. Provide an addressable communication card capable of transmitting all data over a compatible two-wire local area network to a central personal computer for storage and/or printout. The network shall also be capable of transmitting data in RS232c format via a translator module. The following data shall be able to be transmitted:
 - a ON-OFF reset control functions.
 - b Status (ON, OFF, TRIPPED, NO RESPONSE)
 - c Current in each phase
 - d Percent phase unbalance
 - e Control voltage

- f Overload protection settings
- g Cause of trip
- h Trip current magnitude

H. Control Power Transformers

1. Control power transformers (CPT) shall be provided with each combination motor control unit. CPTs shall be 480V-120V, 60 Hz unless shown otherwise, and shall have the following minimum volt-amp ratings:

NEMA Size Starter	VA
1 and 2	200
3	500
4 and 5	500

2. Additional transformer capacity shall be provided when required.
3. CPTs shall be epoxy encapsulated, core and coil units designed for machine tool applications. Insulation classes shall be 185°C (NEMA) and 180°C (UL), 115°C rise. Maximum surface temperature shall be 65°C.
4. CPTs shall be provided with one secondary lead furnished with a Class H control fuse and clip, and the other secondary lead grounded. Both primary leads shall be provided with Class CC control fuses and clips. The above fusing shall apply to all CPTs unless shown otherwise on the Contract Drawings.

I. Control Relays

1. Control relays shall be machine tool type and shall be furnished and installed as required in the unit compartments, or in individual relay panels as shown on the Contract Drawings.
2. Control relays shall be rated 600V with contacts rated 10A continuous, and shall be capable of making 7200VA and breaking 720VA. Coil voltage shall be 120V, 60 Hz unless shown otherwise.
3. Contacts shall be bifurcated and convertible.

4. Relays shall be standard, latching type or time delay type, and shall be furnished with the number of contacts required. Each relay shall contain a minimum of two (2) normally open and two (2) closed contacts.

J. Terminal Blocks

1. Terminal blocks shall be mounted on the right side or bottom of the unit compartment for easy accessibility. Control terminal blocks shall be pull-apart type on plug-in units for easy removal of the unit from the structure. Control terminal blocks on non-plug-in units shall be the fixed type.
2. Control terminal blocks shall be rated 20A, 600V minimum.
3. Pull-apart power terminal blocks shall be 3-pole rated 60 A at 600 volts and shall be supplied through NEMA Size 2 starters. Non-pull-apart terminal blocks rated 195 A at 600V shall be supplied for NEMA Size 3 and larger starters.

K. Seal Leakage Detector – Mixers (M201 – M205, M401 – M405, M601 – M605, M801 – M805)

1. Contact Design: 2PST and 3PST bridge type double break in all possible combinations of normally open and normally closed. Fully enclosed. Buttons are ¼ inch diameter silver cadmium oxide.
2. Contact Rating: 16A @ 115VAC, 8A @ 230 VAC, 1 H.P. @ 115, 230 VAC.
3. Mode of Operation: Direct only. Contacts assume normal position with open circuit.
4. Supply Voltage: 115, 230, 460, 575 VAC models: +10% - 1515%, 50/60Hz.
5. Supply Current: Relay energized 4.4 VA
6. Secondary Circuit: 500 VAC on probes, 6 VA with short circuited electrode circuit
7. Sensitivity: 20K Ohms/cm (150' maximum distance between control and proves).
8. Manufacturer: Warrick Series 2810-1G1, or approved equal.

L. Transient Voltage Surge Suppression

1. The new motor control centers shall be furnished with integrated transient voltage surge suppression (TVSS) equipment suitable for large distribution equipment applications.

TVSS equipment shall be provided for each incoming source of power to the motor control center.

2. The TVSS equipment shall be factory installed by the motor control center manufacturer.
3. The TVSS equipment shall include a disconnect switch and shall be installed using a direct bus connection. There shall be no cable connections between devices.
4. The TVSS shall be connected for seven modes of operation, line to line, line to neutral (as required), line to ground, neutral to ground (as required). The TVSS shall be rated 100,000 A. TVSS shall be tested in accordance with NEMA LS-1. TVSS shall be designed, rated and installed in accordance with UL 1449. Third party test results shall be included in the submittal.
5. The TVSS equipment shall be Cutler-Hammer Clipper Power System Model CPS-S2, General Electric Company equivalent, or equal.

M. Variable Frequency Drives

1. Description
 - a. Provide enclosed variable frequency controllers suitable for operating the indicated loads. Conform to requirements of NEMA ICS 3.1.
 - b. Minimum efficiency at full load: 98 percent.
2. Environment Ratings
 - a. Operating Ambient: -10 degrees C to 50 degrees C.
 - b. Relative Humidity: 5 to 95% non-condensing, all power ratings.
 - c. Altitude: 3,300 feet maximum without derating.
 - d. Vibration: 0.006 inches (0.152 mm) displacement, 1G peak.
 - e. Shock: 15G peak for 11ms duration (+-1.0 ms).
3. Variable Speed Drive Ratings
 - a. Voltage: 460V AC +-10%
 - b. Frequency: 57 to 63 Hz

- c. Phase: 3-phase
- d. Motor Horsepower: HP rating of each motor shall meet rating indicated on Contract Drawings, at a minimum.
- e. Minimum Efficiency: 98% at Full Load
- f. Line Transient Protection: Line transients up to 5,000 volts peak. 320 Joules phase-to-phase 380 Joules phase-to-ground
- g. Logic Power Ride-Thru: 2 seconds or longer
- h. Drive Characteristics: Drive shall use isolated gate bi-polar technology
- i. Control Logic Noise Immunity: Showering arc transients from 350 to 2,000 volts peak
- j. Voltage: 0 to applied input voltage, 480V AC, maximum output voltage shall not exceed applied input voltage.
- k. Frequency Range: 0.1 to 400 Hz with local programmable minimum and maximum limits
- l. Frequency Output Resolution: 0.01 Hz
- m. Volts-per-Hertz: Fully programmable minimum 1 to 14.3 V/Hz through local programming
- n. Intermittent Overload Capability: Programmable MOPC from 50 to 150% of rated output current for up to 1 minute maximum
- o. Carrier Frequency: Carrier frequency shall be adjustable from 1KHZ up to 15 KHZ.
- p. Employ switching power supply operating off DC link. Design for ability to operate controller with motor disconnected from output.
- q. Design to attempt ten automatic restarts following a non-volatile fault condition before locking out and requiring manual restart.
- r. Over-torque protection and multi-Speed operation. Acceleration/Deceleration operation shall have capabilities for linear or s-curve ramp operations.

- s. In case of sustained power loss, the control shall shut down safely without component failure. In the event of momentary power loss, the control shall shut down safely without component failure. Upon return to power the system shall automatically return to normal operation, being able to restart into a rotating motor, regaining positive speed control without power failure.
 - t. Drive shall have two and three wire control capability. Drive shall have Energy Saving Voltage reduction during lightly loaded motor condition. Drive shall have PID control capability or accept external PID control capability. Drive shall have full range automatic torque boost.
 - u. Analog Inputs: 4-20 mA DC or 0-10V DC.
 - v. Drive shall have five (5) programmable output control contacts for external interface with remote control panels as confirmation that the motor was called to start. Show this on the point-to-point interconnection diagram.
 - w. Drive shall have nine (9) input preset speed inputs.
 - x. Keypad shall be English with 2-line by 16-character LCD display.
 - y. Drive shall have built-in overload relay.
4. Variable Speed Drive System
- a. The variable speed drive system shall include a diode bridge converter, filter network and a transistorized inverter section. Base driver signals used to control firing of the power transistors shall be designed with optically coupled isolators for optimum drive protection. The output shall be sinusoidal wave, pulse width modulated, voltage waveform for reduced harmonic heating in the motor. The systems shall include all the necessary control circuits, synchronizing the equipment and protective devices as required by design. The drive unit shall be able to withstand a phase-to-phase and a phase-to-ground short without damage to the drive unit.
 - b. The systems protection as a minimum shall provide the following:
 - 1) Current Limit: 115% of rated current
 - 2) Overcurrent: 180% of rated output current IET (trip fault)
 - 3) Short-circuit: Phase-to-phase (trip fault)

- 4) Overvoltage: High D.C. bus voltage (trip fault)
 - 5) Undervoltage: 20% below line voltage (trip fault)
 - 6) Momentary Power Failure: 30 to 500 milliseconds
 - 7) Burn-out: D.C. bus fuse protection or 3 phase input fusing
 - 8) Alarms: Fault contact (Form C)
 - 9) Digital Indication
 - 10) Individual Fault Condition: Overcurrent of a transistor. Output overcurrent or short-circuit. Overcurrent while running. Thermal overload. Overvoltage of the D.C. bus due to regeneration. Overvoltage of the D.C. bus due to high line voltage. Overtemperature of the enclosure and ground fault shall also be provided.
 - 11) LED Indication: D.C. bus capacitor charge
 - 12) Stall Protection: Prevents current limit activation during overload condition to prevent stall
 - 13) Ground Fault: Detects output short-circuit due to a ground (trip fault)
 - 14) Voltage Limit: Prevents the overvoltage of the D.C. bus during deceleration.
 - 15) Acceleration & Deceleration Time: Fully programmable.
- c. The system parameters shall be shown on the digital display meter before, during, and after the adjustment. The digital display shall indicate the actual setting of the adjustment, not percentage of setting. The following adjustment shall be provided:
- 1) Acceleration: 0.1 to 60 seconds
 - 2) Deceleration: 0.1 to 60 seconds
 - 3) Upper Frequency Limit: 0 to 80 Hz
 - 4) Lower Frequency Limit: 0 to 80 Hz

5) Auto Reference Bias: 0 to 80 Hz

6) Auto Reference Gain: 0 to 80 Hz

- d. The unit shall be self-protecting to prevent any misadjustments by the operator. The upper limit cannot be set below the lower limit, and will signal the operator of this misadjustment.

N. Solid State Reduced Voltage Starter

1. Solid state reduced voltage starter and accessories to be factory installed in the motor control center.
2. The starter shall be rated for 200-575V +/- 10%, 50-60Hz +/- 10%. Control Voltage shall be rated for 100-240V +/- 10%.
3. The starter shall provide the following standard "starting" modes:
 - a. Linear Torque control for Start.
 - b. Variable Torque control for Start.
 - c. Pump Control.
 - d. Current Limit Start.
 - e. Voltage ramp Start.
 - f. Voltage ramp Start with current limit Start.
 - g. Full Voltage Start.
 - h. Remote analog control.
 - i. Soft Start with Selectable Torque Boost.
 - j. Slow Speed time controlled.
 - k. Slow Speed external controlled.
 - l. Dual Ramp Start.
4. The Controller shall provide the following standard "stopping" modes:

- a. Linear Torque control for Stop.
 - b. Variable Torque control for Stop.
 - c. Pump Control.
 - d. Voltage ramp Stop.
 - e. Coast to Stop.
 - f. Remote analog control Stop.
 - g. DC injection Braking.
 - h. Slow Speed time controlled.
 - i. Slow Speed external controlled.
 - j. DC-Brake at slow speed.
 - k. Dual Ramp Stop.
 - l. Accurate position stop control.
 - m. Bypass control (Sequence Stop).
5. The starter shall provide the following additional features:
- a. Jogging forward and reverse.
 - b. 4 parameters sets (externally selectable)
 - c. Analog output (programmable and selectable – 0-1VDC or 4-20mA)
 - d. Built-in Display (w/ optional Remote Display).
6. The starter shall provide the following standard “Operation” interfaces:
- a. Integral Keyboard.
 - b. Remote.
7. The starter shall provide the following optional Operation interfaces:

- a. Serial communication RS 232/485 Modbus RTU.
 - b. Profibus DP.
 - c. DeviceNET.
 - d. Interbus-S.
 - e. Lonworks.
 - f. FIP IO.
 - g. Saflink.
 - h. External Display for mounting on enclosure door.
8. The starter shall provide the following Protection features. The protection shall be maintained when bypass contactor is supplied.
- a. Motor Thermal Overload.
 - b. Soft Start thermal over temperature.
 - c. PTC input
 - d. Motor Shaft Torque (Max) machine process protection.
 - e. Motor Shaft Torque (Min) machine process protection.
 - f. Phase Imbalance.
 - g. Phase reversal.
 - h. Over voltage.
 - i. Under voltage.
 - j. Locked Rotor.
 - k. Excessive Starts per hour for application.
 - l. Phase loss input/output.
 - m. Motor output loss.

