FOR INFORMATIONAL PURPOSES ONLY

PROPOSAL

NOT TO BE USED FOR BIDDING

DEPARTMENT OF PUBLIC WORKS NASSAU COUNTY, NEW YORK CONTRACT NO.: S35114-13G

TO BE COMPLETED BY CONTRACTORS SUBMITTING A BID ON						
		S35114-13G – GENERAL CONSTRUCTION				
ITEM	APPROX.	ITEMS BID WITH PRICE WRITTEN IN WORDS				
NO.	QUANTITIES					
1.	Lump Sum	Base Bid for furnishing all Labor, Materials and Equipment required for all Construction work ready for operation.	N/A	N/A		
2.	500 LINEAR FEET	For concrete crack repair (Section 03930)				
3.	500 SQUARE FEET	For concrete spall repair (Section 03930)				
4.	Allowance	Lump sum for Rehabilitation of the existing grit conveyor, including the removal and disposal of the existing liners and spirals and to furnish and install replacement liners and spirals, as specified in Section 11320 – Grit Handling Equipment.Seventy thousandZero	N/A	N/A	\$70,000	00

PROPOSAL

GLEN COVE WASTEWATER TREATMENT PLANT PRELIMINARY TREATMENT SYSTEM IMPROVEMENTS H2M CONTRACT NO.: NCDP 1701 DEPARTMENT OF PUBLIC WORKS NASSAU COUNTY, NEW YORK CONTRACT NO.: S35114-13G

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07920

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LEAD PAINT & ASBESTOS SURVEY

(FOR INFORMATION ONLY - NOT PART OF CONTRACT S35114-13C CONTRACT DOCUMENTS)



1.01 - BRIEF PURPOSE OF PROJECT / GENERAL

- A. The purpose of the work to be performed in Contract S35114-13G is to improve the preliminary treatment systems associated with the Glen Cove Wastewater Treatment Plant with upgrades to the influent screening systems, grit collection and removal systems, influent pumping station and building electrical/HVAC upgrades.
- B. 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 S35114-13G.

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 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 S35114-13G Construction work includes, but is not limited to, the following in accordance with the Contract Plans and Specifications:
 - 1. Removal and replacement of three (3) influent mechanical bar screens, including but not limited to the removal of all existing mechanical equipment, structural framing and supports, as well as all existing electrical connections, devices and associated appurtenances and the installation of new screening equipment inclusive of all structural supports, mounting hardware, electrical devices, connections and all necessary appurtenances to result in fully functional screens.
 - 2. Removal of the two (2) existing screenings belt conveyors, including all structural supports, mounting hardware and electrical connections and installation of three (3) new screenings washer compactors dedicated to each new bar screen, including all mounting hardware and appurtenances necessary to result in fully functional screenings washer compactors.



- 3. Installation of a new booster pump system to provide pressurized treated effluent ('plant') water to the new screenings washer compactors for use as wash water.
- 4. Rehabilitation of the existing grit collection and removal equipment including furnish and installation of a new grit collector drive and motor, new collector scraper blades, new flow deflector baffles and replacement of the wear bars and liners of the existing shaftless screw grit conveyors.
- 5. Removal of the four (4) vertical dry pit extended shaft influent pumps and replacement with four (4) horizontal dry pit submersible influent sewage pumps, including service carts and new pump cables.
- 6. Removal and replacement of eight (8) plug valves and four (4) swing check valves, including all fittings, valve stem extensions, valve operators and appurtenances necessary for installation to connect inlet and outlet piping to the new influent pumps to the existing suction and discharge piping as shown on the plans.
- 7. Removal and replacement of the influent pump VFD's including a new custom control panel, level sensors, transmitters, and appurtenances necessary to power and control the new influent pump equipment.
- 8. Removal and replacement of miscellaneous isolation slide gates and stop logs for the influent screenings channels, grit chamber, grit chamber bypass channel and influent channel to the wet well chambers.
- 9. Electrical work including the removal and replacement of the existing MCC-HW (A & B) and all appurtenances required thereto and incidental thereof.
- 10. Installation of a new manual transfer switch hookup for portable emergency power generator. Emergency power generator not part of the scope of work covered under this contract.
- 11. Installation of new HVAC equipment and all appurtenances required thereto and incidental thereof.
- 12. Miscellaneous improvements in the Headworks Building, as shown on the Contract Drawings and in accordance with the Specifications for Contract S35114-13G.
- 13. Startup participation for the Headworks Building equipment as necessary to troubleshoot issues pertaining to new equipment initial operations.



- 14. Restore Headworks Building and site areas impacted by construction activities to match pre-existing conditions.
- 15. 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 Plant Operator as they pertain to confined space entry and general site access and safety.
 - e. 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. Always maintain the Owner's ability to operate the facility 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 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 regarding 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 Plant Operator requirements for entry into a confined space whenever it is necessary for a Contractor's employee to enter a Nassau County and/or Plant Operator 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 Plant Operator sanitary sewer manhole, wet well, valve pit and process tank unless he follows all applicable OSHA and Plant Operator 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:
 - Remove and replace MCC-HW (A&B) one half at a time and install new manual transfer switch. Provide temporary feeders to any equipment identified as necessary to remain online during construction.
 - 2. Remove and dispose of odor control scrubber and HVAC equipment to be demolished. Install new HVAC equipment.
 - 3. Rehabilitate concrete in bar screen area.
 - 4. Install new booster pump system including piping and controls.
 - 5. Remove one (1) bar screen, screens' access platform and screenings conveyors from service. Provide interim conveyance of screenings.



- 6. Install (1) new bar screen, washer compactor, and associated controls and equipment.
- 7. Start up and test new bar screen, washer compactor, and associated controls and equipment.
- 8. Remove, replace, and start-up remaining two (2) bar screens, washer compactors, and associated controls and equipment one at a time.
 - a. Two (2) bar screens shall always be in service during construction.
- 9. Bypass the grit removal systems and rehabilitate grit chamber concrete.
 - a. The grit removal systems may not be offline for more than two (2) months.
- Remove and replace grit collector motor and drive. Remove and replace flow deflector baffles and collector scraper blades. Remove and replace grit conveyor liner and spiral. Perform start-up and testing on new grit equipment.
- 11. Place the west wet well offline and perform cleaning activities. Work should not start until pumps, valves and controls are on site. Remove two (2) dry-pit submersible pumps (pumps #3 & #4) and associated valves and fittings.
 - a. One (1) 8-hour shift will be allowed for the removal and replacement of the discharge plug valves. The 24" gate valve located on the combined influent header to the Primary Settling Tanks can be closed for this period to isolate one half of the discharge header to facilitate the mechanical piping connections.
- 12. Remove and dispose of VFDs and controls for pumps that have been removed.
- 13. Install two (2) new dry-pit submersible pumps, service carts and associated valves, fittings and appurtenances.
- 14. Install new VFDs and controls for new dry-pit submersible pumps.
- 15. Perform start-up and testing on dry-pit submersible pumps #3 and #4 while keeping the east and west wet wells isolated from each other.
 - a. This work can only be performed after a minimum of two (2) of the new bar screens are online and the grit chamber has been cleaned and placed back into service.



- 16. Place the east wet well offline and preform cleaning activities. Remove two (2) remaining dry-pit submersible pumps (pumps #1 & #2) and associated valves and fittings.
 - a. One (1) 8-hour shift will be allowed for the removal and replacement of the discharge plug valves. The 24" gate valve located on the combined influent header to the Primary Settling Tanks can be closed for this period to isolate one half of the discharge header to facilitate the mechanical piping connections.
- 17. Remove and dispose of VFDs and controls for pumps that have been removed.
- 18. Install two (2) new dry-pit submersible pumps, service carts and associated valves, fittings and appurtenances.
- 19. Install new VFDs and controls for new dry-pit submersible pumps.
- 20. Perform start-up and testing on dry-pit submersible pumps #1 and #2.
- 21. Project closeout submittals.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used



+ + NO TEXT ON THIS PAGE + +



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:
 - Item No. 4: An allowance of seventy thousand dollars (\$70,000.00) for furnishing and installing the replacement liners, wear bars, bearings and spirals, as specified in Section 11320 – Grit Handling Equipment including Contractor mark-up as specified in Article XXII, "Extra Work."

1.03 – BASIS FOR PAYMENT

- A. General Construction Contractor:
 - Item No. 4: Payment under this allowance item shall be paid on the basis of the itemized invoice costs to furnish and install replacement liners, wear bars, bearings and spirals, as specified in Section 11320 – Grit Handling Equipment 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.

1.01 - GENERAL

- A. This Section specifies the requirements for measurements and records made for payment purposes and describes the item(s) under which payment(s) will be made for the Work performed under this Contract.
- B. All work shown or specified in the Contract Documents will be performed.
- C. Items not specified to be measured or paid for (for which no specific pay item exists in the Price Schedule) will be included in an appropriate unit price item or in a lump-sum item.
- D. Comply with the requirements contained in Section 02480 for the requirements pertaining to the restoration of all surfaces, which may or may not be paid for under a separate unit price item, and which will be restored to a condition equal to or better than that existed prior to work starting under this contract.

1.02 - MEASUREMENT REQUIREMENTS

- A. All required measurements will be made by the Contractor with the Engineer and or Owner's construction representative.
- B. Any measurements not witnessed by Engineer and/or Owner's construction representative and which cannot be verified or substantiated by Engineer and/or Owner's construction representative will not be approved and payment under the item(s) requiring such measurements will not be made.
- C. Coordinate measurements monthly, for the preparation of periodic pay estimates.
- D. Where payments will be made for removing existing materials, or materials generated by work, Contractor shall be required to notify Engineer and/or Owner's construction representative so that he/she may witness the measurements.
 - 1. All materials removed without conforming to the above procedures, which Engineer and/or Owner's construction representative cannot verify or substantiate, will not be paid for.
 - 2. Maintain complete, neat, clean, and legible field notes for all measured items.
 - 3. Notes will contain spaces for Contractor's and Engineer's and/or Owner's construction representative's signatures plus additional space for comments.



- 4. An original and a carbon copy will be made for all notes and one copy will be turned over to Engineer and/or Owner's construction representative daily.
- 5. The Engineer's and/or Owner's construction representative's signature will not be constituted as an acceptance of the work, or the measurements made, but will mean that he was present when the measurements were made.

1.03 - SUBMITTALS

- A. See Section 01300.
- B. Field notes of all measurements for payment purposes delivered to Engineer and/or Owner's construction representative daily.
- C. Copies of all invoices required for payments out of cash allowance(s) and alternate(s) work.
- D. Monthly Applications for Payment.
- E. Record Drawings showing the locations and quantities of all items measured for payment purposes.

1.04 - SCHEDULING

- A. Notify Engineer and/or Owner's construction representative, as far in advance as possible, of the recording of measurements so that Engineer and/or Owner's construction representative may observe existing conditions, work being performed, and measurements being made.
- B. Allow for and afford Engineer and/or Owner's construction representative ample time, space, and equipment to observe measurements and to verify measurements and elevations.

PART 2 - PRODUCTS

2.01 - GENERAL

- A. Provide all labor, materials, facilities, levels, measuring devices and all other equipment and items necessary to perform all measurements properly and accurately for payment purposes.
- B. Payment for certain items not specifically listed in the bid forms but otherwise required by the technical specifications will be deemed included as part of the General Conditions and the individual unit price and lump sum bid items provided for in the proposal.



PART 3 - EXECUTION

- A. Perform all measuring required under this Section.
- B. Record all measurements and calculated quantities on the Record Drawings.
- C. No measurement will be made for work performed within the limits of Lump Sum Items.

ITEM NO. ITEM DESCRIPTION AND MEASUREMENTS

- 2 <u>Concrete Crack Repair</u> Measure the actual linear length of concrete cracks that are repaired as directed by Engineer in the field. Measurement will be made along the entire length of continuous cracks to be repaired.
- 3 <u>Concrete Spall Repair</u> Measure the actual square footage of concrete spalls that are repaired as directed by Engineer in the field. Measurement will be made along the entire area of each surface spall that is repaired.

PART 4 - PAYMENTS

4.01 - GENERAL REQUIREMENTS AND STIPULATIONS

- A. No separate payments will be made for the Work under this Contract except for the pay items stipulated in this Part 4.
- B. All costs in connection with the Work will be included in one or more of the pay items, as appropriated.
- C. Each pay item will be full compensation for all costs in connection with the item including, but not limited to:
 - 1. the furnishing of all materials, labor, equipment, tools, and all incidentals,
 - 2. the installation of all materials, equipment, facilities, accessories, and appurtenant items,
 - 3. proper share of overhead and profit,
 - 4. mobilization/demobilization,
 - 5. submittals,



- 6. General and Supplemental Conditions,
- 7. all temporary facilities and controls
- 8. restoration of surfaces not scheduled to be paid for by bid items
- all related and incidental work and items necessary or required to complete the Work and to provide completely connected, operational and approved systems capable of performing as required.
- D. In addition to those items described above, Paragraph 4.02 lists specific items of work under each pay item to assist Contractor in appropriating the costs to the proper pay item.

4.02 - PAY ITEMS

A. The name of the following pay item is the abbreviated form of the Bid Item as contained on the Price Schedule in the Bid Forms. The name, as shown below or on the Bid Form, will not be construed to represent a complete description of all or the Work included under such time as is provided only as a means of identification and for ease of conversation.

ITEM NO. PAYMENT

- 2 <u>Concrete Crack Repair</u> Payment will be made at the unit price bid per linear foot of crack repaired and accepted. Include costs for routing existing cracks, debris removal and disposal, transmission of water for surface cleaning, repair materials, application of coatings and mortar, and all work incidental thereto and necessary, therefore.
- 3 <u>Concrete Spall Repair</u> Payment will be made at the unit price bid per square foot of spalls repaired and accepted. Include costs for debris removal and disposal of loose materials to sound substrate, transmission of water for surface cleaning, repair materials, application of coatings, and all work incidental thereto and necessary, therefore.



1.01 - SECTION INCLUDES

- A. General: The Alternates described below shall not 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 the 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 added to 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 Contactor 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 to the Contract scope, then all work for the Base Bid and collateral work shall be completed in their entirety.



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, UNDERPINING 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

H 2 M

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

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.
- 3. Section 02222, Demolition
- 4. Section 02419, Selective Demolition

1.02 - PROTECTION

- A. General:
 - Demolition and removal Work shall be performed by competent workers 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, workers on the Site and the public. The Work shall be performed with as little nuisance as possible.
 - 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, workers 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

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



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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:
 - 1. AMCA- Air Moving and Conditioning Association, Inc.
 - 2. AASHTO American Association of State Highway and Transportation Officials.
 - 3. ABMA- American Boiler Manufacturers' Association
 - 4. ACI American Concrete Institute.
 - 5. ACIFS- American Cast Iron Flange Standards.
 - 6. AFBMA- Anti-Friction Bearing Manufacturers Association.
 - 7. AGA- American Gas Association.
 - 8. AGMA- American Gear Manufacturers Association.
 - 9. AIA- American Institute of Architects.
 - 10. AISC- American Institute of Steel Construction.
 - 11. AISI- American Iron and Steel Institute.
 - 12. ANSI American National Standards Institute.
 - 13. APA- American Plywood Association.
 - 14. API- American Petroleum Institute.
 - 15. ASCE- American Society of Civil Engineers.
 - 16. ASME- American Society of Mechanical Engineers.
 - 17. ASTM- American Society for Testing and Materials.

- 18. AWPA- American Wood Preservers Association.
- 19. AWS- American Welding Society.
- 20. AWWA- American Water Works Association.
- 21. CGA- Compressed Gas Association.
- 22. CRSI- Concrete Reinforcing Steel Institute.
- 23. CMAA- Crane Manufacturers' Association of America.
- 24. DIPRA- Ductile Iron Pipe Research Association.
- 25. EEI- Edison Electric Institute.
- 26. EJMA- Expansion Joint Manufacturers' Association.
- 27. Fed Spec Federal Specifications.
- 28. FM- Factory Mutual.
- 29. HMI- Hoist Manufacturers' Institute.
- 30. IEEE- Institute of Electrical and Electronic Engineers.
- 31. IPCEA- Insulated Power Cable Engineers Association.
- 32. NACE- National Association of Corrosion Engineers.
- 33. NB- National Board of Boiler Pressure Vessels.
- 34. NBS- National Bureau of Standards.
- 35. NEC- National Electric Code.
- 36. NEMA- National Electrical Manufacturers Association.
- 37. NFPA- National Fire Protection Association.
- 38. NYSDOT New York State Department of Transportation.
- 39. OSHA- Occupational Safety and Health Act.

- 40. PCA- Portland Cement Association.
- 41. PCI- Pre-stressed Concrete Institute.
- 42. RMA- Rubber Manufacturers' Association.
- 43. SMACCNA Sheet Metal and Air Conditioning Contractors National Association.
- 44. SPI- Society of Plastics Industry.
- 45. SSPC- Steel Structures Painting Council.
- 46. STI- Steel Tank Institute
- 47. 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 + +



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1.01 - SECTION INCLUDES

A. Site Utilization Plan requirements

1.02 - SITE UTILIZATION PLAN REQUIREMENTS

- A. Prepare a Site Utilization Plan (SUP) for each site showing staging areas, parking areas, stockpile areas, debris container areas, unloading areas, and trailer areas for review by the Owner and Engineer. The length and amount of meetings necessary to develop and adopt a SUP shall be as required.
- B. Meeting(s) will be held at the site with all concerned parties to assist the Contractor in developing the criteria for the plan. During these meeting(s), all parties will present their needs and requirements for site utilization. As a minimum, each Contractor shall be allocated a portion of the available staging/parking/material storage area. Representatives from the local municipality or utility companies may be attending. The requirements of the local municipality and utility companies shall be incorporated into the SUP.
- C. Prepare a draft site plan that attempts to incorporate the needs of all concerned parties. Another meeting will then be held at the site to review and present the plan. The plan shall then be revised at that meeting and adopted for use if it is acceptable to all relevant parties. If all parties cannot agree on an acceptable plan, then the Engineer will establish the Site Utilization Plan without any claims from the Contractor.
- D. The Contractor shall understand the importance of a workable Site Utilization Plan and also understands that the Owner and Engineer may be required to select a plan to adopt that is not ideal to the planned construction activities anticipated before the bid was submitted. The Contractor shall not submit claims for damages associated with site utilization.
- E. If a Site Utilization Plan as stipulated above is not prepared, then the Owner reserves the right to back charge the Contractor for the costs associated with having a Site Utilization Plan developed.
- F. If the Contractor fails to participate or attend the meetings scheduled to develop the Site utilization Plan then the Contractor will forfeit any right to comment on the plan that is developed.

PART 2 - PRODUCTS

Not Used



PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

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 S35114-13G

- A. Lump Sum Bid Item No.1: Glen Cove Wastewater Treatment Plant Preliminary Treatment System 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 – UNIT PRICE ITEMS

A. Unit Price Item No. 2 & 3 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.

1.05 – 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 + +



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.
 - 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 11 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. Samples: Submit the number stated in the respective Sections.



- c. 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 – 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.



1.10 – ADDITIONAL SUBMITTAL REQUIREMENTS

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

1.11 – GENERAL PROCEDURES FOR SUBMITTALS

A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in ad vance 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), coord ination 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 ++



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

			(N	lame c	of Contra	ctor)			to d	lesig	n
in ac	cordance with	Section _	(Insei	t P.E.	Respons	ibilitie	es)		fo	r the	_
 The	undersigned	further	certifies	(Name that	e of Proje he/she	ct) has	performed	the	design	of	the
(Nan	ne 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



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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 P6 (or as approved by the Engineer).

1.02 - DETAILS

- A. PRE-CONSTRUCTION SCHEDULE MEETING
 - The Engineer and/or Owner's construction representative will schedule and conduct a Pre-construction Scheduling Meeting with the Contractor within ten (10) working days after the contract has been awarded. 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.



 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 Fifteen (15) 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 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:
 - CPM ACTIVITY NETWORK FORMAT The schedule network shall use the Precedence Diagraming Method. (If the contractor desires to employ an alternative method prior approval by the Engineer is required and no changes to the initial submission date will be permitted.)
 - b. PROJECT DEFINITIONS The following project specific properties within the schedule shall be defined:
 - 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:



- 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) Shop drawing review.
- 5) Any project specifics as required by the Engineer.
- 6) Expected and contemplated weather conditions shall be accounted for in the calendars.
- 2. ACTIVITY CODE- As a minimum, the following activity codes shall be established:
 - 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 bid breakdown.

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.
- 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 fifteen 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 Award" 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.



- 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:

Activity ID	Activity Description	Activity Type	Logic Relationship
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

 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.

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- vi. Fabrication and Delivery.
- g. Scheduled Completion Date Status
 - i. Contract Completion.
 - ii. Interim 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 "sort" as directed by the Engineer and/or as discussed in the preconstruction 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. 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.
- 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. <u>No changes shall be made to the Schedule without prior written approval of the Engineer</u>. 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 CONTRACTORS, General 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. When recovery schedule will affect another prime Contractor on the Project, input on proposed recovery schedule action from the responsible prime Contractors must be



provided within 10 work days of such determination by the Engineer. Incorporate requirements of other prime Contractors into the recovery schedule to the extent applicable.

- 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:
 - 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. Prime 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 + +



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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 + +



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1.01 - DESCRIPTION

- A. 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
 - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, ACGLH
 - 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 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.
 - 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.
 - 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 taskspecific 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 section 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:
 - 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 immediate 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 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.
 - 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.
 - 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 ANSIapproved 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 can enter 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 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.

1.08 – COVID-19 SAFETY PLAN

- A. Construction has been designated as essential under Empire State Development's Essential Business Guidance. Submit for information inly the Contractor's written Safety Plan outlining how its workplace will prevent the spread of COVID-19.
- B. Submit for information only a copy of the affirmation that the Contractor has read and understands their obligation to operate in accordance with the New York State Department of Health Interim Guidance for Construction Activities during the COVID-19 Public Health Emergency ("Interim COVID-19 Guidance for Construction").

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 Worker'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.

- 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									
Contra	actor Name:				Locat	tion of Hot Work:			
Permit	Authorizing Individua	al:					Phone:		
Permit	Issued (Date)	· · · · · · · · · · · · · · · · · · ·		(Time)		AM/PM			
Perinn	Expires (Date)			(Time)					
Туре о	'ype of hot work to be used (Source of ignition):□ Grinding□ Cutting□ Brazing or Soldering□ Welding/Burning□ Heating□ Other								
PPE to	be Used by Person Pe	erforming Hot Wor	rk:						
Descri	be the Hot Work Job a	nd Materials to be	Worked	on:					
Any sp	becial hazards and/or sp	pecial precautions	to be tak	en:					
			_						
Fire	Watch Required?	<u> </u>		1 5	Nur	nber of Fire Wat	tches Required:		
condition adverse regulato Worko Comp	ons existing at the time of ely affects safety. I or the ory requirements. er/Supervisor: any:	f issuance do not cha person(s) performin	ange. The g the wor	ey will stop k are adeq Si D	o the work and uately trained gnature: ate:	l notify the PAI of a in the safe handling	g and use of their equip	a conditions which ment and applicable	
	-	Permit Auth	orizing	Individu	al (PAI) Au	thorization			
I comp hazard hot wo Signat	bleted the site inspection ous conditions which n ork has reviewed the per cure:	on, notified the per may not be obviou ermit and signed th	son performs, and vertices, an	orming th prified tha wledgmer Date	e work or the t the person nt above. (If i ate:	eir crew superviso performing (or din no, hot work is no	or about flammable m rectly supervising the ot permitted)	naterials or e crew performing)	
Notice	: Post this permit in H	ot Work Permit ar	ea until j	permitted	operations a	are complete. Upo	on Completion return	permit to the PAI.	
	F	inal Inspection (I	Fire Wat	ch, or PA	AI if No Fire	e Watch Was Red	quired)		
I comp	leted final inspection a	at the required tim	es after c	completio	n of Hot Wo	rk and observed n	o signs of smoldering	g or combustion.	
Signat	11 r 0•				Date		Time	(Day 1)	
Day	PAI Signature	Date/Time	Accep Yes	otable No	Final Insp./ Initials	/	Comments		
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

- 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.

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 photographs.)
- 7. Date picture was taken.
- 8. Name of photographer.
- F. Two (2) electronic copies containing all photos taken at the site shall be supplied on portable digital media and submitted to the Engineer for approval.

PART 3 - EXECUTION

Not Used

+ + END OF SECTION + +

PART 1 - GENERAL

1.01 - DESCRIPTION

- A. Scope
 - 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.
 - 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.
 - 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.
- 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 + +

Supplement A - Statement of Special Inspections

Project:

Location:

Owner:

Design Professional in Responsible Charge:

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to the Project as well as the name of the Coordinating Special Inspector and the identity of other approved agencies to be retained for conducting these inspections and tests. This *Statement of Special Inspections* encompass the following disciplines:

Structural	Mechanical/Electrical
Architectural	Other:

The Coordinating Special Inspector shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Inspections listed are periodic unless indicated to be continuous or required by code to be continuous.

Interim reports shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Interim Report Frequency: Weekly or per attached schedule. Prepared by: (type or print name) Signature Date Design Professional Seal Owner's Authorization: Building Official's Acceptance: Date Signature Signature Date Page 2 of 9 NCDP 1701 01416A-1

Schedule of Inspection and Testing Agencies

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- Soils and Foundations
 Cast-in-Place Concrete
 Precast Concrete
 Masonry
 Structural Steel
 Cold-Formed Steel Framing
- Spray Fire Resistant Material
- Wood Construction
- Exterior Insulation and Finish System
- Mechanical & Electrical Systems
- Architectural Systems
- 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:		

01416A-4

Cast-in-Place Concrete

Page of

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		
 Sampling and Testing of Concrete 		
9. Curing and Protection		
10. Other:		

Precast Concrete

Page of

Item	Agency # (Qualif.)	Scope
1. Plant Certification / Quality		
Control Procedures		
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:		

Masonry

Required 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:		

Structural Steel

Page of

Ite	m	Agency # (Qualif.)	Scope
1.	Fabricator Certification/ Quality Control Procedures		
	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:		
Cold-Formed Steel Framing

(Qualif.)	Scope
	(Qualif.)

Mechanical & Electrical Systems

Item	Agency # (Qualif.)	Scope
1. Smoke Control		
2. Mechanical, HVAC & Piping		
3. Electrical System		
4. Other:		

Architectural Systems

Item	Agency # (Qualif.)	Scope
1. Wall Panels & Veneers		
2. Suspended Ceilings		
2 Aggess Elegers		
5. Access Floors		
4. Other:		

Special Cases

Item	Agency # (Qualif.)	Scope

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

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 Conversation, 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 an 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 FACILITES

- 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.
 - 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.

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- 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.
- 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.
 - 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 excava-tions, 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 workers 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 Glen Cove WWTP.
 - 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.
- 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:
 - 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.
 - 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.
 - 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:
 - 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:
 - 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
 - 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:
 - 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.
 - 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 – 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 - 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

NCDP 1701

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PART 3 - EXECUTION

Not Used

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PART 1 - GENERAL

1.01 - SECTION INCLUDES

- A. Furnishing of the Contractor's and Engineer's Field Office (Trailer).
- B. The Engineer's Field Office shall be furnished by the General Construction Contractor within the time specified hereinafter.
- C. Furnish the following in accordance with the specifications contained herein as follows:
 - 1. Miscellaneous equipment and supplies
 - 2. Materials
 - 3. Services as may be specified herein.
- D. Temporary electric shall be installed to the Engineer's trailer within two (2) days from the date that the trailer is on-site and ready for power as notified by the Engineer.

1.02 - SERVICE

- A. Applications for electrical service shall be completed by the Contractor.
- B. Provide 100-amp temporary power to the Engineer's trailer.
 - 1. Wire and electrify the trailer.
 - 2. Maintain the service throughout the project up to final completion.
 - 3. Remove the service prior to the last day of final completion.

1.03 - CARE AND PLACEMENT

- A. Field offices shall be placed where directed by the Engineer in accordance with site utilization requirements.
- B. All field offices shall be installed to meet all standard of the Occupational Safety and Health Act of 1970 and subsequent revisions.
- C. In the event of damage to existing facilities, including but not limited to tanks, driveways, walks, pavement, buildings, pipes, conduits, valves, and electrical facilities then immediately make all repairs and replacements to an equal condition prior to the event.



1.04 - QUALITY PERFORMANCE

A. Comply with and perform all work in accordance with the requirements of local authorities and utility companies having jurisdiction.

1.05 - SUBMITTALS

- A. Submit the following:
 - 1. Floor plan of the proposed Engineer Field Office.
 - 2. Catalog cuts of miscellaneous equipment and supplies if they are different from that specified.

PART 2 - PRODUCTS

2.01 - CONTRACTOR 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. Provide adequate facilities for maintaining record documents, for holding small meetings and a telephone upon which calls may be received from Owner, Engineer and others.
- C. Install, maintain, and repair if necessary, temporary electric and telephone to their own field office.
- D. 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.

2.02 - 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. Provide janitorial services two (2) times each week. Thoroughly clean and dust entire office and leave in a condition satisfactory to Owner. Remove and dispose of trash. Provide this service through final completion.
- C. All items shall be delivered prior to the first application for payment, but no later than the day the Engineer's Trailer is delivered.
- D. Duration Provide office by no later than 30 calendar days from the date of the Notice to Proceed and maintained during the duration of the Contract, up to the date of the Final Certificate.
- E. No Construction shall commence until the trailer is provided, furnished as herein specified and made available to the Engineer. The Engineer's field office shall be separate from any office used by the Contractors.
- F. 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. All windows shall be equipped with security grilles.
 - a. Door with hasp and padlock and five keys for Owner/Engineer's use. All doors shall be equipped with locking bars. Provide two (2) commercial grade foot mats at each door.
 - b. Air conditioning unit and heater in each room, sized to maintain an indoor temperature of 60 degrees F with an outdoor temperature range of 10 deg. F to 90 degrees F.
 - c. 110 volts, 100-amp electric service with sufficient receptacles spaced around the room.
- G. Windows shall be the type that will open and close as required. A flush type toilet shall be provided and shall be 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 always be provided. The sanitary facilities shall be connected by the Contractor to an approved location and in accordance with the site utilization requirements.

- H 2 M
- H. 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.
- I. The Contractor shall provide telephone service to the field office, including all Verizon coordination.
- J. Furnish the following equipment and services. All items specified herein shall be new and remain the property of the Owner unless otherwise stated. The following shall be furnished:
 - Four (4) Office chairs. (Stackable type)
 - Four (4) Folding chairs
 - One (1) 30-inch x 72-inch folding table.
 - One (1) Bracketed wall table (3 feet by 5 feet)
 - One (1) Draftsman's stool.
 - Two (2) 30-inch x 60-inch desks with 4 side drawers and a locking center drawer.
 - Two (2) new swivel task chairs for use with desk equal to order no. SUP-12223643 by Superior Chair (Huntington Business Products).
 - Chair mat for each desk area.
 - One (1) new rolling stand with top, Model No. 76MR/76TP from Plan Hold, catalog #27, or equal.
 - One (1) adjustable, heavy-duty three-hole punch, by Master, order no. MAT-1340PB (Huntington Business Products or equal).
 - One (1) 40 sheet capacity heavy-duty two-hole punch, by Master, order no. MAT-327B or equal.
 - One (1) 3-foot x 5-foot cork bulletin board with wall mounting hardware.
 - One (1) 3-foot x 5-foot white board with wall mounting hardware and dry erase marker set
 - One (1) 3-foot x 6-foot metal book shelf
 - 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).
- Thermometer, with indoor and outdoor sensing bulbs, and high, low instantaneous reading, with magnetic reset function by Radio Shack or equal.
- Infrared thermometer, Extech Model #42509.
- Two (2) 23-gallon plastic wastepaper basket.
- Boot brush at each trailer staircases.
- Mud mat at each trailer doorway.
- Three (3) legal size clipboards.
- Five (5) coat hooks or coat rack.
- One (1) 12-inch diameter battery operated wall clock.
- Five (5) extension cords, minimum three plug each, three prong type, 50' minimum each
- One large set of triangles, an engineer's scale and an architect's scale.
- Digital Camera and two 4 GB memory cards.
- Tablet Computer.
- Three (3) Surge protection power strips, five receptacles minimum each.
- Two (2) battery back-up units for desk top computer system: CyberPower Intelligent LCD Battery Backup, 825VA/450 Watts
- One (1) printer, scanner and fax machine with 8½ x 11, 8½ x 14 and 11 x 17 double sided 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, Dell or equal. The Contractor shall provide the following items at a minimum as provided by Dell or equal.
 - Processor: 10th gen Intel® Core™ i7-10850H Processor (2.7GHz, 12M cache)
 - Operating System: Windows 10 Professional English/French 64bit
 - Office Productivity Software: Microsoft® Office Professional 2019, English, French and Spanish
 - Dell Data Protection |Encryption Security SW: 1 Year ProSupport Plus with Next Business Day Onsite Service
 - Adobe Creativity and Productivity Software: Adobe® Acrobat® Professional 2020
 - Video Card: Nvidia GeFroce MX250 Discrete Graphics with Thunderbolt for Intel 10th Gen Core i7-10850HIntel® Integrated HD Graphics 4400
 - Hard Drive: 500GB Solid State Hybrid DriveM.2 512GB PCIe NVMe Class 40 Solid State Drive
 - Latitude 15 5000 SeriesChassis Options: Latitude 15 5000 5511 SeriesBottom Door L10
 - Memory: 4GB (1x4GB) 1600MHz DDR3L Memory16GB, 1x16GB, DDR4 Non-ECC
 - Internal Keyboard: Internal English Single Pointing Keyboard Dual Pointing US English Keyboard Backlit with 10 Key Numeric Keypad
 - Optical Drive: 8X DVD+/-RW
 - Wireless Driver: Intel® Dual Band Wireless-AC 7260 + BT 4.0 DriverIntel Wi-Fi 6AX201 2x2 802.11ax 160MHz + Bluetooth 5.1
 - Wireless: Intel® Dual Band Wireless-AC 7260 802.11AC Wi-Fi + BT 4.0LE Half Mini Card
 - Non-Microsoft Application Software: Additional Software for Window 7 Downgrade
 - Power Supply: 65W A/C Adapter (3-pin)
 - Camera: Light Sensitive Webcam and Noise Cancelling Digital Array Mic
 - LCDDisplay: 15.6" FHD (1366x768)1920 x 1080) Wide View Anti-Glare WLEDbacklit Non-Touch, RGB Cam & Mic, WLAN/WWAN Capable
 - Palmrest: No Fingerprint Reader (Single Pointing) Palmrest
 - FGA Module: Alpine15_R1_106/US/BTS
 - 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, 1250W minimum.
- One (1) refrigerator.
- Bottled drinking water supplied by a service to the site; provide refrigerated drinking fountains with a spigot. Disposable drinking cups shall always be furnished and supplied.
- 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.
- K. All facilities, equipment and utilities furnished under this section shall always be provided and maintained in good working order . In addition, the Contractor shall furnish all necessary washroom supplies. All utility costs for telephone, DSL, etc. shall be paid for by the Contractor for the duration of the project.
- L. 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, refrigerator, 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.

2.03 - TELEPHONE SERVICE

A. Provide on-site telephone line and service, answering machine, and fax machine in Engineers field trailer.

2.04 - INTERNET SERVICE

A. Provide high-speed internet access (minimum 50 mbps) to computer to be used by Owner and Engineer.



2.05 – WATER SERVICE

A. Provide a water service with backflow prevention and freeze in accordance with water utility and health department requirements to serve plumbing fixtures in trailer.

2.06 - WASTEWATER DISPOSAL

- A. Provide a sewer connection or wastewater holding tank with freeze protection below trailer if trailer provided with bathroom.
- B. If wastewater holding tank utilized, provide pump out service to maintain holding tank.

2.07 - REMOVALS

A. Remove all items provided under this Section except as otherwise specified.

PART 3 - EXECUTION

3.01 - REMOVAL OF UTILITIES, FACILITIES AND CONTROLS

- A. Remove temporary above grade or buried utilities, equipment, facilities and materials.
- B. Remove underground installations to a minimum depth of 2 feet or as specified elsewhere.
- C. Regrade area to existing slope and elevation and restore the surface to its existing condition or to the condition shown on the Contract Drawings.
- D. Inventory all equipment that has been turned back to the Contractor prior to agreeing to final payment.



PART 1 - GENERAL

1.01 - DESCRIPTION

- A. Scope:
 - The Contractor shall provide temporary fire protection at the Glen Cove WWTP 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.
 - 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



PART 1 - GENERAL

1.01 - DESCRIPTION

- A. Temporary system of pumps, pipes and appurtenances to convey sanitary wastewater to allow the work to be performed.
- B. Standby equipment for the temporary sanitary wastewater conveyance system to assure continuous operation.

1.02 SYSTEM DESCRIPTION

- A. Each temporary pump shall be capable of conveying the design operating flow rate as coordinated with the Owner. The flow varies throughout the day. The lowest flow typically occurs between the hours of 1:00 a.m. and 6:00 a.m. Flow will be higher during precipitation. The Contractor shall be responsible for determining pump duty point and total dynamic head (TDH) based on final suction and discharge piping layout.
- B. Provide pump control elements such as floats to prevent surcharging of wastewater into the piping system and overflow from structures.
- C. Pumps handling raw and partially treated wastewater shall be capable of passing a sphere of at least 3-inches in diameter. Pump suction and discharge openings shall be at least 4-inches in diameter.
- D. Maintain sanitary conditions to allow work to be performed. Protect equipment, suction piping and discharge piping main from inclement weather, freezing conditions and traffic.
- E. Prevent leakage and spillage of wastewater.
- F. Provide walkways over obstructions on sidewalks to maintain pedestrian traffic.
- G. Provide ramps or below grade piping to maintain vehicular traffic.
- H. Provide alarm system to indicate increase above normal operating liquid level in tank.
- I. Electrical system and components in sewers and raw wastewater wet wells shall comply with the National Electric Code requirements for Class I, Group D, Division 1 locations.
- J. Provide spare suction and discharge piping at the project site.
- K. For temporary sanitary wastewater conveyance systems located in roadways, provide signs and traffic controls in accordance with the State Manual of Uniform Traffic Control Devices.



L. Obtain confined space entry permit from Owner.

1.03 - SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Provide a written plan of the proposed temporary sanitary wastewater conveyance system to the Engineer at least three weeks prior to the need for the system. The written plan shall include number size and type of pumps, material, diameter and proposed route of piping and/or hoses, control system, back-up and spare equipment, method to protect system components from damage, and estimated duration of bypass operation.
- C. Include the following for each site requiring bypass pumping:
 - 1. Staging areas for pumps and ancillary equipment.
 - 2. Flow stoppage system, including pipe and channel plugging method and types of plugs.
 - 3. Number, size, material, location and method of installation of all piping and valves.
 - 4. Sections showing suction and discharge pipe depth and embedment, if applicable.
 - 5. Pump and pipe anchoring details.
 - 6. Suction tube installation, bracing and support in the sewer.
 - 7. Discharge pipe thrust and restraint block sizes and locations.
 - 8. Temporary pipe supports and anchoring required.
 - Plan indicating proposed location of bypass pumping line locations including provisions for access to bypass pumping locations. Drawings shall include standard scale and dimensions to existing referenced site features.
 - 10. Downstream discharge plan.
 - 11. Method of protecting discharge manholes or structures from erosion and damage.
 - 12. Bypass pump dimensions, capacity, pump performance curves, quantity of pumps and power requirements.
 - 13. Calculations for selection of bypass pumping pipe size including static lift, friction losses and flow velocity.



- 14. Pump curves showing pump operating range plotted against the system head curve.
- 15. Pump diesel engine sizing, dimensions, emissions data and location plan.
- 16. Standby power generator size and location.
- 17. Engine and pump noise enclosure details.
- 18. Engine fuel consumption curves.
- 19. Fuel storage tank details.
- 20. Qualifications of site pump operators.
- 21. Complete information on instruments, including calibration certificates.
- 22. Complete operating procedures, including mode of operation, sequence of starting and stopping the pumps and coordination with Owner's staff.
- D. Submit a list of twenty-four (24) hour emergency telephone numbers, which shall include the Project Manager, foreman and a responsible representative from the pump supplier

PART 2 - PRODUCTS

2.01 - PRODUCTS

- A. Provide close coupled centrifugal pump with vacuum priming compressor mounted to a diesel engine or electric motor on skid base or two-wheeled highway trailer, or submersible pump.
- B. Provide solids handling ball type check valve with flexible rubber seat and quick release access feature with centrifugal pumps.
- C. Provide compact unit mounted on skid base or two-wheeled highway trailer.
- D. Provide fuel storage capacity to operate continuously for twenty-four (24) hours without refueling. Provide auxiliary fuel containers to supplement integral fuel tanks as required. Deliver fuel only during normal daytime working hours. Provide spill containment around fuel storage tanks and at tank fill.
- E. Engines shall be equipped with critical silencers and be housed to minimize noise to comply with the applicable noise code regulations.
- F. Provide suction hose from source to pump.