9. The starter shall provide the following standard Monitoring functions. The monitoring functions shall be maintained when bypass contactor is supplied.
 - a. Three Phase Current (average).
 - b. Three Phase Voltage (average).
 - c. Current in L1, L2, L3.
 - d. Voltage between L1-L2, L1-L3, L2-L3.
 - e. Shaft Power in kW/HP (selectable).
 - f. Motor thermal capacity.
 - g. Power factor.
 - h. Torque in Lbs./ft. or Nm (selectable).
10. The starter shall provide the following standard Alarm functions. The alarm functions shall be monitored during bypass contactor operation.
 - a. Line failure.
 - b. Phase imbalance.
 - c. Over temperature-motor.
 - d. Over temperature-Soft Starter.
 - e. Shorted SCR.
 - f. Open SCR.
 - g. Locked Rotor.
 - h. Motor Output loss.
 - i. Overload – Shaft Torque.
 - j. Underload – Shaft Torque.
 - k. Phase imbalance.

- l. Over voltage.
 - m. Under voltage.
 - n. Excessive Starts.
 - o. Phase reversal.
 - p. Event list 15 latest alarms.
- 11. The starter shall be of modular construction, consisting of a Control Module and Power Stack.
- 12. All PCB's shall be compatible with the full range power stack.
- 13. All phases should be controlled during start/stop.
- 14. The power stack shall consist of six SCR's mounted on a heatsink assembly for ratings up to and including 1250 amps.
- 15. The starter shall be DIN Rail mountable up to 145A.
- 16. DIN Rail mountable units should be mountable without space at side.
- 17. Starters 180A and larger shall allow for convenient connection of bypass contactor without modification of standard assembly.
- 18. Starter Control Module:
 - a. Mechanical features:
 - 1) The control module assembly shall consist of a power supply, logic control circuitry, silicon controlled rectifier (SCR) firing circuitry. I/O circuitry, a digital programming keypad, dual LED Displays.
 - 2) The PCB's shall be designed for integral mounting on the control module and shall be compatible with the full range of current ratings – 30 amps to 1250 amps.
 - 3) The control modules shall be easily removed from the power stack, without the need to disassemble associated printed circuit board assemblies.

- 4) Control terminals shall be easily accessible and located on the front bottom of the device. The terminals shall be UL rated for 300 Volts, 15 amps maximum, and accept a maximum of two wires.
- 5) Digital parameter adjustment shall be provided through a built-in keypad. Analog potentiometer adjustments, DIP or rotary switches, or plug-in jumpers are not acceptable.
- 6) Dual built-in alphanumeric, LED displays shall be provided for controller set-up, diagnostics, status and monitoring. The Control Keypad and Display shall have the option for remote mounting.
- 7) The starter shall two green lights for running and start/stop.
- 8) A serial communication port shall be provided as standard. Communication protocol interface modules shall be built in option available for connection to Remote I/O, Devicenet, PROFIBUS, Interbus S, Lonworks, FIP IO and RS 232/485 Modbus RTU.
- 9) A minimum of three auxiliary contacts shall be provided for customer use. These shall be programmable as follows:
 - 10) One form C (SPDT): Fault (dedicated).
 - 11) Two single pole NO: Multifunction (programmable). Ratings: 8A at 250VAC, 2000VA Inrush, B300 NEMA.
- b. Electrical features:
 - 1) The PCB shall provide digital microprocessor control and supervision of all controller operation, including SCR pulse firing control.
 - 2) The PCB power supply shall be self-tuning to accept control power input from 100 to 240, 50/60 Hz.
 - 3) The SCR firing circuitry shall incorporate a latch circuit for three-wire control.
 - 4) Reverse operation of the motor shall be standard in the jog mode without the use of a reversing contactor.
- c. User Adjustments:

- 1) The two acceleration start ramps shall have individual adjustments from 1 to 60 seconds.
- 2) The two acceleration stop ramps shall have individual adjustments from 2 to 120 seconds.
- 3) The initial torque setting shall be adjustable from 0 to 200% of motor torque.
- 4) The end torque setting shall be adjustable from 50 to 200% of motor torque.
- 5) Current limit starting shall be adjustable from 150% to 500% of the motor's full load current.
- 6) A selectable Torque Boost feature shall be available to set a current level from 300-500% of the motor's full load current rating. The time period shall be adjustable from 0.1 to 2.0 seconds.
- 7) Locked rotor function shall be adjustable between 1 to 10 seconds.
- 8) Slow speed shall be adjustable up to 60 seconds or up to 100 external pulses.

d. Protection Diagnostics:

- 1) Motor protection shall be as follows:
 - a) Meets applicable standards and codes as a motor thermal overload protection device.
 - b) Shaft Power measurement without the use of external electro-mechanical sensors.
 - c) Overload trip classes of 10, 20 and 30 shall be provided and user programmable.
 - d) Electronic thermal memory shall be provided for enhanced motor protection.
 - e) Shaft overload and underload protection shall be available through the controller.

- f) All protections shall remain in effect if bypass contactor is supplied.
 - 2) When fault conditions are detected, the controller shall inhibit starting or shut down SCR pulse firing.
- e. Pump Control:
 - 1) The standard feature pump control shall be implemented to provide closed loop control of a motor to match the specific torque requirements of centrifugal pumps for both starting and stopping. This shall aid in eliminating the phenomena commonly reference to as "water hammer". Methods utilizing Soft Start with Soft Stop shall not be acceptable.
 - 2) Closed loop control with linear ramps shall be achieved without using external sensors or feedback devices.
 - 3) Pump stop shall be initiated without the need for a dedicated Pump Stop input.
 - 4) The Pump Stop times shall be user adjustable from 0 to 120 seconds.
- 19. Starters rated for 30A to 145A shall consist of three modules. The three modules shall be mounted on a single heatsink. The heatsink shall be isolated from the power modules and shall have grounding provisions. Power modules rated 30A to 145A shall be encapsulated and shall include two power-switching semi-conductors and control module interface cables. Power connections on units 30-145 amps shall be bus bar type to accommodate wide range of cabling.
- 20. Back-to-back SCR pairs shall be the only power switching semiconductor means acceptable. Diode/SCR combinations shall not be acceptable. Semi conductor fuses shall be required.
- 21. Starter shall be built for continuous operation without need for bypass contactors, either external or internal, for any reason other than when the starter is mounted in a non ventilated enclosure.
- 22. SCRs shall have the following minimum repetitive peak inverse voltage ratings: 200 to 575V: 1600V.

23. For starters rated 30A to 145A, transient protection with snubber circuit including RC-net and capacitors against electrical noise shall be standard.
24. Starters rated 180A and larger will include heavy duty MOV surge absorbers and R-C snubbers as standard.
25. Starters shall deliver its rated current in ambient temperature ranging from 0°C to +40°C. The starter shall be able to operate up to 50°C. The ambient storage temperature shall be -25°C to +70°C.
26. The starter shall be operable in relative humidity of 5 to 95%, non-condensing.
27. The starter shall be suitable for operation up to altitudes of 3000 feet (1000 meters) without derating.
28. The starter shall perform without malfunction from showering arc tests of 500V to 1500V (NEMA ICS 2-230).
29. The starter shall perform without malfunction when subjected to 3000V surges at a rate of 100 bursts per second for 10 seconds (IEEE STD 472).

2.06 - WIRING

- A. Control and power wiring shall be flame-retardant (VW-1) moisture, heat and oil resistant thermoplastic insulation rated 600V, 90°C, with stranded copper conductors, types MTW and THW.
- B. Control wires shall be red. Power wires shall be black. Neutral wires shall be white. Ground wires shall be green.
- C. Control wire size shall be #14 AWG minimum. Power wire size shall be #10 AWG minimum.
- D. Description of control, Variable Speed Drives/Isolations/Input/Output/Bypass Contactors
 1. In the AUTOMATIC position the H-O-A or H-O-R selector switch will provide control power to the pump starter circuit through the isolation, input and output contactors and variable speed drive. The bypass contactor will be electrically and mechanically interlocked via the reversing starter.
 2. In the HAND position the H-O-A or H-O-R switch the pump motor shall start and run whether or not the demand is called for based on level controls. Motor shall operate as in

above except speed control will be via the speed control potentiometer either Local or Remote.

3. In the Drive position of the Drive-Bypass selector switch, the switch shall provide control power to the HAND-OFF-AUTOMATIC (H-O-A or H-O-R) selector switch and the motor shall be controlled as described in A & B above. In the bypass position the selector switch shall provide control power to the H-O-A or H-O-R selector switch to maintain either automatic or manual pump control with the addition of disabling the isolation, input and output contactor and the variable speed drive from the running/starting sequence. In bypass position, the motor shall start and run via bypass contactor (full voltage starter) which is electrically and mechanically interlocked via the input/output contactors.

2.07 - KEY INTERLOCK SYSTEMS

- A. Key interlock systems shall be provided as indicated on the Contract Drawings and as specified herein.
 1. At each double-ended MCC, the key interlock system shall be designed to prevent paralleling of the two incoming sources.
 2. The Contractor shall furnish and install the interlock components in accordance with contract drawings at each MCC to ensure the completeness and satisfactory operation of each system.
 3. Key interlock system manufacturer shall be Kirk, or approved equal.

2.08 - PAINTING

- A. Paint shall be in accordance with the requirements of Specification 09900 – Painting.
- B. Motor control centers shall be painted light-gray ANSI 61 over a phosphate rust inhibitor. All unit compartment interiors shall be painted white over a phosphate rust inhibitor.

2.09 - SHOP TESTS

- A. Certified Shop Tests
 1. Test equipment to demonstrate that it has been properly assembled, properly lubricated, is not overheating, is not overloading, and has no electrical or mechanical defects.
 2. Perform all certified shop test and submit the shop test reports prior to scheduling the witness shop test.

B. Witnessed Shop Tests

1. The Contractor shall perform witnessed shop tests.
2. Obtain approval of the testing procedure and test stand layout prior to scheduling a witnessed shop test.
3. Test all disconnecting devices, starters and controls. Simulate controls for each starter and verify all contacts, relays, and other devices operate properly. Verify all meters, monitors and communication devices operate properly. Verify all miscellaneous devices, such as power supplies, transfer devices, and other equipment operate properly.
4. The Contractor shall submit and obtain acceptance by the Engineer of the witnessed shop test report prior to shipment of the equipment.

PART 3 - EXECUTION**3.01 - INSTALLATION****A. General**

1. Equipment shall be installed in accordance with manufacturer's instructions and recommendations. The Contractor shall follow manufacturer's instructions as to lifting requirements, connecting shipping splits and attachment to structure.
2. Equipment shall be installed so that sufficient access and working space is provided for ready and safe operation and maintenance. The Contractor shall verify NEC clearances as shown on the Contract Drawings, prior to installation.
3. Equipment shall be installed on concrete pads at locations shown on the Contract Drawings. Steel channels shall be provided for support of equipment. Equipment shall be securely mounted to surface with anchor bolts. Anchor the equipment to satisfy the specified seismic requirements in accordance with the anchorage details.
4. The Contractor shall coordinate conduit entry locations through the pad. Conduit locations shall be based on manufacturer's shop drawings.

B. Wiring: The Contractor shall wire all equipment per the Contract Drawings and as required.

C. Adjustments: The Contractor shall test and adjust all equipment within the MCC. This includes short circuit and overload device settings, electronic trip settings of breakers, MCP settings, timing relay settings, and other required settings. All devices shall be properly adjusted such that the MCC protection and control circuits operate correctly and safely.

3.02 - FIELD TESTS

- A. After installation, motor control centers shall be field tested for operation and conformance. The Contractor shall perform field testing in accordance with the Specifications. The field tests shall be witnessed by the Engineer and certified by the Contractor.
- B. Motor control center testing shall be performed by the manufacturer's representative, prior to energizing equipment. The testing shall be in accordance with the recommendations of the manufacturer's representative. Equipment shall not be energized without the permission of the Engineer.
- C. After installation of the equipment, controls and all appurtenances, field test the equipment for system operation and conformance to the specified performance parameters. The Contractor shall perform field tests in accordance with Article 12 of the General Conditions - General Requirements. Test the equipment to demonstrate the following:
 - 1 Equipment has not been damaged in transportation and installation.
 - 2 Equipment has been properly installed.
 - 3 Equipment has been properly lubricated.
 - 4 Equipment has been properly connected.
 - 5 Equipment is not overheating.
 - 6 Equipment is not overloading any part.
 - 7 The equipment has no electrical or mechanical defects.
 - 8 Compliance with performance and design parameters.
 - 9 System operability under all control schemes.

3.03 - GROUNDING

- A. The motor control centers shall be properly grounded per NEC requirements. The MCC ground bus shall be connected to building ground grid.
- B. Conduits entering the MCC shall have insulated grounding bushings tied together with copper jumper cables.

3.04 - IDENTIFICATION

- A. Each motor control center shall be identified with the identification number indicated on the Drawings (e.g. MCC 02-04-13). A nameplate shall be securely affixed in a conspicuous place on each MCC. Nameplates shall be as specified in Specification 16076 Labeling and Identification

3.05 - RUBBER MATS

- A. A three foot wide rubber mat shall be furnished and installed on the floor and in front of each motor control center. The mat shall be long enough to cover the full length of the equipment line-up. The mat shall be 1/4 inch thick with beveled edges, canvas back, solid type with corrugations running the entire length of the mat. The mat shall be guaranteed extra quality, free from cracks, blow holes or other defects detrimental to their mechanical or electrical strength. The mat shall meet OSHA requirements and the requirements of ANSI/ASTM D-178 J6-7 for Type 2, Class 2 insulating matting.

3.06 - MANUFACTURER'S FIELD SERVICES

- A. A qualified manufacturer's representative shall make the necessary modifications to the existing motor control centers as specified herein and indicated on the Contract Drawings. The representative shall also assist in the installation of the new motor control centers, check the motor control center installation before it is placed into operation, assist in the performance of field tests, observe and assist initial operations and train the plant operations and maintenance staff in the care, operation and maintenance of the equipment.
- B. The Contractor shall provide a field report from the manufacturer's representative for each visit to the site. The report shall include complete information on time, schedule, tasks performed, persons contacted, problems corrected, tests results, training, instruction and all other pertinent information.
- C. The service representative shall sign in with the Engineer on each day they are at the site.

3.07 - ACCEPTANCE TESTING

- A. The Contractor shall provide acceptance testing of the motor control centers. All acceptance testing shall be performed by the testing firm, after the completion of the field tests specified under Article 3.2. The acceptance testing shall be witnessed by the Engineer and certified by the Contractor.
- B. Acceptance testing inspection shall be performed on each motor control center. Inspection shall include the following:
 - 1. Physical, electrical and mechanical condition shall be inspected.

2. Proper anchorage, required area clearances, physical damage and proper alignment shall be checked.
 3. All connections shall be inspected for high resistance.
 4. Electrical and mechanical interlock systems shall be checked for proper operation.
 5. Insulators shall be inspected for evidence of damage or contamination.
 6. Equipment shall be cleaned and lubricated as required.
- C. Acceptance electrical testing shall be performed on each motor control center. Testing shall include the following:
1. Ground-resistance tests shall be performed.
 2. Contact-resistance test shall be performed.
 3. Control and metering wiring performance test shall be performed.
 4. Circuit breaker trip characteristics shall be determined by primary current injection.
- D. All tests and values shall be in accordance with the manufacturer's recommendations and NETA, ATS Acceptance Testing Specification.
- E. The Contractor shall provide an acceptance testing report. The report shall be in accordance with NETA, ATS Acceptance Testing Specification.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 – GENERAL**1.01 - SECTION INCLUDES**

- A. The Contractor shall provide, test and place into satisfactory operation automatic transfer switches as shown on the Contract Drawings and specified herein.

1.01 - RELATED SPECIFICATIONS

- A. Specification 16071 - Supporting Devices
- B. Specification 16076 - Labeling and Identification

1.03 - PAYMENT

- A. Payment for automatic transfer switches shall be made as provided for in the Specifications.

1.04 - REFERENCES

- A. Automatic transfer switches shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70 - National Electrical Code
 - 2. ANSI - American National Standards Institute
 - 3. IEEE - Institute of Electrical and Electronics Engineers
 - 4. NEMA - National Electrical Manufacturers Association
 - 5. NFPA - National Fire Protection Agency
 - 6. UL - Underwriters Laboratories
 - 7. NETA - International Electrical Testing Association

1.05 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article 4 – Contractor's Working Drawings, Design and Shop Drawings; and as specified under Division 1 of the Specifications.
- B. Working Drawings
 - 1. Product data sheets identifying all materials used and methods of fabrication.

2. Complete assembly, layout and installation drawings with clearly marked dimensions.
3. Weights of all component parts, assembled weight of units and approximate total shipping weight.
4. Interconnection Wiring Diagrams
5. List of Spare Parts
6. List of Special Tools
7. Painting procedures
8. Installation instructions
9. Automatic transfer switch anchorage details with design calculations signed by licensed Engineer.

C. Testing Methods

1. The Contractor shall submit description of shop and field testing methods, procedures and apparatus with calibration dates. Testing methods and procedures shall be submitted at least 45 days in advance prior to conformation of witness testing dates and actual testing.
2. Qualifications of proposed testing firm to perform acceptance testing shall be submitted. Submit firm experience records at least 45 days in advance to actual testing, five recent references with phone numbers shall be submitted.

D. Certificates of Compliance

1. Seismic qualification certificate from the manufacturer including mounting recommendations.
2. Data and results of witness tests accompanied by a certificate of authenticity sworn to before a notary public by an officer of the manufacturing company. Upon approval, release for shipment to site shall proceed.

E. Reports

1. Shop test and field test reports shall be submitted.
2. Manufacturer's site visit and acceptance testing reports shall be submitted.

- F. Operation and maintenance manuals shall be submitted in accordance with the Specifications.

1.06 - QUALITY ASSURANCE

A. General

1. Automatic transfer switches shall be designed, built and tested in accordance with the latest applicable editions of ANSI/IEEE, NEMA, UL, and NFPA.
2. All structures shall be fabricated of code gauge steel. Steel surfaces shall be chemically cleaned, treated and finished with ANSI No. 61 indoor light grey paint.
3. The automatic transfer switch manufacturer shall use a shop test facility that has recently calibrated testing apparatus and qualified, experienced technicians, for all factory tests. Calibration of testing apparatus shall be within one year.
4. All test equipment and instrument calibration shall be in accordance with the latest edition of the accuracy standard of the U.S. National Institute of Standards and Technology and the NETA acceptance testing specification.
5. Automatic transfer switches shall be designed, constructed and installed suitable for earthquake regulations in accordance with the seismic requirements of the Nassau County Building Code and the Uniform Building Code for zone 2A application.
6. Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacturing, installing and servicing of similar items with a history of successful production acceptable to the Engineer as specified herein and in accordance with Article 5 of the General Conditions.

B. The Contractor shall submit the following information pertaining to the manufacturer(s):

1. Certification that manufacturer has been producing automatic transfer switches for a minimum of five (5) years.

C. Field Tests

1. The automatic transfer switches shall be field tested. Field testing shall be performed in accordance with the requirements specified under article 3.02.
2. The services of the automatic transfer switch manufacturer shall be retained for field service. Field service shall be in accordance with the requirements specified under Article 3.03.

3. Retain the service of an independent testing firm who shall perform field acceptance testing of the automatic transfer switches. The testing firm shall have experience in the inspection and testing of the equipment and shall be a member company of NETA. Provide proof of membership, or demonstrate that the standards and experience required for membership are possessed, all to the satisfaction of the Engineer. Acceptance testing shall be in accordance with the requirements specified under Article 3.04.

1.07 - DELIVERY, STORAGE AND HANDLING

- A. Automatic transfer switch equipment shall be delivered, stored and handled in accordance with the Specifications, the manufacturer's instructions and the following.
 1. Automatic transfer switch equipment shall be inspected for shipping damage or loose parts when received. Evidence of water which may have entered equipment during transit shall be checked.
 2. Automatic transfer switch equipment shall be lifted, rolled or jacked into locations shown on the Contract Drawings.
 3. Automatic transfer switch equipment shall be stored in a clean, dry location in which a uniform temperature is maintained. Equipment shall be protected with coverings and maintain air circulation.
 4. Where dampness or condensation may be encountered, heaters shall be provided for equipment to prevent moisture damage.

1.08 - SPARE PARTS

- A. The Contractor shall furnish and deliver to the Engineer, at that part of the site and at such time as the Engineer may direct, spare parts for the automatic transfer switches in accordance with the Specifications.
- B. The spare parts shall be listed in an index and packed in containers suitable for long term storage, bearing labels clearly designating the manufacturer's part number with complete information for use and reordering.
- C. Spare parts shall be furnished in accordance with the manufacturer's recommendations.

1.09 - SYSTEM DESCRIPTION

- A. In general, the automatic transfer switches included under this Section shall include, but not be limited to, the following:

1. Power Section
2. Control Panel
3. Enclosure

1.10 - DESIGN REQUIREMENTS

- A. The Contractor shall review installation procedures under other Sections and Contracts and coordinate them with the work specified herein.
- B. The Contractor shall notify other Prime Contractors in advance of the installation of the work included to provide them with sufficient time for installation and coordination of interrelated items that are included in their contracts and that must be installed in conjunction with the work included in this Section.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Manufacturers shall be as follows:
 1. Automatic Switch Company
 2. Russelectric Inc.
 3. Zenith Controls Inc.
 4. Or approved equal.

2.02 - GENERAL

- A. Each transfer switch shall be rated for the voltage and ampacity as shown on the Contract Drawings and shall have 600 volt insulation on all parts in accordance with NEMA standards.
- B. The specified current rating shall be a continuous rating when the switch is installed in an unventilated enclosure, and shall conform to NEMA temperature rise standards.
- C. The unit shall be rated based on all classes of loads, that is, resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.
- D. All transfer switches complete with accessories shall be listed by Underwriters Laboratories, under Standard UL-1008 (automatic transfer switches) and approved for use on transfer systems.

- E. Transfer switches shall comply with the applicable standards of UL, ANSI, NFPA, IEEE, and NEMA.
- F. The transfer switches shall be supplied with a solid state based control panel.

2.03 - POWER SECTION

- A. The automatic transfer switch shall be of double throw construction operated by a reliable electrical mechanism momentarily energized. There shall be a direct mechanical coupling to facilitate transfer in three (3) cycles or less. Switches composed of molded case breakers, lighting contactors or components thereof will not be acceptable.
- B. The Source #1 and Source #2 contacts shall be mechanically interlocked such that failure of any coil or disarrangement of any part shall not permit a neutral position.
- C. The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between Source #1 and Source #2 that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.
- D. The contact structure shall consist of a main current carrying contact which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes.
- E. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.
- F. A manual handle shall be provided for maintenance purposes with the switch deenergized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.
- G. For switches installed in systems having ground fault protective devices, and/or wired so as to be designated as a separately derived system by the NEC, a 4th pole shall be provided. This additional pole shall isolate the Source #1 and Source #2 neutrals. The neutral pole shall have the same withstand and operational ratings as the other poles and shall be arranged to break last and make first to minimize neutral switching transients. Add-on or accessory poles that are not of identical construction and withstand capability are not acceptable.
- H. The transfer switch shall have a 3-cycle and closing withstand rating of 100 kA. Current limiting fuses shall be used where required.

2.04 - CONTROL PANEL**A. Solid State Control System**

1. The control system for the automatic transfer switch shall be solid state based and shall also contain all logic devices including control and voltage sensing relays, time delays and any auxiliary equipment required for proper operation.

B. Location

1. All control devices shall be assembled on a door mounted, shielded panel.
2. All components shall be connected with a numbered wiring harness equipped with a disconnect plug that allows isolation of the control panel.

C. Non-Selective Automatic Transfer Switches; Sequence of Operation

1. The ATS shall incorporate adjustable three phase undervoltage monitoring on the two power sources (Source #1 and Source #2).
2. When the voltage of any phase of Source #1 is reduced to 80% of nominal voltage for a period of 1 second (fixed), the transfer switch shall transfer to Source #2 after an adjustable time delay (0-30 seconds).
3. The transfer switch shall remain in the Source #2 position indefinitely. Should any phase of Source #2 be reduced to less than 80% of nominal voltage for a period of 1 second (fixed), the transfer switch shall transfer to Source #1 after an adjustable time delay (0-30 seconds).
4. The transfer switch shall contain red indicating lights. The lights shall indicate switch position. The indicating lights shall be push-to-test, 30 or 30.5MM heavy-duty transformer type. Indicating light voltage shall be 12V.
5. All relays shall be continuous duty industrial type with wiping contacts. Customer interface contacts shall be rated 10 amperes minimum. Coils, relays, timers and accessories shall be readily front accessible.
6. The transfer switch shall contain door mounted transfer/re-transfer pushbuttons. It shall allow operation to switch from Source #1 to Source #2 and from Source #2 to Source #1. Transfer between sources shall be immediate.

2.05 - ENCLOSURE

- A. The entire transfer switch shall be completely assembled within one (1) enclosure. The enclosure shall be NEMA 12, in dry, indoor areas and NEMA 4X stainless steel in corrosive areas.
- B. Exterior surfaces of NEMA 12 enclosures shall be painted gray, ANSI 61. Interior surfaces shall be painted white.