- G. Discharge Piping: Construct using rigid pipe with positive, restrained joints to withstand at least twice the maximum system pressure or 50 psi, whichever is greater. All piping and fittings shall be steel with Victaulic couplings or flanged joints, or fused high-density polyethylene pipe as manufactured by Performance Pipe or equal. Do not use aluminum irrigation type piping or glued PVC pipe. Discharge hose shall only be allowed in short sections and by specific written permission from the Engineer.
- H. Furnish start and stop mercury free float switches to automatically control the operation of the pumps in response to level changes. In the event that a high level is imminent, the control system shall immediately activate the standby pumping system
- I. Road Crossings: Fabricated of galvanized steel and engineered to provide minimal head-loss when used on pumping projects. Road crossing shall be manufactured to remain in compliance with federal bridge laws of 20,000 lbs. single axle. Entrance and exit ramps shall be sloped. Piping connections shall be flanged. Vehicle width clearance 12 feet. Tie downs at each corner out of path of vehicle travel. Manufacturer: Rain for Rent.
- J. Provide temporary lighting at the location of the temporary pumping system.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Furnish all labor, materials, equipment and appliances necessary to maintain both vehicular and pedestrian traffic, to protect the public from all damage to person and property and to minimize inconveniences to the facilities adjacent to the work areas for the duration of the use of the temporary sanitary wastewater conveyance system in accordance with the Contract and the appropriate State, County or local agency.
- B. Install, operate and maintain bypass pumping system in accordance with manufacturer's instructions.
- C. Install plugs or other devices to prevent flow into out of service facilities.
- D. Test temporary conveyance system for a minimum of two hours of continuous run time to the satisfaction of the Engineer prior to usage.
- E. System shall require low level of maintenance, typically confined to checking engine oil levels and seal cavity oil levels. Supply all necessary lubrication, fuel and supplies necessary to maintain the entire installation.
- F. Provide personnel to continuously operate the bypass system to assure continuous wastewater



conveyance for entire time use of the system is required.

- G. Conduct work to minimize duration of bypass pumping system operation.
- H. Provide road crossing to keep pedestrian and road traffic moving during temporary conveyance system operation. Secure road crossing to roadway. Provide traffic delineators to direct vehicles through road crossing.
- I. Restore roadway where anchors utilized at corners of road crossings.

3.02 FIELD QUALITY CONTROL

- A. Subject the pump discharge piping for all systems to a pressure test of 45-psi or two times operating pressure, whichever is greater, for four (4) hours using clean water prior to actual operation. No loss of pressure or visible leakage will be permitted. Provide blind flanges to allow capping of both ends of the piping during testing. Give Engineer a minimum of twenty-four (24) hours notice prior to commencing testing.
- B. Inspect bypass pumping system every two (2) hours to ensure that the system is functioning properly.
- C. During bypass pumping, do not allow sewer flow to be leaked, dumped, spilled, or discharged in or onto any area outside of the existing sewer system.
- D. In the event of overflow, immediately stop the discharge and take action to clean and stabilize disturbed area at own expense and promptly notify Owner and NYSDEC.



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01517-6



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



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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 – Anchor Systems within 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 statues, 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.

- 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.



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:
 - 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:
 - 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.
 - 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



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



+ + 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 + +

01650-4

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:
 - 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.
 - 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



+ + 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 this Section, shall be taken to mean the General Contract, which shall include general construction work involving the rehabilitation of the existing preliminary treatment grit collection systems and installation of new influent screenings equipment, screenings washer compactors, screenings conveyors, influent pumps, hydraulic gates, and appurtenances in the Headworks Building at the Glen Cove WWTP.
- 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 Owner 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.



- F. Except as otherwise permitted, vehicular access to all treatment units and buildings must always be maintained. 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. 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 Owner 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.
- I. 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 each respective Proposal Item number.
- J. 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 Owner. Any required service interruption or shutdowns affecting Plant operation shall be coordinated with and scheduled at times suitable to the Owner. The Contractor shall not remove any items from service without written permission from the Owner. 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 Owner, 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.
- K. 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 Owner. A written request should be received by the Owner 24 hours in advance of beginning the work. The Contractor is responsible for coordination with the Owner 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 Owner.

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- L. 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 Owner 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.
- M. The Contractor shall keep the Owner 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.
- N. 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 Owner.
- O. 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.
- P. 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 Owner. All primes are required to coordinate their work to maintain unobstructed vehicular access.
- Q. 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.



- R. The existing potable water system and fire service supply system shall be kept in operation at all times. All connections to the plant potable water system shall be approved by the Owner 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.
- S. 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 Owner reserves the right to request additional lighting at no additional cost to the Owner.
- Τ. 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 Owner. 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 Owner 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.
- U. 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 Owner 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 approval of shutdown request from the Owner 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 near 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.

- V. The Contractor shall take all protective measures to the satisfaction of the Engineer necessary to ensure 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.
- W. 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 Owner. 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.
- X. Various requirements are listed below that must be complied with during work associated with the Contract, which includes general construction work involving the rehabilitation of the existing preliminary treatment grit collection systems and installation of new influent screenings equipment, screenings washer compactors, screenings conveyors, influent pumps, hydraulic gates, and appurtenances in the Headworks Building at the Glen Cove WWTP.
 - 1. At the Contractor's request, the Owner shall completely stop grit collection and conveyance operations and allow the Contractor to bypass the grit collector and associated conveyors for a maximum period of sixty (60) days to facilitate rehabilitation of the circular grit collector tank and replacement and/or rehabilitation of the specified grit collection and conveyance equipment and tie-in work by the Contractor. Contractor shall be responsible for maintaining all equipment and appurtenances associated with the grit collection and conveyance system that are scheduled to remain. Damage to any grit collection and



conveyance equipment scheduled to remain shall be repaired/replaced by the Contractor at no additional cost to the Owner. 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. When connection of new grit collection and conveyance equipment to existing process systems requires a shutdown of existing systems, except for the final connections, the systems shall be tested prior to proceeding with the shutdown. When the final connection(s) is(are) complete, the newly improved process systems shall be tested again in its entirety. The Contractor shall provide all pumps, piping, valves, etc., as necessary to dewater all conduits, channels, pipes, tanks as required to perform the specified work

- 2. At the Contractor's request, the Owner shall completely stop the aeration tank foam spray pumps and allow the Contractor to extend new piping off the end of the existing spray foam feed header for a maximum period of four (4) hours to facilitate installation of washwater booster pump manifold piping tie-in work by the Contractor. Contractor shall be responsible for maintaining all equipment and appurtenances associated with the aeration tank foam spray system that are scheduled to remain. Damage to any aeration tank foam spray equipment scheduled to remain shall be repaired/replaced by the Contractor at no additional cost to the Owner. 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. When connection of washwater booster pump manifold piping to existing process systems requires a shutdown of existing systems, except for the final connections, the systems shall be tested prior to proceeding with the shutdown. When the final connection(s) is(are) complete, the newly improved process systems shall be tested again in its entirety. The Contractor shall provide all pumps, piping, valves, etc., as necessary to dewater all conduits, channels, pipes, tanks as required to perform the specified work.
- 3. 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.
- 4. 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.

- 5. 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.
- Y. 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.
- Z. The Contractor is required to conduct a day meeting (working meeting) with the Owner 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.

1.04 - 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. Section 01010-1.09 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 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 of existing Headworks Building (between Primary Settling Tanks 1 and 2 and 3 and 4), Control Building basement area (north of Aeration Tanks) and utility tunnel connecting the Control Building basement area to Headworks Building.

GENERAL DESCRIPTION OF WORK

 Modifications to existing Headworks building equipment including but not limited to; installation of new bar screens, washer compactors; replacement of existing isolation slide gates; installation of new booster pump system for washer compactor wash water; rehabilitation of existing grit chamber and mechanical equipment; removal and replacement of existing grit collector motor and gear reducer; removal and replacement of existing influent pumps and controls; replacement of MCC's HWA/HWB; modification of electrical and HVAC systems.

CONSTRAINTS, REQUIREMENTS AND SEQUENCE OF WORK ACTIVITIES

- 1. <u>Working Meeting</u> 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 construction and demolition.
- <u>Shop Drawings</u> 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 mechanical equipment and associated appurtenances to existing facilities and disconnect/demolish existing facilities identified for demolition.
- 3. <u>Preliminary Treatment System Improvements</u> Contractor shall coordinate all temporary shutdowns with treatment facility operations personnel to minimize disruption to operations.

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 deenergized and locked-out/tagged-out by treatment facility operations personnel:

a. Contractor shall coordinate the power and control transfer for the existing loads scheduled to remain from existing MCC-HWA to the Temporary Power Equipment (TPE). GC WWTP operations personnel will isolate one primary settling tank at one time to minimize impacts to the process operations that may result from de-energizing dedicated settling tank drives.



- b. The power and control transfer for each Primary Settling Tank drive shall be completed by the Contractor within one (1) 8-hour shift.
- c. Contractor shall coordinate the transfer of the loads after the TPE has been installed, tested, and determined ready for service.
- d. Contractor shall coordinate with GC WWTP operations personnel as to when each primary settling tank drives power and control feeds have been temporarily transferred to the TPE and then again when permanently transferred to the new MCC and are ready for use.
- e. The existing loads scheduled to remain on MCC-HWB shall not be transferred to the TPE until the loads from existing MCC-HWA have been transferred back to the new MCC-HWA after existing MCC-HWA has been demolished and new MCC-HWA has been installed, tested and determined ready for service.
- f. Existing loads scheduled to remain on MCC-HWB shall be transferred to the new MCC-HWB after the existing MCC-HWB has been demolished and new MCC-HWB has been installed, tested, and determined ready for service.
- g. New influent pumps are not permitted to be tested and/or placed into operation until after at least one (1) new screen, the grit collection and conveyance process improvements, associated new MCC, and new manifold piping and valves have been installed, tested, determined ready for service, and placed into beneficial use and the associated wet well and grit collector tank have been cleaned and accepted for beneficial use.
- 4. <u>Training</u> Training of Plant staff and the submission of O&M manuals shall be completed prior to the start-up of the first bar screen & washer/compactor pair including controls and prior to the startup of the influent pumps and controls and not before the existing preliminary treatment facilities are taken offline for modification as specified herein this Contract.

NO.	ITEM	CALENDAR DAYS	CUMULATIVE CALENDAR DAYS
1a	Notice to Proceed and Working Meeting	1	1
1b	Shop drawings	45	45
2	Contractor mobilization	14	59
3	Preliminary Treatment Improvements construction period		637
4	Start-up, Testing & Training	14	651
5	Project closeout	14	665

SCHEDULE 01700-2 CONSTRUCTION SCHEDULE



Notes:

- The sequence of work activities is for illustrative purposes. The Owner will determine the order of preliminary treatment improvement work based primarily on process needs and existing equipment condition. The Contractors shall coordinate with the Owner to sequence the fabrication and delivery of equipment, and installation, start-up, and testing accordingly.
- 2. 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	Construction of Temporary Power Equipment (TPE)	01700-13
2	Migrate loads from MCC-HWB to the TPE and remove and install new MCC-HWB	01700-14
3	Remove and dispose of existing hydraulic gates and install new hydraulic gates	01700-15
4	Remove and dispose of existing Bar Screen #3, Influent Pump #3, Influent Pump #4, and grit collection and conveyance system and install new Bar Screen #3, Influent Pump #3, Influent Pump #4, HVAC systems and grit collection and conveyance system, connect new and migrate existing electrical loads from TPE to new MCC-HWB.	01700-15
5	Migrate electrical loads from MCC-HWA to the TPE and remove and install new MCC-HWA	01700-17
6	Remove and dispose of existing Bar Screen #1, Bar Screen #2, Influent Pump #1, Influent Pump #2, and screenings belt conveyors and install new Bar Screen #1, Bar Screen #2, all three (3) new screenings washer compactors, new screenings shaftless screw conveyors and associated platforms, Influent Pump #1, Influent Pump #2, connect new and migrate existing electrical loads from TPE to new MCC-HWA.	01700-17
7	Install new booster pump system and controls	01700-18
8	Remove and dispose of existing HVAC systems and install new HVAC systems	01700-19

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MAINTENANCE OF PLANT OPERATIONS

Item Number:	Item Description:	Time Constraints:	Processes Out of Service:	General definition of Work to be performed:
1	Construction of Temporary Power Equipment (TPE)		None	Coordinate installation of TPE, see Item 1 for specific requirements
2	Migrate loads from MCC-HWB to the TPE and remove and install new MCC-HWB		None	Coordinate migration of loads from MCC- HWB, see Item 2 for specific requirements
3	Remove existing hydraulic gates and install new hydraulic gates		None	Coordinate hydraulic gate work, see Item 3 for specific requirements
4	Remove existing Bar Screen #3, Influent Pump #3, Influent Pump #4, HVAC systems and grit collection and conveyance system and install new Bar Screen #3, Influent Pump #3, Influent Pump #4, HVAC systems and grit collection and conveyance system, connect new and migrate existing loads from TPE to new MCC-HWB.	Sixty (60) days*	Grit collection and conveyance system	Coordinate MCC-HWB equipment replacement/improvement and rehabilitation of grit collection process in advance of placing new influent pumps online, see Item 4 for specific requirements
5	Migrate loads from MCC-HWA to the TPE and remove and install new MCC-HWA		None	Coordinate migration of loads from MCC- HWA, see Item 5 for specific requirements
6	Remove existing Bar Screen #1, Bar Screen #2, Influent Pump #1, Influent Pump #2, and screenings belt conveyors and install new Bar Screen #1, Bar Screen #2, all three (3) new screenings washer compactors, new screenings shaftless screw conveyors and associated platforms, Influent Pump #1, Influent Pump #2, connect new and migrate existing loads from TPE to new MCC-HWA.		None	Coordinate MCC-HWA equipment replacement/improvement and demolition of existing belt conveyors and associated access platform, see Item 6 for specific requirements
7	Install new booster pump system and controls	One (1) 4-hour service interruption	Existing aeration tank foam spray pump system	Coordinate installation of new booster pump system and controls, see Item 7 for specific requirements

*Restriction for work associated with the rehabilitation of the grit collection and conveyance process systems

GENERAL NOTE: The existing preliminary treatment process must remain fully operational during construction of the new preliminary treatment process facilities. Any construction/demolition that effects the existing preliminary treatment 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 regard to the requirements set forth.



SEQUENCE OF CONSTRUCTION:

Item 1: Construction of Temporary Power Equipment (TPE)

- 1. The Contractor shall be responsible for the design and construction of the temporary power equipment (TPE) in the approximate location indicated on the drawings, including but not limited to power panelboard, motor starters, motor overloads, overcurrent protection, safety disconnect switches, and all associated hardware and accessories required for a complete code compliant installation. The TPE shall be designed and constructed as required to provide temporary power throughout construction for all the existing critical loads listed in Tables 1 and 2 below, and the proposed new loads specified in the MOPO index above and identified hereinafter. Prior to construction of the TPE, the Contractor shall submit for review in accordance with specification 01300 the following information as it relates to all equipment proposed to meet the requirements of the TPE:
 - a. Manufacturer's product data including but not limited to the following:
 - Equipment type
 - Equipment quantities
 - Equipment model number
 - Equipment dimensions
 - Pertinent equipment sizes and ratings
 - b. Dimensional floor plans including proposed location of equipment installation.
 - c. Dimensional equipment elevations.
- 2. The tables below represent approximate information obtained from existing equipment considered to be critical, and therefore requiring temporary power throughout construction via TPE. The Contractor is responsible for field verifying existing conditions and confirming all associated ratings, sizes, and other information as required to properly design the TPE.

Table 1 -MCC-HWB Critical Loads Requiring Temporary Power from TPE							
Equipment Name	Load (HP/kW/kVA)	FVNR STARTER SIZE	OVERCURRENT PROTECTION RATING	Approx. FLA (A)	Phase	Voltage	Approx. Load (kW)
Pipe Tunnel Exhaust Fan	.75 HP	NEMA 1	3A/3P	2	3	480	1.66
Grit Chamber Conveyor CP	N/A	NEMA 1 (x2)	15A/3P	10	3	480	8.31
Primary Settling Tank #2	1.25 HP	NEMA 1	15A/3P	3	3	480	2.49
Primary Settling Tank #4	1.25 HP	NEMA 1	15A/3P	3	3	480	2.49
Primary Sludge Pump #2	25 HP	NEMA 2	50A/3P	34	3	480	28.27
Hot Water Heater	34 kW	N/A	70A/3P	41	3	480	34.00
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Panel HWL Transformer	30 kVA	N/A	50A/3P	36	3	480	30.00
Panel HWU Transformer	30 kVA	N/A	50A/3P	36	3	480	30.00
Sump Pump B	10 HP	NEMA 1	30A/3P	14	3	480	11.64
Approximate Total	N/A	N/A	N/A	179	N/A	N/A	148.87

Table 2 - MCC-HWA Critical Loads Requiring Temporary Power from TPE							
Equipment Name	Load (HP/kW/kVA)	FVNR STARTER SIZE	OVERCURRENT PROTECTION RATING	Approx. FLA (A)	Phase	Voltage	Approx. Load (kW)
Weld Hoist	N/A	N/A	15A/3P	12	3	480	9.98
Primary Settling Tank #1	1.25 HP	NEMA 1	15A/3P	3	3	480	2.49
Primary Settling Tank #3	1.25 HP	NEMA 1	15A/3P	3	3	480	2.49
Primary Sludge Pump #1	25 HP	NEMA 2	50A/3P	34	3	480	28.27
Sump Pump A	10 HP	NEMA 1	30A/3P	14	3	480	11.64
Approximate Total	N/A	N/A	N/A	66	N/A	N/A	54.87

Item 2: Migrate loads from MCC-HWB to the TPE and remove and install new MCC-HWB

- 1. Confirm tie circuit breaker is in the open position, locked-out, and tagged.
- 2. Relocate one at a time all critical loads (power and control wiring) currently fed from existing MCC-HWA/HWB side "B" to the TPE. Refer to Table 1 above for a list of existing side "B" critical loads requiring temporary power throughout construction.
- 3. Disconnect existing incoming main power feed for MCC-HWA/HWB side "B" from existing Main Switchgear after opening, locking out, and tagging out the associated main disconnect switch at the Main Switchgear section B-6; pull associated feeders back to wireway below, coil-up, and safe off.
- 4. Perform cable testing of the existing incoming main power feeders for side "B" in accordance with the specifications.
- 5. Label and disconnect power and control wiring for all non-critical loads currently fed from existing MCC-HWA/HWB side "B" and pull back to wireway below.
- 6. Remove and dispose of all non-critical loads fed from existing MCC-HWA/HWB side "B" that are not indicated on drawings to be refed from new MCC-HWA/HWB.
- 7. Remove and dispose of existing MCC-HWA/HWB side "B" in its entirety.

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Item 3: Remove existing hydraulic gates and install new hydraulic gates

- 1. Contractor shall be required to facilitate the demolition of the existing hydraulic gates scheduled for removal such that the following requirements are met:
 - a. Coordinate with Owner such that the preliminary treatment processes are uninterrupted for the duration of the removal of existing hydraulic gates and installation of new hydraulic gates.
 - Provide clear pathway/stairway access (temporary or permanent) and access for operations personnel to perform normal operations duties in vicinity of the hydraulic gate work for the duration required. Daily access to the screens, grit collection and conveyance process area and wet well chambers are required for the duration of the Contract aside from the sixty (60) day temporary shut down period for the grit collection and conveyance system.
- 2. Influent Weir Gate and Slide Gates
 - a. Influent weir gate and slide gates to be removed and not replaced will require temporary bypass pumping in order to perform this work. Provide detailed outline of bypass in accordance with Section 01517.
- 3. Bar Screen Stop Logs and Slide Gates
 - Provide temporary flow isolation within the concrete channel to divert all influent flow towards existing Bar Screens #1 and #2 in order to remove and replace the stop logs and slide gates associated with Bar Screen #3 within the duration of the work associated with Item 4.
 - b. Upon completion of the work associated with Item 4, the temporary flow isolation can be removed.
 - c. Provide temporary flow isolation within the concrete channel to divert all influent flow towards new Bar Screen #3 in order to remove and replace the stop logs and slide gates associated with Bar Screens #1 and #2 within the duration of the work associated with Item 6.
 - d. All temporary isolation methods to be removed upon completion of the new stop logs and slide gates.
- 4. Wet Well Sluice Gates
 - a. Provide temporary flow isolation within the concrete channel to divert all flow towards the East Wet Well in order to remove and replace the inlet sluice gate to the West Wet Well. Provide temporary plate over opening between the two wet wells in order to facilitate the removal of the sluice gate on the common wall.
 - b. Upon completion of the sluice gate to the West Wet Well and the temporary isolation plate, provide temporary flow isolation within the concrete channel to divert all flow towards the West Wet Well.
 - c. Remove and replace the inlet sluice gate to the East Wet Well and the sluice gate on the common wall.
 - d. Upon completion of the work in the East Wet Well, utilize the new sluice gates to isolate the West Wet Well to remove the temporary plate.
 - e. The scheduling of this work to be coordinated with the activities of Items 4 and 6

Item 4: Remove existing Bar Screen #3, Influent Pump #3, Influent Pump #4, HVAC systems and grit collection and conveyance system and install new Bar Screen #3, Influent Pump #3, Influent Pump #4, HVAC systems and grit collection and conveyance system, connect new and migrate existing loads from TPE to new MCC-HWB.

1. Contractor shall Remove and install new equipment as specified for Bar Screen #3, Influent Pump #3, Influent Pump #4, HVAC systems and grit collection and conveyance system including all appurtenances required.

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- 2. Provide and install all new MCC-HWA/HWB side "B" sections in their entirety.
- 3. Reroute and extend (splice as required) existing incoming main power feeder for MCC-HWA/HWB side "B" from the wireway below up to the new main circuit breaker for MCC-HWA/HWB side "B" and terminate.
- 4. Close existing main disconnect switch at the Main Switchgear section B-6 to energize side "B" of the new MCC-HWA/HWB.
- 5. The existing Sewage Pump VFDs are currently fed from circuit breakers located within existing MCC-HWA/HWB. RSP-1 and RSP-3 are currently fed from the "A" side of the existing MCC-HWA/HWB, and RSP-2 and RSP-4 are fed from the "B" side of the existing MCC-HWA/HWB. RSP-1 and RSP-2 serve the east wet well; RSP-3 and RSP-4 serve the west wet well. Two of the four sewage pumps, whose suction piping is connected to the same wet well chamber, shall always be active during construction. This way forward flow to the downstream treatment process areas can always be maintained throughout construction; at no point will the owner be limited to the ability to operate only one pump. Any required partial shutdowns to the VFDs for RSP-1,2,3,4 to allow for the transfer of loads to the new VFDs must be scheduled in advance in accordance with these requirements and any additional requirements as identified on the drawings and in the specifications. At the completion of construction, the new VFDs for RSP-1,2,3,4 shall be fed from the new MCC-HWA/HWB as detailed in the contract drawings and specifications. Below is a summary of the phasing of the replacement of the existing VFDs for RSP-3 & 4:
 - a. To maintain adequate operation of the plant throughout construction, a minimum of two RSPs, both of which are connected to the same wet well chamber, shall be maintained in operation.
 - b. The first phase of the VFD replacement will begin with the disconnection and replacement of influent pumps nos. 3 and 4, to coincide with the replacement of the Headworks Building Motor Control Center MCC-HWA/HWB.
 - c. Once side "B" of the existing MCC-HWA/HWB is removed as per the Headworks Building Motor Control Center (MCC-HWA/HWB) Replacement Detailed Summary above, the VFDs feeding RSP-3 and RSP-4 shall be removed in their entirety to allow for the installation of the new VFDs for the Dry Pit Submersible Pumps Nos. 3 and 4.
 - d. Upon completion of the installation of the new VFDs for the Dry Pit Submersible Pumps Nos 3 and 4, as well as the installation of the new MCC-HWA/HWB side "B", the associated new feeders and conduit shall be installed between MCC-HWA/HWB side "B" and the VFDs. Terminate new conduit and feeders at both ends.
 - e. Energize and test the new VFDs and Dry Pit Submersible Pumps Nos. 3 and 4 in accordance with the contract specifications.
 - f. Upon testing and acceptance of the new VFDs and Dry Pit Submersible Pumps Nos. 3 and 4, the Contractor shall be permitted to proceed to the second phase.
- 6. Test new MCC sections in accordance with specifications and manufacturer's recommendations.
- 7. Upon successful testing, Reroute, extend (splice as required), and re-energize one at a time the existing non-critical load circuits (all associated power and control wiring) from wireway below up to associated circuit breaker within new MCC-HWA/HWB side "B". Remove lock and close associated new MCC-HWA/HWB side "B" circuit breakers to power equipment from new MCC. Confirm proper operation of each load with Owner and Engineer's approval prior to moving on to the next. All circuit breakers feeding loads currently un-connected (or spare circuit breakers) shall be maintained in the open position, locked-out, and tagged until load is connected. See next step.
- Relocate and re-energize one at a time all side "B" critical loads (power and control wiring) from the TPE to side "B" of the new MCC-HWA/HWB. Refer to Table 1 above for a list of existing side "B" critical loads requiring temporary power throughout construction. Reroute and extend (splice as required) all associated wiring as required to terminate at new circuit breaker within NCDP 17-01 01700A-16



MCC-HWA/HWB side "B". Close each circuit breaker one at a time as feeder termination is completed. Confirm proper operation of each load with Owner and Engineer's approval prior to moving on to the next.

Item 5: Migrate loads from MCC-HWA to the TPE and remove and install new MCC-HWA

- 1. Contractor shall migrate loads from MCC-HWA to the TPE.
- 2. Do not proceed until the first phase of the new Dry Pit Submersible Pumps Nos. 3 and 4 are full tested and accepted. Refer to phase 1 of the Headworks Building Sewage Pump Variable Frequency Drives (RSP-1,2,3,4) replacement phased MOPO plan below for additional detail.
- 3. Relocate one at a time all critical loads (power and control wiring) currently fed from existing MCC-HWA/HWB side "A" to the TPE. Refer to Table 2 above for a list of existing side "A" critical loads requiring temporary power throughout construction.
- 4. Disconnect existing incoming main power feed for MCC-HWA/HWB side "A" from existing Main Switchgear after opening, locking out, and tagging out the associated main disconnect switch at the Main Switchgear section A-6; pull associated feeders back to wireway below, coil-up, and safe off.
- 5. Perform cable testing of the existing incoming main power feeders for side "A" in accordance with the specifications.
- 6. Label and disconnect power and control wiring for all non-critical loads currently fed from existing MCC-HWA/HWB side "A" and pull back to wireway below.
- 7. Remove and dispose of all non-critical loads fed from existing MCC-HWA/HWB side "A" that are not indicated on drawings to be refed from new MCC-HWA/HWB.
- 8. Remove and dispose of existing MCC-HWA/HWB side "A" in its entirety, including the existing tie circuit breaker.

Item 6: Remove existing Bar Screen #1, Bar Screen #2, Influent Pump #1, Influent Pump #2, and screenings belt conveyors and install new Bar Screen #1, Bar Screen #2, all three (3) new screenings washer compactors, new screenings shaftless screw conveyors and associated platforms, Influent Pump #1, Influent Pump #2, connect new and migrate existing loads from TPE to new MCC-HWA.

- 1. Contractor shall Remove and install new equipment as specified for Bar Screen #1, Bar Screen #2, Influent Pump #1, Influent Pump #2, and screenings belt conveyors including all appurtenances required.
- 2. Provide and install all new MCC-HWA/HWB side "A" sections in their entirety, including the new tie circuit breaker. Interface with MCC-HWA/HWB side "B" in accordance with the equipment manufacturer's instructions.
- 3. Confirm that the tie circuit is and remains open, locked-out, and tagged throughout construction.
- 4. Reroute and extend (splice as required) existing incoming main power feeder for MCC-HWA/HWB side "A" from the wireway below up to the new main circuit breaker for MCC-HWA/HWB side "A" and terminate.
- 5. The existing Sewage Pump VFDs are currently fed from circuit breakers located within existing MCC-HWA/HWB. RSP-1 and RSP-3 are currently fed from the "A" side of the existing MCC-HWA/HWB, and RSP-2 and RSP-4 are fed from the "B" side of the existing MCC-HWA/HWB. RSP-1 and RSP-2 serve the east wet well; RSP-3 and RSP-4 serve the west wet well. Two of the four sewage pumps, whose suction piping is connected to the same wet well chamber, shall always be active during construction. This



way forward flow to the downstream treatment process areas can always be maintained throughout construction; at no point will the owner be limited to the ability to operate only one pump. Any required partial shutdowns to the VFDs for RSP-1,2,3,4 to allow for the transfer of loads to the new VFDs must be scheduled in advance in accordance with these requirements and any additional requirements as identified on the drawings and in the specifications. At the completion of construction, the new VFDs for RSP-1,2,3,4 shall be fed from the new MCC-HWA/HWB as detailed in the contract drawings and specifications. Below is a summary of the phasing of the replacement of the existing VFDs for RSP-1 & 2:

- a. The second phase of the VFD replacement will begin with the disconnection and replacement of influent pumps nos. 1 and 2, to coincide with the replacement of the Headworks Building Motor Control Center MCC-HWA/HWB.
- b. Once side "A" of the existing MCC-HWA/HWB is removed as per the Headworks Building Motor Control Center (MCC-HWA/HWB) Replacement Detailed Summary above, the VFDs feeding RSP-1 and RSP-2 shall be removed in their entirety to allow for the installation of the new VFDs for the Dry Pit Submersible Pumps Nos. 1 and 2.
- c. Upon completion of the installation of the new VFDs for the Dry Pit Submersible Pumps Nos 1 and 2, as well as the installation of the new MCC-HWA/HWB side "A", the associated new feeders and conduit shall be installed between MCC-HWA/HWB side "A" and the VFDs. Terminate new conduit and feeders at both ends.
- d. Energize and test the new VFDs and Dry Pit Submersible Pumps Nos. 1 and 2 in accordance with the contract specifications.
- e. Upon testing and acceptance of the new VFDs and Dry Pit Submersible Pumps Nos. 1 and 3, the phased replacement of the Headworks Building Sewage Pump Variable Frequency Drives (RSP-1,2,3,4) will be complete.
- f. At the completion of the contract the existing VFDs feeding RSP-1,2,3 and 4 will be removed in their entirety.
- 6. Close existing main disconnect switch at the Main Switchgear section A-6 to energize side "A" of the new MCC-HWA/HWB.
- 7. Test new MCC sections in accordance with specifications and manufacturer's recommendations.
- 8. Upon successful testing, Reroute, extend (splice as required), and re-energize one at a time the existing non-critical load circuits (all associated power and control wiring) from wireway below up to associated circuit breaker within new MCC-HWA/HWB side "A". Remove lock and close associated new MCC-HWA/HWB side "A" circuit breakers to power equipment from new MCC. Confirm proper operation of each load with Owner and Engineer's approval prior to moving on to the next. All circuit breakers feeding loads currently un-connected (or spare circuit breakers) shall be maintained in the open position, locked-out, and tagged until load is connected. See next step.
- 9. Relocate and re-energize one at a time all side "A" critical loads (power and control wiring) that were temporarily powered from the TPE to their respective circuit breaker within MCC-HWA/HWB side "A". Refer to Table 2 above for a list of existing side "A" critical loads requiring temporary power throughout construction. Reroute and extend (splice as required) all associated wiring as required to terminate at new circuit breaker within MCC-HWA/HWB side "A". Close each circuit breaker one at a time as feeder termination is completed. Confirm proper operation of each load with Owner and Engineer's approval prior to moving on to the next.

Item 7: Install new booster pump system and controls

- 1. Contractor shall install the new booster pump system, controls, associated fittings, wiring including all appurtenances required.
- 2. Follow the procedure outlined below; the duration of when the existing aeration tank foam spray pump system will be unavailable shall not exceed eight (8) hours:

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- 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 foam spray pumps will be temporarily taken offline and unavailable.
- c. Remove and dispose of existing blind flange on aeration tank foam spray pump manifold, while maintaining all existing isolation valves to hold back foam spray water in the existing feed piping line. Provide new reducer and flange adapters to connect new booster pump system manifold piping to end of aeration tank foam spray pipe manifold at location of former blind flange.
- d. 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 8: Install new HVAC systems and controls

- 1. Contractor shall install the new HVAC systems, controls, associated fittings, wiring including all appurtenances required.
 - a. Provide all temporary HVAC systems required to maintain safe working conditions for the duration of the work until the new systems are tested and in permanent operations.
 - b. Coordinate the new HVAC work with the other items in this specification as to not affect the necessary timelines.
 - c. All existing roof penetrations to be reused must be protected with temporary railing and coverings to maintain fall and weather protection.

+ + END OF SECTION + +



+ + NO TEXT ON THIS PAGE + +

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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:
 - 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:
 - At the completion of the Work, Contractor shall furnish to the Engineer record drawings 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, on CD-R one (1) electronic bound AutoCAD drawing set in Release 2012 or later and one (1) compiled PDF set 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 sets of 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. Three (3) copies of the approved lubrication survey shall be furnished prior to final acceptance.

1.03 - SPARE PARTS AND SPECIAL TOOLS

- A. Spare Parts:
 - 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.
 - 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 shut-down 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.
 - 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 three (3) 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					
ltem	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.

- 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:
 - 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):
 - Define the recommended PM program and schedules for each system and equipment item.
 - 2) Describe PM procedures.



- 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	Description of Equipment	Minimum Training Time
11285	Hydraulic Gates	4 hours
11316	Dry-Pit Submersible Pump	1 Trip, 1 Day
11318	Booster Pump	1 Trip, 1 Day
11332	Sewage Bar Screen	1 Trip, 1 Day
11334	Screenings Washing and Compacting Equipment	1 Trip, 1 Day
13420	Primary Sensors and Field Instruments	3 Days
13440	Panel Mounted Instruments and Devices	3 Days
15785	Packaged Energy Recovery Units	4 hours
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 Manual Transfer Sv		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
 - I. 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 nonrecyclable 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:
 - 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 - SUMMARY

- A. This Section specifies the Contractor's responsibilities in the commissioning process. Commissioning requires the participation of the Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents.
- B. The commissioning process integrates the traditionally separate functions of system documentation, equipment startup, performance testing and training. Commissioning during the construction phase is intended to achieve the following specific objectives in accordance with the Contract Documents:
 - 1. Verify and document that applicable equipment and systems are installed according to the manufacturer's recommendations, contract requirements, and industry standards, and that they receive adequate operational checkout by installing contractors.
 - 2. Verify and document proper performance of equipment and systems.
 - 3. Verify and document that O&M documentation is complete.
 - 4. Verify and document that Owner personnel are properly trained.
- C. The systems and equipment to be commissioned are listed in this Section. The Contractor's general commissioning requirements and coordination are detailed in this Section. Specific requirements for commissioning of each system or piece of equipment are detailed in the specification Section for the individual systems or pieces of equipment. A detailed description of the overall commissioning process is included in the Schedule.
- D. The commissioning process does not reduce the responsibility of the Contractor to provide finished and fully functional systems and equipment.

1.02 - SYSTEMS TO BE COMMISSIONED

- A. The following systems will be commissioned in this project. Specific requirements for the commissioning of each system are included in the related specification Section.
 - 1. Temperature Control System
 - 2. Ventilation Systems
 - 3. Unit Heaters

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- 4. Influent Pumps
- 5. Check Valves
- 6. Pump Control Panel
- 7. Bar Screens
- 8. Bar Screen Control Panel
- 9. Washer Compactors
- 10. Washer Compactor Control Panel
- 11. Booster Pumps
- 12. Booster Pump Control Panel
- 13. Grit Collector Motor and Drive
- 14. Grit Conveyors
- 15. Lighting Fixtures
- 16. Motor Control Center
- 17. Variable Frequency Drives (VFD's)
- 18. Pump Motor Starters
- 19. Manual Transfer Switch
- 20. Fire Alarm System
- 21. Alarm System
- 22. Hydraulic Gates
- B. Example Commissioning Documents: Equipment and system specific Pre-Functional Checklists and Functional Test procedures will be developed by the Commissioning Authority based on approved submittals, and then will be provided to the Contractors.



1.03 DEFINITIONS

- A. Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.
- B. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes in accordance with the Contract Documents.
- C. Commissioning Plan: An overall plan that provides the structure, schedule and coordination planning for the commissioning process.
- D. Commissioning Team: The members of the commissioning team consist of the Owner's representative (s), the Contractor, the architect/engineer.
- E. Deferred Functional Tests: Functional tests that are performed after substantial completion, due to partial occupancy, seasonal requirements, design or other site conditions that prevent the test from being performed prior to substantial completion.
- F. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents.
- G. Factory Testing: Testing of equipment on-site or at the factory by factory personnel.
- H. Functional Performance Test (FT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The Contractor develops the functional test procedures in sequential written form. The Owner's representative coordinates, oversees and documents the actual testing. The Contractor performs the functional tests. FTs are performed after prefunctional checklists and startup is complete.
- Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order to minimize the total construction time. Commissioning shall be provided for each phase according to the schedule for that phase. Some repetition and/or remobilization may be required.
- J. Prefunctional Checklist (PC): A list of items to inspect and component tests to conduct to verify proper installation of equipment prior to initiating functional testing.
- K. Startup: The initial starting or activating of dynamic equipment, including executing prefunctional checklists.

1.04 - COORDINATION

- A. All members of the commissioning team shall work together to fulfill their contractual responsibilities and meet the objectives of the Contract Documents.
- B. Integrate all commissioning activities into the approved progress schedule. All parties will address scheduling problems and make necessary notifications and changes in a timely manner in order to expedite the commissioning process and maintain the approved progress schedule.

1.05 - COMMISSIONING PROCESS

- A. Commissioning Plan. The commissioning plan provides guidance in the execution of the commissioning process. Following the initial commissioning scoping meeting the Owner's representative will update the plan which is then considered the "final" plan, although it may be revised as the project progresses.
- B. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur. A more detailed description of the commissioning process can be found in the Appendix.
 - 1. Commissioning during construction begins with a scoping meeting conducted by the Owner's representative where the commissioning process is reviewed with the Commissioning Team.
 - Additional meetings will be required throughout construction, scheduled by the Owner's Representative, to plan, scope, coordinate, and schedule future activities and to resolve problems. When possible, commissioning meetings will be scheduled immediately following construction meetings.
 - 3. Equipment documentation is submitted to the Engineer during the submittal process, including detailed start-up procedures.
 - 4. The Owner's representative works with the Contractor to develop startup activity lists and startup documentation. The Owner's representative provides pre-functional checklists to be completed by the Contractor during the startup process.
 - 5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels. In each case prefunctional checklists are completed, submitted, and approved before functional testing begins.

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- 6. The Contractor executes and documents the prefunctional checklists, and provides notification to the Owner's Representative. The Contractor performs startup and initial checkout. The Owner's representative documents that the checklists and startup were completed according to the approved plans.
- 7. The equipment manufacturer develops specific equipment and system functional performance test procedures. The Contractor reviews the procedures and submits suggestions or comments. Procedures are finalized by the Owner's representative.
- 8. The procedures are executed by the Contractor.
- 9. Items of non-compliance in material, workmanship, or setup are corrected and retested at the Contractor's expense. The Contractor is responsible for providing all resources, manpower, and materials necessary to rectify deficiencies as per requirements of the approved schedule.
- 10. The O&M documentation prepared by the Contractor is reviewed for completeness by the Owner's representative.
- 11. Commissioning is completed before Substantial Completion.
- 12. The Owner's representative reviews, pre-approves and coordinates the training provided by the Contractor and verifies that is was completed.
- 13. Deferred testing is conducted, as specified or required.

1.06 - CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor's commissioning responsibilities are as follows (all references apply to commissioned systems and equipment only):
 - 1. Construction and Acceptance Phase:
 - a. Attend the commissioning scoping meeting and other necessary meetings scheduled by the Owner's Representative to facilitate the commissioning process.
 - b. Facilitate the coordination of the commissioning work by the Owner's representative, and with the Owner's representative ensure that commissioning activities are being scheduled into the approved progress schedule.