2.06 - SHOP TESTS

- A. Certified Shop Tests
 - 1. Shop testing shall be performed on the automatic transfer switches at the manufacturer's plant prior to shipment. Shop test shall be in accordance with the latest revisions of NEMA and UL and shall demonstrate that the equipment tested conforms to the requirements specified.
 - 2. The Contractor shall provide a shop test report. The report shall identify the tests performed and the results obtained.
 - 3. Automatic transfer switch shop tests shall include the following:
 - a. Physical inspection shall be performed including torque tests of bus bolts.
 - b. Mechanical operations shall be performed to insure proper functioning of operating mechanisms and interchangeability.
 - c. Continuity test shall be performed on power and control wires.
 - d. Functional operations test which shall include pick up, dropout, time delay, sequence and polarity.
 - e. Power cables and buses shall be tested, for insulation breakdown resistance and circuit isolation. Test voltage frequency shall not be less than the frequency of the rated voltage of the equipment tested.
 - 4. The transfer switch manufacturer shall submit test data for each size switch, showing it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity. Each ATS shall be in strict accordance and listed to UL 1008 withstand standards, including 3 cycle ratings.
 - 5. A dielectric test at the conclusion of the withstand and closing tests shall be performed.

6. Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of the units to carry their rated currents within the allowable temperature limits.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. General

1. The automatic transfer switches shall be furnished and installed as shown on the Drawings and in accordance with the manufacturer's installation instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment. The equipment shall be suitably protected until accepted by the Owner.
2. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:
 - a. Checking to ensure that the pad location is level to within .125 inches if applicable.
 - b. Checking to ensure that all power connections are torque to the manufacturer's recommendations.
3. Secure assemblies to foundation on floor channels if applicable.
4. Measure and record Megger readings phase-to-phase, phase-to-ground, and neutral-to-ground (four-wire systems only).
5. Automatic transfer switches shall be fully assembled with all required devices, wiring, nameplates, terminal blocks and enclosures.
6. Mount automatic transfer switches rigidly and securely to the building structure or to supporting devices, which are rigidly and securely supported to the building structure.
7. Automatic transfer switches shall be fastened with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel work.
8. Mount automatic transfer switches with sides parallel or perpendicular to walls or equipment.
9. Install all automatic transfer switches such that door swing is not hampered.

B. Locations and Sizes

1. Automatic transfer switches locations shown on the Contract Drawings are approximate. Sizes shall be as dimensioned on the Contract Drawings, or, if not specifically dimensioned, as required to house all devices, terminal blocks and conduits which enter the enclosure.
2. All automatic transfer switches sizes and locations shall be submitted by the Contractor for the Engineer's approval.

C. Grounding

1. All automatic transfer switches shall be grounded in accordance with NEC requirements.
2. The use of two (2) locknuts and a grounding bushing shall be required at all conduit terminations where hub type fittings are not required. Conduit grounding bushings within automatic transfer switches shall be bonded together with jumper cables where enclosure size or number of conduits warrants their use per NEC requirements.

D. Terminal Blocks

1. Terminal blocks shall be installed parallel or perpendicular to the automatic transfer switch enclosure sides. Approximately 20 percent spare terminals shall be provided (minimum of two (2)). Terminals shall be lettered or numbered to conform to the wiring diagrams.

E. Wiring

1. The wiring within the automatic transfer switch shall be neatly harnessed to prevent the door damaging the wiring and to prevent the wiring from hampering the door operation.
2. All conductors shall have identification markers on each end. Marker numbers shall match the terminal block numbers consistent with the Shop Drawings.

3.02 - FIELD TESTS

- A. After installation, automatic transfer switches shall be field tested for operation and conformance. The Contractor shall perform field testing in accordance with the Specifications. The field tests shall be witnessed by the Engineer and certified by the Contractor.
- B. Automatic transfer switch testing shall be performed by the manufacturer's representative, prior to energizing equipment. The testing shall be in accordance with the recommendations of the

manufacturer's representative. Equipment shall not be energized without the permission of the Engineer.

3.03 - MANUFACTURER'S FIELD SERVICES

- A. A qualified manufacturer's representative shall assist in the installation of the automatic transfer switches, check the automatic transfer switch installation before it is placed into operation, assist in the performance of field tests, observe and assist initial operations and train the plant operations and maintenance staff in the care, operation and maintenance of the automatic transfer switches.
- B. The Contractor shall provide equipment start-up services and training in accordance with the Specifications.
- C. The Contractor shall provide a field report from the manufacturer's representative for each visit to the site. The report shall include complete information on time, schedule, tasks performed, persons contacted, problems corrected, tests results, training, instruction and all other pertinent information.
- D. The service representative shall sign in with the Engineer on each day they are at the site.

3.04 - ACCEPTANCE TESTING

- A. The Contractor shall provide acceptance testing of the automatic transfer switches. All acceptance testing shall be performed by the testing firm, after the completion of the field tests specified under Article 3.02. The acceptance testing shall be witnessed by the Engineer and certified by the Contractor.
- B. Acceptance testing inspection shall be performed on each switchgear. Inspection shall include the following:
 - 1. Physical, electrical and mechanical condition shall be inspected.
 - 2. Proper anchorage, required area clearances, physical damage and proper alignment shall be checked.
 - 3. All connections shall be inspected for high resistance.
 - 4. Electrical and mechanical interlock systems shall be checked for proper operation.
 - 5. Insulators shall be inspected for evidence of damage or contamination.
 - 6. Equipment shall be cleaned and lubricated as required.

- C. Acceptance electrical testing shall be performed on each automatic transfer switch. Testing shall include the following:
 - 1. Ground-resistance tests shall be performed.
 - 2. Insulation-resistance tests shall be performed on each bus, phase-to-phase and phase-to-ground.
 - 3. Test each pole with other poles grounded. An over potential test shall be performed.
 - 4. Contact-resistance test shall be performed.
 - 5. Control and metering wiring performance test shall be performed.
- D. All tests and values shall be in accordance with the manufacturer's recommendations and NETA, ATS Acceptance Testing Specification.
- E. The Contractor shall provide an acceptance testing report. The report shall be in accordance with NETA, ATS Acceptance Testing Specification.

3.05 - PAINTING

- A. After fabrication, bonderize, chemically clean and paint exterior and interior surfaces of the switchboard with a rust inhibiting primer followed by an ANSI 61 gray finish coat cathodic electro-deposition epoxy.
- B. Prior to final completion of the work, all metal surfaces of the equipment shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same lacquer as used for shop finishing coats.

3.06 - IDENTIFICATION

- A. Each automatic transfer switch shall be identified with the identification number indicated on the Drawings. A nameplate shall be securely affixed in a conspicuous place on each automatic transfer switch. Nameplates shall be as specified in Specification 16076 Labeling and Identification.

3.07 - RUBBER MATS

- A. A three foot wide rubber mat shall be furnished and installed on the floor and in front of each automatic transfer switch. The mat shall be long enough to cover the full length of the equipment line-up. The mat shall be 1/4 inch thick with beveled edges, canvas back, solid type with corrugations running the entire length of the mat. The mat shall be guaranteed extra quality, free from cracks, blow holes or other defects detrimental to their mechanical or electrical strength. The

mat shall meet OSHA requirements and the requirements of ANSI/ASTM D-178 J6-7 for Type 2, Class 2 insulating matting.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Requirements for providing lighting fixtures and devices. Lighting fixtures and devices shall be provided in accordance with the requirements specified under this section, the Specifications and the Contract Drawings.
- B. The lighting system shall be complete and include all luminaires, devices and accessories as required for the installation of the lighting fixtures and devices.
- C. The following index of this Specification is presented for convenience.

PART 1 - GENERAL		
Article	Title	Page
1.1	Section Includes	1
1.2	Related Specifications	2
1.3	Payment	2
1.4	References	2
1.5	Submittals	3
1.6	Quality Assurance	4
1.7	Deliver, Storage and Handling	5
1.8	Spare Parts	5

PART 2 - PRODUCTS		
Article	Title	Page
2.1	Light Fixtures	6
2.2	Lamps	8
2.3	Ballasts	8
2.4	Emergency Inverter Systems	10
2.5	Lighting Contactor Panels	11
2.6	Photocells	11
2.7	Receptacles and Switches	12

PART 3 - EXECUTION		
Article	Title	Page
3.1	Installation of Luminaires	15
3.2	Installation of Devices	16
3.3	Field Tests	17
3.4	Manufacturer's Field Services	17
3.5	Cleaning of Luminaires	18

1.02 - RELATED SPECIFICATIONS

- A. Specification 16076 - Labeling and Identification
- B. Specification 16131 - Electric Conduit System

1.03 - PAYMENT

- A. Payment for lighting fixtures and devices shall be made as provided for in the Specifications.

1.04 - REFERENCES

- A. Lighting fixtures and devices shall comply with the latest applicable provisions and recommendations of the following:
1. NFPA 70, National Electric Code.
 2. UL Standard No. 20, General Use Snap Switches.
 3. UL Standard No. 844, Electric Lighting Fixtures for Use in Hazardous Locations.
 4. UL Standard No. 894, Switches for Use in Hazardous Locations.
 5. UL Standard No. 924, Emergency Lighting and Power Equipment.
 6. UL Standard No. 935, Fluorescent Lamp Ballasts.
 7. UL Standard No. 1010, Electrical Receptacle - Plug Combinations for Use in Hazardous Locations.
 8. UL Standard No. 1029, High Intensity Discharge Lamp Ballasts.
 9. UL Standard No. 1570, Fluorescent Lighting Fixtures.
 10. UL Standard No. 1571, Incandescent Lighting Fixtures.
 11. UL Standard No. 1572, High Intensity Discharge Lighting Fixtures.
 12. American National Standard Institute, ANSI.
 13. Certified Ballast Manufacturers, CBM.

1.05 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.
- B. Working Drawings:

1. Prior to equipment submission, submit a list of proposed manufacturers with the products they produce proposed for the contract.
 2. Manufacturer's catalog cuts and drawings showing all technical information, and construction details for lighting fixtures, including dimensions, type of wiring, weight, size, installation methods and provisions for relamping lighting fixtures from the ground.
 3. Photometric data, fixture IES lighting classification, and isolux diagram developed for each fixture type.
 4. Lamp type and technical information.
 5. Ballast type and technical information including power factor, input watts and ballast factor.
 6. Scaled working drawings showing the locations of all fixtures and devices. The Drawings shall include the proposed routing of the branch circuits.
 7. Point-to-point photometric layout drawings detailing the footcandle levels at one foot intervals, six inches above the finished floor. For exterior areas, the footcandle levels shall be detailed at one foot intervals, six inches above grade. For stairways, the footcandle levels shall be detailed at one foot intervals, six inches above each step.
 8. Bills of material.
- C. Reports:
1. Field test reports shall be submitted.
 2. Manufacturer's site visit report shall be submitted.
- D. Operations and Maintenance Manuals shall be submitted in accordance with the Specifications.

1.06 - QUALITY ASSURANCE

- A. General:
1. Lighting fixtures shall be UL listed. The lighting fixture types are noted within the fixture schedule. The descriptions and catalog numbers serve to establish the quality, appearance and performance of the specified lighting fixtures.
 2. All lighting fixtures shall be the products of lighting equipment manufacturers who have previously demonstrated, by performance and reputation, the ability to manufacture

products of the quality specified. Such manufacturers must maintain an organization and manufacturing facility capable of actually manufacturing the specified lighting fixtures. For the purpose of inspection, Contractor shall assure the Engineer, free and easy access to the manufacturing facilities and inventories of any manufacturer whose equipment the Contractor proposes to supply.

3. The Contractor shall be responsible to assure that the exact inscription for exit and stairway signs required by local code is checked against that specified, prior to providing same. The Engineer shall be advised of any changes required to conform to local codes before such changes are effected.
4. The Contractor shall be responsible for reviewing all drawings of each Contract and coordinating with all trades the installation of lighting fixtures and devices. The lighting fixture and device finishes and construction shall be compatible with the wall and ceiling types based upon the Contractor's review of all drawings of each Contract.
5. All industrial fixtures shall be of the highest quality material and construction for their respective types.
6. Lamps for all lighting fixtures shall be in accordance with the Federal Energy Legislation for reduced energy consumption.
7. Fixtures shall be suitable for connection to concealed or exposed conduit runs as required in each particular location and shall be of sizes suitable for lamp sizes indicated on the Contract Drawings.
8. Fittings and other materials for special fixtures not definitely shown or specified shall be of approved material, make and quality and shall have a finish that will harmonize with other parts of the fixtures. Where suitable standard materials are not available such parts of the fixtures shall be specially manufactured.

B. Field Testing:

1. The lighting fixtures shall be field tested. The field testing shall be performed in accordance with the requirements specified under Article 3.03.
2. Retain the services of the emergency inverter system manufacturer for field services. Field service shall be in accordance with the requirements specified under Article 3.04.

1.07 - DELIVERY, STORAGE AND HANDLING

- A. Lighting fixtures and devices shall be delivered, stored and handled in accordance with the Specifications and the manufacturer's instructions.