- c. Provide detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, factory test reports, and full warranty information, including all responsibilities of the Director to keep the warranty in force. The installation, start-up and checkout materials that are actually shipped with the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Owner's representative. The Owner's representative may request further documentation necessary for the commissioning process.
- d. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
- e. Ensure that all subcontractors execute their commissioning responsibilities according to the Contract Documents and approved progress schedule.
- f. Assist in the process of writing detailed test procedures by clarifying the operation and control of commissioned equipment.
- g. Review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
- h. Develop a full start-up and testing plan using manufacturer's start-up procedures and the prefunctional checklists from the Owner's representative for all commissioned equipment. Submit to the Owner's representative for review and approval prior to startup.
- i. During the startup and initial checkout process, execute all portions of the prefunctional checklists for all commissioned systems and equipment. Verify that system installations include all ports, gages, thermometers, access doors, valves, etc., required for specified functional performance testing.
- j. Provide all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment.
- k. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the Owner's representative.
- I. Address incomplete Work before functional performance testing.
- m. Provide skilled technicians to execute startup of equipment and to execute the functional performance tests. Ensure that they are available and present during

the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

- Provide skilled technicians to perform functional performance testing under the direction of the Owner's representative for specified equipment. Provide Manufacturer's Representative as required and as specified in the Specification. Assist the Owner's representative in interpreting the monitoring data, as necessary.
- o. Correct deficiencies (differences between specified and observed performance) as directed by the Owner's Representative.
- p. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions. Provide a copy of the O&M manuals and submittals of commissioned equipment to the Owner's representative for review and approval.
- q. Provide training as specified.
- r. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
- 2. Warranty Period:
 - a. Execute seasonal or deferred functional performance testing in accordance with the specifications.
 - b. Correct deficiencies and make necessary adjustments to O&M manuals and asbuilt drawings for applicable issues identified in any seasonal testing.

PART 2 - PRODUCTS

2.01 - TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Contractor.
- B. Specified special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment shall be provided by the Contractor, and turned over to the Owner at the completion of the Work.



- C. Datalogging equipment and software required to test equipment shall be provided by the Contractor, but shall not become the property of the Owner.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.01 MEETINGS

- A. Scoping Meeting. Prior to the commencement of construction, the Owner's representative will schedule, plan and conduct a commissioning scoping meeting with the Commissioning Team.
- B. Miscellaneous Meetings. Other meetings will be planned and conducted by the Owner's representative as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with the Contractor, appropriate sub-contractors and suppliers and the Engineer.

3.02 - START-UP, PREFUNCTIONAL CHECKLISTS, AND INITIAL CHECKOUT

- A. Prefunctional checklists and initial checkout shall ensure that the equipment and systems are hooked up and operational. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of systems or equipment.
- B. Start-up and Initial Checkout Plan. The Engineer shall assist the commissioning team members responsible for startup of any equipment in reviewing detailed start-up plans for all equipment. The primary role of the Engineer in this process is to ensure that there is written documentation that each of the manufacturer's recommended procedures have been completed.
- C. Execution of Prefunctional Checklists and Startup.
 - 1. Four weeks prior to startup, the Contractor shall schedule startup and checkout with the Owner's Representative.
 - 2. The Contractor shall execute startup and provide the Engineer with a signed and dated copy of the completed start-up and prefunctional tests and checklists.



3.03 - FUNCTIONAL PERFORMANCE TESTING

- A. Development of Test Procedures. Using the requirements in the specifications, develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Prior to testing, provide a copy of the test procedures to the Engineer who shall review the tests for feasibility, safety, equipment and warranty protection.
- B. Functional performance testing shall document that each system is operating in accordance with the Contract Documents. During the testing process, areas of deficient performance shall be identified. Deficiencies shall be corrected by the Contractor and functional testing shall be rescheduled. The Contractor shall be responsible for all costs associated with re-testing for functional performance.
- C. Each system shall be operated through all modes of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.
- D. Test Methods. Each function and test shall be performed under conditions that simulate actual conditions as closely as possible. The Contractor shall execute the test and shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At the completion of the test, the Contractor shall return all building equipment and systems affected by these temporary modifications to their pre-test condition.

3.04 - OPERATION AND MAINTENANCE MANUALS

- A. O&M Manuals. The specific content and format requirements for the O&M manuals are detailed in Section 01782.
- B. Compile and prepare commissioning documentation for all equipment and systems and include this information in the O&M manuals.

3.05 TRAINING

- A. Coordinate, schedule, and document that all required training has been completed successfully.
- B. The Contractor shall have the following training responsibilities:
 - 1. Provide a training plan two weeks before the planned training.
 - 2. Provide comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment.

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- 3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment.
- 4. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
- 5. Training shall include:
 - a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
 - A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, and any emergency procedures.
 - c. Discussion of relevant health and safety issues and concerns.
 - d. Discussion of warranties and guarantees.
 - e. Common troubleshooting problems and solutions.
 - f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
 - g. Discussion of any peculiarities of equipment installation or operation.

3.06 DEFERRED TESTING

- A. Unforeseen Deferred Tests. If any check or test cannot be completed due to project conditions, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the Owner's Representative. These tests will be conducted in the same manner as the seasonal tests as soon as possible.
- B. Seasonal Testing. Seasonal testing (tests delayed until weather conditions are closer to the system's design conditions) shall be completed as part of this Contract. Make any final adjustments to the O&M manuals and as-builts resulting from information gained during testing.

3.07 SCHEDULE

A. Conduct a test of the facility with transfer from normal power to standby power and transfer from standby power to normal power. The duration of the test under standby power shall be 2 hours.

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- B. Test the function of all loads on emergency power.
- C. Verify building ventilation fan turns off when generator is running.
- D. Verify intake and exhaust louvers open and close based on generator operation.
- E. Verify intake and exhaust louvers open and close based on ventilator operation.
- F. Turn off lead pump in each wet well to demonstrate operation of lag pump.
- G. Turn off lead and lag pumps in each wet well to demonstrate operation of high water and highhigh water level alarms at pump panel and to alarm system.
- H. Manually pump down wet well level to demonstrate operation of low level alarm at pump panel and to alarm system.
- I. Conduct 5-day test to demonstrate operation of entire pump station.
- J. Verify that high level alarms in screenings channels communicate to control panels and to alarm system

+ + END OF SECTION + +



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PART 1 - GENERAL

1.01 - DESCRIPTION

- A. Scope:
 - 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:
 - Demolition and removal Work shall be performed by competent workers 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, work ers on the Site and the public. The Work shall be performed with as little nuisance as possible.



- 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, workers 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.

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- 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 prior to rehabilitation:
 - a. Grit Collector Motor and Drive
- 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 to be 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.

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

C. Fine Aggregate (Sand) shall consist of natural or manufactured siliceous sand, clean and free from deleterious substances, and graded within the following limits:

*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 + +



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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 bar screens, screenings conveyors, and screen access platform.
 - 2. Remove existing grit collector motor and drive.
 - 3. Remove existing grit chamber flow deflection plates.
 - 4. Remove existing grit screw conveyor liner and spiral; protect conveyor equipment to remain.
 - 5. Modify existing conveyor motor access platform as directed by Engineer in the field.
 - 6. Remove existing slide gates and sluice gates shown to be removed on the plans.
 - 7. Remove existing dry-pit influent pumps and associated piping and valves.
 - 8. Remove existing ductwork and associated hangers and supports shown to be removed on the plans.
 - 9. Remove existing odor control scrubber.
 - 10. Remove existing infrared heater.
 - 11. Remove existing exhaust fans.
 - 12. Remove existing gravity relief, gooseneck, and curb cap.
 - 13. Remove existing MCC-HWA and MCC-HWB.
 - 14. Remove existing influent sewer pump VFDs and control equipment.
 - 15. Remove existing transformers and power panels HWU and HWL.
 - 16. Remove existing grating and handrails as directed by Engineer in the field.



- 17. Protect and repair affected areas of the building structure adjacent to the demolition activities within the Headworks Building.
- 18. 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.

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- 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 workers.
- 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.
- 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 p ublished 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 Deaprtment 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 + +



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PART 1 - GENERAL

1.01 - RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 - 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.

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- 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 offsite 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.
 - 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.
 - 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.
 - 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.

+ + END OF SECTION + +



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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.

+ + 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 - 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.
 - 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.



++ END OF SECTION ++



PART 1 – GENERAL

1.01 - SECTION INCLUDES

- A. Site preparation for pressure washing of influent screening channel, grit collection tank and influent wet wells.
- B. Pressure washing requirements.

1.02 – RELATED SECTIONS

A. Section 01710 – 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 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 01710.
- 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 - 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:
 - 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 A1064 "Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete."
- D. Steel wire shall conform to ASTM A1064 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 form 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.
 - 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.
 - 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.
 - 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. 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.
 - 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 doweled 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.
 - 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.
 - 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:
 - 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.



- 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.
 - 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.
- 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 DESCRIPTION

- A. Scope:
 - 1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install cast-in-place concrete.
 - 2. Concrete shall be in accordance with requirements of ACI 301 and ACI 350.5 unless otherwise specified.
 - 3. The Work includes providing concrete consisting of portland cement, fine and coarse aggregate, water, and approved admixtures; combined, mixed, transported, placed, finished, and cured.
 - 4. The Work also includes: Providing openings in concrete to accommodate the Work under this and other Sections, and building into the concrete all items such as sleeves, frames, anchorage devices, inserts, and all other items to be embedded in concrete Work.
- B. Coordination: Review installation procedures under other Sections and coordinate installation of items to be installed in the concrete Work.
- C. Classifications of Concrete:
 - 1. Class "A" concrete includes the following: All concrete, unless otherwise shown or indicated.
 - 2. Class "AF" concrete may be used in lieu of Class "A" concrete for the following: Walls and foundations thicker than 16 inches.
 - 3. Class "AS" concrete shall be provided, where shown or indicated, for slabs not exposed to freezing and thawing where troweled finish is required.
 - 4. Class "B" concrete shall be placed without forms or with simple forms, with little or no reinforcing, and includes the following, unless otherwise shown or indicated:
 - a. Concrete fill within structures.
 - b. Duct banks.
 - c. Unreinforced encasements.
 - d. Curbs and gutters.

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- e. Sidewalks.
- f. Thrust blocks.
- 5. Class "C" concrete shall be provided where shown or indicated for slabs that require enhanced durability against wear.
- 6. Class "D" concrete shall be unreinforced and used where required as concrete fill under foundations, filling abandoned piping, and where "lean concrete" or "mudmat" is shown or indicated in the Contract Documents.
- D. Related Sections:
 - 1. Section 03251 Concrete Accessories.
 - 2. Section 03600 Grouting.

1.02 REFERENCES

- A. Standards referenced in this Section include:
 - 1. AASHTO M 182 Specification for Burlap Cloth Made From Jute or Kenaf and Cotton Materials.
 - 2. AASHTO TP23 Test Method for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.
 - 3. ACI 117 Specifications for Tolerances for Concrete Construction and Materials and Commentary.
 - 4. ACI 301 Specifications for Structural Concrete.
 - 5. ACI 305.1 Specification for Hot Weather Concreting.
 - 6. ACI 306.1 Standard Specification for Cold Weather Concreting.
 - 7. ACI 308.1 Specification for Curing Concrete.
 - 8. ACI 318 Building Code Requirements for Structural Concrete and Commentary.
 - 9. ACI 350/350R Code Requirements for Environmental Engineering Concrete Structures and Commentary.
 - 10. ACI 350.5 Specifications for Environmental Concrete Structures.

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- 11. ASTM C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field.
- 12. ASTM C33 Specification for Concrete Aggregates.
- 13. ASTM C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- 14. ASTM C42/C42M Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- 15. ASTM C94/C94M Specification for Ready-Mixed Concrete.
- 16. ASTM C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
- 17. ASTM C138/C138M Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
- 18. ASTM C143/C143M Test Method for Slump of Hydraulic- Cement Concrete.
- 19. ASTM C150 Specification for Portland Cement.
- 20. ASTM C157/C157M Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
- 21. ASTM C171 Specification for Sheet Materials for Curing Concrete.
- 22. ASTM C172 Practice for Sampling Freshly Mixed Concrete.
- 23. ASTM C231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- 24. ASTM C260 Specification for Air-Entraining Admixtures for Concrete.
- 25. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- 26. ASTM C494/C494M Specification for Chemical Admixtures for Concrete.
- 27. ASTM C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.



- 28. ASTM C882/C882M Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
- 29. ASTM C989 Specification for Slag Cement for Use in Concrete and Mortars.
- 30. ASTM C1017 Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- 31. ASTM C1064/C1064M Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
- 32. ASTM C1077 Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- 33. ASTM C1240 Specification for Silica Fume Used in Cementitious Mixtures.
- ASTM C1260 Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
- 35. ASTM C1293 Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
- 36. ASTM C1567 Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
- 37. ASTM D1042 Test Method for Linear Dimensional Changes of Plastics Caused by Exposure to Heat and Moisture.
- ASTM D3574 Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams.
- 39. ASTM E96/E96M Test Methods for Water Vapor Transmission of Materials
- 40. ASTM E329 Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- 41. ASTM E1643 Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- 42. ASTM E1745 Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- 43. NRMCA National Ready Mixed Concrete Association.

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1.03 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Concrete Testing Laboratory:
 - a. Employ independent testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
 - 1) Testing agency shall be in accordance with ASTM E329 and ASTM C1077.
 - 2) Testing laboratory shall have been inspected and passed within previous two years by Cement and Concrete Reference Laboratory (CCRL) of NIST for testing concrete aggregates, and for preparing and testing concrete trial batches with or without admixtures. Testing laboratory shall provide documentation indicating how deficiencies, if any, in most recent CCRL inspection report were corrected.
 - 3) Selection of testing laboratory is subject to Owner's acceptance.
 - 4) Submit written description of proposed concrete testing laboratory giving qualifications of personnel, laboratory facilities, and equipment, and other information requested by Engineer.
 - 2. Batch Plant: NRMCA Program for Certification of Ready-Mixed Concrete Production Facilities or approved equivalent program.
 - Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in jurisdiction of the Work. Requirement may be waived if individual is Contractor's Licensed Professional Engineer.
 - 4. Flatwork Finisher: Unless otherwise permitted, at least one person on finishing crew shall be certified as an ACI Flatwork Finisher, or equivalent.
 - 5. Water Reducing Admixture Manufacturer:
 - a. Water-reducing admixtures shall be manufactured under strict quality control in facilities operated under a quality assurance program.
 - b. Manufacturer shall maintain a concrete testing laboratory approved by CCRL at NIST.

- c. Manufacturer shall be capable of providing services of qualified field service representatives at the Site.
- B. Laboratory Trial Batch:
 - 1. Each concrete mix design specified shall be verified by laboratory trial batch, unless indicated otherwise.
 - 2. For classes of concrete that require air-entrainment, test the trial batch at highest percentage of air allowed for that class of concrete.
 - 3. Perform the following testing on each trial batch:
 - a. Aggregate gradation for fine and coarse aggregates.
 - b. Fly ash testing to verify meeting specified properties, unless fly ash Supplier submits certification by an independent testing laboratory.
 - c. Slump.
 - d. Air content.
 - e. Compressive strength based on three cylinders each tested at seven days and at 28 days.
 - f. Shrinkage test in accordance with this Section, for Class "A" concrete and Class "AF" concrete.
 - 4. Submit for each trial batch the following information:
 - a. Project identification name and number (if applicable).
 - b. Date of test report.
 - c. Complete identification of aggregate source of supply.
 - d. Tests of aggregates for compliance with the Contract Documents.
 - e. Scale weight of each aggregate.
 - f. Absorbed water in each aggregate.
 - g. Brand, type, and composition of cementitious materials.
 - h. Brand, type, and amount of each admixture.

- i. Amounts of water used in trial mixes.
- j. Proportions of each material per cubic yard.
- k. Gross weight and yield per cubic yard of trial mixtures.
- I. Measured slump.
- m. Measured air content.
- n. Compressive strength developed at seven days and 28 days, from not less than three test cylinders cast for each seven day and 28 day test, and for each design mix.
- Shrinkage test results where required and as specified in this Section. Report results and averages for original length and at zero, seven, 14, 21, and 28 days of drying.
- C. Shrinkage Test:
 - 1. Perform drying shrinkage tests for trial batch as specified in this Section.
 - 2. Drying shrinkage specimens shall be four-inch by four-inch by 11-inch prisms with effective gage length of ten inches; fabricated, cured, dried, and measured in accordance with ASTM C157 modified as follows: remove specimens from molds at an age of 23 hours, plus-or-minus one hour, after trial batching; shall be placed immediately in water at 70 degrees F plus-or-minus three degrees F for at least 30 minutes; and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F plus-or-minus three degrees F. Measurement to determine expansion expressed as percentage of original length shall be made at age of seven days. Length at age of seven days shall be base length for drying shrinkage calculations (zero days drying age). Immediately afterward store specimens in humidity-controlled room maintained at 73 degrees F plus-or-minus three degrees F, and 50 percent (plus-or-minus four percent) relative humidity for remainder of test. Obtain measurements to determine shrinkage expressed as percentage of base length and report measurements separately for seven, 14, 21, and 28 days of drying after seven days of moist curing.
 - 3. Determine drying shrinkage deformation of each specimen as the difference between base length (at zero days drying age) and length after drying at each test age. Determine average drying shrinkage deformation of specimens to nearest 0.0001-inch at each test age. If drying shrinkage of a specimen departs from average of that test age by more than 0.0004-inch, results obtained from that



specimen shall be disregarded. Report results of shrinkage test to nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from same concrete used for preparing drying shrinkage specimens. Tests shall be considered part of normal compression tests for the Work. Allowable shrinkage limitations shall be as specified in Part 2 of this Section.

- D. Component Supply and Compatibility: Provide a certificate of compatibility for all admixture materials.
- E. Sample Panels:
 - 1. Provide Sample panels of wall finishes, each at least 12 inches by 12 inches by three inches thick. Revise Sample panels to produce acceptable finished concrete surfaces.
 - a. Provide additional Sample panels as required if original results are unsatisfactory as determined by Engineer.
 - 2. Continuity of color and texture for exposed concrete surfaces is important. Maintain such controls and procedures, in addition to those specified, as necessary to provide continuous match of concrete Work with approved Samples.
- F. Mock-up Panels:
 - 1. Provide mock-up panels representative of specified finished surfaces after sample form panels are approved, at locations on the Site directed by Engineer. Form, reinforce, mix, cast, cure, and finish mock-up panels using selected materials and construction methods proposed for the Work. Provide mock-up panels as follows:
 - a. Wall section of L-shaped panels, approximately four feet high by three feet each side by eight inches thick and set on an 18-inch wide by eight-inch thick base, unless otherwise shown or indicated. Form faces to represent each specified formed surface finish. Include not less than two form ties, two form panel intersections, one vertical construction joint, and one horizontal construction joint. Construction joints are in Section 03251, Concrete Accessories.
 - b. Column section, approximately four feet high and not less than 12-inch diameter for round sections, and not less than 12 inches in the least dimension for rectangular sections, for each specified formed finish, unless otherwise shown or indicated. Set column sections on a six-inch thick concrete base



extending eight inches beyond column. Chamfer exposed edges of rectangular Sample columns.

- c. Slab-on-grade section, approximately four feet square and minimum of four inches thick for each applied finish, with at least one construction joint and one expansion joint, if used.
- d. Pan-formed section using at least two pan form units. Set units to illustrate method of blending exposed pan joints.
- 2. Reinforce mock-up panels as required to prevent cracking and to be structurally stable or as shown or indicated; reinforcing steel shall not be less than 0.25 percent of the gross concrete cross section in each direction.
- 3. Protect mock-up panels from damage and do not remove approved mock-up panels without written Engineer's permission. When directed by Engineer, demolish mock-up panels and remove from the Site.
- G. Existing Example Panels:
 - 1. Engineer will identify sections of existing concrete that will serve as reference examples of acceptable concrete finishes.
 - 2. If appropriate existing concrete members that adequately define required finishes do not exist, provide Sample panels as specified in this Article.
- H. Designated Finish Sample Areas:
 - 1. Engineer will identify areas of concrete members, to serve as reference examples of acceptable concrete finishes, from first members constructed for each finish.
 - 2. At each area so designated, complete the finish as specified.
 - 3. Where specified concrete finish is not obtained, repair the member to provide an acceptable finish. Adjust construction techniques to produce the required finish.
 - 4. Clearly mark each Sample area with name of specified finish to cause no damage to finish.
 - 5. Protect Sample areas from damage and maintain access to view Sample areas.
- I. Thermal Control Plan



- 1. A thermal control plan shall be developed for all concrete placements in excess of 30 inches in thickness.
- 2. Prior to start of concrete placement, test concrete placements a minimum of 6 feet by 6 feet by the each thickness exceeding 30 inches shall be prepared. The test placements shall have thermisters or thermocouples embedded at the mid-point and within 2 inches of the exposed surface. Temperature readings shall be taken at no less than 30 minute intervals until the peak internal temperature is reached. A timetemperature plot of the internal, surface and ambient air temperature shall be prepared. The temperature of the concrete as it is being placed in the test placement shall be recorded. The temperature rise from placement temperature to maximum internal temperature shall be determined.
- 3. If internal peak temperature exceeds 155 degrees F, one or more of the following actions shall be taken:
 - a. Concrete placement temperature shall be reduced by cooling mix ingredients so that the peak temperature does not reach 155 degrees F.
 - b. The concrete mix design shall be adjusted to use supplemental cementitious materials in quantities that will reduce heat of hydration.
 - c. A lower heat of hydration Portland cement shall be used.
 - d. Means to provide internal cooling of the concrete shall be designed and submitted for approval.
- 4. The thermal control plan shall provide how the thermal gradient from the interior to exterior of the concrete shall be kept within the following limits: 35 degrees F for the first five days after placing, 45 degrees F during six to ten days after placing, and 60 degrees F after 10 days after placing.
- J. Concrete Coordination Conference:
 - Conduct concrete coordination conference to review detailed requirements of Contractor's proposed concrete design mixes, to discuss procedures for producing proper concrete construction, and to clarify roles of the parties involved. Organize and schedule the conference, and prepare and distribute to all parties attending conference minutes of the conference.
 - 2. Conduct concrete coordination conference no later than 14 days after the date the Contract Times commence running. Conference shall be held at mutually agreed upon date and time; conference shall be held at the Site unless otherwise mutually



agreed upon. Notify all parties to attend concrete coordination conference not less than five days prior to scheduled date of conference.

- 3. Additional structure specific concrete construction conferences shall be held as required by the Engineer.
- 4. All parties involved in the concrete Work shall attend concrete coordination conference including, but not limited to, the following:
 - a. Contractor.
 - b. Field testing services representative.
 - c. Concrete Subcontractor (if any).
 - d. Reinforcing steel Subcontractor (if any) and reinforcing steel Supplier and detailer.
 - e. Concrete Supplier.
 - f. Admixture manufacturer's representative.
 - g. Engineer.
 - h. Resident Project Representative (if any).

1.04 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Mix Design:
 - a. List of concrete materials and proportions for the proposed concrete 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 this submittal is approved by Engineer.
 - b. Laboratory Trial Batch Reports: Submit laboratory test reports for concrete cylinders, materials, and mix design tests.
 - c. Submit to Engineer laboratory trial batch test results for proposed mixes at least 15 days prior to start of Work. Do not begin concrete production until associated laboratory trial batch test result submittal has been found in compliance with specifications by Engineer.

- d. Test results per ASTM C33 confirming meets limit on deleterious material in fine aggregate.
- e. Test results per ASTM C1260, ASTM C1293, and ASTM C1567 to determine potential for alkali-silica reactivity.
- f. Certificate of compatibility of combined admixtures.
- g. Certification of mix designer.
- 2. Concrete Supply:
 - a. Ready-mixed Concrete: Submit the following information.
 - 1) NRMCA plant certification.
 - 2) Physical capacity of mixing plant.
 - 3) Trucking facilities available.
 - Estimated average amount of the specified concrete that can be produced and delivered to the Site during a normal, eight-hour day, excluding output to other customers.
- 3. Product Data:
 - a. Manufacturers' specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
- 4. Samples:
 - a. Submit Samples of materials as specified and as requested by Engineer. Include with each sample names of product and supplier, and description.
 - b. Colored Cement Pigment Color Samples: Submit complete selection of manufacturer's standard and custom colors for final selection by Engineer.
- 5. Thermal Control Plan:
 - a. Submit plan for controlling internal temperature and temperature gradients within specified limits.
- 6. Curing and Protection Plans:

- a. Submit detailed plan for curing and protection of concrete placed and cured in cold weather.
- b. Submit detailed plan for curing and protection of concrete placed and cured in ambient temperatures over 80 degrees F.
- B. Informational Submittals: Submit the following:
 - 1. Certifications:
 - a. Notarized certification of conformance to reference standards used in this Section, when required by Engineer.
 - b. Flatwork finisher certification.
 - 2. Delivery Tickets: Copies of all delivery tickets for each load of concrete delivered to or mixed at the Site submitted prior to unloading. Each delivery tickets shall contain the information in accordance with ASTM C94 requirements of sections 14.2.1 through 14.2.10 along with project identification name and number (if any), date, mix type, mix time, quantity and amount of water initially withheld and introduced on site.
 - 3. Submit copy of water-reducing admixtures manufacturer's quality assurance handbook to document program existence.
 - 4. Minutes of the Concrete Coordination Conference and other subsequent structure specific concrete construction conferences.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Transportation, Delivery, and Handling:
 - 1. Materials used for concrete shall be clean and free from foreign matter during transportation and handling, and kept separate until measured and placed into concrete mixer.
 - Implement suitable measures during hauling, piling, and handling to ensure that segregation of coarse and fine aggregate particles does not occur and grading is not affected.
- B. Storage: For storage, provide bins or platforms with hard, clean surfaces.



PART 2 – PRODUCTS

2.01 CEMENTITIOUS MATERIALS

- A. Cement:
 - 1. Portland cement shall be Type II(MH) ASTM C150. Type I or Type II may be used in lieu of Type II (MH) when approved by Engineer.
 - 2. Portland cement shall be produced by one manufacturer. Alternate cement sources may be used provided that mix design has been approved and acceptable trial batch verifying performance has been made.
 - 3. Do not use cement that has deteriorated because of improper storage or handling.
- B. Fly Ash:
 - 1. Fly ash, when used, shall conform to the requirements of ASTM C618 Class F, except as follows:
 - a. The loss on ignition shall be a maximum of four percent.
 - b. The maximum percent of sulfur trioxide (SO3) shall be 4.0.
 - 2. Fly ash shall be considered to be a cementitious material.
 - 3. Laboratory trial batches shall be tested to determine compliance with strength requirements, times of setting, slump, slump loss, and shrinkage characteristics.
- C. Slag Cement:
 - 1. Slag Cement, when used, shall conform to ASTM C989, Grade 120.
 - 2. Slag cement is considered a cementitious material.
 - 3. Perform laboratory tests on trial batches to determine compliance with strength requirements, times of setting, slump, slump loss, and shrinkage characteristics.
- D. Silica Fume: Silica fume shall be dry compacted or slurry form and shall conform to ASTM C1240. Silica fume is considered a cementitious material. Application rate, when specified, shall be seven percent by weight of cement, unless indicated otherwise.



- E. For all classes of concrete, when Type II (MH) Cement is used, fly ash or slag cement may be used within the following percentages by weight. When Type II Cement is used, fly ash or slag cement shall be used within the following percentages by weight. When Type I Cement is used, in lieu of Type II (MH) Cement, fly ash or slag cement shall be used such that total tricalcium aluminate content (C3A) of the resulting cementitious material is not greater than eight percent.
 - 1. When fly ash is used, material shall have minimum of 20 percent and maximum of 25 percent of total weight of cementitious material.
 - 2. When slag cement is used, material shall have minimum of 40 percent and maximum of 50 percent of total weight of cementitious material.

2.02 AGGREGATES

- A. General:
 - 1. Aggregates shall conform to ASTM C33, Class Designation 4S, and as specified in this Section.
 - 2. Do not use aggregates containing soluble salts or other substances, such as iron sulfides, pyrite, marcasite, ochre, or other materials, that can cause stains on exposed concrete surfaces.
 - 3. Aggregates shall be tested to determine potential for alkali-silica reactivity.
- B. Fine Aggregate:
 - 1. Provide clean, sharp, natural sand free of loam, clay, lumps, and other deleterious substances.
 - 2. Dune sand, bank run sand, and manufactured sand are unacceptable.
- C. Coarse Aggregate:
 - 1. Provide clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - a. Crushed stone, processed from natural rock or stone.
 - b. Washed gravel, either natural or crushed. Slag, pit gravel, and bank run gravel are unacceptable.



2.03 WATER

A. Water used in producing and curing concrete shall be clean and free of injurious quantities of oils, acids, alkalis, organic materials, and other substances that may be deleterious to concrete and steel.

2.04 CONCRETE ADMIXTURES

- A. Provide admixtures in accordance with product manufacturer's published instructions. Admixtures shall be compatible with each other. Admixtures shall not contain thiocyanates, shall not contain more than 0.05 percent chloride ion, and shall be non-toxic in the concrete mix after 30 days. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless otherwise approved by Engineer.
- B. Air Entraining Admixtures: ASTM C260. Air entraining admixture shall be vinsol resin or vinsol rosin-based.
- C. Water-Reducing Admixture: ASTM C494, Type A or D. Proportion Class "A", Class "AF", Class "AS", and Class "B" concrete with non-air entraining, water-reducing, aqueous solution of modified organic polymer.
- D. High Range Water-Reducing Admixture (HRWR): ASTM C494, Type F or G. Use high range water-reducing admixture in the concrete classifications so specified or indicated. Use of HRWR admixture is allowed at Contractor's option in all other classifications of concrete. Specific admixture formulation shall be as recommended by admixture manufacturer for Project conditions.
- E. Plasticizing Admixtures: ASTM C1017, Type I or Type II. Use plasticizing admixture as an alternate to high range water-reducing admixture. Specific admixture formulation shall be as recommended by admixture manufacturer for Project conditions.
- F. Set Control Admixtures: In accordance with ASTM C494. Use the following as required:
 - 1. Type B, Retarding.
 - 2. Type C, Accelerating.
 - 3. Type D, Water reducing and Retarding.
 - 4. Type E, Water reducing and Accelerating.



- 5. Type G, Water-reducing, high range, and retarding admixtures.
- G. Calcium Chloride: Do not use calcium chloride.
- H. Shrinkage Reducing Admixture: Shrinkage reducing admixture may be used in mix design when necessary to conform to specified shrinkage limitations, provided that specified strength requirements are complied with and there is no reduction in sulfate resistance in the concrete and no increase in concrete permeability.
- I. Corrosion-Inhibiting Admixtures:
 - 1. Corrosion-inhibiting admixture shall be calcium nitrite solution containing minimum of 30 percent calcium nitrite. Admixture shall be added at dosage rate of five gallons per cubic yard of concrete.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. DCI or DCI-S, by Grace Construction Products.
 - b. Rheocrete CNI, by Master Builders, Inc.
 - c. Eucon CIA, by Euclid Chemical Company.
 - d. Or equal.
 - 3. Adjust quantity of mix water to account for water portion of calcium nitrite solution.
 - 4. Provide retarding admixtures as required, if set time is accelerated.
- J. Colored Cement Pigments:
 - 1. Provide the following, where shown or indicated: Commercial iron oxide, manganese dioxide, ultramarine blue, chromium oxide, or carbon black compounded for use in concrete.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Truetone Mortar Colors by Frank D Davis Company, subsidiary of Rockwood Industries, Inc.
 - b. Sonobrite by Sonneborn Building Products, division of Rexnord Chemical Products, Inc.
 - 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. Engineer will select colors from manufacturer's full range of standard colors.

2.05 PROPORTIONING AND DESIGN OF MIXES

A. Prepare concrete design mixes in accordance with Table 03300-A:

			Minimum				Min Comp
Concrete Class	Size A	Size B	Cementitious ⁽⁵⁾ (Ibs/cu yd)	Max. W/CM ⁽⁴⁾	Slump ⁽²⁾	Air ⁽⁶⁾ (%)	Strength ⁽³⁾ (psi)
Class "A"	No. 57	No. 8	535	0.42	4" max.	6 +/- 1.5	4,500
Class "AF"	No. 467	No. 8	517	0.42	4" max.	5 +/- 1.5	4,500
Class "AS"	No. 57	No. 8	535	0.42	4" max.	-	4,500
Class "B"	No. 57 or No. 67		517	0.50	4" max.	6 +/- 1.5	3,000
Class "C"	N. 57 or No. 67		564	0.40	4" max.	3 Max.	5,000
Class "D"	Any ASTM C33		No requirements				2,000

TABLE 03300-A CONCRETE DESIGN MIX CRITERIA

Notes Applicable to Table 03300-A:

- Coarse aggregate size numbers refer to ASTM C33. Where Size A and B are designated in Table 03300-A, it is intended that the smaller Size B aggregate is to be added, replacing a portion of the coarse or fine aggregate, in the minimum amount necessary to make a workable and pumpable mix with sand content not exceeding 41 percent of total aggregate.
- 2. Slumps indicated are prior to addition of high range water reducing admixture or plasticizing admixture.
- 3. Mix designs shall be made for all but Class "D", which does not require trial batch, so that the compressive strength achieved for laboratory trial batches will not be less than 125 percent of specified design strength.



- Quantity of water to be used in the determination of water-cementitious materials (W/CM) ratio shall include free water on aggregates in excess of SSD and water portion of admixtures.
- 5. Minimum cementitious content shall be adjusted in accordance with the requirements of Table 5.2.2.1 of ACI 350.5 and Table 4.2.2.1 of ACI 301 if smaller maximum coarse aggregate size is used.
- 6. Required air content listed shall be adjusted in accordance with the requirements of Table 5.2.2.4 of ACI 350.5 and Table 4.2.2.7.b.1 of ACI 301 for severe exposure if a different maximum coarse aggregate size is used.
- B. Lightweight Concrete: Not used.
- C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, Site conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as approved by Engineer. Before using adjusted concrete mixes, laboratory test data and strength results shall be submitted to and approved by Engineer.
- D. Admixtures:
 - 1. Use air-entraining admixture in concrete, unless otherwise shown or indicated. Add air-entraining admixture at admixture manufacturer's prescribed rate to produce concrete at point of placement having air content within prescribed limits.
 - 2. Use water-reducing or high-range water-reducing admixtures in all Class "A" and Class "AF" concrete.
 - 3. Use amounts of admixtures recommended by admixture manufacturer for climatic conditions prevailing at the Site at time of placing. Adjust quantities and types of admixtures as required to maintain quality.
- E. Slump Limits with High-Range Water Reducer: Slump shall not exceed four inches prior to adding high-range water reducer and shall not exceed eight inches, measured at point of placement, after adding high-range water reducer.
- F. Shrinkage Limitation:
 - Concrete shrinkage for specimens cast in laboratory from trial batch with total water of 30.2 gallons per cubic yard or less, as measured at 21-day drying age and at 28day drying age shall not exceed 0.039 percent and 0.045 percent, respectively. For trial batch with total water of 32.7 gallons per cubic yard or greater respective limits



shall not exceed 0.035 percent and 0.040 percent. Limits in between shall be linear interpolated. Use mix design for construction that complies with trial batch shrinkage requirements. Shrinkage limitations apply to Class "A" concrete and Class "AF" concrete.

- 2. Trial Batch Does Not Comply with Shrinkage Limitation:
 - a. If trial batch results do not comply with shrinkage limitation specified in the Contract Documents, redesign the mix to reduce shrinkage.
 - b. After mix has been repeatedly redesigned and Engineer is satisfied that all reasonable means to provide concrete mix that complies with shrinkage requirement have been exercised; and mix design still fails to comply with shrinkage limitation in the Contract Documents, Engineer reserves the right to accept the higher-shrinkage mix, provided that the quantity of shrinkage reinforcing in structures is increased.
 - c. "Reasonable means" will be construed as reducing the total water content to a maximum of 27 gallons per cubic yard, having the large aggregate blended so that eight percent to 18 percent of combined aggregate is retained on each sieve, using an alternate aggregate source, and a combination of these means.
 - d. Basis for shrinkage reinforcing increase will be proportional to amount that shrinkage value is over the specified shrinkage limitation and will be determined by Engineer. The cost of providing additional shrinkage reinforcement will be paid by the Owner.
- G. Color: Provide colored concrete where shown and indicated. Incorporate pigments into concrete mix according to pigment manufacturer's written instructions. Match color of Sample approved by Engineer.

2.06 BONDING AGENT

A. Provide epoxy and epoxy-cement bonding agents in accordance with Section 03251, Concrete Accessories.

2.07 CONCRETE CURING MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 10 ounces per square yard and complying with AASHTO M 182, Class 3.

- H 2 M
- B. Curing Mats: Shall be heavy carpets or cotton mats, quilted at four inches on centers, and weighing minimum of 12 ounces per square yard when dry.
- C. Moisture-Retaining Cover: Provide one of the following, complying with ASTM C171:
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. White burlap polyethylene sheet.
- D. Liquid Curing Compound: ASTM C309 Type 1-D (water retention requirements):
 - 1. Provide fugitive dye.
 - 2. Curing compound shall be applied by roller or power sprayer.

2.08 FINISHING AIDS

- A. Evaporation Retardant:
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Confilm, by Master Builders.
 - b. Eucobar, by Euclid Chemical Company.
 - c. SikaFilm, by Sika Corporation.
 - d. Or equal.

2.09 VAPOR RETARDER

- A. Vapor Retarder:
 - 1. Vapor retarder membrane shall comply with the following.
 - a. Water Vapor Transmission Rate, ASTM E96: 0.04 perms or lower.
 - b. Water Vapor Retarder, ASTM E1745: Meets or exceeds Class C.
 - c. Thickness of Retarder (plastic), ACI 302 1R: Not less than 10 mils.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. Stego Wrap 10-mil Vapor Retarder, by Stego Industries LLC.

- b. Griffolyn 10-mil, by Reef Industries.
- c. Moistop Ultra, by Fortifiber Industries.
- d. Or equal.
- B. Accessories:
 - 1. Provide accessories by same manufacturer as vapor retarder.
 - 2. Seam Tape:
 - a. Tape shall have water vapor transmission rate (ASTM E96) of 0.3 perms or lower.
 - b. Products and Manufacturers: Provide one of the following:
 - 1) Stego Tape by Stego Industries LLC.
 - 2) Griffolyn Fab Tape by Reef Industries.
 - 3) Moistop Tape by Fortifiber Industries.
 - 4) Or equal.
 - Vapor Proofing Mastic: Mastic shall have a water vapor transmission rate ASTM E96, 0.3 perms or lower.
 - 4. Pipe Boots: Construct pipe boots from vapor barrier material, pressure sensitive tape, mastic, or a combination thereof, in accordance with manufacturer's recommendations.

2.10 SOURCE QUALITY CONTROL

A. Concrete materials may require testing, as directed by Engineer, at any time during the Work if concrete quality is in question. Provide access to material stockpiles and facilities at all times. Tests shall be done at no expense to Owner.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine the substrate and conditions under which the Work will be performed and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected.



3.02 CONCRETE MIXING

- A. General:
 - Concrete may be produced at batch plants or by the ready-mixed process. Batch plants shall comply with recommendations of ACI 301 and have sufficient capacity to produce concrete of qualities required and in quantities required to comply with the accepted Progress Schedule. All plant facilities are subject to acceptance of Engineer.
 - 2. Mixing:
 - a. Mix concrete with a rotating type batch machine, except where hand mixing of very small quantities is approved by Engineer.
 - b. Remove hardened accumulations of cement and concrete from drum and blades to ensure proper mixing action.
 - c. Replace mixer blades upon loss of ten percent of mixer blades' original height.
- B. Site Mixing:
 - 1. When Site mixing of concrete is approved by Engineer mix all materials for concrete in a drum-type batch mixer.
 - a. For mixers of one cubic yard or smaller capacity, continue mixing at least 1.5 minutes but not more than five minutes after all ingredients are in the mixer, before any part of batch is released.
 - b. For mixers of capacity larger than one cubic yard, increase minimum 1.5 minutes of mixing time by 15 seconds for each additional cubic yard or fraction thereof.
 - 2. Do not exceed mixer manufacturer's published rating of the mixer, or mixer nameplate capacity, for total volume of materials used per batch.
 - 3. Equip mixer with automatic controls for proportioning materials and proper, measured quantities.
 - 4. Do not exceed 45 minutes total elapsed time between intermingling of damp aggregates and cement to discharge of completed mix.
- C. Ready-Mix Concrete:



- 1. Comply with ASTM C94 and the Contract Documents.
 - a. Plant Equipment and Facilities: Conform to requirements of NRMCA certification.
 - b. Mix concrete in revolving-type truck mixers that are in good condition and produce thoroughly-mixed concrete conforming to the Contract Documents.
 - c. Do not exceed rated capacity of mixer.
 - d. Mix concrete for minimum of two minutes after arrival at the Site, or as recommended by mixer manufacturer.
 - e. Do not allow drum to mix while in transit.
 - f. Mix at proper speed until concrete is discharged from mixer.
 - g. Maintain adequate facilities at the Site for continuous delivery of concrete at required rates.
 - h. Provide access to mixing plant for Engineer upon request.
- 2. When silica fume is used in dry compacted form, comply with the following mix requirements and ensure full dispersion:
 - a. For all types of mixing equipment, increase mix times by 40 percent over minimum mix time required to achieve mix uniformity defined in ASTM C94.
 - b. For truck-mixed and central-mixed concrete, maximum allowable batch size shall be 80 percent of maximum in accordance with ASTM C94.
- D. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery to prevent delay of placing concrete after mixing, or holding dry-mixed materials too long in mixer before the adding water and admixtures.