1.08 - SPARE PARTS

- A. The Contractor shall furnish and deliver to the Engineer, at that part of the site and at such time as the Engineer may direct, spare parts for the lighting fixtures in accordance with the Specifications.
- B. The spare parts shall be listed in an index and packed in containers suitable for long term storage, bearing labels clearly designating the manufacturer's part number with complete information for use and reordering.
- C. The following spare parts shall be furnished:
 - 1. 10 percent lamps shall be provided of each wattage of each type of HID lamp, but not less than the requirement for two fixtures.
 - 2. 5 percent ballasts shall be provided of each type of HID type ballast, but not less than two.
 - 3. 10 percent lamps shall be provided of each wattage of each type of fluorescent lamps, but not less than the requirement for two fixtures.
 - 4. 5 percent ballasts shall be provided of each type of fluorescent type ballast, but not less than two.
 - 5. 200 percent lamps shall be provided of each wattage of each type incandescent lamp.
 - 6. 10 percent lamps shall be provided of each type of LED fixture, but not less than the requirement for five fixtures.
 - 7. 10 percent fuses shall be provided of each size and type, but not less than two.

PART 2 - PRODUCTS**2.01 - LIGHT FIXTURES**

- A. A lighting fixture shall be provided for each fixture symbol shown on the Contract Drawings. Light fixtures shall be provided in accordance with the lighting fixture schedule shown in the Specifications.

- B. Light fixtures shall be provided with all necessary hangers, supports, conduit adaptors, reducers, hooks, brackets and other support hardware. All hardware shall have a protective, non-corrosive finish.
- C. Recessed fixtures shall be provided with trim moldings and frames suitable for the types of ceilings.
- D. Pendant fixtures shall be suspended by means of an enclosed and gasketed cushion type hanger. The hanger shall be suitable to be mounted directly to the fixture outlet box and shall provide a minimum of 8 degrees swing from the vertical. Fixture stems shall be threaded rigid metal conduit, 1/2 inch minimum size. In corrosive areas stems shall be PVC coated.
- E. Where fixtures are subjected to moisture, or assembled of dissimilar metals, gaskets of approved material and thickness shall be provided.
- F. Explosion-proof type fixtures shall comply with the requirements of the National Electric Code for the hazardous locations indicated on the Contract Drawings.
- G. Fixtures shall be completely wired except where they will be directly connected to branch circuit wiring. The conductors shall be not less than No. 12 gauge, stranded, with approved heat resistant covering.
- H. Mounting heights of all fixtures shall be as shown on the Contract Drawings. For special types, the height shall be determined at the time of installation.
- I. Metal halide fixtures shall be screw-in type. The only wiring required shall be attaching of two (2) wires to a connection block in the mounting hood. Wiring to the ballast shall not be required.
- J. Metal halide fixtures shall be constructed of copper free aluminum (4/10 of 1% maximum copper content) for the mounting hoods, ballast bodies and guards. Mounting hoods, ballast bodies and guards shall have an epoxy-clad finish. Finish shall be two (2) coat baked, electrostatically applied for complete uniform surface protection. Reflectors shall be polyester. Globes and refractors shall be heat-resistant prismatic glass.
- K. Lighting fixture types A and AA shall be furnished with 4600 lumen LED lamp.
- L. Provide luminaires in accordance with the lighting fixture schedule on sheet E-8.0.

2.02 - LAMPS

- A. LED Lamps shall have voltage ratings suitable for the voltages shown on the Contract Drawings.

- B. Fluorescent lamps shall be cool white, energy efficient rapid start type. Unless specifically indicated otherwise, fluorescent lamps shall be 32 watt T8, suitable for operation in ambient temperature above 50 degrees F. For operation outdoors, at 50 degrees and below, standard lamps shall be provided.
- C. Lamps shall be by General Electric Company, Sylvania Company or approved equal.

2.03 - BALLASTS

- A. General:
 - 1. Ballasts shall be matched for proper operation of lamps and shall meet the requirements for fixture light output, reliable starting and operation.
 - 2. Ballasts shall be UL listed and certified by Electrical Testing Laboratories and shall conform to certified ballast manufacturer's specifications.
 - 3. Ballasts shall be by Advance Transformer, Magnetek or approved equal.
- B. Fluorescent Ballasts:
 - 1. Fluorescent ballasts shall be high power factor, energy efficient type. Ballasts shall be Class P protected with a Class A sound rating. Ballast used with fixtures outdoors shall be cold weather type.
 - 2. Ballasts for use with 32 watt T8 lamps shall be electronic type, with total harmonic distortion less than 10 percent total. The ballast factor shall be .85 or greater with total of less than 61 watts input.
 - 3. Controllable electronic ballasts shall continuously dim between 20 and 100 percent of light output. The dimming circuitry shall be UL Class 2 fully isolated and shall provide a 0-10 VDC control signal between ballast and control element.

2.04 - PHOTOCELLS

- A. Photocells shall be provided for the control of lighting contactors where specifically indicated on the Contract Drawings. The photocell control and devices shall be arranged facing the northwest sky for proper operation in accordance with the control schematics shown on the Contract Drawings.
- B. Photocell Turn-ON shall be 1 to 3 footcandles. Turn-OFF to Turn-ON ratio is 5 footcandles max. Photocell shall contain a time delay for ON and OFF to avoid activation from intermittent artificial light sources.

- C. Photocell shall be cadmium sulphide type with solid brass locking prongs, which responds to the light spectrum near to that of a human eye. Photocell shall resist effects of moisture and airborne contaminants.
- D. Internal photocell relay shall be Bi-metal providing positive snap action switching, reducing bounce and prolonging contact life.
- E. Photocell shall be equipped with a surge arrestor rated 380 joule MOV (metal oxide varistor).
- F. Operating temperature range: -40° to +140°F (-40° to +60°C).
- G. In the event of unit failure, the photocell switch shall remain in the "on" position.
- H. Photocell shall be manufactured by Tork, 5000M Series or approved equal.

2.05 - RECEPTACLES AND SWITCHES

A. General:

- 1. Receptacles and switches shall be provided in accordance as shown on the Contract Drawings. The receptacles and switches shall be complete and shall include all accessories for proper installation.
- 2. Outlet boxes for receptacles and switches shall be in accordance with Specification 16131 - Electric Conduit System.
- 3. Unless specifically shown otherwise or stated in the Specifications explosion proof devices in hazardous locations shall comply with the requirements of the National Electric Code for Class I, Division 1, Group D locations.

B. Receptacles:

- 1. Receptacles shall be duplex grounding type, two pole, three wire, 125 volt AC, 15 ampere. Where shown on the Contract Drawings, other special receptacles with number of poles, voltage and current rating shall be provided. Matching plugs shall be provided for each special receptacle.
- 2. Receptacles for indoor dry, dusty locations shall be heavy duty, straight blade type, with reinforced polyester base and impact resistant nylon face.
- 3. Receptacles for wet and corrosive locations shall be marine duty, straight blade type, with heat resistance melamine body. Special receptacles in wet and corrosive locations shall be Type 316 stainless steel.

4. Receptacles for hazardous locations shall be factory sealed. Receptacles for hazardous locations shall be in accordance with the following:
 - a. Explosion-proof type receptacles shall be of the delayed action type requiring the turning of a plug shell on withdrawal to allow time for extinction of arcs.
 - b. Surface mounted explosion-proof receptacles shall be provided with cast iron or cast aluminum angle type covers with hinged flaps.
 - c. Flush mounted explosion-proof receptacles shall be provided with brass, chromium plated, flush plates with double hinged flaps.
 - d. Plugs shall be provided where required for each type of explosion-proof receptacle. Plugs shall be of explosion-proof construction, and shall have steel bodies with corrosion resistant finish. Plugs shall be fitted with aluminum alloy cable clamps and chloroprene cable bushings.
5. Receptacles for installation in floors shall be in accordance with the following:
 - a. Floor receptacles shall comprise a watertight unit consisting of a cast iron box with an adjustable top, permitting permanent angular and vertical adjustment, brass cover plate and 3/4 inch brass floor extension. The extension shall be of an approved height and shall be surmounted with a brass head arranged for a duplex receptacle. Exposed metal parts shall be finished to match adjacent metal finish.
 - b. For low voltage signal and telephone work, floor outlets shall be equal to those specified above for floor installation, except that the interiors shall be designed for cable extension as approved.
6. Fan or clock outlets shall be single receptacles with molded composition or bakelite bodies. Rating shall be 15 amperes, 125 volts. Fan outlets shall be furnished with stud supports. Clock outlets shall be of the recessed type and shall be furnished with yokes for clock support.
7. 480 volt receptacles in non-hazardous areas shall be a mechanically interlocked type with circuit breaker disconnect. The circuit breaker disconnect cannot be closed until the plug is fully inserted and the plug cannot be withdrawn or inserted unless the switch is open. The receptacle enclosure shall be copper - free aluminum with stainless steel parts. Rating shall be 600 volt, three phase, 60 amperes.

8. Receptacles shall be by Hubbell Incorporated, Arrow-Hart Incorporated or approved equal. Hazardous located receptacles and 480 volt receptacles shall be by Crouse-Hinds Company, Appleton Electric Company, or approved equal.

C. Switches:

1. Switches shall be industrial-heavy duty, AC toggle, quiet type. Switches shall be rated 120/277 volt, 20 ampere. Poles and switching shall be as shown on the Contract Drawings.
2. Switches for hazardous locations shall be factory sealed tumbler type. The switch body and cover shall be cast gray iron alloy or cast malleable iron with zinc electroplate finish.
3. Switches shall be by Hubbell Incorporated, Arrow-Hart Incorporated or approved equal. Hazardous located receptacles shall be by Crouse-Hinds Company, Appleton Electric Company, or approved equal.

D. Plates and Covers:

1. Stainless steel plates shall be furnished for devices in indoor dry, dusty locations. They shall have beveled edges and shall be made of Type 302/304, stainless steel.
2. Plates shall have satin finish. Attachment screws shall have matching head finish.
3. For wet and corrosive locations neoprene gasketed covers shall be used. Covers shall be galvanized ferrous or cast ferrous metal. Covers shall be PVC-coated in corrosive locations. Covers shall be equipped with gasketed spring doors for receptacles and an external operating mechanism for switches.
4. Plates shall be by Hubbell Incorporated, Arrow-Hart Incorporated or approved equal. Covers shall be by Crouse-Hinds Company, Appleton Electric Company, or approved equal.

PART 3 - EXECUTION

3.01 - INSTALLATION OF LUMINAIRES

- A. Luminaires shall be installed at locations shown on the Contract Drawings. Luminaires locations shall be adjusted where necessary to clear conflicts and obstructions.
- B. All luminaires shall be installed complete with all hardware, and supporting devices necessary to make a safe complete and fully operative installation. The Contractor shall obtain from the manufacturer for each lighting fixture, diagrams, illustrations and other installation instructions.

The Contractor shall install in strict conformance with such instructions and the requirements of NFPA 70 National Electrical Code.

- C. LED fixtures shall be installed in conformance with manufacturer's recommendations and to suit the architectural details of the area involved. Independent supports from structural members of the building shall be provided. Unless otherwise shown on the Contract Drawings or stated in the Specifications, every fluorescent fixture shall have at least two supports, and continuous lines of LED fixtures shall be supported at 4 foot intervals.
- D. Pendant mounted fixtures shall be installed with pendants 1/2 inch for stems up to 5 feet and 3/4 inch for longer lengths.
- E. All pendant stem hangers shall be furnished with suitable aligner canopies or outlet box covers so that the lighting fixtures hang vertical to the finished floor irrespective of the angle of the surface from which they are suspended. When lighting fixtures or hanger canopies are mounted flush to the ceiling or wall, and where raceways and outlet boxes serving the lighting fixtures are surface mounted to the ceiling or wall, finishing rings shall be provided to conceal the outlet box. All visible hanging devices and appurtenances shall have the same finish as the lighting fixture.
- F. Reflectors, lenses, diffusers, louvers and decorative elements of lighting fixtures shall not be installed until completion of plastering, ceiling tile work, painting, and general clean-up in the area.

3.02 - INSTALLATION OF DEVICES

- A. Emergency Inverter System:
 - 1. Equipment shall be installed in accordance with manufacturer's instructions and recommendations.
 - 2. Equipment shall be installed on concrete pads at locations indicated on the Contract Drawings so that sufficient access and working space is provided for ready and safe operation and maintenance.
 - 3. Install system nameplates for identification of equipment.
- B. Lighting Contactor Panels:
 - 1. Panels shall be mounted rigidly and securely to the building structure or to supporting devices which are rigidly and securely supported to the building structure.

2. Panels shall be fastened with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units and with machine screws or welded studs on metal.
3. All panels shall be mounted parallel or perpendicular to walls, such that panels are installed in a neat and professional manner.