3.03 TRANSPORTING CONCRETE

- A. Transport and place concrete not more than 90 minutes after water has been added to the dry ingredients.
- B. Avoid spilling and separation of concrete mixture during transportation.
- C. Do not place concrete in which the ingredients have separated.
- D. Do not retemper partially set concrete.

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E. Use suitable equipment for transporting concrete from mixer to forms.

3.04 PREPARATION FOR CONCRETING

- A. Notify Engineer a minimum of 24 hours in advance of placing concrete to allow for inspection of form work, joints, waterstops, reinforcement, embedded items, and vapor retarders. The section to be placed shall be fully prepared for concrete placement at the time of notice. Confirm inspection status with Engineer a minimum of 4 hours prior to concrete placement. Do not begin placing concrete until Work is in conformance with the Contract Documents.
- B. Subgrade surfaces shall be thoroughly wetted by sprink ling, prior to the placing of concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.
- C. Reinforcing steel and embedded items shall be completely cleaned of mortar, loose rust, form release compounds, dirt, or other substances which would interfere with proper bonding with concrete. Protective coatings on embedded aluminum items shall continuously cover the surface to be in contact with concrete. Defects in the coating shall be repaired.
- D. Do not place concrete until flow of water entering space to be filled with concrete has been properly stopped or has been diverted by pipes, or other means, and carried out of the forms, clear of the Work. Do not deposit concrete underwater, and do not allow water to rise on concrete surfaces until concrete has attained its initial set. Do not allow water to flow over concrete surface in manner and or velocity that will injure concrete surface finish. Provide temporary pumping or other dewatering operations for removing water as required.
- E. Prepare joint surfaces in accordance with Section 03251, Concrete Accessories.
- F. Installation of Vapor Retarder:
 - 1. Provide vapor retarder under slabs-on-grade and outside walls to receive resilient floor finishes, carpet, ceramic and slate tile, chemical resistant coatings, and where shown or indicated on the Drawings.
 - 2. Install in accordance with manufacturer's instructions, ASTM E1643, and the following:
 - a. Unroll vapor retarder with longest dimension parallel with direction of the pour.
 - b. Lap vapor retarder over footings and seal to foundation walls.



- c. Overlap vapor retarder joints by six inches and seal with vapor retarder manufacturer's tape.
- d. Seal penetrations, including pipes, in accordance with vapor retarder manufacturer's instructions.
- e. Penetration of vapor retarder is not allowed except for reinforcing steel and permanent utilities.
- f. Repair damaged areas of vapor retarder by providing, for each damaged area, patch of vapor retarder material and overlapping damaged area with the patch by six inches on each side, and securely and continuously taping all four sides of patch to undamaged vapor retarder.

3.05 CONCRETE PLACEMENT

- A. General:
 - Place concrete continuously, so that no concrete will be placed on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. If section cannot be placed continuously, provide construction joints in accordance with Section 03251, Concrete Accessories.
 - Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to action that may cause segregation.
 - 3. Screed concrete that is to receive other construction to proper level to avoid excessive skimming or grouting.
 - 4. Do not use concrete that becomes non-plastic and unworkable, or does not conform to required quality limits, or that has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the Site and dispose of it in conformance with Laws and Regulations.
 - 5. Do not place concrete until forms, bracing, reinforcing, and embedded items are each in final position and secure.
 - 6. Do not place footings in freezing weather unless adequate precautions are taken against frost action.
 - 7. Do not place footings, piers or pile caps on frozen soil.
 - 8. Unless otherwise instructed, place concrete only when Engineer is present.



- 9. Allow minimum of three days between adjoining concrete placements. At expansion joints, allow minimum of one day between adjoining concrete placements.
- B. Bonding for Next Concrete Pour:
 - 1. Prepare for bonding of fresh concrete to concrete that has set but is not fully cured, as follows:
 - a. Thoroughly wet the surface, but allow no free-standing water.
 - b. For horizontal surfaces place a six-inch layer of Construction Joint Grout, as specified in Section 03600, Grouting, over the hardened concrete surface.
 - c. Place fresh concrete before the grout has attained its initial set.
 - 2. Accomplish bonding of fresh concrete to fully cured, hardened, existing concrete by using a bonding agent as specified in Section 03251, Concrete Accessories.
- C. Concrete Conveying:
 - 1. Handle concrete from point of delivery at the Site, transfer to concrete conveying equipment, and transfer to locations of final deposit as rapidly as practical by methods that prevent segregation and loss of concrete mix materials.
 - 2. Provide mechanical equipment for conveying concrete to ensure continuous flow of concrete at delivery end of conveyor. Provide runways for wheeled concrete conveying equipment from concrete delivery point to locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice, and other deleterious materials.
 - 3. Do not use chutes for distributing concrete, unless accepted by Engineer.
 - 4. Pumping concrete is allowed, however do not use aluminum pipe for conveying concrete.
- D. Placing Concrete into Forms:
 - 1. Deposit concrete in forms in horizontal layers not deeper than 18 inches each and in manner that avoids inclined construction joints. Where placement consists of several layers, place concrete at such rate that concrete being integrated with fresh concrete while still plastic.
 - 2. Do not allow concrete to free-fall within the form from height exceeding four feet. Where high-range water reducer is used to extend slump to at least six inches,



maximum allowable free-fall of concrete is six feet. Use "elephant trunks" to prevent free-fall and excessive splashing of concrete on forms and reinforcing. Discontinue free-falls in excess of four feet if there is evidence of segregation.

- 3. Remove temporary spreaders in forms when concrete placing has reached elevation of such spreaders.
- 4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidating concrete in accordance with requirements of ACI 301. Vibration of forms and reinforcing is not allowed unless otherwise accepted by Engineer.
- 5. Where height of concrete placement in walls exceeds 14 feet, provide temporary windows in formwork to facilitate vibration. Properly close temporary windows when height of concrete approaches windows. Determine location, size, and spacing of temporary windows to suit equipment used.
- 6. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly-spaced locations not farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate the layer of concrete and at least six inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcing and other embedded items without causing segregation of concrete mix.
- 7. Do not place concrete in beam and slab forms until concrete previously placed in columns and walls is no longer plastic.
- 8. Prevent voids in the concrete. Force concrete under pipes, sleeves, openings, and inserts from one side until visible from the other side.
- E. Placing Concrete Slabs:
 - 1. Deposit and consolidate concrete slabs in continuous operation, within limits of construction joints, until placing of a slab panel or section is completed.
 - 2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcing and other embedded items and into corners.



- 3. Consolidate concrete placed in beams and girders of supported slabs, and against bulkheads of slabs on ground, as specified in this Article for formed concrete structures.
- 4. Bring slab surfaces to correct elevation and level. Smooth the surface, leaving surface free of humps or hollows. Do not sprinkle water on surface while concrete is plastic. Do not disturb slab surfaces prior to commencing concrete finishing.
- 5. Where slabs are placed in conditions of high temperature or wind that could lead to formation of plastic shrinkage cracks, provide evaporation retardant applied in accordance with retardant manufacturer's recommendations.
- F. Quality of Concrete Work:
 - 1. Concrete shall be solid, compact, and smooth, and free of laitance, cracks, and cold joints.
 - 2. Concrete for liquid-retaining structures, and concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
 - 3. Cut out and properly replace to extent directed by Engineer, or repair to satisfaction of Engineer, defects as defined in 3.12. Thin patches or plastering are unacceptable.
 - Leaks through concrete that exhibit flowing water, and cracks, holes, or other defective concrete in areas of potential leakage, shall be repaired and made watertight.
 - 5. Repair, removal, and replacement of defective concrete as directed by Engineer shall be at no additional cost to Owner.
- G. Cold Weather Placing:
 - 1. Protect concrete Work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures, in compliance with ACI 306.1 and the Contract Documents.
 - 2. When air temperature has fallen to or may be expected to fall below 40 degrees F, provide adequate means to maintain temperature in area where concrete is being placed between 50 degrees F and 70 degrees F for at least seven days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Maintain temporary heating and protection as necessary so that ambient temperature does not fall more than 30 degrees F in the 24 hours following the



seven-day period. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.

- 3. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing for concrete as required to obtain concrete mixture temperature not less than 55 degrees F and not more than 85 degrees F at point of placement.
- 4. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Before placing concrete, verify that forms, reinforcing, and adjacent concrete surfaces are entirely free of frost, snow, and ice.
- 5. Do not use salt or other materials containing antifreeze agents. Do not use chemical accelerators or set-control admixtures unless approved by Engineer and tested in mix design proposed for use.
- H. Hot Weather Placing:
 - 1. When hot weather conditions exist that would impair the quality and strength of concrete, place concrete in compliance with ACI 305.1 and the Contract Documents.
 - 2. When ambient air temperature is at or above 90 degrees F and rising, cool ingredients before mixing concrete to maintain concrete temperature at time of placement below 80 degrees F. When ambient air temperature is at or above 90 degrees F and falling, cool the ingredients before mixing concrete to maintain concrete temperature at time of placement below 85 degrees F. In no case shall the concrete temperature at time of placement exceed 90 degrees F.
 - Mixing water may be chilled, or chopped ice may be used to control concrete temperature provided the water equivalent of ice is calculated in total amount of mixing water. If required, reduce the time from addition of mix water to placement, or use set-retarding admixture.
 - 4. Cover reinforcing materials with water-soaked burlap if ambient air temperature becomes too hot, so that reinforcing material temperature does not exceed ambient air temperature immediately before embedment of reinforcing in concrete.
 - 5. Wet forms thoroughly before placing concrete.
 - 6. Do not place concrete at temperature that causes difficulty from loss of slump, flash set, or cold joints.



7. Obtain Engineer's approval of substitute methods and materials proposed for use.

3.06 FINISHING OF FORMED SURFACES

- A. Standard Form Finish:
 - 1. Standard form finish shall be basically smooth and even, but is allowed to have texture imparted by the form material used. Repair defects in accordance with the Contract Documents.
 - 2. Use standard form finish for the following:
 - a. Exterior vertical surfaces from foundation up to one foot below grade.
 - b. Vertical surfaces not exposed to view.
 - c. Other areas shown or indicated.
- B. Smooth Form Finish:
 - 1. Produce smooth form finish by selecting form materials that will impart smooth, hard, uniform texture. Arrange panels in orderly and symmetrical manner with minimum of seams. Repair and patch defective areas in accordance with the Contract Documents.
 - 2. Use smooth form finish for the following:
 - a. Exterior surfaces exposed to view.
 - b. Surfaces to be covered with coating material. Coating material may be applied directly to concrete or may be a covering bonded to concrete such as waterproofing, dampproofing, painting, or other similar system.
 - c. Interior vertical surfaces of liquid-containers.
 - d. Interior and exterior exposed beams and undersides of slabs.
 - e. Surfaces to receive abrasive blasted finish.
 - f. Surfaces to receive smooth rubbed or grout cleaned finish.
 - g. Other areas shown or indicated.
- D. Grout Cleaned Finish:



- 1. Provide grout cleaned finish to concrete surfaces that have received smooth form finish and where defects have been repaired, as follows:
 - a. Combine one part portland cement to 1.5 parts fine sand by volume, and mix with water to consistency of thick paint. Blend standard portland cement and white portland cement, in proportions determined by trial patches, so that final color of dry grout will closely match adjacent concrete surfaces.
 - b. Thoroughly wet concrete surface and apply grout uniformly by brushing or spraying immediately to wetted surfaces. Scrub surface with cork float or stone to coat surface and fill surface holes. Remove excess grout by scraping, followed by rubbing with clean burlap to remove visible grout film. Keep grout damp during setting period by using fog spray on surface for at least 36 hours after final rubbing. Complete each area the same day the area is started, with limits of each area being natural breaks in the finished surface.
- 2. Use grout cleaned finish for the following:
 - a. Interior exposed walls and other vertical surfaces.
 - b. Exterior exposed walls and other vertical surfaces down to one foot below grade.
 - c. Interior and exterior horizontal surfaces.
 - d. Interior exposed vertical surfaces of liquid-containing structures down to one foot below normal operating liquid level.
 - e. Other areas shown.
- E. Abrasive Blasted Finish:
 - 1. Provide abrasive blasted finish where shown or indicated.
 - 2. Where abrasive blasted finish is required, apply finish to smooth formed finish after end of curing period, with defects repaired, to match approved finish provided on mock-up or Sample panel, as applicable.
 - 3. Heavy Abrasive Blasted Finish: Abrasive blast to uniformly expose coarse aggregate.
 - 4. Light Abrasive Blasted Finish: Abrasive blast to uniformly expose fine aggregate.



F. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise shown or indicated.

3.07 SLAB FINISHES

- A. Float Finish:
 - After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently. Check and level the surface plane to tolerance not exceeding 1/4-inch in ten feet when tested with a ten-foot straightedge placed on surface at not less than two different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to uniform, smooth, granular texture.
 - 2. Use float finish for the following:
 - a. Interior exposed horizontal surfaces of liquid-containing structures, except those to receive grout topping.
 - b. Exterior below-grade horizontal surfaces.
 - c. Surfaces to receive additional finishes, except as shown or indicated.
- B. Trowel Finish:
 - 1. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over the surface.
 - Consolidate concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with surface plane tolerance not exceeding 1/8-inch in ten feet when tested with a ten foot straight edge. Grind smooth surface defects that would otherwise project through applied floor covering system.
 - 3. Use trowel finish for the following:
 - a. Interior exposed slabs, unless otherwise shown or indicated.
 - b. Slabs that receive one of the following: resilient flooring, carpeting, or ceramic tile.

- C. Non-Slip Broom Finish:
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming in direction perpendicular to main traffic route. Use fine fiber-bristle broom, unless otherwise directed by Engineer. Coordinate required final finish with Engineer before applying finish.
 - 2. Use non-slip broom finish for the following:
 - a. Exterior exposed horizontal surfaces subject to lightweight foot traffic.
 - b. Interior and exterior concrete steps and ramps.
- D. Scratched Finish:
 - 1. After providing float finish, roughen concrete surface with rake before concrete's final set. Amplitude of surface shall be minimum of 1/4-inch.
 - 2. Provide scratched finish for the following:
 - a. Horizontal surfaces that will receive grout topping or concrete equipment pad.
 - b. Surfaces so indicated on the Drawings or elsewhere in the Contract Documents.

3.08 CONCRETE CURING AND PROTECTION

- A. General:
 - 1. Protect freshly placed concrete from premature drying, excessive cold or hot temperatures, and maintain without drying at relatively constant temperature for period necessary for hydration of cement and proper hardening of concrete.
 - 2. Start curing after placing and finishing concrete, as soon as free moisture has disappeared from concrete surface. Keep surface continuously moist during entire curing period. Cure for a minimum of 10 days and in accordance with requirements of ACI 301 and ACI 308.1. For concrete sections over 30-inches thick, the curing period shall be for a minimum of 14 days. Avoid rapid drying at end of final curing period.
 - 3. For curing, use water that is free of impurities that could etch or discolor exposed concrete surfaces.
 - 4. Confine water for curing to area being cured.


- B. Curing Methods: Curing methods are specified below. Curing methods to be used on each type of concrete surface are specified elsewhere in this Article.
 - 1. Water Curing. Cure by one of the following methods:
 - a. Keep concrete surface continuously wet.
 - b. Ponding or immersion.
 - c. Continuous water-fog spray.
 - d. Covering concrete surface with curing mats, thoroughly saturating mats with water, and keeping mats continuously wet with sprinklers or porous hoses. Place curing mats to cover concrete surfaces and edges with four-inch horizontal lap over adjacent mats; provide eight-inch lap over adjacent mats at vertical surfaces. If necessary, weigh down curing cover to maintain contact with concrete surface.
 - 2. Form Curing. Cure by one of the following methods:
 - a. Forms shall be maintained and loosened during curing period.
 - b. Immediately after forms are loosened or removed, continue with the required curing method as applicable, for remainder of curing period.
 - c. Where wood forms are kept in place, apply water to keep forms wet.
 - 3. Moisture Retaining Cover Curing. Cure as follows: Cover concrete surfaces with the required moisture retaining cover for curing concrete, placed in widest practical width with sides and ends lapped at least three inches and sealed using waterproof tape or adhesive. Immediately repair holes or tears during curing period using cover material and waterproof tape.
 - 4. Liquid Compound Curing. Cure as follows:
 - a. Unless otherwise approved by Engineer, provide water curing or form curing. Request to use liquid curing compound will be considered by Engineer on case-by-case basis. Construction joints, formed surfaces prior to receiving specified form finish, and concrete to receive surface treatment where surface treatment will be bonded to concrete surface (such as, but not limited to grout fill, coatings, lining, water repellent, painting, resilient flooring, terrazzo flooring, ceramic tile, quarry tile, chemical resistant coatings, or other applications) shall be water-cured or form-cured.

- b. In liquid-retaining structures, provide water curing or form curing, unless other curing method is approved by Engineer. Requests to use liquid curing compound will be considered by Engineer on case-by-case basis. Request shall provide valid construction reason or safety reason for using liquid compound curing including reason why other curing methods are not viable.
- c. Apply curing compounds immediately after final finishing or after terminating water curing. Apply curing compound in continuous operation by power spray equipment in accordance with curing compound manufacturer's directions. If areas are subjected to rainfall within three hours after completing curing compound application, area shall be recoated. Maintain coating continuity and repair areas damaged during curing period.
- d. When liquid curing compound is used, apply first coat of liquid curing compound at compound manufacturer's recommended coverage rate, and subsequently apply second coat at identical rate, thus providing twice the curing compound manufacturer's recommended coverage.
- e. At end of curing period, remove liquid curing compound where required.
- C. Formed Surfaces: Use the following curing methods:
 - 1. Walls That Will Retain Liquid or That are Under Ground Surface:
 - a. If forms are wood, form curing is allowed for entire curing period. If forms are steel, form curing is allowed for maximum of three days after which forms shall be removed so that concrete is free of the forms for remainder of the curing process.
 - b. Immediately after the forms are loosened or removed, continue with water curing for remainder of curing period.
 - c. When wall surface will not receive surface treatment and when allowed by Engineer, use of liquid curing compound is allowed. Before using liquid compound curing, use water curing or form curing for at least the first three days of curing.
 - 2. Formed Slab Underside and Beam Surfaces Where Will Retain Liquid:
 - a. Form curing is allowed for the full curing period.
 - b. Immediately after forms are loosened or removed, continue with water curing for remainder of curing period.

- c. When slab surface will not receive surface treatment and when allowed by Engineer, use of liquid curing compound is allowed.
- 3. Vertical Joint Surfaces and Surfaces to Receive Surface Treatment:
 - a. Form curing is allowed for entire curing period.
 - b. Immediately after forms are loosened or removed, continue with water curing for remainder of curing period.
- 4. Cure other formed surfaces using an appropriate curing method specified in the Contract Documents.
- D. Unformed Surfaces: Treat with one of the following curing methods:
 - 1. Slabs and Mats That Will Retain Liquid or are Below Ground Surface:
 - a. Water curing.
 - b. Moisture-retaining cover curing when allowed by Engineer.
 - c. When slab or mat surface will not receive surface treatment and when allowed by Engineer, use of liquid curing compound is allowed. Before using liquid compound curing, use water curing or form curing for at least the first three days of curing.
 - 2. Construction Joint Surfaces and Slab and Mat Surfaces to Receive Surface Treatment.
 - a. Water curing.
 - b. Moisture-retaining cover curing.
 - 3. Cure other formed surfaces using an appropriate curing method specified in the Contract Documents.
- E. Temperature of Concrete During Curing:
 - When ambient temperature is 40 degrees F or less, continuously maintain concrete temperature between 50 degrees F and 70 degrees F throughout curing period. When necessary, before concrete placing provide for temporary heating, covering, insulation, or housing as required to continuously maintain specified temperatures and moisture conditions throughout concrete curing period. Provide cold weather protection in accordance with requirements of ACI 306.1.

- 2. When the ambient temperature is 80 degrees F and above, or during other climatic conditions that would cause too-rapid drying of concrete, before starting concrete placing, provide wind breaks and shading as required, and fog spraying, wet sprinkling, or moisture retaining coverings as required. Continuously protect concrete throughout concrete curing period. Provide hot weather protection in accordance with requirements of ACI 305.1, unless otherwise specified.
- 3. Maintain concrete temperature as uniformly as possible, and protect from rapid ambient temperature changes. Avoid concrete temperature changes that exceed five degrees F in one hour and 50 degrees F in 24-hour period.
- F. Protection: During curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and damage by rain and flowing water. Protect finished concrete surfaces from damage by subsequent construction operations.

3.09 CONCRETE INSTALLATION TOLERANCES

- A. Installation Tolerances:
 - 1. Concrete placement tolerances, unless otherwise specified in the Contract Documents, shall be in accordance with ACI 117.
 - 2. Notify Engineer in writing when concrete placement does not conform with required tolerances, as soon as the condition is known to Contractor.
 - 3. When concrete installation does not conform to required tolerances, do not repair or correct by grinding unless specified in the Contract Documents or approved by Engineer in writing.
 - 4. Verification Measurements:
 - a. If surfaces where tolerances are in question, obtain measurements to verify conformance with tolerances in manner acceptable to Engineer.
 - b. If surfaces tolerances are in question, cost of obtaining measurements shall be at no additional cost to the Owner.
 - c. Before obtaining measurements, obtain Engineer's acceptance of method proposed for obtaining measurements.
 - d. After obtaining measurements, submit measurements to Engineer.



5. Submit with verification measurements submittal proposed method to rectify out-oftolerance concrete. Do not start repair Work without obtaining Engineer's approval.

3.10 FIELD QUALITY CONTROL

- A. Field Testing Services:
 - 1. Owner will employ testing laboratory to perform field quality control testing for concrete. Engineer will direct the testing requirements.
 - 2. Testing laboratory will make standard compression test cylinders and entrained air tests as specified in this Article, under observation of Engineer or Resident Project Representative.
 - 3. Testing laboratory will provide all labor, material, and equipment required for sampling and testing concrete, including: scale, glass tray, cones, rods, molds, air tester, thermometer, and other incidentals required.
 - 4. Provide all curing and necessary cylinder storage facilities in accordance with ASTM C31.
- B. Quality Control Testing During Construction:
 - 1. Perform sampling and testing for field quality control during placement of concrete, as follows:
 - a. Sampling Fresh Concrete: ASTM C172.
 - b. Slump: ASTM C143; one test for each concrete load at point of discharge.
 - c. Concrete Temperature: ASTM C1064; one for every two concrete loads at point of discharge, and when a change in the concrete is observed. Test each load when time from batching to placement exceeds 75 minutes.
 - d. Air Content: ASTM C231; one for every two concrete load at point of discharge, and when a change in the concrete is observed.
 - e. Unit Weight: ASTM C138; one for every two concrete loads at point of discharge, and when a change in the concrete is observed.
 - f. Compression Test Specimens:
 - 1) In accordance with ASTM C31; make one set of compression cylinders for each 50 cubic yards of concrete, or fraction thereof, of each mix design



placed each day. Each set shall be four standard cylinders, unless otherwise directed by Engineer.

- 2) Cast, store, and cure specimens in accordance with ASTM C31.
- 3) Test and record the following when cylinders are cast: slump, concrete temperature, air content, and unit weight.
- g. Compressive Strength Tests:
 - In accordance with ASTM C39; one specimen tested at seven days, and two specimens tested at 28 days. Test fourth cylinder if needed to verify test results. If 4-inch by 8-inch cylinders are used, three specimens shall be tested at 28 days.
 - 2) Adjust mix design if test results are unsatisfactory and resubmit for approval.
 - 3) Concrete that does not comply with strength requirements will be considered as defective Work.
- Water/Cementitious Materials Ratio: Perform one test from each sample from which compression test specimens are taken, in accordance with AASHTO TP23.
- i. Within 24 hours of completion of test, testing laboratory will submit certified copy of test results to Contractor and Engineer.
- C. Evaluation of Field Quality Control Tests:
 - 1. Do not use concrete delivered to final point of placement having slump, concrete temperature, total air content or unit weight outside specified values.
 - 2. Water/Cementitious Materials Ratio:
 - a. When water content testing indicates water/cementitious materials ratio to exceed specified requirements by greater than 0.02, remaining batches required to complete concrete placement shall have water content decreased in the mix and water reducing admixture dosage increased as required to bring subsequently-batched concrete within specified water/cementitious materials ratio.

- b. Perform additional testing to verify compliance with specified water/cementitious materials ratio.
- c. Do not resume concrete production for further concrete placement until Contractor has identified cause of excess water in the mix and revised batching procedures, or adjusted the mix design (and obtained Engineer's associated approval) to bring water/cementitious materials ratio into conformance with the Contract Documents.
- 3. Compressive Strength:
 - a. Compressive strength tests for laboratory-cured cylinders will be acceptable if the averages of all sets of three consecutive compressive strength tests results equal or exceed specified 28-day design compressive strength of the associated type or class of concrete, and no individual strength test falls below required compressive strength by more than 500 psi.
 - b. Questionable Field Conditions During Concrete Placement:
 - Where questionable field conditions exist during concrete placement or immediately thereafter, strength tests of specimens cured under field conditions will be required by Engineer to check adequacy of curing and protecting of concrete placed. Specimens shall be molded at the same time and from the same samples as laboratory-cured specimens.
 - Provide improved means and procedures for protecting concrete when 28day compressive strength of field-cured cylinders is less than 85 percent of companion laboratory cured cylinders.
 - 3) When laboratory-cured cylinder strengths are appreciably higher than minimum required compressive strength, field-cured cylinder strengths need not exceed minimum required compressive strength by greater than 500 psi even though the 85 percent criterion may not be met.
 - 4) If individual tests of laboratory-cured specimens produce strengths more than 500 psi below the required minimum compressive strength, or if tests of field-cured cylinders indicate deficiencies in protection and curing, provide additional measures to ensure that load-bearing capacity of the structure is not jeopardized or impaired. If likelihood of low-strength concrete is confirmed and evaluations indicate load-bearing capacity may have been reduced, perform tests of cores from the concrete in question at Contractor's expense.



- c. If compressive strength tests fail to indicate compliance with minimum requirements of the Contract Documents, concrete represented by such tests will be considered defective.
- D. Testing Concrete Structure for Strength:
 - 1. When there is evidence that strength of in-place concrete does not comply with the Contract Documents, employ the services of concrete testing laboratory to obtain cores from hardened concrete for compressive strength determination. Cores and tests shall comply with ASTM C42 and the following:
 - a. Obtain at least three representative cores from each concrete member or suspect area of concrete at locations directed by Engineer.
 - b. Strength of concrete for each series of cores will be acceptable if average compressive strength is at least 85 percent of specified compressive strength and no single core is less than 75 percent of required 28-day required concrete compressive strength.
 - c. Testing laboratory shall submit test results to Engineer on same day that tests are completed. Include in test reports Project name and number (if any), date of sampling and testing, Contractor name, name of concrete testing laboratory, exact location of test core in the Work, type or class of concrete represented by core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength, and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizon-tal plane of concrete as placed, and moisture condition of the core at time of testing.
 - 2. Fill core holes solid with non-shrink grout in accordance with Section 03600, Grouting, and finish to match adjacent concrete surfaces.
 - 3. If results of core tests are unacceptable or if it is impractical to obtain cores, perform static load test and evaluations complying with ACI 318 and ACI 350, as directed by Engineer.
- E. Concrete Tolerance Verification Measurements: Refer to Article 3.9 of this Section.
- F. Supplier's Services: Water-Reducing Admixture Manufacturer: Furnish services of qualified concrete technician employed by admixture manufacturer to assist in proportioning concrete for optimum use of admixture. Concrete technician shall advise on

proper addition of admixture to concrete and on adjustment of concrete mix proportions to meet changing conditions at the Site.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Temporary Openings:
 - 1. Openings in concrete walls and slabs required for passage of Work are allowed only upon approval of Engineer.
 - 2. Temporary openings made in concrete shall be provided with waterstop in belowground or liquid-retaining members and structures. Reinforcement going through and around the opening shall be made continuous to provide continuity and shall be approved by the Engineer.
 - 3. Temporary openings that remain in concrete structures shall be filled with the same class of concrete as the adjoining construction, after the Work causing need for temporary opening is complete, unless otherwise shown or directed by Engineer. Mix, place, and cure concrete as specified in this Section to blend with in-place construction. Provide miscellaneous concrete filling shown or required to complete the Work.
- B. Bases or Pads for Piping, Panels, and Equipment:
 - Unless specifically shown or indicated otherwise, provide concrete bases or pads for equipment, floor-mounted panels, and floor-mounted supports for piping and similar construction. Provide all concrete pad and base Work not specifically included under other Sections.
 - 2. Dimensions and Elevations:
 - a. Coordinate and construct bases and pads to dimensions shown or indicated, or as required to comply with equipment, panel, or piping manufacturer's requirements and elevations indicated on the Drawing.
 - b. Unless otherwise shown or indicated, place concrete bases for equipment up to one-inch below the equipment manufacturer's base or mounting plate.
 - c. Where specific dimensions or elevations are not shown or indicated, bases and pads shall be six inches thick and extend three inches outside dimensions of the equipment, panel, or supports.



- 3. Finish: Bases and pads outside of areas to receive non-shrink grout shall have smooth trowel finish, unless special finish such as terrazzo, ceramic tile, quarry tile, or heavy-duty concrete topping is required. In such cases, provide appropriate concrete finish. Surfaces of bases and pads to receive non-shrink grout shall have broom finish.
- C. Curbs:
 - 1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green followed by steel-troweling surfaces to hard, dense finish with corners, intersections, and terminations slightly rounded.
 - 2. Exterior curbs shall have rubbed finish for vertical surfaces and b roomed finish for top surfaces.

3.12 REPAIR OF CONCRETE PLACED UNDER THIS CONTRACT

- A. Repair of Formed Surfaces:
 - 1. Repair the following defects in all formed finishes:
 - a. Spalls, air bubbles, rock pockets, form depressions, and other defects that are more than 1/4-inch in depth.
 - b. Holes from tie rods and other form tie systems.
 - c. Fins, offsets, and other projections that extend more than 1/4-inch beyond designated concrete member surface.
 - d. Structural cracks, as defined by Engineer.
 - e. Non-structural cracks greater than 0.010-inch wide as defined by Engineer. In liquid-retaining structures, elevated slabs subject to the elements or washdowns, below-grade members, and cracks that evidence leakage. Where it is not possible to verify whether a crack is leaking, repair the crack.
 - 2. Repair the following defects in smooth-finish surfaces, in addition to those listed above in this Section:
 - a. Spalls, air bubbles, rock pockets, form depressions, and other defects that extend to more than 1/2-inch in width in any direction, no matter how deep.

- b. Spalls, air bubbles, rock pockets, form depressions, and other defects of any size that exceed three in number in a 12-inch by 12-inch area, or 12 in number in a three-foot by three-foot area.
- c. Fins, offsets, and other projections shall be completely removed and smoothed.
- d. Scratches and gouges in concrete surface.
- e. Texture and color irregularities. In liquid-retaining surfaces, texture and color irregularities need not be repaired when greater than 12 inches below minimum normal operating liquid surface elevation, except where such defects are indicative of reduced durability.
- 3. Where smooth rubbed or grout cleaned finish is specified, minor surface defects repairable by the finishing process need not be repaired prior to finish application, when approved by Engineer.
- B. Method of Repair of Formed Surfaces:
 - Immediately after removing forms, repair and patch defective areas with cement mortar or concrete repair mortar as directed by Engineer. Make repairs made to liquid-retaining structures and below-grade surfaces with repair mortar only. Repair form tie holes in liquid-retaining or below-grade surfaces with non-shrink grout in accordance with Section 03600, Grouting.
 - 2. Honeycombs, Rock Pockets, and Holes Left by Tie Rods and Bolts:
 - a. Cut out honeycomb, rock pockets, voids, and holes left by tie rods and bolts, down to solid concrete but, in no case, to depth less than one-inch for cement mortar and 1/2-inch for repair mortar. Make edges of cuts perpendicular to concrete surface.
 - b. Before placing cement mortar, thoroughly clean and brush-coat area to be patched with specified bonding agent.
 - c. When using concrete repair mortar, use of bonding agent is optional; prepare the surface and place mortar in accordance with mortar manufacture's recommendations.
 - d. Repairs at exposed-to-view surfaces shall match the color of surrounding concrete, except color matching is not required for interior surfaces of liquid-retaining surfaces up to one foot below typical minimum liquid level. Impart



texture to repaired surfaces to match texture of existing adjacent surfaces. Provide test areas at inconspicuous locations to verify mixture, texture, and color match before proceeding with patching.

- e. Compact mortar in place and strike off slightly higher than the surrounding surface.
- Structural Cracks: Pressure-grout structural cracks using injectable epoxy installed using pressurized system. Apply in accordance with epoxy manufacturer's directions and recommendations.
- Non-structural Cracks: Shall be pressure-grouted using hydrophobic or hydrophilic resin. Install in accordance with resin manufacturer's directions and recommendations.
- 5. Determination of the crack type shall be made by the Engineer.
- 6. Holes Through Concrete:
 - a. Using plunger-type gun or other suitable device, fill holes extending through concrete from least-exposed face, using flush stop held at exposed face; completely fill the hole with specified repair material.
 - b. At below-grade and liquid-containing members, fill holes with concrete repair mortar and use color-matched cement mortar for outer two inches at exposedto-view surfaces.
- 7. Where powerwashing or scrubbing is not adequate, abrasive blast exposed- to-view surfaces that require removal of stains, grout accumulations, sealing compounds, and other substances marring the surfaces. Use sand finer than No. 30 and air pressure from 15 to 25 psi.
- C. Repair of Unformed Surfaces:
 - 1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to specified tolerances for each surface and finish. Correct low and high areas in accordance with this Section.
 - 2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using template having the required slope. Correct high and low areas in accordance with this Section.



- 3. Repair finish of unformed surfaces containing defects that adversely affect concrete durability. Surface defects include crazing, cracks in excess of 0.01-inch wide, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
- 4. Repair structural cracks in all structures and non-structural cracks in liquid-retaining structures. In liquid-retaining structures, where dry face of concrete member can be observed, repair all cracks evidencing any rate of water flow through crack. Where dry face of member cannot be observed, repair all cracks.
- D. Methods of Repair of Unformed Surfaces:
 - 1. Correct high areas in unformed surfaces by grinding, after concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
 - 2. Correct low areas in unformed surfaces, during or immediately after completion of surface finishing, by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Where repairs are required and concrete has already set, sawcut around perimeter of area to be repaired to depth of 1/2-inch and remove concrete so that minimum thickness of repair is 1/2-inch. Apply specified concrete repair mortar in accordance with repair mortar manufacturer's directions and recommendations.
 - 3. Repair defective areas, except random cracks and single holes not exceeding oneinch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Minimum thickness of repair shall be 1.5 inches. Dampen concrete surfaces in contact with patching concrete and brush with specified bonding agent. Place patching concrete while bonding agent is tacky. Mix patching concrete of same materials and proportions to provide concrete of same classification as original, adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
 - 4. Repair isolated, random, non-structural cracks (in members that are not below grade or liquid-retaining), and single holes not greater than one-inch diameter, by dry-pack method. Groove top of cracks, and cut out holes to sound concrete, and clean repair area of dust, dirt, and loose particles. Dampen all cleaned concrete surfaces and brush with the specified bonding agent. Place dry-pack before cement grout takes its initial set. Mix dry-pack, consisting of one part portland cement to 2.5 parts fine aggregate passing No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for at least 72 hours.



- 5. Structural cracks shall be pressure-grouted using injectable epoxy. Apply in accordance with epoxy manufacturer's directions and recommendations.
- 6. Non-structural cracks in below-grade and liquid-retaining structures shall be pressure-grouted using hydrophilic resin. Apply in accordance with resin manufacturer's directions and recommendations.
- 7. Determination of crack type will be by Engineer.
- 8. Ensure that surface is acceptable for flooring material to be installed in accordance with flooring manufacturer's recommendations.
- E. Other Methods of Repair:
 - 1. Repair methods not specified in this Section may be used when approved by Engineer.

+ + END OF SECTION + +



PART 1 – GENERAL

1.01 – DESCRIPTION

A. Furnish all materials, labor, and equipment required to provide all grout used in concrete work and as bearing surfaces for base plates, in accordance with the Contract Documents.

1.02 – RELATED SECTIONS

A. Requirements of related work are included in Division 1 and Division 2 of these Specifications.

1.03 – PAYMENT

A. Payment for work furnished and installed under this Section shall be included in the lump sum price bid for the Contract.

1.04 – 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 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. CRD-C 621 Corps of Engineers Specification for Non-shrink Grout
 - 5. ASTM C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cube Specimens)
 - ASTM C230/C230M, Specification for Flow Table for Use in Tests of Hydraulic Cement.
 - ASTM C531 Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings
 - 8. ASTM C579 Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings



- 9. ASTM C827 Standard Test Method for Early Volume Change of Cementitious Mixtures
- 10. ASTM C882/C882M, Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
- 11. ASTM C939, Text Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
- 12. ASTM C1107/C1107M, Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- 13. ASTM C1181, Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.
- 14. ASTM C144 Standard Specification for Aggregate for Masonry Mortar
- 15. ASTM C1107 Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

1.05 – SUBMITTALS

- A. Submit the following in accordance with Section 01300 Submittals.
 - 1. Certified test results verifying the compressive strength and shrinkage and expansion requirements specified herein.
 - 2. Schedule of Project-specific grout applications, installation locations, and the grout type proposed for each
 - 3. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of grout used in the work.
 - 4. 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.

1.06 – QUALITY ASSURANCE

- A. Field Tests
 - 1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the



Engineer to ensure continued compliance with these Specifications. The specimens will be made by the Engineer or its representative.

- Compression tests and fabrication of specimens for cement grout and nonshrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.
- b. 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. 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. Supply all materials necessary for fabricating the test specimens, at no additional cost to the Owner.
- 3. 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.

PART 2 -- PRODUCTS

2.01 - 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 3.5-Schedule 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. Hi-Flow Grout, by Euclid Chemical Company.
- 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.
 - 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:
 - 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 3.5-Schedule 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. 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).



- 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.
- E. 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.
 - 2. The minimum compressive strength at 28 days shall be 4000 psi.
 - 3. 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.
 - 4. Sand shall conform to the requirements of ASTM C144.



2.02 – CURING MATERIALS

A. Curing materials shall be as recommended by the manufacturer for prepackaged grouts.

PART 3 – EXECUTION

3.01 – GENERAL

- A. The different types of grout shall be used for the applications stated in the Schedule unless noted otherwise in the Contract Documents. Where grout is called for in the Contract Documents which does not fall under any of the applications stated below, non-shrink grout shall be used unless another type is specifically referenced.
 - 1. Cement grout shall be used for grout toppings and for patching of fresh concrete.
 - 2. Non-shrink grout shall be used for grouting beneath base plates of structural metal framing.
 - 3. Epoxy grout shall be used for bonding new concrete to hardened concrete.
 - 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.
- B. New concrete surfaces to receive cement grout shall be as specified in Section 03350, Concrete Finishes, and shall be cleaned of all dirt, grease and oil-like films. Existing concrete surfaces shall likewise be cleaned of all similar contamination and debris, including chipping or roughening the surface if a laitance or poor concrete is evident. The finish of the grout surface shall match that of the adjacent concrete. Curing and protection of cement grout shall be as specified in Section 03370, Concrete Curing.
- C. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- D. The Contractor, through the manufacturer of a non-shrink grout and epoxy grout, shall provide on-site technical assistance upon request, at no additional cost to the Owner.

3.02 – CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow.



- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

3.04 – GROUT INSTALLATION

A. Place grout quickly and continuously. Completely fill the space to be grouted and thoroughly compact free of air pockets. The grout may be poured in place, pressure grouted by gravity, or pumped. The use of pneumatic pressure or dry-packed grouting requires approval of the Engineer. For grouting beneath base plates, pour grout from one side only and thence flow across to the open side to avoid air-entrapment.

3.05 – SCHEDULE

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
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
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)
Motorized equipment or machinery equal to and greater than 50 horsepower, and motorized equipment or machinery equipment less than 50 horsepower subject to severe shock loads or high vibration	Class III Non-Shrink Epoxy (unless otherwise recommended by equipment manufacturer)
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)
Grout fill or grout toppings less than four inches thick	Grout Fill
Grout fill greater than four inches thick	Class "B" Concrete in accordance with Section 03300, Cast-In-Place Concrete
Applications not listed above, where grout is indicated on the Drawings	Class I Non-Shrink, unless shown or indicated otherwise

GROUT APPLICATIONS AND MATERIAL TYPES

+ + 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 as indicated on plans
 - 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 + +



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PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Shop and field fabricated ferrous metal items.
- B. Structural steel members.
- C. Weld repairs to steel lap seams.

1.02 REFERENCES

- A. AISC Code of Standard Practice Manual of Steel Construction Allowable Stress Design (ASD).
- B. ASTM A36/A36M Structural Steel.
- C. ASTM A53 Hot-Dipped, Zinc-coated Welded, and Seamless Steel Pipe.
- D. ASTM A108 Steel Bars, Carbon, Cold-Finished, Standard Quality.
- E. ASTM A123 Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
- F. ASTM A153 Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- G. ASTM A307 Carbon Steel Externally Threaded Standard Fasteners.
- H. ASTM A563 Carbon and Alloy Steel Nuts.
- I. ASTM A568/A568M General Requirements for Steel, Carbon and High-Strength Low-Alloy Hot-Rolled Sheet and Cold-Rolled Sheet.
- J. AWS A2.4 Symbols for Welding, Brazing, and Nondestructive Examination.
- K. AWS D1.1 Structural Welding Code.
- L. SSPC (Steel Structures Painting Council) Painting Manual.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, connections, reinforcing, anchorage, size and type of fasteners, and accessories.
 - 2. Include erection drawings, elevations, and details where applicable.
- C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.
- D. Welders' Certificates: Certify welders employed on the Work have met AWS qualification within the previous twelve (12) months.
- E. Manufacturer's Mill Certificate: Certify that Products meet or exceed specified requirements.

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1.04 QUALIFICATIONS

- A. Prepare Shop Drawings 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. Shop drawings must be signed and sealed by a Professional Structural Engineer.
- B. Fabricate structural steel members in accordance with AISC Code of Standard Practice.

1.05 FIELD MEASUREMENTS

- A. Verify field measurements.
- B. Replacement fabrications shall be of same dimensions, strength, and gage as original members, unless noted differently on drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel Sections: ASTM A36; sizes to match existing where not indicated on drawings.
- B. Plates: ASTM A283; gage to match existing where not indicated on drawings.
- C. Pipe: ASTM A53, Grade B; schedule to match existing where not indicated on drawing.
- D. Bolts, Nuts, and Washers ASTM A325 and Teflon coated: ASTM A325
- E. Welding Materials: AWS D1.1; type required for materials being welded.

2.02 FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise. Components shall be comparable in size and capacity to existing components in similar anchorage situations.
- F. Fabricate support framing for openings and edges where existing supports are inadequate.

2.03 FINISHES

- A. Do not prime surfaces in direct contact with concrete or where field welding is required.
- B. Shop prime structural steel members.



PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work, including the removal of existing metal fabrications that require replacement.
- B. Beginning of installation means erector accepts existing conditions.
- C. Verify that opening sizes and dimensional tolerances are acceptable.
- D. Verify that supports are correctly positioned.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on shop drawings.
- D. Connections shall be capable of transferring loads identical to capacity of existing connections.
- E. Perform field welding in accordance with AWS D1.1. Provide a fire watch during all hot work operations.
- F. Secure to prevent movement and anchor by welding.
- G. Obtain Engineer approval prior to site cutting or making adjustments not scheduled.

+ + END OF SECTION + +



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PART 1 - GENERAL

1.01 – SECTION INCLUDES

- A. All labor, materials, equipment and services necessary to furnish and install aluminum handrails and guardrails, posts, 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 F593 Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
- F. ASTM F594 Specification for Stainless Steel Nuts.

1.03 - SUBMITTALS

- A. Comply with the requirements contained in Section 01300 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. Catalog cuts for anchorage hardware. Indicate size and type of anchorage hardware.
 - 5. Samples of all components, bases and pipe.
 - 6. 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. 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.
- D. 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 01610 Transportation and Handling of Materials and Equipment.
- 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. 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 five (5) 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, 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. Openings in the handrailing shall be guarded by 304 stainless steel safety chains with s.s. hardware for easy removal.
- G. 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.



H. 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: 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.



- 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 01760 Project Closeout.

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 + +



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PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass fiber reinforced, resin fabrications.
- B. FRP guardrail and handrail systems.
- C. FRP gratings, support systems and connections.
- D. FRP stair treads.
- E. FRP toeplates

1.02 REFERENCE STANDARDS

- A. ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.
- B. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- C. FM (AG) FM Approval Guide; current edition.
- D. ITS (DIR) Directory of Listed Products; current edition.
- E. UL (DIR) Online Certifications Directory; current listings at database.ul.com.

1.03 DESIGN REQUIREMENTS

- A. Grating and stair design Live and Dead Loads: 100 lbs/sq ft or a concentrated load of 300 pounds with deflection limited to 1/360 of span unless noted otherwise on the design drawings.
- B. Railing systems shall be designed to withstand a single concentrated 200 pound point load applied in any direction at any point along the top rail in accordance with the Building Code of New York State.
- C. Molded grating and molded stair treads shall not deflect more than ¼" and structural support members shall not deflect more than L/180 of span for structural members unless specifically stated otherwise in drawings and/or supplementary conditions. Connections shall be designed to transfer the design loads.
- D. Layout: Each grating section shall be readily removable, except where indicated on drawings. Manufacturer to provide openings and holes where located on the contract drawings. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.
- E. Design items with sufficient strength for handling stresses.
- F. The FRP standard railing system, including connections, shall be designed to meet the configuration and loading requirements of OSHA 1910.23 and IBC with a minimum 2.0 factor of safety.
- G. Additional ADA handrail to be installed where indicated on plans.



- H. Temperature exposure is limited to 100°F (38°C) unless specifically stated otherwise in drawings and/or supplementary conditions.
- I. Stair Tread Design:
 - 1. Load/Deflection: Fibertred® stair treads shall meet manufacturer's published recommended loading with deflection not to exceed the following:
 - a. Concentrated load of 500 pounds, placed at the centerline of a 36" tread span with a maximum deflection not to exceed 0.32".
 - b. The concentrated load is applied at the centerline of the tread, over a width of 4" and a depth of 6", starting at the nosing edge to simulate the landing of a foot.
 - c. The manufacturer shall certify that the stiffness of all panels manufactured are never more than 2.5% below the published load-deflection values.

1.04 SUBMITTALS

- A. See Section 013300 SUBMITTALS for submittal procedures.
- B. Product Data: Provide data on specified component products.
- C. Shop Drawings: Indicate design load parameters, dimensions, adjacent construction, material, thicknesses, fabrication details, required clearances, field jointing, tolerances, colors, finishes, methods of support and anchorages. Shop drawings shall bear seal and signature of Professional Engineer.
- D. Samples: Submit two samples, 6 x 6 inch in size, illustrating color, texture, and finish.
- E. Maintenance Data: Include instructions for stain removal, surface and gloss restoration, and general cleaning recommendations.
- F. Stair assembly shop drawings shall bear the seal and signature of a registered professional engineer licensed in the state of New York.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. The material covered by these specifications shall be furnished by an ISO-9001:2008 certified manufacturer of proven ability who is regularly engaged in the manufacture, fabrication and installation of FRP systems.
- C. Manufacturer Qualifications: Company specializing in architectural glass fiber and resin components with five years documented experience with sufficient production capacity to produce required units without causing delay in the work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. All systems, sub-systems and structures shall be shop fabricated and assembled into the largest practical size suitable for transporting.
- B. Protect components from damage by retaining shipping protection in place until installation.
- C. Identify and match-mark all materials, items and fabrications for installation and field assembly.
- D. All materials and equipment necessary for the fabrication and installation of guardrail/handrail and appurtenances shall be stored before, during, and after shipment in a manner to prevent



cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the Architect, has become damaged as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.

1.07 FIELD CONDITIONS

- A. Do not install site fabricated components when site conditions may be detrimental to successful installation.
- B. Maintain temperature and humidity conditions favorable to proper curing of resin during and after installation.
- C. Field verify measurements for stair and railing assemblies that require coordination and consideration to existing and new previously installed construction, including items installed under other prime contracts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass Fiber and Resin Fabrications:
 - 1. Fibergrate Composite Structures, Inc.; Vi-Corr® molded grating, Fibertred® stair treads and Dynaform SAFRAIL railing systems
 - 2. Strongwell; DURAGRATE Molded grating and Strongwell Railing system. .
 - 3. Substitutions: See Section 016000 Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Conform to UL (DIR) Assembly Design No. UL 94 V-0..
- B. Conform to applicable code for a flame/smoke index rating of 25 / 0 in accordance with UL (DIR) listed product requirements.

2.03 MATERIALS

- A. Pultruded FRP Materials:
 - 1. Materials used in the manufacture of the FRP products shall be raw materials in conformance with the specification and certified as meeting the manufacturer's approved list of raw materials.
 - 2. All structural shapes are to be manufactured by the pultrusion process with a glass content minimum of 45%, maximum of 55% by weight. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.
 - 3. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.
 - 4. The visual quality of the pultruded shapes shall conform to ASTM D4385.
 - 5. FRP guardrail/handrail shall be manufactured using a pultruded process utilizing vinyl ester resin with flame retardant and ultraviolet (UV) inhibitor additives. Unless a phenolic resin system is utilized, a synthetic surface veil fabric shall encase the glass reinforcement. FRP shapes shall achieve a flame spread rating of 25 or less in accordance with ASTM test method E-84, the flammability characteristics of UL 94 V0 and the self-extinguishing requirements of ASTM D635.



- 6. FRP products exposed to weather shall contain an ultraviolet inhibitor. Should additional ultraviolet protection be required, a one mil minimum UV coating may be applied. Products manufactured with a phenolic resin system shall be coated with a one mil minimum UV coating.
- 7. All exposed railing surfaces shall be smooth and true to form, consistent with ASTM D4385.

Fibergalss Pultruded Material Properties					
Properties	Test	Units	Value		
Tensile Strength	ASTM D790	psi	30,000		
Tensile Modulus	ASTM D638	psi	2.5 x 10^6		
Flexural Strength	ASTM D790	psi	30,000		
Flexural Modulus	ASTM D790	psi	1.8 x 10^6		
Flexural Modulus (Full Section)		psi	2.8 x 10^6		
Short Beam Shear (Transverse)	ASTM D2344	psi	4,500		
Shear Modulus (Transverse)	N/A	psi	4.5 x 10^5		
Coefficient of Thermal Expansion	ASTM D696	in/in/deg F	8.0 x 10^-6		
Flame Spread	ASTM E84	N/A	25 or less		

B. FRP Molded Grating Materials:

- 1. All mechanical performance standards set forth by the Fiberglass Grating Manufacturers Council (FGMC) in the FRP Composites Grating Manual for Pultruded and Molded Grating and Stair Treads.
- A flame spread rating of 25 or less in accordance with ASTM E84, and flammability characteristics of UL 94 V0 and the self-extinguishing requirements of ASTM D635. (Polyester resin is available without flame retardant and UV inhibitor additives.)
- 3. NSF® Standard 61 Certified with flammability characteristics of UL 94 V0 and the self-extinguishing requirements of ASTM D635.
- 4. Food-grade with flammability characteristics of UL 94 V0 and the self-extinguishing requirements of ASTM D635.

Resin Systems			
Description	Resin Base		
Chemical Resistant - Fire Retardant	Vinyl Ester		
Industrial Grade - Fire Retardant	Isophthalic		
Architectural Grade - Fire Retardant	Orthophthalic		
High Temperature – Low Smoke/Low Flame	Phenolic		
Low Flame/Class 1 Smoke	Custom Blend		

- C. FRP Molded Grating System:
 - Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement shall be no more than 1/8" below the top surface of the grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall not exceed 35% so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements of the CONTRACT.
 - 2. The FRP molded grating and treads shall be manufactured by the open mold process.



- 3. Grating shall be 2" square mesh with a 2" depth with a tolerance of plus or minus 1/16" mesh centerline to centerline. Grating shall be a molded type with a meniscus top surface. Color shall be as selected by the Owner.
- 4. Molded stairtreads shall be 1-1/2" (38.1 mm) thick in a 1-1/2" (38.1 mm) x 6" (152.4 mm) rectangular mesh pattern. The resin system will be the same as the molded grating. The stairtread shall come complete with anti-slip nosing.

2.04 FRP RAILINGS

- A. The FRP standard railing system, including connections, shall be designed to meet the configuration and loading requirements of OSHA 1910.23 and IBC with a minimum 2.0 factor of safety.
- B. Guardrail height is 42" (1067mm) from the top of walkway to the top of the guardrail.
- C. The rails and posts shall be:
 - 1. 1 3/4" x 1 3/4" x .125" (50.8 mm x 50.8 mm x 3.81 mm) square tubes with 1 3/4" x 6" bottom plates and angle connectors to vertical subframe support posts with Quad-Head Pedestal caps and threaded adjustment rods set into support legs in sizes indicated or required to accommodate loading requirements.
 - 2. Provide continuous Toe Plates with corner and splice connectors bolted to the rail posts with 1/4 inch diameter stainless steel round head bolt assemblies as per the manufacturer.
 - 3. The pultruded parts shall be made with a fire retardant resin that achieves a flame spread rating of 25 or less in accordance with ASTM test method E84, flammability characteristics of UL 94 V0 and meet the self-extinguishing requirement of ASTM D635. The resin matrix shall be polyester and shall contain a UV inhibitor. The color shall be chosen from manufacturer's standard colors.
- D. The SAFRAIL fiberglass standard railing system shall be fabricated into finished sections by fabricating and joining together the pultruded square tube using glass-reinforced thermoset components; epoxy bonded and connected as shown in the fabrication details. Railing sections shall be fabricated to the size shown on the approved fabrication drawings and shall be piece marked with a water proof tag.
- E. For Side Mount: Post shall be constructed with a pultruded bottom plug. Length shall be sufficient to extend a minimum of 1" (25.4 mm) beyond the uppermost bolt hole to prevent crushing of post tubing. Bolt holes shall provide clearance of 1/16" (1.59 mm) for 1/2" (12.7 mm) diameter bolts/studs. On square tubes, holes shall be on longitudinal center line of post, 1" (25.4 mm) from bottom of post (minimum) and not less than 3" (76.2 mm) apart on center. Posts shall be fastened with stainless steel anchor bolts or studs, 1/2" (12.7 mm) diameter.
- F. Post locations shall be no greater than 18" (457 mm), nor less than 9" (229 mm) from horizontal or vertical change in handrail direction. For square tubes, post centers shall be no greater than 60" (1524 mm) apart on any straight run or rail, or 48" (1220 mm) apart on any inclined rail section.

2.05 FRP STAIR TREADS

A. FRP Stair treads shall be Fibertred® as manufactured by Fibergrate Composite Structures Incorporated or approved equal. Fibertred® stair treads shall be of a one-piece molded construction and shall have a 1 1/2" x 6" rectangular mesh pattern providing unidirectional strength in the tread span direction. Fibertred® shall be reinforced with continuous rovings in each direction. The top layer of reinforcement shall be no more than 1/8" below the top surface of the tread so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall not exceed 35% so as to achieve



maximum corrosion resistance, and as required to maintain the structural requirements. After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas.

- B. Non slip surfacing: Fibertred® stair treads shall be manufactured with a concave, meniscus profile on the top of each bar providing maximum slip resistance. For additional safety, and to meet OSHA requirements, stair treads shall be manufactured with a 1 1/2" solid, molded nosing. Nosing shall be gritted with an angular quartz grit, integrally molded into the top surface of the nosing area only.
- C. Fire rating: Fibertred® stair treads shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E84. Test data performed only on the resin shall not be accepted.
- D. Resin system: The resin system used in the manufacture of Fibertred® stair treads shall be Vi-Corr®. Manufacturer may be required to submit corrosion data from tests performed on actual stair tread products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of stair tread product corrosion resistance and shall not be accepted.
- E. Thickness: 1-1/2" thick with a tolerance of plus or minus 1/16".
- F. Mesh Configuration: 1-1/2" x 6" rectangular mesh pattern with double cross bars on 6" centers which allows optimum utilization and ease of fabrication.
- G. Hardware: Type 316 stainless steel hold down clips shall be provided and spaced as recommended by the manufacturer. A minimum of four hold-down clips shall be required for each tread.

2.06 FABRICATION

- A. Finish other surfaces not in contact with the mold to match the molded surfaces in appearance.
- B. Finish trim corners and edges.
- C. Cure components prior to shipment and remove material that may be toxic to plant or animal life.
- D. The fabricated railing sections shall be supplied complete with fittings by the FRP manufacturer. The components used to join fabricated sections together may be shipped loose, to be epoxied and riveted together in the field by the contractor.

2.07 FINISH

- A. Color: As selected by the Architect or Owner.
- B. Surface Texture: Railing surfaces shall be smooth, grating surfaces shall be non-slip.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.



3.02 INSTALLATION

- A. Install fabrications in accordance with shop drawings and fabricator's instructions.
- B. Fasten grating panels securely in place with hold down fasteners as specified herein.
- C. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as determined by the Design Engineer.
- D. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades for drilling and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; measured from established lines and levels.
 - 1. All field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer.
- E. The fabricated handrail sections shall be installed as shown on the approved shop drawings. The handrail sections shall be accurately located, erected plumb and level. The sections shall be fastened to the structure as shown on the approved shop drawings.

3.03 TOLERANCES

- A. Maximum variation from true position: 1/4 inch.
- B. Maximum offset from true alignment: 1/8 inch.

3.04 CLEANING

- A. Clean components of foreign material without damaging finished surface.
- B. Hand rub smooth surfaces with polishing cream.
- C. Clean fabrications in accordance with fabricator's instructions.

3.05 PROTECTION

A. Place protective structural covering over installed units.

+ + END OF SECTION + +



+ + NO TEXT ON THIS PAGE + +



PART 1 GENERAL

1.01 SUMMARY

A. Roof patching and flashing as necessary for HVAC modifications to rooftop equipment.

1.02 SECTION INCLUDES

- A. SBS modified bituminous membrane roofing system, including all components specified.
- B. Asbestos-containing materials may be present in the existing roofing system. Remove, handle, and dispose of asbestos-containing material in manner complying with all applicable federal, state, and local regulations.
- C. Commencement of work by Contractor shall constitute acknowledgement by Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.03 REFERENCE STANDARDS

- A. ASTM C208 Standard Specification for Cellulosic Fiber Insulating Board; 2012.
- B. ASTM C1177/C1177M Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- C. ASTM C1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2016.
- D. ASTM D41/D41M Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.
- E. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- F. ASTM D6163/D6163M Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements; 2000 (Reapproved 2015).
- G. ASTM D6164/D6164M Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements; 2011.
- H. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- I. ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2016.
- J. CAN-ULC-S770 Standard Test Method Determination of L-Term Thermal Resistance Of Closed-Cell Thermal Insulating Foams; 2009.
- K. FM DS 1-28 Wind Design; Factory Mutual System; 2007.
- L. FM DS 1-29 Roof Deck Securement and Above-Deck Roof Components; Factory Mutual System; 2006.



- M. PS 20 American Softwood Lumber Standard; 2010.
- N. SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2011. (ANSI/SPRI/FM 4435/ES-1)

1.04 SUBMITTALS

- A. Product Data:
 - 1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
 - 2. Where UL or FM requirements are specified, provide documentation that shows that the roofing system to be installed is UL-Classified or FM-approved, as applicable; include data itemizing the components of the classified or approved system.
 - 3. Installation Instructions: Provide manufacturer's instructions to installer, marked up to show exactly how all components will be installed; where instructions allow installation options, clearly indicate which option will be used.
- B. Samples: Submit samples of each product to be used.
- C. Installer Qualifications: Letter from manufacturer attesting that the roofing installer meets the specified qualifications.
- D. Pre-Installation Notice: Copy to show that manufacturer's required Pre-Installation Notice (PIN) has been accepted and approved by the manufacturer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Roofing installer shall have the following:
 - 1. Current Firestone Red Shield Licensed Contractor status.
 - 2. At least five (5) years' experience in installing specified system.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
- B. Store materials clear of ground and moisture with weather protective covering.
- C. Store roll materials on ends. Store materials left overnight on pallets.
- D. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within temperature range required by roofing manufacturer.
- E. Keep combustible materials away from ignition sources.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Firestone Building Products
 - 2. Garland Company, Inc. (The)

07555 - 2



3. Siplast

2.02 ROOFING SYSTEM DESCRIPTION

- A. Roofing System: Styrene-butadiene-styrene modified bituminous membrane.
 - 1. Membrane and Attachment: Mineral granule surfaced cap sheet and base sheet, cold adhesive applied.
 - 2. Granule Color: White.
 - 3. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.
 - 4. Provide assembly complying with Factory Mutual Corporation (FM) Roof Assembly Classification, FM DS 1-28 and 1-29, and meeting minimum requirements of FM 1-90 wind uplift rating.

2.03 SBS MODIFIED BITUMEN MATERIALS

- A. Cap Sheet: Granule surfaced SBS polymer-modified bitumen sheet, reinforced with non-woven polyester fabric, complying with ASTM D6164/D6164M, Type II, Grade G, with the following additional characteristics:
 - 1. Formulated for hot asphalt and cold adhesive application.
 - 2. Reinforcing Fabric: 7.8 oz per sq yd (265 g/sq m), with continuous fiberglass strands in machine direction.
 - 3. Nominal Thickness: 0.160 inch (4.1 mm).
 - 4. Post Consumer Recycled Content: 5 percent, nominal.
 - 5. Sheet Width: 3.3 feet (1 m), nominal.
 - 6. Acceptable Product: SBS Premium FR by Firestone.
- B. Interply Base Sheet: SBS polymer-modified bitumen sheet, complying with ASTM D6163/D6163M, Type II, Grade S, with glass fiber reinforcing fabric, formulated for hot asphalt and cold adhesive application to substrate and cap sheet, with the following additional characteristics:
 - 1. Nominal Thickness: 0.09 inch (2.3 mm).
 - 2. Sheet Width: 3.3 feet (1 m), nominal.
 - 3. Acceptable Product: SBS Premium Base by Firestone.
- C. Flashings: Same materials and configuration as roofing membrane.
- D. Cold Adhesive Roof Field: Multi-Purpose MB Cold Adhesive by Firestone.
- E. Cold Adhesive Base Flashing: Multi-Purpose MB Flashing Cement by Firestone.

2.04 FLUID APPLIED FLASHING

- A. Resin for all flashing applications: A ready to use, single component polyurethane bitumen resin.
 - 1. Ultraflash Liquid Flashing by Firestone.
 - 2. Or approved equal.

2.05 ACCESSORY MATERIALS

- A. Cant Strips and Tapered Edge Strips: 45 degree face slope and minimum 5 inch (127 mm) face dimension; provide at all angle changes between vertical and horizontal planes that exceed 45 degrees.
 - 1. Type: Wood fiber, complying with ASTM C208.



2. Install using hot asphalt (Type IV), roofing mastic, or mechanically fastened using fasteners and plates approved by roofing manufacturer.

PART 3 INSTALLATION

3.01 GENERAL

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
- B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).
- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
 - 1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
 - 2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
 - 3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.
- C. Examine roof substrate to verify that it is properly sloped to drains.



D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

- A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
- C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable insulation to membrane manufacturer.
- D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

3.04 MODIFIED BITUMEN INSTALLATION WITH COLD ADHESIVE

- A. Start at the low point with a full width sheet; embed sheets in full application of cold adhesive.
- B. Maintain one-half sheet stagger between first and second layer; install with minimum 3 inch (75 mm) side laps and 6 inch (150 mm) end laps; keep sheets free of wrinkles, buckles and fish mouths.
- C. Apply adhesive by method and at rate recommended by roof membrane manufacturer.
- D. Heat fuse the side and end laps of all layers; ensure that no adhesive is applied in the side or end laps of any layer.
- E. Perform heat fusing using a roofing torch or automatic heat welding equipment in accordance with roofing manufacturer's recommendations.

3.05 FIELD QUALITY CONTROL

- A. Inspection by Manufacturer: Before surface coating is applied, provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).
- B. Perform all corrections necessary for issuance of warranty.

3.06 CLEANING

- A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.



3.07 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

+ + 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 03930, Concrete Rehabilitation.

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.
 - 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.
 - 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:
 - 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.
- 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).
- 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.
- 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.



- 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:
 - 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

- 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:
 - 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.
 - 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.
- 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.
 - 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:
 - 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 handpull 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:
 - 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 - 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 05500, Metal Fabrication
 - 3. Section 07920, Joint Sealants.
- 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. Fiberglass grating, treads and doors.
- 6. Collector bearings, shafts and chains, wood flights, wood stop logs, and wood or fiberglass baffles.
- 7. 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.
- 8. 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.
- 9. 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.
- 10. 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. 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 Genera; 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 D3359- Measuring Adhesion by Tape Test
 - 2. ASTM D4258- Practice for Surface Cleaning Concrete for Coating
 - 3. ASTM D4263, Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method



- 4. ASTM D4541, Test Methods for Pull-Off Strength of Coatings Using Portable Adhesion-Testers.
- 5. ASTM E329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- 6. Green Seal, Inc. Paint, (GS-11).
- 7. GLUMRB, Recommended Standards for Wastewater Facilities.
- 8. 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 eater 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 all items by the Architect.
 - 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 if 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.

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- 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:
 - 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:
 - 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 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 (TCl); 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, highgloss, 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.
- C. 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 aminecatalyzed 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 (TCl); 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:
 - 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.



- D. 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.
- E. 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:
 - 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.
- F. New and Existing Exterior Surfaces of Ductile Iron Pipe; Buried Exterior:
 - 1. Refer to Section 15145, Ductile Iron Pipe.
- G. 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.
- H. 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.

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 radiused 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 shopprimed 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.
 - 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.
- I. 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 twentyfour 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 + +



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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.
 - 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 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.
 - 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.
 - 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:
 - 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 assembles or installed to minimize contrast.
 - b. Aluminum Finishes:
 - Clear Anodic Finish: Manufacture's standards clear anodic coating, 0.018mm or thicker, over a satin (directionally textured mechanical finish.



- 9. Tactile and Braile Copy shall be as follows:
 - a. Raised signs shall be of the three-in-one construction style having the following characteristics:
 - One-piece construction with tactile characters and symbols raised 1/32inch from sign plate face. Added-on or engraved characters are unacceptable.
 - 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:
 - 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:



- 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-inplace 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. 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:



- 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 e 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):
 - Carbon Dioxide (C02) 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:
 - Provide one first aid cabinet. First aid cabinet 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 + +



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PART 1 - GENERAL

1.01 - SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to install, ready for operation and field test stainless steel gates and appurtenances as shown on the Contract Drawings and as specified herein.
- B. The gates and appurtenances shall be supplied in accordance with the latest edition of AWWA C561 Standard for Fabricated Stainless Steel Slide Gates as modified herein. The allowable leakage rate for the stainless steel gates in this specification shall be 1/2 the allowable leakage listed in the latest revision of AWWA C561.

1.02 - SUBMITTALS

- A. Provide the following information to confirm compliance with the specification in addition to the submittal requirements specified in Section 01300.
 - 1. Complete description of all materials including the material thickness of all structural components of the frame and slide.
 - 2. Installation drawings showing all details of construction, details required for installation, dimensions and anchor bolt locations.
 - 3. Maximum bending stress and deflection of the slide under the maximum design head.
 - 4. The location of the company headquarters and the location of the principle manufacturing facility. Provide the name of the company that manufactures the equipment if the supplier utilizes an outside source.

1.03 - QUALITY ASSURANCE

A. Qualifications

- 1. All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 20 years experience designing and manufacturing water control gates. The manufacturer shall have manufactured water control gates for a minimum of 100 projects.
- 2. The specification is based on the Fontaine-Aquanox Weir Gates as manufactured by ISE Metal Inc. or approved equal.



1.04 – WARRANTY

- A. The manufacturer shall provide a standard factory notarized warranty that guarantees all components of each stop gate to be free from defects in design, materials and workmanship for a period of five (5) years commencing on the date the stop gate is placed into and accepted for permanent operation.
- B. During the guarantee period, if any part or component is defective or falls to perform then the manufacturer shall repair or exchange such defective part(s).

PART 2 - EQUIPMENT

2.01 - GENERAL

- A. Gates shall be as specified herein and have the characteristics and dimensions shown on the Contract Drawings.
- B. The gate shall utilize self-adjusting seals. Due to the difficulty of accessing gates when they are in service, gates that utilize adjustable wedges, wedging devices or pressure pads are not acceptable.
- C. All structural components of the frame and slide shall be fabricated of stainless steel having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
- D. Slide gate frames shall be shipped fully assembled with the invert member welded to the side frames and the slide installed in the frame unless the overall width of the slide gate exceeds 96 inches or the overall height of the slide gate exceed 25 feet.
- E. All welds shall be performed by welders with AWS D1.6 certification.
- F. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale.All iron and steel components shall be properly prepared and shop coated with a primer.

G. Materials:

COMPONENTS	MATERIALS
Frame Assembly and Retainers	Stainless Steel, Type 304L, ASTM A240
Slide and Stiffeners	Stainless Steel, Type 304L, ASTM A240
Stem	Stainless Steel, Type 304, ASTM A276
Anchor Studs, Fasteners and Nuts	Stainless Steel, Type 316, ASTM A276
Invert Seal (Upward Opening Gates Only)	Neoprene ASTM D-2000 or EPDM
Seat/Seals and Facing	Ultra-High Molecular Weight Polyethylene ASTM D4020
Lift Nuts	Bronze ASTM B584
Pedestals and Wall Brackets	Stainless Steel, Type 304L, ASTM A240
Operator Housing	Cast aluminum or ductile iron

H. Manufacturers:

- 1. Fontaine-Aquanox Series 20, Series 25, Series 95
- 2. Alfa-Laval Coplastix
- 3. Approved equal.

2.02 - FRAME

- A. The frame assembly, including the guide members, invert member and yoke members, shall be constructed of formed stainless steel plate with a minimum thickness of 1/4-inch.
 - 1. Frame design shall allow for embedded mounting, mounting directly to a wall with stainless steel anchor bolts and grout or mounting to a wall thimble with stainless steel mounting studs and a mastic gasket material. Mounting style shall be as shown on the Contract Drawings.
 - 2. All wall mounted or wall thimble mounted gates shall have a flange frame. Flat frame gates are not acceptable.
 - 3. The structural portion of the frame that incorporates the seat/seals shall be formed into a one-piece shape for rigidity. Guide members that consist of two or more bolted structural members are not acceptable. Guide member designs where water loads are transferred through the assembly bolts are specifically not acceptable.
 - 4. Gussets shall be provided as necessary to support the guide members in an unseating head condition. The gussets shall extend to support the outer portion of the guide assembly and shall be positioned to ensure that the load is transferred to the anchor bolts or the wall thimble studs.



- 5. The frame shall extend to accommodate the entire height of the slide when the slide is in the fully opened position on upward opening gates or downward opening weir gates.
- 6. On self-contained gates, a yoke shall be provided across the top of the frame. The yoke shall be formed by two structural members affixed to the top of the side frame members to provide a one-piece rigid assembly. The yoke shall be designed to allow removal of the slide.
- A rigid stainless steel invert member shall be provided across the bottom of the opening.
 The invert member shall be of the flush bottom type on upward opening gates.
- 8. A rigid stainless steel top seal member shall be provided across the top of the opening on gates designed to cover submerged openings.
- 9. A rigid stainless steel member shall be provided across the invert of the opening on downward opening weir gates.

2.03 - SLIDE

- A. The slide and reinforcing stiffeners shall be constructed of stainless steel plate. All structural components shall have a minimum thickness of 1/4-inch.
 - 1. The slide shall not deflect more than 1/360 of the span or 1/16 inch, whichever is smaller, under the maximum design head.
 - 2. When the width of the gate opening multiplied by the maximum design head is greater than 80 square feet, the portion of the slide that engages the guide members shall be of a "thick edge" design. The thick edge portion of the slide shall have a minimum thickness of 3 inches.
 - 3. Reinforcing stiffeners shall be welded to the slide and mounted horizontally. Vertical stiffeners shall be welded on the outside of the horizontal stiffeners for additional reinforcement.
 - 4. The stem connector shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.

2.04 - SEALS

A. All gates shall be provided with a self-adjusting seal system to restrict leakage in accordance with the requirements listed in this specification.



- 1. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide.
- 2. The seat/seals shall extend to accommodate the 1-1/2 x the height of the slide when the slide is in the fully closed or fully opened position.
- 3. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member or the bottom of the slide and it shall be held in place with stainless steel attachment hardware.
- 4. All downward opening weir gates shall be provided with UHMW polyethylene seat/seals across the invert member.
- 5. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.
- All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place with adhesives are unacceptable.
- 7. The seals shall be mounted so as not to obstruct the water way opening.
- 8. Gates that utilize rubber "J" seals or "P" seals are not acceptable.
- 9. The seal system shall have been factory tested to confirm negligible wear (less than 0.01") and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.

2.05 - STEM

- A. A threaded operating stem shall be utilized to connect the operating mechanism to the slide. On rising stem gates, the threaded portion shall engage the operating nut in the manual operator or motor actuator. On non-rising stem gates, the threaded portion shall engage the nut on the slide.
 - The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches.
 Stem extension pipes are not acceptable.
 - 2. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi.



- 3. The stem shall be threaded to allow full travel of the slide unless the travel distance is otherwise shown on the Contract Drawings.
- 4. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
- 5. In compression, the stem shall be designed for a critical buckling load caused by a 40 lb effort on the crank or handwheel with a safety factor of 2, using the Euler column formula.
- The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the crank or handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
- 7. The threaded portion of the stem shall have machine rolled threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.
- Stems of more than one section shall be joined by stainless steel or bronze couplings. The coupling shall be bolted to the stems.
- 9. Stems, on manually operated gates, shall be provided with adjustable stop collars to prevent over closing of the slide.

2.06 - STEM GUIDES

- A. Stem guide shall be provided when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less.
 - 1. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings.
 - 2. Adjustable in two directions.

2.08 - MANUAL OPERATORS

- A. Unless otherwise shown on the Drawings, gates shall be operated by a manual handwheel or a manual crank-operated gearbox. The operator shall be mounted on the yoke of self contained gates or on the pedestal of non-self contained gates.
 - 1. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40 lb effort when the gate is in the closed position and experiencing the maximum operating head.



- 2. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate.
- 3. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.
 - a. Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - b. Handwheel operators shall be equipped with roller bearings above and below the operating nut.
 - c. Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - d. The handwheel shall be removable and shall have a minimum diameter of 15 inches.
- 4. Crank-operated gearboxes shall be fully enclosed and shall have a cast aluminum or ductile iron housing.
 - a. Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.
 - b. Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - c. Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.
 - d. Gears shall be steel with machined cut teeth designed for smooth operation.
 - e. The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings.
 - f. Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - g. The crank shall be cast aluminum or cast iron with a revolving nylon grip.
 - h. The crank shall be removable.



- 5. All gates having widths in excess of 72 inches and widths greater than twice their height shall be provided with two gearboxes connected by an interconnecting shaft for simultaneous operation.
 - a. Interconnecting shafting shall be constructed of aluminum or stainless steel.
 - b. Flexible couplings shall be provided at each end of the interconnecting shaft. Couplings shall be stainless steel or non-metallic.
 - c. One crank shall be provided to mount on the pinion shaft of one of the gearboxes.
- 6. An extended operator system utilizing chain and sprockets shall be furnished by the manufacturer when the centerline of the crank or handwheel, on a non-geared operator, is located over 48-in above the operating floor. Chain wheels are not acceptable.
 - a. A removable stainless steel or aluminum cover shall be provided to enclose chain and sprockets.
 - b. The extended operator system shall lower the centerline of the pinion shaft to 36-in above the operating floor.
 - c. A handwheel may be utilized in conjunction with a gearbox in lieu of the extended operator system if the centerline of the pinion shaft is 60-in or less above the operating floor.
- 7. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
 - a. The pedestal height shall be such that the handwheel or pinion shaft on the crank-operated gearbox is located approximately 36-in above the operating floor.
 - b. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of stainless steel.
 - c. Wall brackets shall be reinforced to withstand in compression at least two times the rated output of the operator with a 40 lb effort on the crank or handwheel.
 - d. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the ENGINEER. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly.



- 8. Operators shall be equipped with fracture-resistant clear butyrate or lexan plastic stem covers.
 - a. The top of the stem cover shall be closed.
 - b. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
 - c. Stem covers shall be complete with indicator markings to indicate gate position.
- 9. When shown on the Contract Drawings, provide 2 inch square nut, mounted in a floor box, with a non-rising stem.
 - a. The square nut shall be constructed of bronze.
 - b. The floor box shall be constructed of stainless steel or cast iron and shall be set in the concrete floor above the gate as shown.
 - c. Provide one aluminum or stainless steel T-handle wrench for operation.

2.09 - ANCHOR BOLTS

- A. Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances.
 - 1. Quantity and location shall be determined by the gate manufacturer.
 - 2. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts.
 - 3. Anchor bolts shall have a minimum diameter of 1/2-inch.

2.10 - STOP LOGS

- A. Stop logs shall be substantially watertight under the design head conditions. Leakage shall not exceed 0.1 gallons per minute per foot of periphery for the rated seating head/
- B. Stop logs shall be constructed entirely of stainless steel. All hardware shall be stainless steel.
- C. The frame shall be made of stainless steel channels. It shall be suitable for mounting inside an existing channel.



- D. Logs shall consist of a flat plate reinforced with formed plates or structural members to limit their deflection to 1/360 of the gate's span under the design head. The guide shall be of ultra high molecular weight polyethylene (UHMWPE).
- E. Seals shall be made of EPDM attached to the logs by means of an UHMWPE retainer guide. The bottom seal shall be attached to the log with a stainless steel retainer and seal on top of the log immediately underneath.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Installation of the gates and appurtenances shall be done in a workmanlike manner. It shall be the responsibility of the Contractor to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's recommendations.
- B. The Contractor shall review the installation drawings and installation instruction prior to installing the gates.
- C. The gate assemblies shall be installed in a true vertical plane, square and plumb.
- D. The Contractor shall fill the void in between the gate frame and the wall with non-shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.
- E. The Contractor shall add a mastic gasket between the gate frame and wall thimble (when applicable) in accordance with the manufacturer's recommendations.

3.02 - FIELD TESTING

A. After installation, all gates shall be field tested in the presence of the Engineer and Owner to ensure that all items of equipment are in full compliance with this Section. Each gate shall be cycled to confirm that they operate without binding, scraping, or distorting. The effort to open and close manual operators shall be measured and shall not exceed the maximum operating effort specified above. Each gate shall be water tested by the Contractor, at the discretion of the Engineer and Owner, to confirm that leakage does not exceed the specified allowable leakage.

+ + END OF SECTION + +



PART 1 - GENERAL

1.01 - SECTION INCLUDES

- A. Work of this Section includes:
 - 1. Flanged and mechanical joint plug and check valves for large diameter process piping.
 - 2. Valve actuators, floor stands, and floor stand extension rods with intermediate supports.
 - 3. Trench adapter type valve boxes
 - 4. 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 15060 Pipe Hangers and Supports
- B. 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

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- 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 PD1.0, 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 01300:
 - 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 01730.
- 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 01610.
- 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 - 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 - 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.

2.02 – 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.
- 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. Valves to be operated on the floor above shall be provided with valve stem extensions and indicating floor stands.
 - a. Valve stem extension rods shall be Type 304 stainless steel.
 - b. Extension rods shall extend directly above the valve actuator without universal couplings.
 - c. Valve stem extensions shall be provided with a 2-inch square nut.
 - d. Floor stands shall be of the non-rising stem, indicating type, and designed for counterclockwise operation. The floor stands shall have a valve identification label on the pedestal of type 316 stainless steel. The pedestal shall have a vertical indicating slot sealed by a clear Lexan plate. A bronze indictor shall travel on a type 316 stainless steel threaded stem to indicate the position of the valve.
 - e. The floor stand shall be operated by a 14" diameter handwheel of type 316



stainless. The word "OPEN" shall be cast in the pedestal at the top of the indicating slot. A "CLOSED" tag will be field mounted to the pedestal to indicate the closed position of the valve. The coupling used to connect the floor stand stem to the extension stem shall be stainless steel, type 316. Floor stands fabricated by welding flanges to pipe are not acceptable. Cast stainless steel floor stands shall be as manufactured by Trumbull Industries, Youngstown, Ohio.

- 10. Buried: Mechanical joint, gear actuator and enclosure for buried installation.
- 11. Exposed: Flanged joint, gear actuator with handwheel or valve stem extension.
- 12. 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.
 - 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.



2.03 - 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 then 6" nominal diameter shall be provided with handwheel 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.

2.04 – 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.



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.
 - 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 09900 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 + +



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PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish, install, test and place in satisfactory operation, as shown on the Plans and specified herein, dry-pit submersible sewage pumps complete with all appurtenances and accessories to produce a complete and workable installation.

1.02 REFERENCES

- A. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. ASTM A48 Gray Iron Castings.
 - 2. NFPA 70 National Electric Code
 - 3. Hydraulic Institute Standards
 - 4. National Electrical Manufacturers Association
 - 5. Institute of Electrical and Electronic Engineers
 - 6. American National Standards Institute
 - 7. NEMA ICS 1 General Standards for Industrial Control and Systems.
 - 8. NEMA ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies.
 - 9. NEMA ICS 3 Industrial Systems.
 - 10. NEMA ICS 6 Enclosures for Industrial Controls and Systems.

1.03 SERVICE CONDITIONS

- A. All components of the system shall be designed for continuous duty.
- B. Provisions shall be made for lubrication, adjustments, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.

1.04 SUBMITTALS

- A. Submit information in accordance with the requirements in Section 01300.
- B. Submit the following:



- 1. Pump curve for the units supplied, showing Total Dynamic Head, Pump Efficiency, Brake Horsepower, Power Input to Electric Drive Motor of Pumping Unit for the various conditions under which the units are to operate including duty point along with descriptive data and specifications describing in detail the construction of the complete units.
- 2. VFD head curve analysis at 40 Hz to 60 Hz in 5 Hz increments with one, two and three pumps in operation.
- 3. Shop drawings, showing all weights and dimensions necessary for the installation of foundations, anchor bolts, piping and valve connections.
- 4. Electrical data sheet for pump motor.
- 5. Field-wiring diagram for pump motor and control wiring.
- 6. Catalog cuts and/or engineering data for each accessory item specified to be provided herein and a written description of each spare part.
- 7. Storage, handling and installation instructions.
- 8. Warranty Certificate in the form specified herein.
- 9. Certified pump curve for each pump after the pump is constructed and before shipment to the project site. The plot shall be prepared in accordance with the standards of the Hydraulic Institute.
- 10. Manufacturer Startup Report (MSR's).
- 11. Submit an operation and maintenance manual in accordance with the requirements in Section 01730.

1.05 QUALITY ASSURANCE

- A. The pump and accessories specified herein shall be furnished by one single supplier (manufacturer). This requires the supplier to be responsible for the development, design, fabrication, assembly, and delivery of the pumping system. The pump, motor, and mechanical seals shall all be designed, manufactured, and warranted by the pump manufacturer.
- B. The submersible sewage pumps specified herein and as shown to be installed on the Contract Drawings, are manufactured by Xylem/FLYGT. The specified unit provides a standard of quality, specification dimensions and performance required for this project.

- C. Acceptable alternate manufacturers for dry-pit submersible sewage pumps include: Pentair Fairbanks Nijhuis pumps. The listing of this alternate manufacture does not guarantee the acceptability of the entire product line for that manufacturer. The specific equipment must be of equal quality and performance. By listing one of the substitute products in his/her bid, the Contractor understands that he/she is ultimately responsible for all design modifications and associated costs that may be required to adapt, modify, and otherwise satisfy the design and operating requirements.
- D. Any other proposed substitutions from manufacturers other than those listed will require full compliance with the requirements of Article GC17 – Materials and Equipment, Approvals, Substitutions and Deviations.
- 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. The manufacturer shall have a minimum of five installations of the exact pump and motor model proposed to be furnished for this project. Installations must be in operation for a minimum of five years and shall list the pump model, motor model and horsepower, date of installation, duty point, and contact information including telephone number. A list of these installations shall be furnished to the Engineer with submittals.
- G. The system shall be designed, furnished, and installed to achieve the conditions of service specified herein.
- H. The manufacturer shall have at least ten (10) years of experience in the design and manufacturing of raw sewage, non-clog, and submersible pumps.
- 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.

1.06 FIELD SERVICES

A. Supply and credit to the Owner field services



- B. Provide the following field services as a minimum
 - 1. One (1) day for providing installation supervision to the Contractor.
 - 2. Two (2) days totaling two (2) trips for each pair of pumps for a total of four (4) days and four (4) trips once each half of the system has been installed to check the completed installations, make all necessary adjustments and otherwise place the system into permanent operation. Electrical wiring of pump power and control cords shall be verified by the representative. During one of these trips, and before substantial completion, provide operation and maintenance instruction to the Owner. A complete review of the Operations and Maintenance Manual shall be presented at this time.

1.07 WARRANTY

- A. Provide a warranty certificate typed on manufacturer's letterhead and signed by an officer of the manufacturer. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located.
- B. The manufacturer's standard five (5) year warranty on the pump and motor shall apply. The initial year from start-up of the equipment shall be covered 100% for parts and labor. The following years 2 through 5 shall be covered 50% for parts and labor. The warranty shall not be limited by hours of running time.
- C. In addition, the manufacturer shall guarantee all components of the equipment specified to be furnished under this Section to be free from defects in design, materials and workmanship for a period of one (1) year commencing on the date of the Manufacturer's Startup Report. That being the day that the pump was placed into permanent, automatic, and consistent, fault free operation.
- D. 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(s), the supplier shall repair or exchange, at the discretion of the Owner, such defective part(s) free of any and all charges. 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 shall be borne solely by the supplier.
- E. The manufacturer shall guarantee clog-free operation to the Owner for a period of 12 months from the date of start-up of the pumps by the local authorized factory representative. A certificate shall be provided to the Owner on the day of start up with the local contact information and effective date. Should the impeller clog with typical solids and debris normally found in domestic wastewater during this period, an authorized representative shall either travel to the jobsite remove the pump, clear the obstruction and reinstall the pump at no cost or reimburse the Owner for reasonable cost to provide



this service. A written report shall be provided to the Owner detailing the service call with pictures for verification purposes.

1.08 EXTRA MATERIALS

- A. Supply the following spare parts to match the pumps provided under Part 2 of this Section:
 - 1. Duplicate nameplate for each pump.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Sewage pumps shall be manufactured by Xylem/FLYGT, Pentair Fairbanks Nijhuis, or preapproved equal.

2.02 MANUFACTURED UNITS

- A. Pumps: Xylem/FLYGT Model NZ 3202.830 LT 3~ 615 capable of delivering 8,848 U.S. GPM at 36 feet TDH, including 29 feet static head and pipe friction with two of four pumps in operation.
- B. Pump motor: 54 HP, 460 volt, 3 phase, 60 cycle, 1185 RPM, submersible explosion proof motor.

2.03 MATERIALS

- A. General Requirements:
 - Each pump shall be equipped with a submersible, electric motor connected for operation. Each pump shall be supplied with submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and have P-MSHA Approval. The schedules at the end of this Section note the electrical service requirements.
 - 2. Each pump shall come with a MAS801 supervisory relay by Xylem/Flygt or equal via two wire communication cables to monitor seal failure, motor temperature by three (3) separate RTD sensors for each phase, upper and lower bearing temperature with RTD sensors, three axis vibration and keep event history in a memory chip.
 - 3. Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the pump, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.



- 4. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber o-rings. Fittings shall be the result of controlled compression of rubber O-rings in two planes and o-ring contact of four sides without the requirement of a specific torque limit.
- Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical o-rings, grease, or other devices shall be used.
- B. Stainless steel nameplates shall be attached to each pump and motor giving pertinent design data, horsepower, voltage, phase, running amps, model, serial numbers, and manufacturer's name.
 Provide one spare duplicate nameplate for each pump.
- C. Volute:
 - Pump volute(s) shall be single-piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass nay solids that may enter the impeller.
 - 2. The volute shall have a replaceable suction cover insert ring in which are cast spiralshaped, sharp-edged groove(s). The spiral grooves shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross in each rotation to maintain an unobstructed opening.
 - 3. Clearance between volute grooves edges and impeller leading edges shall be adjustable.
- D. Impeller
 - 1. Impellers shall be of Hard-Iron[™] (ASTM A-532 (Alloy III A) 25% chrome cast iron), dynamically balanced, semi-open, multi-vane, back-swept, screw-shaped, non-clogging designs. The impeller leading edges shall be mechanically self-cleaned during rotation, maintaining an unobstructed leading edge. The leading edges of the impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. Any impeller material with less that Rc60 hardness shall not be acceptable. Coating of standard cast iron to increase hardness shall not be allowed. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw.
 - 2. Impellers shall be locked to the shaft, held by an impeller bolt, and shall be coated with



alkyd resin primer.

- 3. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request.
- E. Wear Rings: An insert ring made of Hard-Iron[™] (ASTM A-532 (Alloy III A) 25% chrome cast iron integral with the volute shall provide effective sealing between the multi-vane semi-open impeller and the volute housing.
- F. Pump Shaft: Pump and motor shaft shall be a solid continuous shaft. The pump shaft shall be an extension of the motor shaft. Couplings or pieced shafts shall not be acceptable. The pump shaft shall be AISI type 431 stainless steel and shall be completely isolated from the pumped liquid.
- G. The pump shaft shall rotate on at least three grease-lubricated bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing to handle radial loads. The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust. The upper support bearing, provided for radial forces, shall be a single roller. The minimum L₁₀ bearing life shall be 50,000 hours at any usable portion of the pump curve. Single row lower bearings are not acceptable.

2.04 MOTORS

- A. Submersible Motors
 - 1. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the current-UV-dip impregnation method using Class H monomerfree polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for submersible pump usage and continuous duty pumping media of up to 40°C (104°F) and capable of at least 30 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum or copper. The motor shall be explosion-proof.
 - The premium efficiency motor rotor shall have end rings and rotor bars constructed of copper. The premium efficiency motor shall meet the efficiency levels specified in the IEC standard 60034-30 for international efficiency, Class IE3.
 - 3. All motors shall be provided as variable speed ready, unless noted otherwise.



- 4. Thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding. Three (3) PT-100 type temperature sensor shall be installed in the stator winding, one for each phase. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection for connection to the control panel.
- 5. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. A mechanical float switch (FLS) shall be mounted in the junction chamber to signal if there is water intrusion. A pump memory module shall be provided and mounted in the junction chamber to record pump run time, number of starts, as well as contain the motor unit performance and manufacturing data and service history. Wire nuts or crimping type connection devices shall not be acceptable. The motor and pump shall be designed and assembled by the same manufacturer.
- 6. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C.
- 7. A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.
- 8. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.
- B. Bearings:
 - 1. The pump shaft shall rotate on at least three grease-lubricated bearings. The upper bearing shall be a single roller bearing to handle radial loads. The upper bearing shall have an insulated outer ring to provide protection against potential bearing damage from electrically induced currents that can be created especially when the motor is used with a VFD. The outer ring shall have a plasma-spray technique or oxide-ceramic coating that provides an insulating barrier between the bearing face and the bearing housing of the pump. Upper and lower bearings shall have PT-100 sensors for over temperature protection.
 - 2. The lower bearing shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust. Housing for lower bearings shall include an independent thermal sensor to monitor the bearing temperature. If a high temperature



occurs, the sensor shall activate an alarm and shut the pump down.

- 3. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve at maximum product speed.
- C. Cooling System
 - 1. Each unit shall be provided with an integral, closed-loop motor cooling system. A Type 304 stainless steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C), in accordance with NEMA standards. Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.
- D. Mechanical Seals
 - 1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall be a leakage-free seal, and shall contain one stationary and one positively driven rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber.
 - 2. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either direction of rotation without damage or loss of seal.
 - 3. Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm. Any intrusion of fluid shall not come into contact with the lower bearings.

- 4. The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Cartridge type systems will not be acceptable. No system requiring a pressure differential to offset pressure and to effect sealing shall be used. Other seal materials than tungsten carbide shall not be accepted.
- 5. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate continuously while non-submerged without damage while pumping under load.
- 6. Seal lubricant shall be FDA Approved, non-toxic.
- F. Power Cables: The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box, shown on the Contract Drawings, without the need of any splices. Provide fifteen (15) extra feet in addition to the length between pump motor and junction box for each cable. Coil and bundle excess cable and secure. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.
- G. Cable Entry Seal: The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the cable entry unit, providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable
- H. Protection
 - 1. In addition to power and earth conductors, the pump motor cables shall contain shielded and twisted leads for digital communication. Communication of signals from pump sensors shall be made on two leads inside the power cable without using a separate multi-wire pilot cable.
 - 2. The pump monitoring system shall be able to stop pump operation at imminent danger by



an interlock relay and shall also alert the user in case of deviating measurement values. The electronic system shall be designed to support the principle of redundancy. Therefore, a separate set of modules should be used to monitor each pump. In the event a module fails, this will not affect the operation of other pumps in the station. When a pump-related alarm is generated, the system shall support the user in the form of measurement data linked to the specific alarm item for analysis, text information about possible root cause errors and remedial actions. The system shall support the service and maintenance policy that applies to the pump by generating service reminders and graphically providing users with an overview of service status that facilities planning of upcoming service.

- 3. A pump electronic module should be installed in the pump providing for connection of pump sensors as well as measurement and logging. Measurement values and other information shall be exchanged with a base unit in the electrical cabinet using an interference resistant digital communication bus. The pump electronic module shall contain information about the pump as well as features for startup and service support including:
 - a. The pump serial number and other data plate information
 - b. Specific configuration of monitoring functions for the actual pump such as alarm limits, delays, reset types, etc.
 - c. Counters by which the system can generate service reminders in accordance with the service policy specified in the pump manual.
 - d. Data, operating statistics and alarms list with associated so-called black box to see the condition of the pump and enable quick troubleshooting and reporting.

The PEM database shall, for all monitoring channels, contain measurements taken each second and averaged data for effective analysis and troubleshooting. A max value is the highest measurement value of resolution "second" within the averaged period, while a min-value is the lowest measurement value of resolution "second" within the averaged period.

Time resolution	Time period	Max value	Min value
Second	2 hours	-	-
Minute averages	1 week	*	**
Hour averages	1 year	*	**
24-hour averages	20 years	*	**

Measurement data linked to alarm events (so-called black box)

Time resolution	Time period	Max value	Min value
Second	1 hour	-	-
Minute averages	6 hours	*	**

- 4. The pump shall be equipped with the following sensors as standard: Thermal contacts, one in each motor winding (alternatively thermistors) for motor protection; leakage sensor in the stator housing, inspection chamber, or on the connection housing (alternatively); Pt100 for measuring motor temperature in one phase; Pt100 for measuring temperature in main bearing, current transformer in one phase of measurement of pump current and supplied frequency to the motor; three-axis vibration sensor for vibration in mm/s or inch/s with a frequency range 10-600 Hz. Other standard recordings are accumulated running time and number of starts and pump duty rate (percentage of operation). Optional pump sensors is Pt100 for measuring motor temperature in three phases, Pt100 for measuring temperature in the support bearing and leakage sensor in the oil housing.
- 5. A power meter (PAN 312) shall be provided for measuring the following electrical quantities: main voltage, voltage imbalance, pump power, current imbalance, power factor and energy.
- 6. For each pump, there must be a MAS 801 base unit in the cabinet with which interference resistant communication is established with the pump electronic module. The base unit shall be able to stop the pump if required via an interlocking relay, function as a gateway by relaying data traffic between the central unit and the pump electronic module, and provide for connection of optional measuring modules such as a power meter and other I/O modules.
- 7. A central unit (CU) shall be provided for external access and information exchange with the monitoring system via one single point. The user should be able to connect to the CU via an RJ45 jack to the local PC point to point, local area network and the Internet. A local operator panel shall be possible to connect to the CU via a separate RJ45 socket. The CU shall have a functionality based on embedded web pages that can be used through a PC or operator panel that allows for quick installation, configuration, pump status overview, alarm management, and analysis through trend graphs and histograms. The CU shall contain the same pump data and logged data stored in each pump electronic module for quick access and redundancy. External communication with pump control or SCADA system shall be possible with Modbus RTU or Modbus TCP.



2.05 REMOVAL SYSTEM

- A. Each pump shall have an integral 316 stainless steel telescoping inlet for inspection and visual verification of impeller clearance using a feeler gage. The use of gasketed spool pieces, clamping type fittings, TEEs, or other devices which require removal of fittings and/or potentially impart hydraulic impact to the pump inlet shall not be considered acceptable. All service inlet devices shall be certified hydrostatically tested at the factory and mounted to the pump for the pump working pressure. Pumps that rely on externally adjusted wear plates risk non-uniform adjustment, bearing damage, and which do not facilitate visual impeller inspection will not be acceptable. A pressure gauge connection shall be included standard on telescoping inlet. The volute shall have a conveniently located drain connection to aid with inspection and or maintenance operations.
- B. A 316 stainless steel service cart shall be provided integral to the mounting for rigid support and removal of rotating assembly from volute without disturbing volute or piping and without the need for hoists or lifting apparatus during maintenance. A controlled, hydraulically operated service cart shall be used which provides simple and controlled extension and retraction and adequate clearance of volute to enable wear ring, impeller, and lower seal replacement without the need for hoists, cable or pulley systems,

2.06 ACCESSORIES

A. Cable Holder: Heavy duty, type 316 stainless steel.

2.07 FINISHES

- A. Primer and Finish Paint-Shop apply epoxy coating to all exterior ferrous surfaces of the pump and motor.
 - 1. Surface Preparation Prepare all surfaces to receive coating system. Surfaces shall be free from dust, grease, rust, scale, and other coatings
 - Primer and Finish Paint Shop apply to all exterior ferrous surfaces of the pump and motor a single coat of two component epoxy. Coating shall be resistant to sewage of normal pH and contain no more than 3.5 pounds per gallon of VOCs.
 - 3. Finish Coat Color: Grey.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install pumps plumb and level.
- B. Install motor and pump in accordance with manufacturers installation instructions.



C. Check the pump's rotation in the presence of the manufacturer's representative.

3.02 SOURCE QUALITY CONTROL

- A. Pump Shop Tests: Shop Test all pumps provided under this Section.
 - 1. Hydrostatically test pump bodies per ANSI/HI 1.6, to the greater of: twice specified pump discharge head at the full speed design point, or 1.5 times pump's shutoff head.
 - 2. Witnessed Factory Performance Test
 - a. Each pump shall be subject to a witnessed performance shop test to determine the head, capacity, speed, brake horsepower, and efficiency at each condition specified in the Design and Performance Criteria. Pump shall be tested in dry-pit operation.
 - Performance shop tests shall be witnessed by the Owner's representatives.
 Owner and Engineer shall be informed of the test dates a minimum of four weeks in advance. Presence of Owner's representatives during testing does not relieve Contractor from complying with the Contract Documents and does not indicate or imply acceptance of the equipment.
 - c. One Construction Manager and two additional representatives of the Owner shall attend the witness testing. Expenses and costs for witnessing shall be paid by Contractor, including the following:
 - 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.
 - Overnight accommodations (three single occupancy rooms) in a hotel in reasonable proximity to the factory testing location. Room quality to be standard business class.
 - 3) Ground transportation between the hotel and factory testing location.
 - Meals for the duration of the testing. Meal allowance shall not be less than U.S. Internal Revenue Service guidelines.
 - d. Each pump shall be operated at the rated duty point. Results of the tests shall be shown on a plot of test curves showing head, flow, horsepower, efficiency, and current.



- e. Operate each pump at full speed against a closed discharge valve for a minimum of two minutes. Inspect the wear rings for contact by removing the suction cover.
 Pumps exhibiting contact shall be rejected.
- f. For a single pump, perform an extended pumping test at the full speed design point for a minimum of two hours to verify that the pump will operate at the rated capacity without loss of flow, head, or efficiency.
- g. If equipment fails tests, retesting shall be scheduled as soon as possible. Repeat tests until results indicate compliance with the Contract Documents.
- h. Submit copies of all Shop Test results certified by a Professional Engineer and signed by an officer of the manufacturing corporation.
- i. Equipment shall not be shipped to the site until the Contractor has received written notification from the Engineer of their acceptance of the results.

3.03 FIELD QUALITY CONTROL

- A. After the installation of the pumps, controls and all appurtenances, and when construction of other units of the pump station will permit, each complete pumping unit will be subject to field tests as specified herein under actual operating conditions.
- B. Field tests shall be conducted by the Contractor under the direct supervision of a qualified factory trained engineer, and in the presence of, and as directed by the Engineer. Provide, calibrate and install all temporary gauges and meters, make necessary tapped holes in the pipes, and install all temporary piping and wiring required for the field tests.
- C. The field tests shall determine the head, discharge flow and overall efficiency characteristics of each pumping unit and in addition, shall demonstrate that under all conditions of operation each unit:
 - 1. Has not been damaged by transportation or installation.
 - 2. Has been properly installed.
 - 3. Has no mechanical defect.
 - 4. Is in proper alignment.
 - 5. Has been properly connected.
 - 6. Is free of overheating of any parts.



- 7. Is free of all-objectionable vibration and noise.
- 8. Is free of overloading of any parts.
- D. Test each electric motor and record operating voltage and amperage. Have the manufacturer's representative record this information on the manufacturer's startup report (MSR).
- E. Submit the MSR for each pump startup for record purposes. Record the model number, serial number, and nameplate data on each MSR. Separate MSR's shall be provided for each pump.
- F. Review use of pump service cart during startup training for the installation.

3.04 SCHEDULE

GENERAL:

Quantity:	4
Xylem/FLYGT Model Number:	NZ 3202 LT 3 ~ 615
Xylem/FLYGT Impeller Diameter:	342 mm

PUMPING CHARACTERISTICS

The system head curves for a "C" value equal to 100 at minimum and maximum static head conditions for 2 pumps in operation with existing 12-inch to 24-inch discharge piping are as follows:

Flow (gpm)	2,083	4,908	8,848	9,816	10,784
TDH-Maximum Static (ft.)	29.42	31.10	35.65	37.15	38.81
TDH-Minimum Static (ft.)	25.26	26.94	31.48	32.99	34.65

Two pumps in operation, at 100% operating speed and maximum static head, shall deliver a minimum flow of 8,848 gpm at 36 feet TDH. NPSHR shall not exceed 25 feet at any operating condition.

PHYSICAL CHARACTERISTICS

Pump Discharge Size (inches): 12

Pump Suction Size (inches): 12

ELECTRICAL CHARACTERISTICS:
Minimum Motor Horsepower (HP):	54
Motor Speed (RPM):	1185
Service Voltage (V):	460
Frequency (HZ):	60
Phase:	3

NOTES:

- 1. Variable Frequency Ready Motor Required
- 2. Pump control cord separate from power cord.

+ + END OF SECTION + +



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PART 1 - GENERAL

1.01 – DESCRIPTION

A. Furnish, install, test and place in satisfactory operation, as shown on the Plans and specified herein, booster pumps and controls complete with all appurtenances and accessories to produce a complete and workable installation.

1.02 – 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.

1.03 – MAINTENANCE

A. Spare Parts: Deliver one spare set of mechanical seals for each size and type of pump equipped with mechanical seals. 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.

1.04 - 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:

H 2 M

"(*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. 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
 - a. 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	Pump Stages	Quantity
75	176	5	3500	4	2

Note: Motor shall be wired for 460V/3 Phase/60 Hz.

- C. Pump Construction:
 - 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 selfcentering and easily replaceable.
 - 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 topmost 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.

2.03 – CONTROLS AND INSTRUMENTATION

- A. Control panel shall include, but not be limited to the following devices:
 - 1. Hand-Off-Automatic (HOA) selector switches for each pump, plus pilot device for automatic control.
 - 2. Emergency E-stop pushbutton.
 - 3. System failure alarm indication light (for common VFD fault alarms)
 - 4. Common audible system alarm horn with silence/reset pushbutton
- B. Variable Frequency Drives
 - The drive shall be solid state, with a Pulse Width Modulated (PWM) output. The drive shall be a Direct Torque Control (DTC) or sensorless vector equivalent AC to AC converter utilizing the latest isolated gate bipolar transistor (IGBT) technology. The drive must also provide an optional operational mode for scalar or V/Hz operation.
 - The Drive shall be UL listed, comply with EMC Directive 89/336 EEC, Low Voltage Directive 73/23 EEC and Machinery Directive 98/37 EC in accordance with the European Union's CE directive.
 - The Drive shall utilize the same communications architecture, utilizing plug-in communications cards, for high-speed noise immune connectivity throughout the entire Drive manufacturer's Power range.
 - 4. Ratings
 - a. The Drive shall be rated to operate from 3-phase power at 230VAC to 500VAC ±10%, 48Hz to 63Hz. The Drive shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.97 at all speeds and loads.

- b. The Drive efficiency shall be 98% or better at full speed and load. An internally mounted AC line reactor or DC choke shall be provided to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions.
- c. The overload current capacity shall be 110% of rated current for one (1) minute out of five (5) minutes. Output frequency shall be adjustable between 0Hz and 180Hz.
- 5. Operator Control Panel (Keypad)
 - Each Drive shall be equipped with a front mounted operator control panel (keypad) consisting of a four- (4-) line by 20-character back-lit alphanumeric display and a keypad with keys for Run/Stop, Local/Remote, Increase/Decrease, reset, menu navigation and parameter select/save.
 - b. The control panel shall include a feature for uploading parameter settings to control panel memory and downloading from the control panel to the same drive or to another drive.
 - c. All Drives throughout the entire power range shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating.
 - d. The keypad shall be removable and insertable under drive power, capable of remote mounting, and shall have its own non-volatile memory.
 - e. During normal operation, one (1) line of the control panel shall display the setpoint reference, run/stop and local/remote status. The remaining three (3) lines of the display shall be programmable to display the values of any three (3) operating parameters. At least 24 VFD and 18 pump related parameter selections shall be available including the following:
 - 1) Pump process variable in units of psig, gpm, ft, etc.
 - 2) Vibration level in units of IP/s or mm/s
 - 3) Energy Savings verses a constant speed pump
 - 4) RPM
 - 5) Output frequency, voltage, current and torque
 - 6) Input voltage, power and kilowatt hours
 - 7) Heatsink temperature and DC bus voltage
 - 8) Status of discrete inputs and outputs
- 6. I/O Capabilities

- a. Six (6) discrete inputs shall be designed for "dry contact" inputs used with either an internal or external 24 VDC source.
- b. Three (3) form C relay contact outputs, all independently programmable. Relay contacts shall be rated for continuous 2 Amps at 24VDC or 115/230VAC.
- c. Function selections shall include indications that the drive is ready, running, faulted. General and specific warning and pump fault indications shall be available
- d. Three (3) analog inputs, expandable to five (5), one (1) +/- 0VAC 10VAC and two (2) 4mA 20mA, all independently programmable. A differential input isolation amplifier shall be provided for each input. Analog input signal processing functions shall include scaling adjustments and adjustable filtering. If the input reference (4-20mA or 2-10V) is lost, the AFD shall give the user the option of the following: (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning and/or over the serial communications bus.
- e. Two (2) analog, expandable to four (4), outputs providing 4mA to 20mA signals. Analog output signal processing functions shall include scaling adjustments, adjustable filtering and signal inversion. Outputs shall be independently programmable to provide signals proportional to at least 11 output function selections including output speed, frequency, current, process variable and vibration level.
- 7. Serial communications
 - Serial communication interface modules are available for a wide selection of communication protocols. Available adapters are as follows: Modbus, Modbus Plus, Profibus, DeviceNet and Ethernet.
 - b. Serial communication capabilities shall include, but not be limited to, run-stop control; setpoint adjustment, current limit, and accel/decel time adjustments. The drive shall have the capability of allowing the Distributed Drive Controller (DDC) to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, and diagnostic warning and fault information. Additionally, remote Local Area Network (LAN) VFD fault reset shall be possible.
 - c. A fiber optic communication port shall also be provided for personal computer interface. Microsoft Windows®-based software shall be available for drive setup,



diagnostic analysis, monitoring and control. The software shall provide real time graphical displays of drive performance.

- 8. Drive Protective Functions
 - a. For each programmed warning and fault protection function, the drive shall display a message in complete English words or Standard English abbreviations. The sixty-four (64) most recent fault messages and times shall be stored in the drive's fault history.
 - b. The drive shall include internal MOV's for phase to phase and phase to ground line voltage transient protection.
 - c. Output short circuit and ground fault protection rated for 65,000 amps shall be provided per UL508C without relying on line fuses. Motor phase loss protection shall be provided.
 - d. The drive shall provide electronic motor overload protection qualified per UL508C.
 - e. Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated voltage or undervoltage at 65% of min. rated voltage and input phase loss.
 - f. A power loss ride through feature will allow the drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.
 - g. Stall protection shall be programmable to provide a warning or stop the drive after the motor has operated above a programmed torque level for a programmed time limit.
 - h. Underload protection shall be programmable to provide a warning or stop the drive after the motor has operated below a selected underload curve for a programmed time limit.
 - i. Over-temperature protection shall provide a warning if the power module temperature is less than 5°C below the over-temperature trip level.
- 9. All logic set forth in this specification must reside internal to the drives internal microprocessor. No systems using an external controller shall be acceptable.
- 10. Drive shall be preprogrammed with a centrifugal pump specific application macro.
- 11. The two drives shall be connected via fiber optic cables to allow communication between the drives.



- a. A master drive shall have the ability to stage and de-stage up to three (3) lag pumps based on demand of the system.
- b. If for any reason a pump fault or VFD fault is detected the drive shall stop the pump and single the lag pumps to compensate.
- c. The drive should have the ability to automatically switch lead lag based on a timed value.
- 12. The program must be designed for ease of use and come standard with a user friendly programming manual specific for centrifugal pumps.
- 13. The Control Panel (keypad) should have the ability to display pump nomenclature (PSIG, GPM, IP/s, mm/s, etc.) to allow the operator to have a better understanding of the current pump and system status.
- 14. Drive shall have an internal controller to control a process variable such as pressure, flow, level, etc.
- 15. Controls functions shall be as follows:
 - a. A motor parameter ID function shall automatically define the motor equivalent circuit used by the sensorless vector torque controller.
 - b. The VFD shall be capable of starting into a rotating load and accelerate or decelerate to reference without safety tripping or component damage (flying start).
 - c. The VFD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage or pump protect fault. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
 - d. Discrete Inputs
 - 1) Start/Stop functions shall include two (2) or (3) wire start/stop discrete inputs.
 - 2) Drive shall have a discrete input for a remote manual override/jog function in two (2) wire start/stop control.
 - e. Drive shall include a digital input that allows two preprogrammed setpoints to be toggled back and forth to allow the ease of changing the setpoint for different modes, time of day, etc.
 - f. Drive shall include a drive permissive or emergency stop digital input.
 - g. Drive shall have adjustable accel/decel ramp rates to limit the in-rush current and prevent water hammer in the piping system.
- 16. Pump Protection Features



- a. Drive shall have the ability to detect and protect against detrimental pump conditions including:
 - 1) Dry Run
 - 2) Shut Off
 - 3) Dead Head
 - 4) Severe Cavitation
 - 5) Low Flow
- b. Drive shall have a minimum of two digital inputs dedicated for a secondary pump protection binary input such as level, pressure, flow, temperature switches.
- 17. Condition Monitoring
 - a. Drive shall have the capability to monitor bearing vibration via a 4-20mA analog input. The keypad display should clearly indicate the units of the vibration condition such as IP/s or mm/s. The drive will have two programmable levels to signal a warning and alarm. If the alarm level is reached the drive shall either reduce the pump speed to pre-programmed speed or fault the pump.
- 18. Hydraulic Wear Monitor
 - a. Drive should have the capability to detect pump wear at programmable levels of 10%, 15%, 20%, 25% and indicate when these levels have been achieved.
 - b. The drive shall have the ability to distinguish between actual pump performance degradation and system changes.
- 19. Sequence of Operation
 - a. Setpoints shall be entered at the keypad of the lead drive. Alternately setpoint in auto mode may be provided via a 4-20mA input to the lead drive, or over Ethernet (Ethernet card required).
 - b. In Automatic mode, the system shall monitor discharge pressure via the suction pressure transmitter. System shall receive a start signal from the washer/compactor and up to and maintain 70 psi (operator adjustable) until run signal is released.
 - c. When enabled in auto mode, the system shall automatically stage and destage pumps if a single pump cannot meet system demand.
 - d. The lead pump shall be automatically rotated every 48 hours of run time.



- e. The drives shall be programmed to automatically protect the pumps from flow below minimum flow and from run-out using the drives' sensorless flow feature. No external flow meter shall be required.
- C. Instrumentation and Accessories
 - 1. Provide discharge pressure transmitter with local display of pressure reading. Transmitter shall be loop powered, IP65, linear 4-20mA output proportional to pressure, and installed with isolation valve.
 - 2. Pumps' status shall be monitored by pump-mounted condition monitors to record equipment status and predict maintenance requirements. Condition monitor shall have internal memory to record data for 60 days hourly or maintain a weekly summary for 5 years, IP 67 rating, 2400-2483.5 MHz Blue-Tooth connectivity for reporting of RMS Velocity and Fast Fourier Transform and machine run time, 3 year battery life, equipment status indicator light, and three-axis accelerometer with range of +/-16g.

2.04 – HYDROPNEUMATIC TANKS

- A. Manufacturers:
 - 1. Amtrol, Model WX-405C
 - 2. Wessels Company
 - 3. Approved equal
- B. Tank set points shall be designed for an 60 PSI cut-in and 80 PSI cut-out, at 30 gpm of draw down.
- C. Tank construction shall consist of:
 - 1. Carbon steel shell, heavy duty butyl and epoxy lined system connection;
 - 2. NPT piping connections and standard tire valve charging connection
 - 3. Lifting rings and floor mounting skirt for vertical installation
 - 4. Conform to the requirements of Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code, latest revision
- D. Tank shall be pre-charged at 30 PSI from factory and shall be field adjustable.



PART 3 – EXECUTION

3.01 – INSTALLATION

- 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 + +



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PART 1 - GENERAL

1.01 – SECTION INCLUDES

- A. Grit collector drive
- B. Grit collector replacement parts
- C. Grit screw conveyor replacement parts

1.02 – REFERENCES

A. ANSI/AGMA 6034-B92 "Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors."

1.03 - SUBMITTALS

- A. Submit the following in accordance with the requirements in Section 01300:
 - 1. Technical specifications for the conveyor, motor, and accessories.
 - 2. Detailed specifications and data covering materials used, parts, and other accessories forming a part of the system.
 - 3. Field wiring diagram for each electrically operated piece of equipment.
 - 4. Electrical data sheet for each size motor.
 - 5. Storage, handling, and installation instructions.
- B. Manufacturer Start-up Reports in accordance with paragraph 3.01 herein.
- C. Operations and Maintenance Manual prepared in accordance with the requirements contained in Section 01730 Operations and Maintenance Data.

1.04 – QUALITY ASSURANCE

- A. The grit collector motor, drive, 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 automatic operation of the system. The grit collection equipment shall be manufactured by Walker Process Equipment or pre-approved equal.
- B. The shaftless screw conveyor replacement parts 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 automatic operation of the system. The shaftless screw conveyor shall be manufactured by JDV Equipment or pre-approved equal.

- C. The specified products provide a standard of quality, specification dimensions, and performance required for this project.
- D. Any proposed substitutions must be compatible with the existing equipment by Walker Process Equipment and JDV Equipment to remain.
- E. Any proposed substitutions from manufacturers other than those listed will require full compliance with the requirements in Article GC17 of the General Conditions.

1.05 - FIELD SERVICES

- A. Supply and credit to the Owner the costs for field services as specified in Section 01660 Quality Control.
- B. Field services shall be provided in accordance with the requirements contained in Section 01650 -Starting of Systems and Paragraph 3.02 herein.

1.06 – WARRANTY

- A. Provide a warranty certificate typed on manufacturer's letterhead and signed by an officer of the manufacturer. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located
- B. The manufacturer shall guarantee all components of the equipment to be free from defects in design, materials and workmanship for a period of one (1) year commencing on the date the equipment was permanently placed on-line.
- C. 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 – GRIT COLLECTOR DRIVE

- A. The center drive mechanism shall consist of a motor driven primary gear reduction unit, steel chain roller drive, shear pin coupling, enclosed worm gear reduction unit, and an overload system.
- B. Gear Design:
 - The continuous output torque rating and the allowable stress values used in the design of the worm gear reduction unit shall be in strict conformance with the latest revision of ANSI/AGMA 6034-B92, "Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors."
 - 2. The drive shall be designed and rated to develop the following minimum torque values:

Operating Condition	<u>Minimum Torque</u>	<u>Notes</u>
Continuous	7,350 foot-pounds	
Alarm	7,350 foot-pounds	100% of Continuous
Motor Cut-Off	9,190 foot-pounds	125% of Continuous
Momentary Peak	14,700 foot-pounds	200% of Continuous
Shear Pin		Less than 200% of Continuous

- 3. The equipment manufacturer shall submit calculations to the Engineer for approval substantiating the continuous output torque rating. Calculations shall include the worm gear set and all bearings used in the gear reduction unit. The worm gear set calculations shall be reviewed and certified by an associate member of AGMA. A statement of AGMA recognition, subject to the approval of the Engineer, shall be included with the calculations to confirm this requirement is met.
- C. Primary Gear Reduction Unit:
 - The primary gear reduction unit shall consist of a totally enclosed, horizontal type gear motor with C-face mounted drive motor, mounted on top of the worm gear housing. The primary gear reducer shall be a heavy-duty worm gear type conforming to ANSI/AGMA 6019-B89, and shall have a service factor of 1.4, based upon the specified continuous running torque.
 - 2. All gearbox bearings shall be of the anti-friction type and running in oil in a cast iron or steel housing.



- D. Chain Drive:
 - 1. Power transmission between the primary gear reduction unit and the worm gear reduction unit shall be through a steel roller chain and steel sprocket assembly. The driven sprocket shall include a shear pin overload to provide overload protection to the drive train.
 - 2. The chain drive shall be enclosed with a chain guard meeting OSHA requirements.
 - 3. The shear pin overload shall be easily accessible by removal of the chain guard. Direct drives, in lieu of a chain drive, will not be acceptable.
- E. Worm Gear Reduction Unit:
 - The worm gear reduction unit shall consist of a worm gear driven by an integral straddle mounted worm and shaft, supported by heavy-duty anti-friction bearings running in an oil bath, and housing. Shell worms will not be acceptable. Plain or sleeve type bearings will not be acceptable. All bearings shall have a minimum L10 life of 20 years, based on the continuous torque rating.
 - 2. The integral worm and shaft shall be single piece and made from AISI 8620 alloy steel carburized, hardened and ground and shall have a case hardness of minimum 58 Rc. The worm gear shall be centrifugally cast, conforming to ASTM B271 and ANSI/AGMA 2004-B89, high strength, manganese bronze. The worm gear shall have a minimum 200 Brinnel hardness and shall have a minimum pitch diameter of 16 inches and have a minimum face width of 2.5 inches. The worm gear housing shall be ASTM A48 Class 40 cast iron complete with vents, seals, oil fill, oil level sight gauge and drain plugs. Fabricated housings will not be acceptable.
 - 3. The base of the housing shall be mounted as indicated on the Plans. The worm gear shall be fastened to the top flange of the torque tube and be designed to support the rotating grit collector mechanism.



2.02 – GRIT COLLECTOR MOTOR

- A. The drive motor shall be 3 hp, 1800 rpm, TEFC, severe duty, explosion proof, Division 1, Class I Groups C & D, and shall include a sealed conduit box.
- B. The motor shall be designed for 3 phase, 60 hertz, 230/ 460 volt power supply.

2.03 – GRIT COLLECTION EQUIPMENT OVERLOAD PROTECTION

- A. The overload protection system shall include a totally enclosed actuator and visual load indicator that plainly shows the overload points. Non-enclosed actuator systems will not be acceptable.
- B. The overload alarm and shut-off system shall consist of two (2) explosion proof micro switches, one to close an alarm circuit when the load reaches the alarm running torque of the drive assembly, and one to cut off the motor when the load reaches the cut-off running torque of the drive assembly. The micro switches shall be mounted in a watertight housing and shall be actuated by the movement of the worm shaft in the intermediate worm gear speed reducer.
- C. A plexiglass window shall be mounted on the overload housing for observance of the dial position.