C. Receptacles and Switches:

1. Receptacles and switches shall be installed within outlet boxes at locations indicated on the Contract Drawings and in accordance with code requirements.
2. Receptacles shall be mounted 2 feet above the finished floor, except in hazardous locations where receptacles shall be mounted 4 feet-6 inches above the finished floor.
3. Switches shall be mounted 4 feet 6 inches above the finished floor.
4. Where devices are grouped they shall be mounted under a common plate. Where directed or where space conditions limit gang mounting, tandem or tandem gang arrangement shall be provided.
5. Where four or more switches controlling fixtures that are not visible from the switch location are grouped, the switch plate shall be engraved and filled with colored material or otherwise suitably marked to designate the control of each switch.

3.03 - FIELD TESTS

- A. After installation, the completed lighting system and receptacle devices shall be field tested for operation and conformance. The field tests shall be witnessed by the Engineer and certified by the Contractor. The Contractor shall provide testing consisting of the following:
 1. Wiring continuity test shall be performed.
 2. Branch circuit load balance test shall be performed.
 3. Fixture and control operation test shall be performed.
 4. Emergency inverter system operation and functionality test shall be performed.
 5. Receptacle polarity and grounding.
- B. The Contractor shall provide a field test report. The report shall identify the test performed and the results obtained.

3.04 - MANUFACTURER'S FIELD SERVICES

- A. A qualified manufacturer's service representative shall assist in the installation of the emergency inverter system, check the installation before it is placed into operation, assist in the performance of field tests, observe the initial operation and train the plant operations and maintenance staff in the care, operation and maintenance of the system.
- B. The Contractor shall provide equipment start-up services and training in accordance with the Specifications.
- C. The Contractor shall provide a field report from the manufacturer's representative for each visit to the site. The report shall include complete information on time, schedule, tasks performed, persons contacted, problems corrected, tests results, training instruction and all other pertinent information.
- D. The service representative shall sign in with the Engineer on each day they are at the site.

3.05 - CLEANING OF LUMINAIRES

- A. Luminaires shall be cleaned inside and out to remove construction dust prior to substantial completion.
- B. Fixtures shall be relamped prior to substantial completion.

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. Requirements for providing outdoor lighting. Outdoor lighting shall be provided in accordance with the requirements under this section, the Specifications and the Contract Drawings.
- B. The outdoor lighting system shall be complete and include all luminaires, poles, pole bases, reinforced concrete foundations and accessories as required for the installation of the outdoor lighting.
- C. The Contractor shall perform all excavations, complete all forms, and do backfilling and tamping as required, unless specifically shown otherwise on the Contract Drawings or stated in the Specifications.

1.02 - RELATED SPECIFICATIONS

- A. Specification 02200 - Earthwork
- B. Specification 02500 – Surface Restoration
- C. Specification 03300 - Cast-in-Place Concrete
- D. Specification 05120 - Structural Steel
- E. Specification 16511 - Lighting Fixtures and Devices

1.03 - PAYMENT

- A. Payment for outdoor lighting shall be made as provided for in the Specifications.

1.04 - REFERENCES

- A. Outdoor lighting shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70, National Electrical Code.
 - 2. UL Standard No. 1572, High Intensity, Discharge Lighting Fixtures.

1.05 - SUBMITTALS

- A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article GC-14 – Contractor Submissions; and as specified under Division 1 of the Specifications.

B. Working Drawings:

1. Prior to equipment submission, submit a list of proposed manufacturers with the products they produce proposed for the contract.
2. Manufacturer's catalog cuts and drawings showing all technical information, and construction details for lighting fixtures, including dimensions, type of wiring, weight, size, installation methods and provisions for relamping lighting fixtures from the ground.
3. Photometric data, fixture IES lighting classification and isolux diagram developed for each fixture type..
4. Lamp type and technical information.
5. Ballast type and technical information including power factor, input watts and ballast factor.
6. Pole and base construction details. For poles submit wind loading, complete dimensions and finish, include anchor bolt sizing and circle diameter.
7. Scaled working drawings showing the locations of all fixtures and shall include the proposed routing of supply conduits.
8. Point-to-point photometric layout drawings detailing the footcandle levels at one foot intervals, six inches above the finished floor. For exterior areas, the footcandle levels shall be detailed at one foot intervals, six inches above grade. For stairways, the footcandle levels shall be detailed at one foot intervals, six inches above each step.
9. Bills of material.

C. Reports:

1. Field test reports shall be submitted.
2. Manufacturer's site visit report shall be submitted.

D. Operations and Maintenance Manuals shall be submitted in accordance with the Specifications.

1.06 - QUALITY ASSURANCE

A. General:

1. Lighting fixtures shall be UL listed. The lighting fixture type are noted within the fixture schedule. The descriptions and catalog numbers serve to establish the quality, appearance and performance of the specified lighting fixtures.
 2. All lighting fixtures shall be the products of lighting equipment manufacturers who have previously demonstrated, by performance and reputation, the ability to manufacture products of the quality specified. Such manufacturers must maintain an organization and manufacturing facility capable of actually manufacturing the specified lighting fixtures. For the purpose of inspection, Contractor shall assure the Engineer, free and easy access to the manufacturing facilities and inventories of any manufacturer whose equipment the Contractor proposes to supply.
 3. Outdoor lighting system shall use low carbon alloy steel with minimum yield strength of 50,000 p.s.i. or stainless steel bolts, nuts, washers and screws.
 4. All industrial fixtures shall be of the highest quality material and construction for their respective types.
 5. Lamps for all lighting fixtures shall be in accordance with the Federal Energy Legislation for reduced energy consumption.
 6. Fixtures shall be suitable for connection to concealed or exposed conduit runs as required in each particular location and shall be of sizes suitable for lamp sizes indicated on the Contract Drawings.
 7. Fittings and other materials for special fixtures not definitely shown or specified shall be of approved material, make and quality and shall have a finish that will harmonize with other parts of the fixtures. Where suitable standard materials are not available such parts of the fixtures shall be specially manufactured.
- B. Field Testing: The outdoor lighting system shall be field tested. The field testing shall be performed in accordance with the requirements specified under Article 3.02.

1.07 - DELIVERY, STORAGE AND HANDLING

- A. Outdoor lighting equipment shall be delivered, stored and handled in accordance with the Specifications and the manufacturer's instructions.

1.08 - SPARE PARTS

- A. The Contractor shall furnish and deliver to the Engineer, at that part of the site and at such time as the Engineer may direct, spare parts for the outdoor lighting in accordance with the Specifications.
- B. The spare parts shall be listed in an index and packed in containers suitable for long term storage, bearing labels clearly designating the manufacturer's part number with complete information for use and reordering.
- C. The following spare parts shall be furnished, with all fractions rounded up to the next number:
 - 1. 5 percent driver shall be provided of each type of LED fixture, but not less than two.
 - 2. 10 percent lamps shall be provided of each type of LED fixture, but not less than the requirement for five fixtures.
 - 3. 10 percent fuses shall be provided of each size and type, but not less than two.

PART 2 - PRODUCTS**2.01 - LUMINAIRES**

- A. A luminaire shall be provided for each lighting fixture symbol shown on the Contract Drawings. Luminaires shall be provided in accordance with the lighting fixture schedule shown in the Specifications.
- B. Luminaires and lighting fixtures shall be provided for each lighting fixture symbol shown on the Contract Drawings. Luminaires, lighting fixtures, and the mounting heights shall be provided in accordance with lighting fixture schedule, specifications and drawings included in Appendix A at the end of this section.
- C. Heights of all outdoor fixtures shall be as shown on the Contract Drawings.
- D. Provide luminaires in accordance with the lighting fixture schedule on sheet E-8.0.
- E. Manufacturer for custom Luminaires B and C shall submit one mock-up and two prototypes to the Engineer for review and approval. The first prototype shall not be fabricated until the mock-up has been submitted and approved. The second prototype shall not be fabricated until the first prototype has been submitted and approved. The production fixtures shall not be fabricated until the second prototype has been submitted and approved. The production fixtures shall be identical to the second prototype except as modified by the Engineer's comments on the second prototype. All prototypes submitted for approval shall be working fixtures constructed of materials

identical to those proposed for production including all supports, brackets and fasteners. The contractor shall conduct a shop witness test for each first prototype. The second prototypes shall be installed in their final location and tested at nighttime. Power shall be supplied by the Contractor.

- F. Manufacturer for custom luminaires and lighting fixtures shall obtain and submit to the Engineer a certification of approval from UL approval for every custom fixture prior to production.
- G. Contractor shall furnish and install LED lighting controller, data power integration box, wire, cable, conduit, and termination resistors for a complete outdoor lighting system.

PART 3 - EXECUTION

3.01 - INSTALLATION OF OUTDOOR LIGHTING

- A. Fixtures shall be installed at locations indicated on the Contract Drawings. Fixture locations shall be adjusted where necessary to clear conflicts and obstructions.
- B. Contractor's field services, including all labor and materials, shall be provided after installation of all fixtures for adjustment, refocusing, field testing of controllers, and re-aiming of all fixtures. Adjustments shall include adjustments to mounting height, length or rotation of the fixtures and their bases. The Contractor shall provide at least 30 eight hour days of field services on at least six separate visits. The field services will be required during the daytime or during the nighttime, as directed by the Engineer.

3.02 - FIELD TESTS

- A. After installation, the completed outdoor lighting system shall be field tested for operation and conformance. The field tests shall be witnessed by the Engineer and certified by the Contractor. The Contractor shall provide testing consisting of the following:
 - 1. Wiring continuity test shall be performed.
 - 2. Branch circuit load balance test shall be performed.
 - 3. Fixture and photo cell operation test shall be performed.
 - 4. Point-to-point footcandle measurements shall be performed.
- B. The Contractor shall provide a field test report. The report shall identify the tests performed and the results obtained.

3.03 - CLEANING OF OUTDOOR LIGHTING

- A. Luminaires shall be cleaned inside and out to remove construction dust prior to substantial completion.
- B. Fixtures shall be relamped prior to substantial completion.

+ + END OF SECTION + +

PART 1 - GENERAL**1.01 - SECTION INCLUDES**

- A. The cable and conduit schedule lists conduit number, size and type, cable quantity and size from/to destinations, circuit purpose and remarks.
- B. All conduits and wiring shall be furnished and installed under this Contract, unless specifically noted otherwise.
- C. The conduit numbering system consists of two parts separated by hyphen. First part is the equipment identification number. The second part is the individual conduit identification number. The individual conduit identification number may be presented in a 2- or 3-digit format (for example, 01 and 001) and represents the same conduit.
- D. The definition of the term conduit shall include all types of raceway provided under this Contract.
- E. In all cases where the word install or installed refers to conduit it shall mean install all conduit, raceways, fittings, supports, boxes and appurtenances. In addition it shall include all grounding and bonding. Drag lines are to be pulled upon completion of each raceway.
- F. Where install or installed refers to cable it shall include pulling the cable and testing the cable for insulation resistance, continuity and absence from grounds, as well as terminating all conductors and testing for proper connection.
- G. In general, the conduit and cable schedules do not indicate lighting and receptacle circuits, as well as some of the other cable and conduit to be provided under this Contract. The Contractor is advised to refer to the Specifications and Drawings for the additional conduit and cable requirements.
- H. Conform to the specifications requirements for Conduit and Cable Sections 16131 and 16131E - Electric Conduit System, and Sections 16121 and 16121E - Electric Wire and Cable.
- I. The conduit and cable schedule begins on the following page.
- J. Refer to the Contract Drawings for specific type of conduit installed. Should there be a conflict between the type of conduit indicated on the Drawings and the following specifications schedule type, the Drawings shall take precedence.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

+ + NO TEXT ON THIS PAGE + +



H2M architects + engineers

538 Broad Hollow Rd, 4th Floor East, Melville, NY 11747

tel 631.756.8000 fax 631.694.4122

www.h2m.com



architects + engineers

538 Broad Hollow Road, 4th Floor East tel 631.756.8000
Melville, NY 11747 fax 631.694.4122

June 18, 2015

Nassau County Department of Public Works
1194 Prospect Avenue
Westbury, New York 11590-2723

**Re: Limited Asbestos and Lead Inspection Survey Report
Glen Cove Wastewater Treatment Plant
H2M Job No.: NCDP 1501**

Nassau County Department of Public Works:

H2M architects + engineers (H2M) conducted limited asbestos and lead based paint sampling at the above-referenced property.

Asbestos Sampling

On May 27, 2015, H2M collected bulk samples of suspect asbestos containing materials (ACM) that were located in the Flotation Thickener Building of the above mentioned facility. H2M inspected the interior and exterior of the Flotation Thickener Building, which may be disturbed during the proposed renovation activities. The materials sampled included pipe insulation, grout, roofing materials, flashing, and caulk.

Bulk samples were submitted to EMSL Analytical, Inc. (EMSL) of Carle Place, New York. EMSL is certified by the New York State Department of Health (NYSDOH), Environmental Laboratory Approval Program (ELAP), No. 11469. Bulk samples were collected and submitted by New York State Department of Labor (NYS DOL) certified inspector Ms. Veronica A. Bickmeyer (NYSDOL Cert. No. 09-12681).

Asbestos Results

According to the Asbestos Hazard Emergency Response Act (AHERA, USEPA), the Occupational Safety and Health Administration (OSHA) and the NYSDOL (12 NYCRR Part 56); asbestos containing material (ACM) is defined as any material or product which contains greater than one percent (1%) of asbestos.

Please be advised that the following materials were found to contain greater than one percent (1%) of asbestos and therefore is considered to be **positive** for asbestos:

- Exterior, Roof – Caulk (Window)
Approximate Quantity: 75 linear Feet
- Exterior, Roof – Roof Membrane, 2nd Layer, 3rd Layer Roofing, and associated Flashing
Approximate Quantity: 1,450 Square Feet

Please be advised that the following materials were found to contain equal to or less than one percent (1%) of asbestos and therefore is considered to be **negative** for asbestos:

- Interior - Grout (Wall Tile)
- Interior - Pipe Elbow Insulation
- Exterior - Caulk (Expansion Joint-Tan)

Lead Based Paint Sampling

On May 27, 2015, H2M collected paint chip samples of suspect lead containing paint. Paint chips were collected from areas which were determined to be part of future renovations. H2M collected samples

from the Flotation Thickener Building. All samples were collected by certified Lead Based Paint Inspector Ms. Veronica Bickmeyer (Certification #NY-I-150318-1). Bulk samples were submitted to EMSL Analytical, Inc. (EMSL) of Carle Place, New York. EMSL is certified by the New York State Department of Health (NYSDOH), Environmental Laboratory Approval Program (ELAP), No. 11469.

Lead Based Paint Results

Please be advised that the following components were tested using Lead Based Paint Chip Analysis and are determined to contain less than 0.5% lead by weight, therefore, as set forth by the USEPA, the following components are considered to be **negative** for lead based paint:

- Flotation Thickener Building – Metal, Flotation Thickener (Red)
- Flotation Thickener Building – Metal, Pump (Grey)
- Flotation Thickener Building – Concrete, Wall (Tan)

Laboratory analytical reports and copies of the chain of custody forms are included in Attachment 1. H2M's company license and H2M personnel certifications are included in Attachment 2. EMSL's certifications are included in Attachment 3. Photographic documentation is provided in Attachment 4.

H2M certifies that the information contained herein is based on the inspection and sample collection conducted on May 27, 2015. All findings stated in this report are based upon facts and circumstances as they existed at the time of inspection and at the time that this report was prepared. A change in any of the site conditions, facts or circumstances upon which this report is based may affect the findings expressed in this report.

If you have any questions, please contact the undersigned at (631) 756-8000 extension 1609.

Very truly yours,

H2M architects + engineers



Veronica A. Bickmeyer
Industrial Hygienist

Enclosures



ATTACHMENT 1

LABORATORY ANALYTICAL REPORTS
&
CHAIN(S) OF CUSTODY

**EMSL Analytical, Inc.**

528 Mineola Avenue, Carle Place, NY 11514

Phone/Fax: (516) 997-7251 / (516) 997-7528

<http://www.EMSL.com>carleplacelab@emsl.com

EMSL Order: 061507892

CustomerID: H2ML50

CustomerPO:

ProjectID:

Attn: **Travis Irving**
H2M Architects and Engineers
538 Broad Hollow Road
4th Floor East
Melville, NY 11747

Phone: (631) 756-8000
Fax:
Received: 05/28/15 11:24 AM
Collected: 5/27/2015

Project: **NCDP1501-Glen Cove****Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)***

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Lead Concentration</i>
S1	061507892-0001	5/27/2015	5/29/2015	0.011 % wt
Site: Flotation Thickener				
S2	061507892-0002	5/27/2015	5/29/2015	0.28 % wt
Site: Grey Motor/Pump				
S3	061507892-0003	5/27/2015	5/29/2015	0.023 % wt
Site: West Wall				

Michelle McGowan, Laboratory Manager
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, unless specifically indicated otherwise.

Samples analyzed by EMSL Analytical, Inc. Carle Place, NY Lab ID 102344 is accredited by the AIHA-LAP, LLC in the Environmental Lead accreditation program for Lead in Paint, CT PH-0249, NYS ELAP 11469

Initial report from 05/29/2015 17:01:24

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Lead (Pb) Chain of Custody

EMSL Order ID (Lab Use Only):

061507892

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Company: H2M L50		EMSL-Bill to: <input checked="" type="checkbox"/> Same <input type="checkbox"/> Different If Bill to is Different note instructions in Comments**	
Street:		Third Party Billing requires written authorization from third party	
City:	State/Province:	Zip/Postal Code:	Country:
Report To (Name): Vernica A Bickmeyer		Telephone #:	
Email Address: V.Bickmeyer@H2M.com		Fax #:	Purchase Order: NCDP1501
Project Name/Number: NCDP 1501 - Glen Cove		Please Provide Results: <input type="checkbox"/> Fax <input checked="" type="checkbox"/> Email	
U.S. State Samples Taken: NY		CT Samples: <input type="checkbox"/> Commercial/Taxable <input type="checkbox"/> Residential/Tax Exempt	
Turnaround Time (TAT) Options* - Please Check			
<input type="checkbox"/> 3 Hour	<input type="checkbox"/> 6 Hour	<input type="checkbox"/> 24 Hour	<input checked="" type="checkbox"/> 48 Hour
<input type="checkbox"/> 72 Hour	<input type="checkbox"/> 96 Hour	<input type="checkbox"/> 1 Week	<input type="checkbox"/> 2 Week
*Analysis completed in accordance with EMSL's Terms and Conditions located in the Price Guide			
Matrix	Method	Instrument	Reporting Limit
Chips <input checked="" type="checkbox"/> % by wt. <input type="checkbox"/> mg/cm ² <input type="checkbox"/> ppm	SW846-7000B	Flame Atomic Absorption	0.01%
Air <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	NIOSH 7082	Flame Atomic Absorption	4 µg/filter
	NIOSH 7105	Graphite Furnace AA	0.03 µg/filter
	NIOSH 7300 modified	ICP-AES/ICP-MS	0.5 µg/filter
Wipe* <input type="checkbox"/> ASTM <input type="checkbox"/> non ASTM <input type="checkbox"/> *If no box is checked, non-ASTM Wipe is assumed	SW846-7000B	Flame Atomic Absorption	10 µg/wipe
	SW846-6010B or C	ICP-AES	1.0 µg/wipe
TCLP	SW846-1311/7000B/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)
	SW846-1131/SW846-6010B or C	ICP-AES	0.1 mg/L (ppm)
Soil	SW846-7000B	Flame Atomic Absorption	40 mg/kg (ppm)
	SW846-6010B or C	ICP-AES	2 mg/kg (ppm)
Wastewater Unpreserved <input type="checkbox"/> Preserved with HNO ₃ pH < 2 <input type="checkbox"/>	SM3111B/SW846-7000B	Flame Atomic Absorption	0.4 mg/L (ppm)
	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)
	EPA 200.7	ICP-AES	0.020 mg/L (ppm)
Drinking Water Unpreserved <input type="checkbox"/> Preserved with HNO ₃ pH < 2 <input type="checkbox"/>	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)
	EPA 200.8	ICP-MS	0.001 mg/L (ppm)
TSP/SPM Filter	40 CFR Part 50 (2013)	ICP-MS	1.2 µg/filter
Other:			
Name of Sampler: Vernica Bickmeyer		Signature of Sampler: VMA	
Sample #	Location	Volume/Area	Date/Time Sampled
S1	Flotation Thickener	6 in ²	5/28/15 7:30
S2	Grey motor pump	↓	5/28/15 7:35
S3	West wall	↓	5/28/15 7:40
Client Sample #'s: S1 - S3		Total # of Samples: 3	
Relinquished (Client): Vernica Bickmeyer	Date: 5/28/15	Time: 11:24 am	
Received (Lab): Carla Gule	Date: 5/28/15	Time: 11:24 am	
Comments: PO signed 5/28/15			

**EMSL Analytical, Inc.**

528 Mineola Avenue, Carle Place, NY 11514

Phone/Fax: (516) 997-7251 / (516) 997-7528

<http://www.EMSL.com>carleplacelab@emsl.com

EMSL Order: 061507935

CustomerID: H2ML50

CustomerPO:

ProjectID:

Attn: **Travis Irving**
H2M Architects and Engineers
538 Broad Hollow Road
4th Floor East
Melville, NY 11747

Phone: (631) 756-8000
 Fax:
 Received: 05/28/15 11:24 AM
 Analysis Date: 6/2/2015
 Collected:

Project: **Glen Cove WW Treatment Plant, Plant****Test Report:Asbestos Analysis of Bulk Material**

Test	Analyzed Date	Color	Non Asbestos		Asbestos
			Fibrous	Non-Fibrous	
Sample ID 1a 061507935-0001		Description Homogeneity	Interior - Wall tile-grout Heterogeneous		
PLM NYS 198.1 Friable	6/2/2015	White		60.00% Quartz 15.00% Ca Carbonate 25.00% Non-fibrous (other)	None Detected
PLM NYS 198.6 VCM					Not Analyzed
PLM NYS 198.6 NOB					Not Analyzed
TEM NYS 198.4 NOB					Not Analyzed
Sample ID 1b 061507935-0002		Description Homogeneity	Interior - Wall tile-grout Heterogeneous		
PLM NYS 198.1 Friable	6/2/2015	White		55.00% Quartz 15.00% Ca Carbonate 30.00% Non-fibrous (other)	None Detected
PLM NYS 198.6 VCM					Not Analyzed
PLM NYS 198.6 NOB					Not Analyzed
TEM NYS 198.4 NOB					Not Analyzed
Sample ID 2a 061507935-0003		Description Homogeneity	Interior - Elbow insulation Heterogeneous		
PLM NYS 198.1 Friable	6/2/2015	Gray	15.00% Glass 10.00% Min. Wool	20.00% Ca Carbonate 55.00% Non-fibrous (other)	None Detected
PLM NYS 198.6 VCM					Not Analyzed
PLM NYS 198.6 NOB					Not Analyzed
TEM NYS 198.4 NOB					Not Analyzed
Sample ID 2b 061507935-0004		Description Homogeneity	Interior - Elbow insulation Heterogeneous		
PLM NYS 198.1 Friable	6/2/2015	Gray	15.00% Glass 10.00% Min. Wool 15.00% Cellulose	25.00% Ca Carbonate 35.00% Non-fibrous (other)	None Detected
PLM NYS 198.6 VCM					Not Analyzed
PLM NYS 198.6 NOB					Not Analyzed
TEM NYS 198.4 NOB					Not Analyzed

**EMSL Analytical, Inc.**

528 Mineola Avenue, Carle Place, NY 11514

Phone/Fax: (516) 997-7251 / (516) 997-7528

<http://www.EMSL.com>carleplacelab@emsl.com

EMSL Order: 061507935

CustomerID: H2ML50

CustomerPO:

ProjectID:

Test Report:Asbestos Analysis of Bulk Material

		Non Asbestos			
Test		Color	Fibrous	Non-Fibrous	Asbestos
Sample ID	2c	Description	Interior - Elbow insulation		
	061507935-0005	Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable	6/2/2015	Gray	10.00% Min. Wool 15.00% Glass 10.00% Cellulose	25.00% Ca Carbonate 40.00% Non-fibrous (other)	None Detected
PLM NYS 198.6 VCM					Not Analyzed
PLM NYS 198.6 NOB					Not Analyzed
TEM NYS 198.4 NOB					Not Analyzed
Sample ID	3a	Description	Roof - Window caulk		
	061507935-0006	Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					Not Analyzed
PLM NYS 198.6 VCM					Not Analyzed
PLM NYS 198.6 NOB	6/2/2015	Black			5.1% Chrysotile 5.1% Total
TEM NYS 198.4 NOB					Not Analyzed
Sample ID	3b	Description	Roof - Window caulk		
	061507935-0007	Homogeneity			
PLM NYS 198.1 Friable					Not Analyzed
PLM NYS 198.6 VCM					Not Analyzed
PLM NYS 198.6 NOB	6/2/2015				Positive Stop (Not Analyzed)
TEM NYS 198.4 NOB					Not Analyzed
Sample ID	4a	Description	Roof - Roof caulk		
	061507935-0008	Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					Not Analyzed
PLM NYS 198.6 VCM					Not Analyzed
PLM NYS 198.6 NOB	6/2/2015	Tan			Inconclusive: None Detected
TEM NYS 198.4 NOB	6/3/2015	Tan			None Detected
Sample ID	4b	Description	Roof - Roof caulk		
	061507935-0009	Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					Not Analyzed
PLM NYS 198.6 VCM					Not Analyzed
PLM NYS 198.6 NOB	6/2/2015	Tan			Inconclusive: None Detected
TEM NYS 198.4 NOB	6/3/2015	Tan			None Detected
Sample ID	5a	Description	Roof - Flashing		
	061507935-0010	Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					Not Analyzed
PLM NYS 198.6 VCM					Not Analyzed
PLM NYS 198.6 NOB	6/2/2015	Black			Inconclusive : <1%Chrysotile Inconclusive - <1% Total
TEM NYS 198.4 NOB	6/3/2015	Black			<1% Chrysotile <1% Total