2.04 – FLOW DEFLECTORS

- A. The grit chamber shall be provided with inlet flow deflectors to evenly distribute the incoming flow across the grit chamber. The deflectors shall consist of steel plates rigidly welded to steel operating shafts.
- B. The operating shafts shall be rigidly secured to operating handles provided with large diameter locking lugs. Each lug shall engage any one of several openings provided in an anchorage flange cast in concrete.

2.06 – PAINTING

- A. All fabricated steel parts shall be commercially cleaned and given one (1) shop coat of rust inhibitive primer.
- B. All items such as motors, reducers and equipment completely shop assembled and ready for installation shall be given one (1) shop coat of the manufacturer's machinery enamel.
- C. The Contractor shall furnish and apply all touch-up of the prime coat and all finish coats.



2.06 – SHAFTLESS SCREW CONVEYOR REPLACEMENT PARTS

- A. Spiral flighting for the shaftless screw conveyors shall be designed to convey material without a center shaft. The conveyor will include an inner flight to increase axial strength and capacity of the conveyor. A steel pipe shall be installed down the center of the spiral to limit fallback of material. Steel pipe shall be tack welded to the spiral flighting.
- B. The inner and outer flight of the shaftless helical screw shall be fabricated of cold formed high strength alloy carbon steel. The outer flight should be a minimum 60 mm wide by 25 mm material. The inner flight should be a minimum 40 mm wide by 15 mm material. The drive end of the shaftless helical screw shall be terminated with a semicircular drive disc.
- C. Spiral flights shall be cold-formed high strength 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 flighting shall be reached at 30% of the Fy value in the extreme fiber of the flight material.
- D. Supplier shall demonstrate that at 250% of the motor nameplate horsepower, the drive unit cannot produce more torque than the torsional rating of the flighting, and that the "spring effect" of the spiral shall not exceed + 0.8 mm per meter of length at maximum load conditions.
- E. The spiral flighting shall be formed in sections from one continuous flat bar and shall be concentric to within ±2 mm.
- F. Sectional flighting formed from plate shall not be permitted.
- G. The wear liner shall be Hardox 400 Hardened carbon steel wear bars tack welded to an AISI 304 stainless steel segmented backing plate. The wear liner shall be furnished in maximum 4 ft. sections for ease of replacement.

2.07 – SPARE PARTS

- A. Provide the following spare parts for the grit collector motor and drive:
 - 1. (1) Complete intermediate guide bearing assembly for the torque tube
 - 2. (1) Complete set of gear motor bearings for the drive
 - 3. (1) Set of felt seals for the drive
 - 4. (1) Set of oil seals for the drive
 - 5. (1) Set of gaskets for the drive



PART 3 - EXECUTION

3.01 – GENERAL

- A. All components of the system shall be installed in accordance with the supplier's written and/or verbal instructions, and in compliance with all OSHA, local, state, and federal codes and regulations.
- B. All components shall be fully tested and verified for service by the manufacturer. The manufacturer shall provide a MSR. 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 – FIELD QUALITY CONTROL

- A. Suppliers 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 provide complete and thorough training of operator personnel. The service technician shall be an employee of the equipment 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:
 - 1. One (1) day totaling one (1) trip by the manufacturer of the grit screw conveyor 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 the manufacturer of the grit screw conveyor to field check the completed installation and verify proper operation during normal plant operating conditions.
 - 3. One (1) day totaling one (1) trip by the manufacturer of the grit collection equipment to instruct and assist the Contractor in the start-up of the grit collection equipment.
- C. Submit a written manufacturer's report certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting equipment or anchorage and has been operated under full load conditions and that it operates satisfactorily.



+ + END OF SECTION + +

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PART 1 - GENERAL

1.01 – SECTION INCLUDES

- A. Work of this Section includes:
 - 1. Front-cleaning, front-return link driven mechanically cleaned modular construction bar screen assembly, auxiliary equipment and accessories that removes solids (screenings) from raw wastewater.
 - 2. The bar screen shall automatically discharge screenings mechanically raised on the screen to the washer/compactor.
 - 3. Interleaving, dual auger washer compactor assembly on casters. A single unit shall provide washing and compacting action on wastewater screenings.
 - 4. Discharge chutes from the washer compactor units to shaftless screw conveyors to convey screenings to the disposal receptacle.
 - 5. Coordination with shaftless screw conveyor manufacturer for controls and discharge chute to conveyor transition.

1.02 – REFERENCES

- A. American Society for Testing and Materials (ASTM) A36: Standard Specification for Carbon Steel Plate
- B. American Society for Testing and Materials (ASTM) A536: Standard Specification for Ferritic Ductile Iron Castings
- C. American Iron and Steel Institute (AISI) 303 Stainless Steel
- D. American Iron and Steel Institute (AISI) 304 Stainless Steel
- E. American Iron and Steel Institute (AISI) 316 Stainless Steel
- F. American Iron and Steel Institute (AISI) 4130 Heat Treated Alloy Steel
- G. American Iron and Steel Institute (AISI) 4140 Heat Treated Hexagon Steel
- H. American Welding Society (AWS)
- I. American Institute of Steel Construction (AISC)



- J. American Bearing Manufacturers Association (ABMA)
- K. American Gear Manufacturers Association (AGMA)
- L. National Electrical Manufacturer's Association (NEMA) Standards
- M. National Electrical Code (NEC)
- N. Underwriters Laboratory (UL)

1.03 – SUBMITTALS

- A. Submit the following in accordance with the requirements in Section 01300:
 - 1. 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.
 - 2. Field wiring diagram for each motor operated piece of equipment.
 - 3. Layout and installation drawing based on field measured influent channel drawings that illustrate the layout of the equipment, equipment weight, principal dimensions with related verifications required for installation including anchorage locations.
 - 4. Layout and installation drawing that illustrate the layout of the equipment, including discharge chutes, required for installation, including anchorage locations.
 - 5. Anchor bolt template drawings and anchor bolt loads.
 - 6. Dimensional data and capacity data for the screening system.
 - 7. Technical specifications for the discharge chute and support system.
 - 8. Dimensional data and capacity data for the washer compactor.
 - 9. Storage, handling and installation instructions.
 - 10. Control panel wiring schematic.
 - 11. Control panel layout drawing and nameplate details.
 - 12. Catalog cuts of every device inside the control panel.

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- 13. List of spare parts and miscellaneous equipment to be provided under this Section
- 14. Warranty Certificate prepared in accordance with the requirements contained herein.
- B. Manufacturer Start-up Reports in accordance with paragraph 3.01 herein.
- C. Operations and Maintenance Manuals prepared in accordance with the requirements contained in Section 01730 Operation and Maintenance Data. The operating instructions shall include a cross-sectional view of screen and motor combination, which indicates materials of construction, weights, principle dimensions and other important details.
- D. Submit location of the nearest permanent service headquarters of the screen and motor manufacturer for the submitted screen and motor.

1.04 – QUALITY ASSURANCE

- A. The complete screen and washing/compacting system shall be furnished by one single supplier. This requires the supplier to be responsible for coordination with the Contractor and the development, design, fabrication, assembly, delivery, and proper sustained operation of all system equipment but does not require that all system equipment and accessories be the products of one single manufacturer.
- B. The mechanically cleaned bar screen and washer/compactor shall be fully assembled and shop tested at the manufacturing facility prior to shipment.
- C. All equipment furnished under this Section and related sections shall be of a single manufacturer who has been regularly engaged in the design and manufacture of the equipment and demonstrates, to the satisfaction of the Engineer, that the quality is equal to equipment made by those manufacturers specifically named herein. The screen manufacturer shall have at least 25 installations of mechanically cleaned bar screen equipment that has been in successful operation, at similar installations, for at least five (5) years.
- D. The equipment furnished shall be fabricated, assembled, installed and placed in proper operation condition in conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.
- E. The specified products provide a standard of quality, specification dimensions, and performance required for this project.

F. Any proposed substitutions from manufacturers other than those listed will require full compliance with the requirements of Specification Section 01030 – Alternates and Article GC-17 from the General Conditions.

1.05 – WARRANTY

- A. Provide a warranty certificate typed on manufacturer's letterhead and signed by an officer of the manufacturer. The certificate shall be witnessed by a notary public in the state in which the company headquarters is located.
- B. The manufacturer shall guarantee all components of the equipment to be free from defects in design, materials and workmanship for a period of one (1) year commencing on the date the equipment was permanently placed on-line.
- C. The manufacturer shall guarantee all rotating parts of the bar screen and washer compactor to be free from defects in design, materials and workmanship for a period of five (5) years commencing on the date the equipment was permanently placed on-line. This shall include the gear motor, bearing, drive head, and the link system including the links, castings, pins and retaining rings.
- D. 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 - MANUFACTURER

- A. Bar Screens shall be FlexRake® Model, Full Penetration Fine Screens manufactured by Duperon Corporation.
- B. Washer/compactors shall be by Duperon Corporation.
- C. Acceptable alternate manufacturers are Parkson Corporation or pre-approved equal.

2.02 – PERFORMANCE/DESIGN CRITERIA

A. Each unit of equipment shall be identified with a corrosion resistant nameplate, securely affixed in a conspicuous place. Nameplate information shall include equipment model number, serial

number, supplier's name, electrical information and location. Provide spare nameplate and turnover to Engineer/Owner.

- B. All components of the system shall be designed for continuous duty.
- C. The mechanically cleaned bar screen shall run continuously without an operator.
- D. Provisions shall be made for lubrication, adjustments, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.
- E. The mechanically cleaned bar screen shall have a head sprocket only, with no sprockets, bearings, or similar drive components under water to trap the chain. Equipment featuring reciprocating rake arms or lower bearings/sprockets/tracks below the water is not acceptable.
- F. The mechanically cleaned bar screen shall meet the total screen debris removal capacity of:
 - 1. Debris Volume per Linear Foot: 0.152 cubic feet/hour
 - 2. One discharge/minute
- G. The equipment shall have multiple scrapers/stagers on the bar screen at one time cleaning continuously from bottom to top, the entire width of the bar screen. The drive output shaft rotation shall be constant and in one direction in order to reduce maintenance. Units which have single raking arms or that require cycle times will not be allowed. Cleaning mechanisms that utilize shock absorbers, springs or other dampening or hydraulic actuations will not be accepted.
- H. The link system shall have jam evasion capability by flexing around and collecting large objects such as a 2 X 4, bowing ball, grease balls and surges of solids at peak loading times without overloading and shutting down the unit. The link system shall be such that it bends in one direction only which allows it to become its own lower sprocket and frame and shall have a 1,000 pound lifting capacity.
- I. Designs employing the use of endless moving media or cables and hydraulic cylinders to remove debris from the channel and units utilizing proximity or limit switches for reverse cycles are not acceptable.
- J. Equipment utilizing a greater than ½ HP motor or two or more motors to complete a screen cleaning cycle will not be accepted.
- K. The design shall be such to ensure that all maintenance can be accomplished at the operating floor level or above. No part of the drive system including sprockets shall be located below the water surface at maximum design flow.
- L. Design Criteria

- 1. Maximum flow: 12.74 MGD
- 2. Average daily flow: 5.5 MGD
- 3. Channel widths: 3.5 feet
- 4. Channel depth: 5.5 feet
- 5. Bar Clear Opening Size: 0.375 inches
- 6. Angle of Installation: 75 degrees from horizontal
- M. Headloss at 12.74 MGD maximum flow per screen with 0.375-inch clear opening at 1.66 feet/second velocity upstream in 3.5-foot wide channel with 25% blinding and 3.40 foot upstream water level shall not exceed 4.33 inches of headloss through the bar screen.
- N. The washing press shall reduce the organic content, moisture content and volume of screenings material from a mechanical bar screen. Screenings material shall enter the inlet hopper and be transported by the rotating screw into the washing zone. In the washing zone, wash water shall be sprayed into the screenings material to help dissolve and remove organic material.
- O. The washer/compactor shall be capable of processing screenings in continuous service. The shaftless screw conveyors shall be interlocked such that they run when the washer/compactor is running.
- P. Maximum wash water supply: 10 GPM supplied at a pressure of 40 to 60 psi.
- Q. Minimum volume reduction: 70%.
- R. Minimum mass/weight reduction: 60%.

2.03 - MANUFACTURED UNITS

A. Bar screen assembly: Bar screen assembly shall be of Type 304 stainless steel except for screen bars. Bar screen assembly designed to withstand 1 foot head differential. A stainless steel channel bottom plate shall be an integral part of the bar screen assembly to fully engage scrapers in the bar screen at the base of the unit and assure that the raking mechanism reaches the bottom of the screen to assure debris accumulation is not allowed. The bar screen assembly shall be shipped in one piece.

- Screen Bars: Bars shall be 316L stainless steel and be teardrop shaped with a hydraulic coefficient shape factor of 0.76 and minimum dimensions of 0.25 inch x 0.75 inch x 0.13 inch. Bars shall be individually replaceable without welding.
- 2. Side Fabrication: The screen framework shall be stainless steel bent plate with a minimum thickness of 3/16- inch. Horizontal members shall be of stainless steel bent plate with a minimum thickness of 0.25 inch or stainless steel pipe. Support members and frame shall adequately support the bar screen based on site specific requirements.
- 3. Dead Plate: Dead plate shall be 0.25 inch thick stainless steel. The dead plate shall span the entire width of the unit and transition from bar screen to discharge point.
- 4. Discharge Chute: The discharge chute shall be 11 ga. (0.12 inch) stainless steel. The discharge chute shall be bolted to the dead plate and shall be designed to allow debris to be transferred from discharge point into the debris container.
- 5. Link Slides: Link slide assembly shall be constructed of UV Stable UHMW PE rollers and stainless steel supports and components.
- B. Return Guide/Closeouts: Return guide/closeouts shall be stainless steel and shall assure proper alignment of scrapers as they enter the bar screen and assure that there is no space wider than the clear opening between bars to prevent passage of larger solids than allowed through the screen.
- C. Debris Blade: A stainless steel and UV Stable UHMW-PE debris blade assembly shall be installed to assist in removing debris from the scraper/stagers on the mechanically cleaned bar screen unit as recommended by the manufacturer. The debris blade shall not require a separate drive.
- D. Screen Enclosure: A 14ga. #4 brushed satin finish stainless steel Enclosure shall be installed to cover the screen above the operating deck level. Front Enclosure shall include removable panels for maintenance. Removable panels shall be 16ga Type 304 stainless steel and shall be provided with knurled knobs for "no tool required" access. Alignment notches shall be included to support repositioning of removable panels. Rear Enclosure shall have hinged removable doors and shall be secured with a lift-slide-latch handle. Rear removable door shall include an integral viewing door that shall be secured with a lift-slide-latch handle to provide access for a quick look inside.
- E. The link system shall be passivated stainless steel castings and have a minimum ultimate strength of 60,000 lbs with a minimum cross section of 1.5 inches and weighing a minimum of 4.5 lbs each.
 - 1. Link System Material of Construction: Type 304 stainless steel.

- F. Scrapers: Scrapers shall be spaced 21 inches apart. The scraper shall move at no greater than 28 inches per minute at standard operating speed of ½ rpm allowing for approximately 1 debris discharge per minute. Staging Scrapers and Thru Bar Scrapers shall be a maximum ratio of 3:1 per manufacturer recommendations. At least one scraper every 84 inches shall fully penetrate the bar screen, cleaning all three sides of the bars as well as through to the cross members in openings of 0.5 inches.
 - Staging Scrapers; 1 inch thick x 4 inches UV Stable UHMW-PE with a serrated edge. Staging scrapers shall be easily modified by the Owner if necessary to suit future changes in debris conditions.
 - 2. Thru Bar Scrapers: .375 inch thick x 5 inches Type 304 stainless steel.
- G. Drive Head: The Drive Head shall be located at the top of the mechanically cleaned bar screen.
 - 1. Drive Unit: Each mechanically cleaned bar screen unit shall operate independently and shall have its own drive unit and driven components.
 - a. Drive Sprockets and end castings shall be cast stainless steel.
 - b. Drive Shaft shall be stainless steel.
 - c. The Gearbox shall be shaft-mounted, right angle type that incorporates cycloidal and spiral bevel gearing. The gear reducer output shaft speed shall be controlled by a vector type inverter or per rake manufacturer's recommendation. It shall have at least a 1.52 service factor based on machine torque requirements. The gearbox shall not be vented to the outside atmosphere.
 - d. The Motor shall be AC induction type, inverter duty, 3 phase 240/480 volt and mounted to the gear reducer. Motor shall be ½ hp, designed for 1800 RPM base speed and rated for Class I, Groups C & D, Class II Groups F & G environments. Motor shall have an EPNV enclosure, NEMA design B with a 56C frame size. Service factor shall be 1.0. The motor shall have 1600V, Class F insulation and be optimized for IGBT type inverters. The motor must be UL listed and designed for continuous operation.
 - e. Motor shall have built in thermostat to protect from overheating that is to be field wired to corresponding terminal in control panel for redundant (ambient) overload protection.

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- 2. Bearing: Bearing shall be greased ball bearing type, non self-aligning, sealed and lubricated. Bearings shall have a 24/7/365 L10 life of 20 years when in compliance with stated O&M recommendations.
- 3. Speed Reducer: The speed reducer shall be a double-reduction, cycloidal style and shall comply with all applicable AGMA standards. The speed reducer shall be capable of a 4/1 speed range with variable output speeds between 0.50 to 2.2 output RPMs (in high flow conditions). The speed reducer shall produce an output torque of 11,417 in.lb. and have a gear ratio of 809:1.
- H. Standard Coating: Coat all non-stainless bar screen components in accordance with the paint manufacturer's specification. Surface Preparation shall be done in accordance with SSPC-SP-10 Near White. Material shall meet all state and federal VOC and other regulatory requirements. The three-part coating system shall be manufactured by Tnemec (or equivalent) as follows:
 - 1. Prime Coat Series 90-97 Tneme-Zinc at 2.5-3.5 mils DFT,
 - 2. Intermediate Coat Series 27 F.C. Typoxy at 3.0-5.0 mils DFT,
 - 3. Top Coat Series 1075U Endura-Shield II at 2.0-3.0 mils DFT. Color: 11SF Safety Blue.
- I. The washer/compactor shall accept solids removed from a wastewater stream and effectively wash, de-water, compact and discharge these solids for subsequent transport to a landfill. The washer/compactor shall be comprised of a hopper with perforated trough, compaction elbow, transport tube and discharge, wash water piping, drive assembly and a dual auger.
- J. Compacting Action: The washer/compactor shall have dual augers to provide positive displacement action. Augers shall be oriented on top of each other and rotate in opposing directions. Augers shall be intermeshed, with one left-hand and one right-hand lead. Augers shall be designed with a limited float on top of a strainer to allow for the accommodation of irregular debris.
- K. Washing Action: The wash port manifold shall be integrated prior to the compaction housing and sized to deliver 3 to 10 GPM based on a supply pressure of 40 to 60 PSI at a 1/2- inch NPT connection for attaching water source utilizing filtered effluent or municipal water. Washing action shall be flood wash type from a single 1/2- inch NPT supply. Drain connection shall be 3-inch NPT male.
- L. Operation: The washer/compactor shall be designed for continuous run not requiring operator. Washer/compactor shall be equipped with a self-regulating, active pressure zone designed to accept non-standard wastewater debris in its original form, such as rocks, broken concrete, and metal (bolts, short pipe, etc.) up to 4 inches long. Washer Compactor shall have the ability to

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process multiple pieces of clothing, variable volumes of debris, and unprocessed septage or grease. Compactor shall move at normal operating speed of 2.2 RPM and be able to run intermittently to sync with upstream equipment.

- M. Main Housing: The main housing of the washer compactor shall be constructed of stainless steel with a minimum thickness of 11 gauge. Support and flange connections shall be 3/8 inch.
- N. Hopper: The hopper of the washer compactor shall be constructed of stainless steel with a minimum thickness of 11 gauge.
- O. Augers: The augers shall be of stainless steel with 8 inch diameter flights, 3/8 inch thick, with 4 inch flight pitch. The augers shall be coupled to a transmission at the drive end and be supported at the compaction end with UHMW plane bearings. This arrangement shall allow for the accommodation of irregular debris. The auger shaft shall be 2 inch stainless steel schedule 40 pipe with 2 inch solid stainless steel stub shaft.
- P. Compaction Housing: The compaction housing of the washer/compactor shall be ¼ inch stainless steel and shall house a spring and gate assembly to provide the resistance for compaction. The compaction housing shall contain the auger supports.
- Q. Discharge Chute: The discharge chute of the washer/compactor shall be constructed of stainless steel with a minimum thickness of 14 gauge. Support and flange connections shall be 1/4 inch. The discharge chute shall be tapered outward toward the discharge end. The chutes shall convey the screenings directly from the washer/compactor to the disposal receptacle as shown on the drawings.
- R. Water Supply: The water supply shall connect at a single point with a ½ inch NPT female connector. A NEMA 7/9 Explosion proof solenoid valve is provided to limit the wash water flow to only when the washer compactor is running. Ball valves, additional ½ inch quick connect fittings and flexible hoses as shown on plans shall be provided to distribute flow to the washing and trough sprayer connections and provide flexible and removable connections.
- S. Strainer: A strainer shall be located beneath the lower auger to filter the washed solids. The strainer shall be removable via drain trough and pressed against the lower auger with spring pressure. The strainer shall be self-cleaning through continuous, even contact with the lower auger. Strainers requiring auger-mounted brushes will not be accepted.
- T. Drain Trough: A removable pan shall be provided beneath the main housing to collect washwater.
 Washwater shall be drained through a 3 inch NPT male drain port. The pan shall be a minimum of 11 gauge stainless steel.

U. Drive Assembly:

- 1. Each washer/compactor unit shall operate independently, with its own drive unit and driven components. The gearbox shall not be vented to the outside atmosphere.
- 2. The gearbox shall be grease lubricated and designed for 5 years, or 20,000 hours of operation, between recommended clean and re-grease services. The gearbox shall be right angle type and shall incorporate cycloidal and spiral bevel gearing with a total ratio of 809:1. The gear reducer output shaft speed shall be 0.5 RPM minimum to 2.2 RPM maximum and controlled by an AC Tech, vector-type inverter (or greater service factor) based on unit torque requirements. It shall be shaft-mounted utilizing the keyless Taper-Grip[®] bushing.
- 3. The motor shall be mounted to the gear reducer by utilizing a quill, C-Face mounting style. The motor shall be AC induction type, 0.75 HP, 3/60/230/460 volt, explosion-proof, inverterduty model. Each motor shall be equipped with an explosion proof cable with 7-pin male plug, length of cable to be determined based on coordinated layout with location of junction box. Provide female side of 7-pin plug to contractor for installation in junction box. 7-pin plug shall consist of the male and female portions of the Meltric DS7c Multipin, or equal.
- 4. Motor shall have built in thermostat to protect from overheating that is to be field wired to corresponding terminal in control panel for redundant (ambient) overload protection
- 5. The drive assembly shall incorporate the standard three-part coating system as specified in this section.
- V. Auger Transmission:
 - 1. The Drive Assembly shall be coupled to a dual gear transmission, which drives the augers in a counter-rotation.
 - Spur gears shall be contained in a stainless steel housing and supported by Delrin (or equal) plane bearings
 - 3. Grease fittings shall be located outside of the transmission housing to provide lubrication to the gears.
- W. Speed Reducer: The Speed Reducer shall have a maximum output of 2.2 RPM, 809:1 reduction ratio with 18,900 in-lb. of output torque.

- X. Thrust Bearings: Thrust Bearings shall be Delrin (or equal), self-lubricating, and capable of withstanding a minimum of 2,000 lb. of thrust load (each auger) at 2.2 RPM for life of machine.
- Y. Screw Supports: Screw supports shall be UHWM plane type, self-lubricating, and fastened into place using stainless steel fasteners.
- Z. Fabrications: All welded fabrications shall be made from stainless steel. All welded connections and welding procedures shall comply with AWS "Structural Welding Code Sheet Steel" D1.3/D1.6
- AA. Standard Coating: Motor gearbox shall be coated in strict accordance with the paint manufacturer's specification. Surface preparation shall be done in accordance with SSPC-SP-10 near White. Material shall meet all State and Federal VOC and other regulatory requirements. The three-part coating system shall be manufactured by Tnemec (or equal) as follows:
 - 1. Prime Coat Series 90-97 Tneme-Zinc at 2.5-3.5 mils DFT;
 - 2. Intermediate Coat Series Typoxy at 3.0-5.0 mils DFT;
 - 3. Top Coat Series 1075U Endura-Shield II at 2.0-3.0 mils DFT. Color: 11SF Safety Blue.
- BB. Washer compactors shall rest on caster frames for easy relocation and shall be equipped for quick disconnect fittings for drain, water supply and electrical connections. Discharge chutes shall be designed such that the washer compactors can be disconnected and relocated if necessary with the discharge chute remaining in place. Discharge chutes shall also be designed such that the final piece can be removed should a conveyor be taken out of service and a temporary container need to be placed for capture of removed screenings.
- CC. Provide a 0-100 psi pressure gauge with 1/2 inch isolation ball valve for each washer compactor.

2.04 – CONTROLS

- A. General: Controls for each bar screen and washer/compactor combination shall be in enclosures provided by the bar screen manufacturer. The bar screen manufacturer shall be responsible for proper sizing and function of the controls at 480V.
 - 1. Controls shall be designed to accept incoming power supply per the drawings and shall include a step-down transformer as needed to achieve 120V.
 - 2. Control Panels shall be constructed to meet the appropriate NEMA classification requirements and will include a main, lockable disconnect. The panel will be constructed by a UL certified control panel build facility and will be supported by the appropriate UL labeling.

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- Controls shall be tested prior to shipment to owner. The rake manufacturer shall verify all overload settings in the rake controller to insure proper overload and speed settings required for the application are properly programmed.
- 4. Control panels shall be wired complete with a minimum of #16 MTW wire in the appropriate colors for the circuits being supplied. 120VAC control shall be red, grounded AC neutral shall be white, DC control shall be blue, DC neutral shall be blue with a white tracer, equipment ground shall be green and all incoming and outgoing external power source wires shall be a yellow configuration. All AC power wiring shall be a minimum of #12 Black. All wires shall be labeled at both ends with heat-shrink wire markers. Internal panel wiring shall be contained in non-flammable, covered wire way.
- 5. All panels and panel mounted devices shall be labeled with engraved I.D. markers that reference back to the system schematics. Device tags shall be 1-inches high, white with black letters, and attached to the panel face with stainless steel screws. Panel tag shall be 2-inches high, red with 1-inch high black letters, and attached to the panel face with stainless steel screws, engraved "Bar Screen No. 1 Control Panel", as applicable for each Bar Screen (No. 1 through 3)
- B. Main Control Panels
 - 1. Main control panels shall also comply with all requirements contained with the Division 13 specifications regarding conrols.
 - 2. Each bar screen and washer/compactor combination shall have a Main Control Panel. The Control Panels shall be furnished, completely pre-wired and tested, requiring only wall or rack mounting and connection to external wiring in the field by an electrician. The Control Panels shall include all equipment required to control one bar screen and washer/compactor as specified herein. They shall have an interlock sharing information with the motor starter/control panel for the associated shaftless screw conveyors. The panels shall be located in a non-classified area where no corrosive gasses are present.
 - 3. Enclosures shall be NEMA 4X 304 stainless steel.
 - 4. Enclosure shall have a continuous hinge, exterior, lockable door, and shall be located outside of any explosive environment. Lifting lugs shall be provided. All seams shall be continuously welded and ground smooth with no holes or knockouts. All gasketing shall be oil resistant, securely attached with oil-resistant adhesive and held in place with stainless steel retaining strips or pour in place gasket/adhesive. A 3-point latch shall be provided,

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clips will not be accepted for this project.

- 5. Main Control Panels shall be designed with a SCCR rating of 18KA at 480VAC minimum and labeled as such.
- 6. All terminals utilized in the main panel shall be 600V rated terminals and 20% spare terminal space shall be provided for any potential future revisions.
- 7. The manufacturer's name, location and project number shall be shown on the front door and inside the panel on a nameplate.
- 8. The Main Control Panels shall include at a minimum the following
 - a. Main fusible disconnect with lockable operator.
 - b. Hand/Off/Auto (HOA) Selector Switches for the screen and washer/compactor
 - c. Red Push/pull E-Stop button.
 - d. Elapsed run-time meter
 - e. White Power On light
 - f. Red Screen Run light
 - g. Red Washer/Compactor Run light
 - h. Red Conveyor Run light (one for each conveyor)
 - i. Yellow Alarm light
- 9. PLC Based Controls shall include the following:
 - a. Programmable Logic Controller (PLC)
 - b. Variable Frequency Drive (VFD)
 - c. HMI programmable functions
- 9. The motor controller shall be capable of sending a common output alarm to a SCADA system.
- C. Local Control Push Button Station
- 1. Each bar screen and washer/compactor shall have a dedicated local control push button station on the upper floor level.
- 2. Enclosure shall be rated for installation area. Local push button station must be local to the equipment to maintain requirements of local safety codes.
- 3. The remote pushbutton station shall include a Forward/Off/Jog Reverse switch and an E-Stop button.
- 4. Provide a local control station with E-stop to be located at lower level for each screen.
- 5. Provide a cable operated safety stop, Model RS by Conveyor Components Company or equal, for each local control station to be mounted on the screening unit and connected to the E-Stop circuit.
- D. Level Control: For each bar screen, provide one level controller with an ultrasonic level transducer.
 - 1. Level system shall have a 1 to 50 feet range, accuracy 0.25%.
 - 2. The level sensors shall perform liquid level measurements with signal outputs of 4 to 20 mA to the controller.
 - 3. The level sensors shall be rated for the installation environment.
 - 4. Level control system shall be Siemens HydroRanger 200 with Ultrasonic Level Transducer or approved equal.
- E. Each bar screen raking assembly shall be controlled by its dedicated "HAND-OFF-AUTO" selector switch. In the "HAND" position, the raking assembly shall be activated by the operator. In the "AUTO" position, the pump shall be controlled and be operated as specified hereinafter.
- F. Each bar screen raking assembly shall operate off a dedicated level sensor installed in the channel upstream of the screen.
 - 1. The raking assembly shall run when the level reaches an operator set level.
 - 2. The raking assembly shall run at its higher speed when the level reaches a higher operator set level.
 - 3. The raking assembly shall shut off after the level reaches an operator set level. An offdelay timer shall prevent intermittent equipment starting/stopping.

- 4. Cycle timing logic shall be included and shall function in parallel with the level control for optimal rake run time.
- G. If a level transducer has an error, the screen shall run continuously.
- H. The screen shall also have a back-up timer that will allow the screen to operate. The timer shall be adjustable for both start frequency and duration of run.
- I. When a power failure occurs while the screen is in a fail condition, once power is restored the fail indicator shall reactivate and remain until reset.
- J. When a power failure occurs while the system is operating the system shall return to normal operation, running as dictated by the permissive and programmed run sequence.
- K. The controller shall provide motor overload protection.
- L. The controller shall be equipped with a main power disconnect switch. Motor branch circuits shall be short-circuit protected.
- M. Each washer/compactor shall be controlled by its dedicated "HAND-OFF-AUTO" selector switch. In the "HAND" position, the washer compactor shall be activated by the operator. In the "AUTO" position, the pump shall be controlled and be operated as specified hereinafter.
- N. The washer/compactor shall run off an interlock with the bar screen controller & conveyor controller.
 - 1. The washer/compactor shall turn on when the bar screen turns on.
 - 2. The washer/compactor shall run at low speed when the bar screen runs at low speed.
 - 3. The washer/compactor shall run at high speed when the bar screen runs at high speed.
 - 4. The washer/compactor shall shut off after the bar screen shuts off. An adjustable timer shall delay shut off of the washer/compactor so debris can be cleared out of the hopper.
 - 5. The conveyors shall turn on when the washer/compactor turns on. An adjustable timer shall delay shut off of the conveyors so debris can be cleared from the discharge point.
- O. The washer/compactor control panels shall correctly match the washer/compactor to its bar screen in the event a washer/compactor is moved to a different screen by way of energizing the corresponding 7-pin plug.

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PART 3 - EXECUTION

3.01 – GENERAL

- A. All components of the system shall be installed in accordance with the supplier's written and/or verbal instructions, and in compliance with all OSHA, local, state, and federal codes and regulations.
- 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. Install system components in accordance with the manufacturer's installation instructions, as submitted with Shop Drawings, Operation and Maintenance Manuals and/or pre-installation checklists. Installation shall utilize standard torque values and be installed secure in position and neat in appearance. Installation shall include site preparation tasks as required by the Engineer or manufacturer; such as unloading, touch-up painting, etc. and any other installation tasks and materials such as wiring, conduit, controls stands as determined by the Owner and/or specified by the manufacturer.
- B. Wire local control push station to the corresponding terminal inputs in the main control panel.
- C. Install submersible transducers to a rigid conduit using a 0.5-inch NPT male conduit fitting.

3.03 - FIELD QUALITY CONTROL

- A. After completion of installation, provide testing. Perform testing in conformance with the manufacturer's start-up instructions. Testing of the bar screen shall demonstrate that the equipment is fully operational by picking up and depositing materials into specified container.
- B. Field certification shall include inspection of the following:
 - 1. Verify equipment is properly aligned and anchored in accordance with the installation instruction and drawings. Assure the bar screen unit is square, flat and unobstructed with required clearances maintained.
 - 2. Check drive motor for rotation. Assure controls and instrumentation work in all modes.
 - 3. Check equipment for proper operation of debris blade, scrapers, and drive as well as

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completion of the Start-Up requirements in the installation guide.

- 4. Verify washer/compactor is properly leveled and anchored per the installation instructions and site drawings.
- 5. Verify controls and instrumentation work in all modes.
- 6. Verify proper auger rotation.
- 7. Check to assure all start-up requirements are completed per the Installation Guide.
- C. Provide the following field services as a minimum of a factory trained representative in accordance with the requirements in Section 01650 Starting of Systems:
 - 1. One Trip, one (1) 8-hour day on-site for each screen and washer/compactor combination 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 than one (1) day of installation instruction. The Contractor, at least one week prior to the installation instruction, shall uncrate, sort, separate and arrange parts of screening equipment and otherwise become familiar with the installation of all equipment components.
 - 2. One Trip, two (2) 8-hour days on-site for each screen and washer/compactor combination once each system has been mechanically installed to check the completed installation, make all necessary mechanical adjustments, place the screen motor control into service, provide operations and maintenance instruction to the Owner, and otherwise place the system into permanent, fault free operation as specified in Section 01650 Starting of Systems.
 - 3. Unused days shall be credited back to the Owner.
 - 4. Notify manufacturer at least 10 days notification prior to the need for such services.

3.04 – SPARE PARTS

NCDP

A. Provide specialty tools and recommended spare parts required to maintain the equipment as follows:

ITEM	QUANTITY
Drive Clevis Pin	1
Snap/Retaining Rings	10
Link Clevis Pins	4
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Scraper Bolts	4
Scraper Nuts	4
Snap Ring Tool	1
Never Seez, 3 oz. tube	1

- B. Provide a 5-year supply of lubricants required to maintain all bar screen components.
- C. Provide the following spare parts for each unit:
 - 1. Three (3) fuses for each type supplied
 - 2. Three (3) NEMA 4X LED lamps for each color supplied
 - 3. Two (2) space flex links (one with and one without mount)
 - 4. Two (2) spare bars.
 - 5. Plane bearing kit that includes the following:
 - a. Side Screw Supports (2)
 - b. Upper Screw Supports (2)
 - c. Lower Screw Supports (2)
 - d. FHSCS: ¹/₄-20 x 1.00 LG (24)
 - e. Washer: ¹/₄ Flat SAE (24)
 - f. Nut: ¼-20 Nylock (24)
 - g. Grease Tube (14oz.) (1)
 - h. Never-Seez (1oz.) (1)
 - 6. One (1) solenoid valve rebuild kit
 - 7. One-year supply of lubricants.
- D. Store controller spare parts inside the control panel.
- E. Package spare parts in containers suitable for long-term storage bearing labels clearly designating the contents and the equipment for which they are intended.



+ + END OF SECTION + +

PART 1 - GENERAL

1.01 - SECTION INCLUDES

- A. This Section details the requirements for construction and demolition activities affecting Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), Trace Asbestos Materials (i.e., building materials containing less than or equal to 1% of asbestos), and asbestos wastes, as found in ACM survey report and as specified herein, or required to complete the work. All work under this Section shall be performed using methods, tools, and equipment that have demonstrated effectiveness in preventing asbestos fibers from migrating outside of the Regulated Abatement Work Area.
- B. Perform work to minimize the creation of airborne emissions; minimize the quantity of waste generated; protect the health and safety of all site personnel and welfare of the public; and avoid adverse environmental impacts.
- C. Perform the abatement and disposal of additional ACM and PACM not shown on the Contract Drawings. Unless otherwise specified, the work of this Section shall also be performed in accordance with the most current and applicable federal, state, and local regulations.
- D. Any unforeseen ACM or PACM discovered during the work to be performed under this Section shall be abated in accordance with this Section, and the New York State Department of Labor's (NYSDOL's) Asbestos Rules and Regulations (12 NYCRR 56) prior to its disturbance.
- E. Perform all work under this Section without damaging or contaminating adjacent areas to where the work is being performed. Where such areas are damaged or contaminated, as determined by the Owner, restore the areas to their original condition at no additional cost to the Owner.

1.02 - RELATED SPECIFICATIONS

- A. Section 01355, Hazardous Materials Control
- B. Section 02050, Demolition, Removals and Modifications

1.03 - PAYMENT

- A. Payments to abate and dispose of ACM, PACM, and resulting asbestos wastes produced by this work shall be made as part of the lump sum price bid.
- B. Payment for the disposal of asbestos wastes will not be made until a signed copy of the manifest from the Treatment, Storage, and Disposal Facility (TSDF), certifying the amount of asbestos wastes delivered, is returned with complete chain-of-custody (COC) documentation to the Owner.

1.04 - REFERENCES

- A. Comply with all applicable regulations, standards, and guidelines of federal, state, and local environmental and occupational safety and health agencies regarding ACM, PACM, Trace Asbestos Materials, and asbestos wastes. These regulations, standards, and guidelines include, but are not limited to the following:
 - 1. ASTM International:
 - a. E1368 Standard Practice for Visual Inspection of Asbestos Abatement Projects
 - 2. Department of Transportation (DOT):
 - a. 49 CFR 171 General Information, Regulations, and Definitions
 - b. 49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response information, and Training Requirements
 - c. 49 CFR 173 Shippers: General Requirements for Shipments and Packagings
 - d. 49 CFR 178 Specifications for Packagings
 - 3. Environmental Protection Agency (EPA):
 - a. 40 CFR 61 National Emission Standards for Hazardous Air Pollutants (NESHAP)
 - b. 40 CFR 268 Land Disposal Restrictions
 - c. 40 CFR 302 Designation, Reportable Quantities, and Notification
 - d. 40 CFR 763 Asbestos Hazard Emergency Response Act (AHERA)
 - 4. National Institute for Occupational Safety and Health (NIOSH):
 - a. Method 7400 Asbestos and Other Fibers by PCM
 - b. Method 7401 Asbestos by TEM
 - 5. New York State Department of Environmental Conservation (NYSDEC):
 - a. 6 NYCRR 360 Solid Waste Management Facilities
 - b. 6 NYCRR 364 Waste Transporter Permits

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- c. 6 NYCRR 376 Land Disposal Restrictions
- 6. New York State Department of Labor (NYSDOL):
 - a. 12 NYCRR 56 Asbestos Rules and Regulations
- 7. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910 Occupational Safety and Health Standards
 - b. 29 CFR 1910.28 Safety Requirements for Scaffolding
 - c. 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response
 - d. 29 CFR 1910.134 Respiratory Protection Standard
 - e. 29 CFR 1910.1001 Asbestos Standard for General Industry
 - f. 29 CFR 1910.1200 Hazard Communication Standard
 - g. 29 CFR 1926 Safety and Health Regulations for Construction
 - h. 29 CFR 1926.1101 Asbestos Standard for the Construction Industry
- 8. Underwriters Laboratories, Inc. (UL):
 - a. UL 586 Standard for Safety High Efficiency, Particulate, Air Filter Units.