**EMSL Analytical, Inc.**

528 Mineola Avenue, Carle Place, NY 11514

Phone/Fax: (516) 997-7251 / (516) 997-7528

<http://www.EMSL.com>carleplacelab@emsl.com

EMSL Order: 061507935

CustomerID: H2ML50

CustomerPO:

ProjectID:

Test Report:Asbestos Analysis of Bulk Material

Test		Non Asbestos		Asbestos
Sample ID	Color	Fibrous	Non-Fibrous	
5b 061507935-0011	Description Homogeneity	Roof - Flashing Homogeneous		
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB	6/2/2015	Black		Inconclusive : <1%Chrysotile Inconclusive - <1% Total
TEM NYS 198.4 NOB	6/3/2015	Black		1.3% Chrysotile 1.3% Total
Sample ID	6a 061507935-0012	Description Homogeneity	Roof - Roof membrane Homogeneous	
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB	6/2/2015	Black		7.8% Chrysotile 7.8% Total
TEM NYS 198.4 NOB				Not Analyzed
Sample ID	6b 061507935-0013	Description Homogeneity	Roof - Roof membrane	
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB	6/2/2015			Positive Stop (Not Analyzed)
TEM NYS 198.4 NOB				Not Analyzed
Sample ID	7a 061507935-0014	Description Homogeneity	Roof - 2nd layer roofing Homogeneous	
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB	6/2/2015	Black		9.9% Chrysotile 9.9% Total
TEM NYS 198.4 NOB				Not Analyzed
Sample ID	7b 061507935-0015	Description Homogeneity	Roof - 2nd layer roofing	
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB	6/2/2015			Positive Stop (Not Analyzed)
TEM NYS 198.4 NOB				Not Analyzed
Sample ID	8a 061507935-0016	Description Homogeneity	Roof - 3rd layer roofing Homogeneous	
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB	6/2/2015	Black		2.7% Chrysotile 2.7% Total
TEM NYS 198.4 NOB				Not Analyzed

Initial Report From 06/03/2015 21:37:09

Test Report 198VCM-7.30.1 Printed: 6/3/2015 9:37:09 PM

Page 3

**EMSL Analytical, Inc.**

528 Mineola Avenue, Carle Place, NY 11514

Phone/Fax: (516) 997-7251 / (516) 997-7528

<http://www.EMSL.com>carleplacelab@emsl.com

EMSL Order: 061507935

CustomerID: H2ML50

CustomerPO:

ProjectID:

Test Report: Asbestos Analysis of Bulk Material

Test	Color	Non Asbestos		Asbestos
		Fibrous	Non-Fibrous	
Sample ID 8b 061507935-0017	Description Homogeneity	Roof - 3rd layer roofing		
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB	6/2/2015			Positive Stop (Not Analyzed)
TEM NYS 198.4 NOB				Not Analyzed

The samples in this report were submitted to EMSL for analysis by Asbestos Analysis of Bulk Materials via NYS ELAP Approved Methods. The reference number for these samples is the EMSL Order ID above. Please use this reference number when calling about these samples.

Report Comments:

Sample Receipt Date:: 5/28/2015 Sample Receipt Time: 11:24 AM

Analysis Completed Date: 6/2/2015 Analysis Completed Time: 5:25 PM

Analyst(s):

Niruban Balasingam PLM NYS 198.1 Friable (5)

Niruban Balasingam PLM NYS 198.6 NOB (8)

Jason Rubin TEM NYS 198.4 NOB (4)

Samples reviewed and approved by:Michelle McGowan, Laboratory Manager
or other approved signatory

NOB = Non Friable Organically Bound N/A = Not Applicable VCM = Vermiculite Containing Material

-In New York State, TEM is currently the only method that can be used to determine if NOB materials can be considered or treated as non-asbestos containing. All samples examined for the presence of vermiculite when analyzed via NYS 198.1.

-NYS Guidelines for Vermiculite containing samples are available at http://www.wadsworth.org/labcert/elapcert/forms/VermiculiteInterimGuidance_Rev070913.pdf EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples were received in good condition unless otherwise noted.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. This report may contain data that is not covered by the NVLAP accreditation.

Samples analyzed by EMSL Analytical, Inc. Carle Place, NY NYS ELAP 11469

H2M L50	Site Address Glen Cove WW treatment Plant		Date Submitted 5/28/15
Address 538 Broad Hollow Road 4 th Floor East Melville, NY 11747	Work Area Plant		Turn Around Time: 1 WEEK
	Fax Results to:	E-mail Results to: TIRVING@H2U.com	Number of Samples:

Analytical Procedure: (Circle One)	NY ELAP Method 198.1 (friable in NY)	NY ELAP Method 198.6 (non-friable-NY)	NY ELAP Method 198.4 (TEM)	Billing # NCDP1501
---------------------------------------	---	--	-------------------------------	------------------------------

Sample Number	Location (SD)	Sample Description	Comments
1a	Interior	wall tile-grout	
1b	" "	" "	
2a		elbow insulation	
2b			
2c	↓	↓	
3a	Roof	Window caulk	
3b		" "	
4a		Roof Caulk	
4b		" "	
5a		flashing	
5b		" "	
6a		Roof membrane	
6b		" "	
7a		2nd Layer Roofing	
7b		" "	
8a		3rd layer Roofing	
8b	↓	" "	
* Stop @ 1st ⊕ *			
061507935			

RECEIVED
EMSL ANALYTICAL
CARLE PLACE
15 MAY 28 AM 11:24

Relinquished by (signature) V. [Signature]	Date 5/28/15	Time	Received by (signature) [Signature]	Date 5/28/15	Time 11:24 AM	Agent of EMSL
Relinquished by (signature)	Date	Time	Received by (signature)	Date	Time	Agent of



ATTACHMENT 2

H2M LICENSE

H2M PERSONNEL CERTIFICATIONS

New York State – Department of Labor

Division of Safety and Health
License and Certificate Unit
State Campus, Building 12
Albany, NY 12240

ASBESTOS HANDLING LICENSE

H2M Architects & Engineers, Land surveying and
Landscape Architecture, D.P.C.
4th Floor East
538 Broad Hollow Road
Melville, NY 11747

FILE NUMBER: 00-0724
LICENSE NUMBER: 28582
LICENSE CLASS: RESTRICTED
DATE OF ISSUE: 10/30/2014
EXPIRATION DATE: 10/31/2015

Duly Authorized Representative – Travis Irving:

This license has been issued in accordance with applicable provisions of Article 30 of the Labor Law of New York State and of the New York State Codes, Rules and Regulations (12 NYCRR Part 56). It is subject to suspension or revocation for a (1) serious violation of state, federal or local laws with regard to the conduct of an asbestos project, or (2) demonstrated lack of responsibility in the conduct of any job involving asbestos or asbestos material.

This license is valid only for the contractor named above and this license or a photocopy must be prominently displayed at the asbestos project worksite. This license verifies that all persons employed by the licensee on an asbestos project in New York State have been issued an Asbestos Certificate, appropriate for the type of work they perform, by the New York State Department of Labor.



Eileen M. Franko, Director
For the Commissioner of Labor

United States Environmental Protection Agency

This is to certify that

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402, and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226

Holzmacher, McLendon & Murrell, P.C.



New York

This certification is valid from the date of issuance and expires

February 27, 2016

NY-1482-4

Certification #

February 14, 2013

Issued On



Michelle Price

Michelle Price, Chief

Lead, Heavy Metals, and Inorganics Branch

STATE OF NEW YORK - DEPARTMENT OF LABOR
ASBESTOS CERTIFICATE



VERONICA A BICKMEYER
CLASS(EXPIRES)
C ATEC(04/16) D INSP(04/16)
H PM (04/16)

CERT# 09-12681
DMV# 314401403

MUST BE CARRIED ON ASBESTOS PROJECTS



01213 000419705 69

EYES GRN
HAIR BLN
HGT 5' 04"

IF FOUND RETURN TO:
NYSOL - L&C UNIT
ROOM 161A BUILDING 12
STATE OFFICE CAMPUS
ALBANY NY 12240

NYC DEP ASBESTOS CONTROL PROGRAM
ASBESTOS CERTIFICATE



BICKMEYER,
VERONICA A
INVESTIGATOR
135950

EXPIRES: 4/18/2017
DOB: 4/18/1984 F 5' 04"

MUST BE CARRIED ON ALL ASBESTOS PROJECTS



01213 000241685 75

DMV ID: 314401403

This certificate must be shown to a
NYCDEP representative upon request.
Report loss immediately to NYCDEP
Asbestos Control Program, 8th floor
59-17 Junction Blvd., Flushing, NY 11373

United States Environmental Protection Agency

This is to certify that



Veronica A Bickmeyer

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402, and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226 as:

Inspector

In the Jurisdiction of:

New York

This certification is valid from the date of issuance and expires April 01, 2018

NY-I-1150318-1

Certification #

March 18, 2015

Issued On



John Gorman, Chief

Pesticides & Toxic Substances Branch



ATTACHMENT 3

EMSL's CERTIFICATIONS

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER



Expires 12:01 AM April 01, 2016
Issued April 01, 2015

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. MICHELLE MCGOWAN
EMSL ANALYTICAL, INC.
528 MINEOLA AVE.
CARLE PLACE, NY 11514

NY Lab Id No: 11469

is hereby APPROVED as an Environmental Laboratory for the category
ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved subcategories and/or analytes are listed below:

Miscellaneous

Asbestos in Friable Material	Item 198.1 of Manual EPA 600/M4/82/020
Asbestos in Non-Friable Material-PLM	Item 198.6 of Manual (NOB by PLM)
Asbestos in Non-Friable Material-TEM	Item 198.4 of Manual
Asbestos-Vermiculite-Containing Material	Item 198.8 of Manual
Lead in Dust Wipes	EPA 7000B
Lead in Paint	EPA 7000B

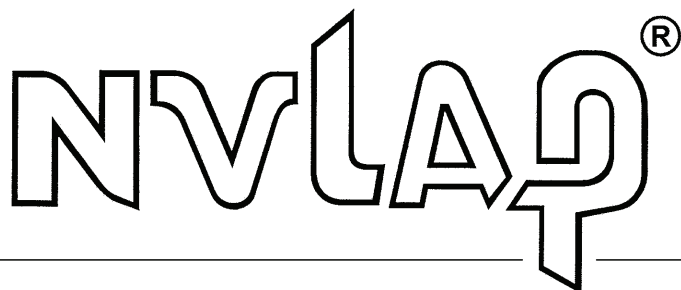
Sample Preparation Methods

EPA 3050B

Serial No.: 52390

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-10

EMSL Analytical, Inc.
Carle Place, NY

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

BULK ASBESTOS FIBER ANALYSIS

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2014-07-01 through 2015-06-30

Effective dates



A handwritten signature in black ink, appearing to read "William R. Mallon".

For the National Institute of Standards and Technology



National Voluntary Laboratory Accreditation Program



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.

528 Mineola Ave.

Carle Place, NY 11514

Michelle McGowan

Phone: 516-997-7251 Fax: 516-997-7528

E-Mail: ssiegel@emsl.com

URL: <http://www.emsl.com>

BULK ASBESTOS FIBER ANALYSIS (PLM)

NVLAP LAB CODE 101048-10

<i>NVLAP Code</i>	<i>Designation / Description</i>
--------------------------	---

18/A01	EPA 600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples
--------	--

18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials
--------	---

2014-07-01 through 2015-06-30

Effective dates

For the National Institute of Standards and Technology



ATTACHMENT 4

PHOTOGRAPHIC DOCUMENTATION



Non-asbestos containing wall grout.



Non-asbestos pipe elbow insulation.



Asbestos Containing Window Caulk



Non-asbestos containing building caulk (expansion joint)



Asbestos Containing Roof Flashing.



Asbestos Containing Roofing Material (all layers)



Non-Lead based paint.



Non-Lead based paint.



Non-Lead based paint.