1.05 - DEFINITIONS/EXPLANATION OF TERMS

- A. Abatement: Any and all procedures physically taken to control fiber releases from Asbestos-Containing Materials (ACM) and Presumed Asbestos-Containing Materials (PACM). This includes the removal, encapsulation, enclosure, repair, cleanup or handling of these materials. This also includes the handling and disposal of materials which are attached to ACM or PACM (e.g., a pipe segment consisting of an asbestos-containing gasket secured between two pipe flanges) during demolition activities.
- B. Adequately Wet: Defined by the EPA (40 CFR 61.141) as a material sufficiently mixed or penetrated with amended water to prevent the release of visible emissions. If visible emissions are observed coming from an Asbestos-Containing Material (ACM), Presumed Asbestos-Containing Material (PACM), or asbestos waste, then the material has not been "adequately wetted." However, the absence of visible emissions is not evidence of being adequately wet. ACM or PACM must be fully penetrated with the wetting agent to be adequately wet. If the ACM or PACM being

abated is resistant to amended water penetration, the wetting agent shall be applied to the material prior to and abatement as necessary to minimize the potential for fiber releases.

- C. Aggressive Air Sampling: A method of sampling in which mechanical equipment is used before and during the sampling period to stir up settled dust/asbestos fibers. "Mechanical equipment" includes 20-inch fans and forced air equipment (e.g., a 1-horsepower leaf blower).
- D. Air Sampling Technician: Any person who performs asbestos project air sampling and possesses a valid Air Sampling Technician certificate issued by the NYSDOL.
- E. Airlock: A system for permitting entrance and exit, while restricting air movement between a contaminated area and an uncontaminated area. The system consists of two curtained doorways (constructed of plastic sheeting) separated by a distance of at least three feet such that an individual passes through the first doorway into the airlock, allowing the doorway sheeting to overlap and close off the opening before proceeding through the second doorway, thereby preventing flow-through contamination.
- F. Amended Water: Water to which a surfactant/wetting agent has been added in order to increase the liquid's ability to adhere to dust/fibers and prevent the dust/fibers from becoming airborne.
- G. Area Monitoring: Stationary air sampling inside and outside the Regulated Abatement Work Area and Restricted Area for the purpose of complying with 12 NYCRR 56. Area monitoring shall be conducted during the background air monitoring, pre-abatement, abatement, cleaning/re-cleaning, and final clearance phases of Large Asbestos Projects and Small Asbestos Projects. For the purpose of this Section, area monitoring shall also be conducted during these phases of Minor Asbestos Projects. All area monitoring shall follow pertinent NIOSH or EPA sampling methodologies.
- H. Asbestos: Any naturally-occurring, hydrated, mineral silicate separable into commercially usable fibers, including chrysotile (serpentine), amosite (cumingtonite-grunerite), crocidolite (riebeckite), tremolite, anthophyllite, and actinolite.
- I. Asbestos Abatement Contractor: A contractor licensed by the NYSDOL who performs abatement during an Asbestos Project, or employs persons performing such abatement.
- J. Asbestos-Containing Material (ACM): Any material containing greater than one percent (1%) asbestos.
- K. Asbestos Handler: An individual certified by the NYSDOL who disturbs, removes, encapsulates, repairs, or encloses Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM).

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- L. Asbestos Handler Supervisor: An individual certified by the NYSDOL who supervises the Asbestos Handlers during an Asbestos Project, and ensures that proper asbestos abatement procedures as well as individual safety procedures are being adhered to.
- M. Asbestos Project: Any work performed in connection with the alteration, renovation, modification, demolition of a building or structure which will involve the abatement, disturbance, or cleanup of friable or non-friable asbestos. Asbestos Projects are classified as either Large Asbestos Projects, Small Asbestos Projects, or Minor Asbestos Projects in New York State, and each type of project involves several phases, which can include: background air monitoring, mobilization, pre-abatement/containment construction, abatement, cleaning/re-cleaning, final clearance air monitoring, containment breakdown, and demobilization.
- N. Asbestos Waste: Non-specific liquid or solid waste generated during the abatement, disturbance, handling, or cleanup of Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM). Asbestos Waste also includes objects contaminated by ACM or PACM, or materials attached to ACM or PACM that are subject to demolition and disposal.
- O. Certified Industrial Hygienist (CIH): Refers to an Industrial Hygienist employed by the Contractor who is currently certified by the American Board of Industrial Hygiene (ABIH) in comprehensive practice.
- P. Clean Room: An uncontaminated area or room that is part of the personal decontamination enclosure system, with provisions for the storage and changing of "street clothes" into clean Personal Protective Equipment (PPE).
- Q. Clearance Air Monitoring: Area air monitoring performed inside the Regulated Abatement Work Area after the completion of the final cleaning, final waiting period, and final visual inspection by the Asbestos Supervisor Handler and Project Monitor. Aggressive Air Sampling shall be performed as part of the clearance air monitoring activities inside of the Containment.
- R. Containment: The Negative-Pressurized Enclosure (NPE) within the Restricted Area, which establishes the Regulated Abatement Work Area, and surrounds the location where the asbestos abatement is actually taking place.
- S. Critical Barrier: Barriers that seal-off all openings to or within the defined Regulated Abatement Work Area, including but not limited to operable windows, skylights, doorways, ducts, grills, diffusers, and any other penetrations to surfaces adjacent to or within the Regulated Abatement Work Area.
- T. Curtained Doorway: An assembly of overlapping plastic sheets in a framed doorway used to separate the rooms/areas within the Personal Decontamination Enclosure System and Waste

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Decontamination Enclosure System, and designed to inhibit airflow if the negative air ventilation system shuts down.

- U. Disturbance: Any activities that disrupt the matrix of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), or asbestos wastes. This includes activities that generate dust, debris, visible emissions, or airborne asbestos fibers, including moving friable ACM, PACM, or asbestos wastes from one place to another.
- V. Encapsulation: The coating or spraying of Asbestos-Containing Materials (ACM), Presumed Asbestos-Containing Materials (PACM), or the bare substrate surface that is exposed after an abatement, with a pigmented (i.e., non-transparent) liquid sealant that creates a membrane over the surface of the material (bridging encapsulant) or penetrates into the material and binds its components together (penetrating encapsulant).
- W. Enclosure: The construction of airtight walls, ceilings, and floors between the Asbestos-Containing Material (ACM), Presumed Asbestos-Containing Materials (PACM), or surfaces coated with these materials, and the building/structure environment, in order to prevent the accidental disturbance of these materials and the potential release of asbestos fibers.
- X. Equipment Room: A contaminated area or room, which is part of the Personal Decontamination Enclosure System, with provisions for the storage of contaminated Personal Protective Equipment (PPE).
- Y. Exclusion Zone: (See definition of "Regulated Asbestos Work Area").
- Z. Excursion Limit: Defined in the OSHA Asbestos Standard for the Construction Industry (29 CFR 1926.1101) as individual exposure, without regard to the use of respirators, to an airborne concentration of asbestos fibers of 1.0 fiber per cubic centimeter of air (1.0 f/cc) averaged over a 30-minute sampling period. No employee of the Contractor shall at any time be exposed to concentrations of asbestos fibers above the Excursion Limit.
- AA. Exposure Monitoring: Personal air sampling performed outside the respirator within the breathing zone of individuals, for the purpose of determining compliance with OSHA's Asbestos Standard for the Construction Industry (29 CFR 1926.1101). Analytical results from exposure monitoring will be used to select appropriate respiratory protection and Personal Protective Equipment (PPE) for individuals within a Regulated Asbestos Work Area. For the purpose of this Section, exposure monitoring samples shall be collected from individuals who are representative of each type work task being conducted by the Contractor, and all exposure monitoring shall follow pertinent NIOSH or EPA sampling methodologies.

- BB. Final Visual Inspection: An inspection performed by the Project Monitor at the completion of the final waiting period on an Asbestos Project (but prior to Clearance Air Monitoring). The inspection is performed in accordance with ASTM E1368 to determine the completeness of abatement and completeness of cleanup.
- CC. Friable Asbestos: Any Asbestos-Containing Material (ACM), Presumed Asbestos-Containing Material (PACM), or asbestos waste that can be crumbled, pulverized or reduced to powder when dry, by hand pressure.
- DD. Glovebag: A manufactured, impervious, bag-like enclosure with two inward-projecting long sleeve gloves, one inward-projecting waterwand sleeve, an internal tool pouch, and an attached, labeled receptacle for asbestos waste. The glovebag is constructed and installed to surround an object or area to be abated, and contain all asbestos fibers released during the abatement process.
- EE. High-Efficiency Particulate Air (HEPA) Filter: A filter designed to remove 99.97% of all particles greater than 0.3 micrometers (μm) in diameter. For the purpose of this Section, HEPA vacuum and negative air pressure equipment (i.e., microtraps) used by the Contractor shall meet the Standard for Safety High-Efficiency, Particulate, Air Filter Units (UL 586) developed by Underwriters Laboratories.
- FF. Holding Area: A room or area in the Waste Decontamination Enclosure System utilized for the temporary (i.e., no longer than the current work shift) storage of containerized asbestos waste, prior to its transfer to a final, on-site storage container (i.e., dumpster, trailer, or roll-off) or a licensed asbestos waste transport vehicle. The holding area is located between the washroom and an uncontaminated area.
- GG. Independent Third Party Monitor: A NYSDOL- licensed asbestos contractor who must be contracted by the property owner or owner's agent, and is completely independent of the Asbestos Abatement Contractor involved with the Asbestos Project. The third party who conducts air monitoring or project monitoring on an Asbestos Project shall not have any business, personal, or other relationship with the Asbestos Abatement Contractor.
- HH. Isolation Barrier: (See definition of "Critical Barrier").
- II. Large Asbestos Project: An Asbestos Project involving the removal, enclosure, encapsulation, repair, disturbance, cleanup, or handling of 260 linear feet or more of Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM), or 160 square feet or more of ACM or PACM, or 35 cubic feet or more of ACM or PACM.
- JJ. Microtrap: (See definition of "Negative Air Pressure Equipment").

- KK. Minor Asbestos Project: An Asbestos Project involving the removal, enclosure, encapsulation, repair, disturbance, cleanup, or handling of 25 linear feet or less of Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM), or 10 square feet or less of ACM or PACM.
- LL. Negative Air Pressure Equipment: A local exhaust system capable of maintaining air pressure within the Containment at a lower pressure than the air outside of the Containment. The negative air pressure equipment also provides for the HEPA filtration of all air exhausted from the Containment.
- MM. Non Friable Asbestos: Any Asbestos-Containing Material (ACM), Presumed Asbestos-Containing Material (PACM), or asbestos waste that cannot be crumbled, pulverized or reduced to powder when dry, by hand pressure.
- NN. Non-Friable Organically Bound (NOB) Asbestos Materials: Non-friable Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM) that are embedded in flexible-to-rigid asphalt or vinyl matrices, including but not limited to the following: flooring materials, adhesives, mastics, asphalt shingles, roofing materials, and caulks. The NYSDOH has determined that the analysis of NOB materials by Polarized Light Microscopy (PLM) is not consistently reliable in detecting asbestos. Therefore, as of August 3, 1992, all NOB materials must also be analyzed by Transmission Electron Microscopy (TEM) in order to verify that they do not contain asbestos.
- OO. OSHA Monitoring: (See definition of "Exposure Monitoring").
- PP. P-100 Filter: (See definition of: "High-Efficiency Particulate Air (HEPA) Filter").
- QQ. Perimeter Monitoring: (See definition of "Area Monitoring").
- RR. Permissible Exposure Limit (PEL): Defined in the OSHA Asbestos Standard for the Construction Industry (29 CFR 1926.1101) as individual exposure, without regard to the use of respirators, to an airborne concentration of asbestos fibers of 0.1 fiber per cubic centimeter of air (0.1 f/cc) calculated as an 8-hour Time-Weighted Average (TWA). No employee of the Contractor shall at any time be exposed to concentrations of asbestos fibers above the PEL.
- SS. Personal Decontamination Enclosure System: A series of connected rooms designed to control the passage of Asbestos Handlers, and other authorized individuals into the Regulated Abatement Work Area from uncontaminated areas. The system consists of a clean room, a shower room, and an equipment room separated from each other and the Regulated Abatement Work area by airlocks and curtained doorways.
- TT. Personal Monitoring: (See definition of "Exposure Monitoring").

- UU. Phase Contrast Microscopy (PCM): An analytical method (e.g., NIOSH 7400) used for determining the asbestos fiber concentration in an air sample.
- VV. Polarized Light Microscopy (PLM): An analytical method (e.g., 40 CFR 763, Subpart F, Appendix A or ELAP Item 198.6) used for determining the asbestos content in a bulk material.
- WW. Post Abatement Air Monitoring: (See definition of "Clearance Air Monitoring").
- XX. Presumed Asbestos-Containing Material (PACM): All friable and non-friable materials suspected of containing asbestos as determined by a certified NYSDOL Asbestos Inspector, which have not been sampled and analyzed for asbestos content.
- YY. Project Designer: Any person who performs asbestos project design functions and possesses a valid Project Designer certificate issued by the NYSDOL.
- ZZ. Project Monitor: Any person who performs asbestos project monitoring functions and possesses a valid Project Monitor certificate issued by the NYSDOL.
- AAA. Regulated Abatement Work Area: The portion of the Restricted Area where abatement work actually occurs. This includes the interior of the Restricted Area containment enclosure. For glovebag operations, the areas contiguous to where the operation takes place are Regulated Abatement Work Areas. For tents, the interior of each tent is a Regulated Abatement Work Area. For exterior, non-friable asbestos abatement conducted without the establishment of negative air ventilation systems or containment enclosures, the entire Restricted Area surrounding the abatement location is considered to be the Regulated Abatement Work Area.
- BBB. Remote Decontamination Enclosure System: Decontamination enclosure systems that are not attached to the Regulated Abatement Work Area, but are within the Restricted Area.
- CCC. Removal: The stripping of any Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM) from surfaces or components of a building or structure.
- DDD. Repair: A corrective action using specified work practices (e.g., glovebags or tents) to minimize potential asbestos fiber releases from damaged Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM).
- EEE. Restricted Area: An area established and marked for the abatement portion of an Asbestos Project. The area shall include, but not be limited to, Regulated Abatement Work Areas and any contiguous decontamination enclosure systems, adjoining staging areas where work materials, debris, or waste materials from such work may accumulate, and waste storage areas (e.g., dumpsters, trailers, or roll-offs).

- FFF. Shower Room: A room between the clean room and the equipment room in the Personal Decontamination Enclosure System set up to prevent cross-contamination by ensuring the removal of potential asbestos contamination from the body that may have accumulated during abatement operations. The shower room shall have hot and cold running water controllable at the tap, as well as clean towels, soap, and shampoo in quantities sufficient to accommodate the personnel working on the Asbestos Project.
- GGG.Small Asbestos Project: An Asbestos Project involving the removal, enclosure, encapsulation, repair, disturbance, cleanup, or handling of more than 25 linear feet but less than 260 linear feet of Asbestos-Containing Materials (ACM) or Presumed Asbestos-Containing Materials (PACM), or more than 10 square feet but less than 160 square feet of ACM or PACM, or less than 35 cubic feet of ACM or PACM.
- HHH. Suspect Asbestos-Containing Material (ACM): (See definition of "Presumed Asbestos-Containing Material (PACM)").
- III. Tent: (See definition of "Containment").
- JJJ. Time-Weighted Average (TWA): The average time over a given work period (e.g., an 8-hour workday) of a person's exposure to a chemical or agent. The average is determined by sampling for the chemical or agent throughout the time period.
- KKK. Transmission Electron Microscopy (TEM): An analytical method (e.g., 40 CFR 763, Subpart F, Appendix A or ELAP Item 198.4) used for determining the asbestos fiber concentration in an air sample, or for determining the asbestos content in a bulk material.
- LLL. Trace Asbestos Material: A building material that contains less than or equal to 1% of asbestos.
- MMM.Variance: Relief from specific requirements set forth in state asbestos regulations, which is granted in writing by the agency that enforces the regulations.
- NNN. Visible Emission: Any emission containing particulate material that can be seen without the aid of instruments.
- OOO.Washroom: An area or room between the Regulated Abatement Work Area and the holding area in the Waste Decontamination Enclosure System, where contaminated equipment and waste containers are wet cleaned or HEPA vacuumed prior to disposal or passage into an uncontaminated area.
- PPP. Waste Decontamination Enclosure System: A series of connected rooms designed to control the transfer of materials and equipment from the Regulated Abatement Work Area. The system

consists of a washroom and a holding area separated from each other and the Regulated Abatement Work Area by airlocks and curtained doorways.

- QQQ.Waste Staging Area: The area near the airlock to the Waste Decontamination Enclosure System where bagged or containerized asbestos waste has been placed prior to removal from the Regulated Abatement Work Area.
- RRR. Wet Cleaning: The process of eliminating asbestos contamination from surfaces, equipment, or other objects by using cloths, mops, or other cleaning tools that have been saturated with amended water.
- SSS. Worker Decontamination Enclosure System: (See definition of "Personal Decontamination Enclosure System").

1.06 - SUBMITTALS

- A. Within 30 business days of the "Notice to Proceed", submit the following:
 - 1. Asbestos Management Plan: Submit a detailed, project-specific Asbestos Management Plan that addresses work procedures and equipment to be used during the disturbance, abatement, removal, handling, collection, cleanup, and disposal of ACM, PACM, and asbestos wastes. The Asbestos Management Plan shall be prepared in accordance with 12 NYCRR 56, and all other pertinent federal, state, and local regulations. In addition, the Asbestos Management Plan shall follow all Nassau County Policies and Procedures, and shall be coordinated with the Responsible Individual or Responsible Personnel from the Owner. The plan shall also be signed and dated by a Project Designer meeting the qualifications set forth in Article 1.05.BBB of this Section, and a Certified Industrial Hygienist (CIH) meeting the qualifications set forth in Article 1.05.R of this Section. The Asbestos Management Plan shall include the following elements:
 - a. Asbestos Control:
 - Drawings showing the location and details of the following: (a) each Regulated Asbestos Work Area; (b) the type, location, and number of negative air pressure machines that will be used; (c) proposed electrical hookups and temporary electrical panels; (d) proposed water hookups; (e) each Restricted Area; (f) each Personal Decontamination Enclosure System; (g) each Waste Decontamination Enclosure System; (h) each waste storage area (e.g., dumpster, trailer, or roll-off); (i) restroom areas; (j) areas designated for eating and drinking;

- A detailed discussion regarding the interfacing of trades (i.e., how the Contractor will coordinate the work with other contractors or Owner employees working at the site) and the sequencing of asbestos-related work;
- A detailed discussion regarding the collection, handling procedures, cleanup, and disposal of asbestos wastes (including the collection, filtering, and disposal of wastewater);
- iv. A detailed discussion regarding the procedures and methodologies that will be used to conduct exposure monitoring. Provide the name and qualifications (i.e., training and experience documentation) of the individual who will be responsible for conducting the exposure monitoring.
- A detailed discussion regarding housekeeping procedures to be used for maintaining clean Regulated Abatement Work Areas, clean Restricted Areas, and clean decontamination enclosure systems;
- vi. A detailed discussion regarding the specific methods and procedures that will be used to control fiber releases, and ensure that fiber concentrations less than the clearance and action criteria of 0.01 f/cc of air, or background levels (whichever are greater), are not exceeded outside of each Regulated Abatement Work Area.;
- vii. A detailed task analysis for each work activity that has the potential to disturb ACM, PACM, or asbestos wastes. Each task analysis shall include, but is not be limited to, the following information: (a) the type of work activity; (b) the tools/equipment that will be used; (c) operation and maintenance practices and procedures that will be used for the tools/equipment; (d) the types of ACM or PACM that may be disturbed, or asbestos wastes that may be generated when performing the activity; (e) the engineering controls that will be used to control the spread of asbestos fibers during the activity; (f) the proposed crew size for the activity and individual employee responsibilities during the activity; (g) housekeeping procedures that will be used during the activity; (h) Personal Protective Equipment (PPE) and proposed respiratory protection that will be used for the activity;
- viii. Equipment and Supplies: Identify the materials and equipment that will be used to perform the work, including materials and equipment designed to

be non-combustible or fire retardant in accordance with the National Fire Protection Association (NFPA) Standards 701 and 255;

- ix. Rental Equipment Notification: If rental equipment is to be used during the work, the Contractor shall notify the rental agency in writing concerning the intended use of the equipment;
- Material Safety Data Sheets (MSDSs): Provide MSDSs for all chemical products (including wetting agents and encapsulants) to be used for the work;
- b. Waste Management:
 - i. A description of the types of ACM, PACM, and asbestos wastes associated with the work (include details regarding whether the materials are friable or non-friable);
 - ii. The estimated quantity of each waste stream that will be generated and disposed of;
 - The name, address, phone number, and qualifications of each vendor and facility that has not been identified in a Construction Waste Management Plan (as described in Section 01733 – Construction Waste Management), but will be transporting, storing, or disposing of the wastes. Include a 24hour phone contact for each vendor and facility;
 - iv. Current permit documentation for the disposal facility indicating that the facility is approved by federal, state, and local regulatory agencies to receive asbestos wastes. The documentation shall include an "acceptance letter" from the facility indicating its ability to accept the specific asbestos waste streams that will be generated during this Contract work;
 - Current 6 NYCRR 364 permit documentation for the waste transporter that will transport asbestos wastes from the work site to the disposal facility. The documentation shall clearly indicate the transporter's ability to deliver the asbestos wastes to the chosen disposal facility;
 - vi. Spill prevention, containment, and cleanup contingency measures to be implemented during the work, as well as procedures to be followed during a suspected fiber release or emergency situation;

- vii. A detailed discussion of the on-site handling, storage, removal, cleanup, and disposal of waste materials. This discussion shall include, but is not limited to, the following: (a) the methods of demarcation that will be used to identify the waste storage areas and each waste bag/container; (b) the methods and procedures that will be used to collect and containerize wastes on a daily basis; (c) the types of bags/containers that will be used to containerize the wastes; (d) the posting of weekly waste inspection records as defined in Article 1.06.B.2 of this Section.
- c. The name and qualifications (i.e., experience and training documentation) of Asbestos Handler Supervisor who will be responsible for the oversight and execution of the Asbestos Control Plan during activities affecting ACM, PACM, and asbestos wastes. At a minimum, the Asbestos Handler Supervisor shall satisfy the requirements set forth in Article 1.07.F.2 of this Section.
- d. Asbestos Abatement Project Notifications and Permits: Documents that may be required based upon the scope and location of the project include, but are not limited to, the following:
 - i. NYSDOL Asbestos Project Notification;
 - ii. NYSDOL Asbestos Variance Application.
- e. A detailed schedule for the implementation of the Asbestos Management Plan elements. The schedule shall clearly indicate the proposed starting and completion dates for the work, and shall allow adequate time for cleanup, inspections, and air monitoring activities.
- f. Medical Surveillance: For all activities that take place within a Regulated Abatement Work Area, the Contractor shall provide a sufficient number of properly trained and experienced workers, each of whom shall: (a) have received a medical exam that included a Pulmonary Function Test (PFT) within the past year; (b) have received written medical clearance within the past year, by a licensed physician, to wear a respirator; (c) have received a qualitative or quantitative respirator fit-test within the past year for the specific respirator the employee will be using for this work.
- g. Employee Documentation: For all activities that take place within a Regulated Abatement Work Area, the Contractor shall provide a sufficient number of properly trained and experienced workers, each of whom shall: (a) have written proof of

training (i.e., current NYSDOL-issued asbestos certificates) in accordance with Article 1.07.F of this Section for Asbestos Handlers and Asbestos Handler Supervisors that will be used for each Asbestos Project; (b) copies of resumes for Asbestos Handlers and Asbestos Handler Supervisors that will be used for each Asbestos Project, indicating work experience as defined in Article 1.07.F of this Section; (c) dates and written proof of initial medical surveillance by the Contractor or other employer within the past year, and proof that the employee is currently participating in the employer's ongoing medical surveillance program in accordance with Article 1.06.A.1.f of this Section; (d) dates and written proof of respiratory clearance and a completed medical exam in accordance with Article 1.06.A.1.f of this Section.

- h. A current (i.e., within the last month) signed and notarized statement disclosing all of the Contractor's Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), NYSDOL, County, and Department of Transportation (DOT) citations/violations on Asbestos Projects within the past three (3) years. If the Contractor will be using a subcontractor, a current signed and notarized statement disclosing all of the subcontractor's OSHA, EPA, NYSDOL, County, and DOT citations/violations on asbestos projects within the past three (3) years will also be required.
- i. Analytical Laboratory Qualifications for Analyzing Air Samples and Suspect ACM Samples: Submit the name, address, and telephone number of each analytical laboratory selected to perform the analyses of all air samples collected for exposure monitoring purposes, as well as all bulk samples collected to classify suspect ACM or PACM. The analytical laboratory shall be currently accredited by the American Industrial Hygiene Association (AIHA) and the New York State Department of Health's (NYSDOH's) Environmental Laboratory Approval Program (ELAP). Provide copies of current AIHA and ELAP certificates along with dates of accreditation/reaccreditation. ELAP certificates should show evidence of certification for the specific analytical methods that will be used to analyze each type of sample that will be collected.
- 2. Independent Third Party Monitor: The Third Party Monitor shall submit a detailed, project-specific Asbestos Monitoring Plan that addresses air monitoring, abatement oversight, and inspection activities that will be conducted in accordance with the Contractor's Asbestos Management Plan. Area monitoring for airborne concentrations of asbestos fibers shall be performed in accordance with 12 NYCRR 56 and Article 1.05.G of this Section. The

Contractor shall assume that area monitoring will be conducted on all Asbestos Projects (regardless of the project type, the project size, or any conflicting applicable variance) unless the Owner makes a determination that area monitoring for a specific project is not necessary. For Asbestos Projects where air monitoring would normally not be required under state or local asbestos regulations, the number of air samples to be collected will be determined by the Engineer prior to the start of work. In addition to area monitoring, the Independent Third Party Monitor shall conduct the Final Visual Inspection on each Asbestos Project in accordance with 12 NYCRR 56-9.2(e)(1).

- a. Qualifications:
 - i. Independent Third Party Monitor: The Independent Third Party Monitor shall possess a current NYSDOL asbestos license, and shall have successfully performed area monitoring and final visual inspections on at least two (2) Asbestos Projects of comparable scope and methodologies to the work being performed under this Section within the past three (3) years. This experience shall be documented by identifying the following: (a) the name, address, and phone number of each facility where the area monitoring/visual inspection was performed; (b) the name of the individual representing the owner who supervised the area monitoring/visual inspections was performed (i.e., Large Asbestos Projects, Small Asbestos Projects, or Minor Asbestos Projects); (d) the area monitoring requirements that were followed (i.e., 12 NYCRR 56) during each Asbestos Project.
 - ii. Air Sampling Technician: The Independent Third Party Monitor shall have an Air Sampling Technician assigned to this Contract who is currently certified by the NYSDOL. In addition, the Air Sampling Technician shall have a minimum of two (2) years experience in conducting area monitoring on Asbestos Projects in New York State.
 - iii. Project Monitor: The Independent Third Party Monitor shall have a Project Monitor assigned to this Contract who is currently certified by the NYSDOL. In addition, the Project Monitor shall have a minimum of two (2) years experience in conducting abatement oversight and final visual inspections on Asbestos Projects in New York State. It is acceptable for an individual who meets the criteria of the Project Monitor, to also serve as the Air Sampling Technician for this Contract as long as the individual fulfills all of the requirements of Article 1.06.A.2.a(2).

- iv. Laboratory Qualifications for Analyzing Air Samples: Submit the name, address, and telephone number of the AIHA and ELAP-accredited analytical laboratory selected to perform the analyses of all air samples collected for area monitoring purposes. Provide copies of current AIHA and ELAP certificates along with dates of accreditation/reaccreditation. ELAP certificates should show evidence of certification for the specific analytical methods that will be used to analyze each type of sample that will be collected.
- b. The Independent Third Party Monitor shall collect area air samples in accordance with the requirements of 12 NYCRR 56. During sampling activities, all air sample filter cassettes shall be positioned approximately five to six feet above the ground (in order to simulate an individual's breathing zone), and shall not be placed immediately adjacent to obstructions (e.g., walls or columns) which may restrict the flow of air to the filter cassette. Documentation regarding the sample numbers, sample locations, specific phase of the Asbestos Project when the sampling was conducted (i.e., background, pre-abatement, abatement, cleanup, or clearance), the date of sampling, the employee hours that were worked during the shift, and the total sampling times, shall accompany each laboratory COC form.
- c. If at any time, Phase Contrast Microscopy (PCM) analysis of any air sample in any phase of the Asbestos Project (i.e., background, pre-abatement, abatement, cleanup, or clearance) indicates that the filter was "overloaded" and a fiber count cannot be obtained, the sample shall immediately undergo Transmission Electron Microscopy (TEM) analysis.
- All clearance air monitoring results shall be below background ambient air levels or 0.01 f/cc of air, prior to the breakdown of the containment. If clearance air monitoring results indicate a fiber count greater than background ambient air levels or 0.01 f/cc of air in any area, the Contrac¬tor will be required to re-clean that area. Repeated cycles of cleaning and clearance air monitoring will be performed until a fiber count is achieved that is below background ambient air levels or 0.01 f/cc of air within the area.
- 3. Documentation: Complete documentation of all area monitoring activities shall be in accordance with Article 1.06.B.1.
- 4. The Contractor shall submit all air monitoring results to the Owner within 24 hours from when the air samples were collected.

- B. Field Reports and Recordkeeping: During all work performed under this Section, the Contractor shall maintain and provide the following documentation:
 - 1. Air Monitoring Documentation: All daily air monitoring reports shall be provided to the Owner within 24 hours of the date the samples are collected. The results shall be signed by the laboratory employees who analyzed or supervised the analysis of the samples, as well as the individual who physically performed the air sampling at the work site. All laboratory analytical results shall be accompanied by complete COC documentation.
 - a. Each daily air monitoring report shall be signed by the individual who generated the report. The content of these reports shall include, but is not limited to, the following information: (a) sample "start" and "stop" times; (b) flow rates (initial and final) for each sample; (c) the total volume of air collected for each sample; (d) sample location descriptions or sample location drawings or names of individuals being sampled (as applicable to the type of monitoring being performed); (e) types (i.e., makes and models) of sampling equipment used; (f) types of sample media (i.e., filters and cassettes) used; (g) the most recent calibration dates, along with the calibration results, for the sampling equipment used; (h) name of the individual who conducted the air monitoring; (i) dates that the air monitoring; (k) unique sample numbers used to identify each sample; (l) the phase of the Asbestos Project being performed (i.e., background, pre-abatement, abatement, cleaning, or clearance);
 - 2. Waste Documentation: Completed and signed waste manifests from the approved, asbestos-permitted landfill, shall be provided to the Owner within ten (10) business days of disposal. In addition, on-site waste storage areas shall be inspected weekly by the Asbestos Handler Supervisor.
 - a. Each weekly waste storage area inspection shall be documented in the form of a written report, and each report shall be signed by the Contractor's employee who generated the report. All reports shall be provided to the Owner within 24 hours of the date the inspection is completed. The content of these reports shall include, but is not limited to, the following information: (a) the name of the individual that conducted the inspection; (b) descriptions of waste streams being stored; (c) types and quantities of waste containers being used; (d) the current disposal status (i.e., when the waste container is scheduled to be removed from the work site) and physical condition of each waste container; (e) the present condition of each waste storage area; (f) the presence/absence of proper labeling for each waste container in accordance with Article 3.05.C of this Section and federal, state, and local

regulations.; (g) the methods being used to secure/lock each waste storage area any prevent unauthorized entry;

- 3. Asbestos Project Inspection Documentation: Regulated Abatement Work Areas and Restricted Areas shall be inspected daily by the Asbestos Handler Supervisor.
 - a. Each daily asbestos project inspection shall be documented in the form of a written report, and each report shall be signed by the Contractor's employee who generated the report. All reports shall be provided to the Owner within 24 hours of the date the inspection is completed. The content of these reports shall include, but is not limited to, the following information: (a) the type of Asbestos Project (i.e., Large Asbestos Project, Small Asbestos Project, or Minor Asbestos Project) being conducted; (b) the current phase of the Asbestos Project (i.e., mobilization, background pre-abatement, abatement, cleaning, clearance air monitoring, or containment breakdown); (c) the names of the Asbestos Handlers, Asbestos Handler Supervisors, Project Monitors, and Air Sampling Technicians on site, as well as the name of the company each individual is representing; (d) the types of air monitoring (i.e., exposure monitoring or area monitoring) being conducted, and the number of samples being collected for each type of air monitoring activity; (e) the results of decontamination enclosure system, critical barrier, and negative air pressure equipment inspections; (f) a summary of corrective actions and repairs; (q) work stoppages and the reasons for the work stoppage; (h) manometer readings (at least twice per work shift); (i) emergency and fire exit checks; (j) verification that functional fire extinguishers are present in the Restricted Areas; (k) any unusual events that occurred during the work; (I) non-compliance issues observed (i.e., observations that conflict with the requirements of the Contractor's Asbestos Management Plan, this Section, or federal, state, and local regulations) along with the corrective actions that were taken to achieve compliance.
- 4. Contractor Project Record: The Asbestos Handler Supervisor shall maintain a project record at the work site. The Contractor Project Record shall be made available to the Engineer or Owner for review at any time during the Asbestos Project, and shall be submitted to the Owner within 24 hours after the completion of the Asbestos Project.
 - a. At a minimum, the Contractor Project Record shall contain the following information: (a) copies of NYSDOL asbestos certificates/licenses for all individuals/companies working on the Asbestos Project; (b) copies of all notifications, amendments, permits, work safety plans, and variances related to the Asbestos Project; (c) copies of all air monitoring results generated during the Asbestos Project; (d) documentation of all pressure differential readings for

Regulated Abatement Work Areas; (e) copies of all available bulk sample analytical data as well as asbestos survey reports relating to the Asbestos Project; (f) copies of all daily sign-in sheets; (g) a list of emergency phone numbers, including the local fire department, local police department, nearest hospital, as well as phone numbers for the Engineer and Owner personnel responsible for administering the Asbestos Project; (h) (NOT USED); (i) a copy of New York State's Asbestos Rules and Regulations (12 NYCRR 56); (j) a copy of the NESHAP regulations for asbestos (40 CFR 61, Subpart M); (k) copies of all MSDSs pertaining to all chemicals being used during the Asbestos Project; (l) a copy of this Section; (m) a copy of the Contractor's Asbestos Management Plan; (n) copies of all daily Asbestos Project inspection records as defined in Article 1.06.B.3; (o) copies of all weekly waste storage area inspection records as defined in Article 1.06.B.2.

- 5. Daily Sign-In Sheets: Generate a daily sign-in sheet for all individuals entering and exiting each Regulated Abatement Work Area and Restricted Area, for the duration of the Asbestos Project. The daily sign-in sheets shall be maintained by the Asbestos Handler Supervisor. The daily sign-in sheets shall be made available to the Engineer or Owner for review at any time during the Asbestos Project. All daily sign-in sheets shall be submitted to the Owner within 24 hours after the completion of the Asbestos Project.
 - At a minimum, each daily sign-in sheet shall include: (a) the individual's full name (printed); (b) the individual's signature; (c) the name of the company the individual is representing; (d) the times of entry and exit from the work areas; (e) verification by the Asbestos Handler Supervisor that the individual possesses current NYSDOL asbestos certifications, if the individual intends to enter a Regulated Abatement Work Area.

1.07 - QUALITY ASSURANCE

- A. Permits and Notifications: Make all necessary notifications, secure any necessary permits and variances, complete agency-required forms, and pay all fees in conjunction with asbestos abatement activities, waste transportation, and waste disposal in accordance with federal, state, and local asbestos regulations. Prior to the submittal of any notifications, permit/variance applications, or forms to regulatory agencies, provide them to the Engineer for information.
- B. Scheduling: Coordinate and schedule all phases of the work to be performed under this Section with the Owner, subcontractors, material suppliers, and other parties as necessary to ensure the proper execution of the work.

- C. Compliance: In addition to the detailed requirements of this Section and Owner's policies and procedures, comply with all applicable regulations of federal, state, and local authorities pertaining to the abatement, disturbance, cleanup, handling, transportation, storage, and disposal of ACM, PACM, Trace Asbestos Materials, and asbestos wastes. All matters regarding the interpretation of any regulations, standards, or policies shall be submitted to the Engineer for resolution before starting the work. Where the requirements of this Section, and federal, state, or local regulations conflict or vary, the most stringent requirements or regulations shall apply.
- D. Rejection of Non-Complying Items: The Owner reserves the right to reject items incorporated into the work which fail to meet the specified minimum require¬ments. The Owner also reserves the right to reject Contractor submittal items that are deemed inappropriate or unacceptable by the Owner. Submittal items that may be deemed inappropriate or unacceptable include proposed vendors or subcontractors with regulatory citations/violations. The Owner further reserves the right, and without prejudice to other recourse, to accept non-complying items subject to an adjustment in the Contract amount, as approved by the Owner.
- E. Suspect Material Characterization: In order to classify a suspect ACM or PACM as non-asbestos containing, bulk samples of the material must be collected, and the bulk samples must be sent to an analytical laboratory meeting the requirements set forth in Article 1.06.A.1.i of this Section. New York State asbestos regulations specify that only NYSDOL-certified Asbestos Inspectors are permitted to collect these bulk samples. Analytical results for bulk samples that are collected by individuals not certified by the State will not be recognized or accepted as valid by the Owner.
 - If the material to be sampled is also suspected of containing PCBs (e.g., a bitumastic coating), the Asbestos Inspector or Asbestos Investigator must also possess current (i.e., completed within the past year) PCB awareness training.
- F. Qualifications:
 - 1. Asbestos Abatement Contractor: The Contractor shall possess a current NYSDOL asbestos license, and shall have successfully completed at least two (2) Asbestos Projects of comparable scope and methodologies to the work being performed under this Section within the past three (3) years. This experience shall be documented by identifying the following: (a) the name, address, and phone number of each facility where the work was performed; (b) the name of the individual representing the owner who supervised the work at each facility; (c) the types of facilities where the work was performed; (d) the volume and type of each material that was abated; (e) the specific methods of abatement used at each facility (including the tools, technologies, and engineering controls employed);

- 2. Asbestos Handler Supervisor: The Contractor shall have on staff and assigned to this Contract an Asbestos Handler Supervisor. The Asbestos Handler Supervisor shall be currently certified by the NYSDOL. In addition, the Asbestos Handler Supervisor shall have a minimum of two (2) years experience on Asbestos Projects, and shall have served as the Asbestos Handler Supervisor on at least three (3) Asbestos Projects of comparable scope and methodologies to the work being performed under this Section.
- 3. Asbestos Handler: The Contractor shall have on staff and assigned to this Contract a sufficient number of experienced and properly trained Asbestos Handlers. Asbestos Handlers shall be currently certified by the NYSDOL, and shall have a minimum of one (1) year of experience on Asbestos Projects, and shall have worked on at least three (3) Asbestos Projects of comparable scope and methodologies to the work being performed under this Section.

1.08 - SPECIAL REQUIREMENTS

- A. Commencement of Work: Ten (10) business days prior to the proposed start of work at each separate location, notify the Engineer and the onsite safety staff. No work may proceed at any location until authorized by the Engineer.
- B. Coordinate any required equipment shutdowns with Owner personnel prior to starting the work.
- C. Access Restrictions: Inform the Engineer and Owner personnel of proposed access restrictions (i.e., areas or items of equipment which will not be accessible during the proposed Asbestos Project), and give them estimated time frames (including specific dates) of such proposed access restrictions. The Contractor shall be aware that other contractors may be at any of the work sites associated with this Contract. As a result, the Contractor shall not have exclusive rights to any work site, and shall fully cooperate and coordinate this work with the work of other contractors who may be on site. Therefore, the Contractor shall notify other contractors in advance of the abatement work included herein, to provide them with sufficient time for coordination of interrelated items that are included in their contracts and that must be performed before, after, or in conjunction with the work included under this Section.
- D. Meetings: Visit and investigate the site, review the Contract Drawings, review this Section, review Owner policies and procedures, and become familiar with any conditions which may affect the work, as part of the pre-construction meeting and site walk-though. Hold meetings with appropriate parties as scheduled and as otherwise necessary to accomplish the work of the Contract in accordance with its specific requirements and standards. In addition to the pre construction meeting and site walk-through, other meetings may be required or may be requested by the Engineer, including briefings with Owner personnel. Written documentation (i.e., "minutes") of all



meetings shall be generated by the Contractor, and copies shall be provided to the Owner within three (3) business days following each meeting.

PART 2 - PRODUCTS

2.01 - MATERIALS

- A. Respirators: The Contractor shall select respirators approved by the National Institute for Occupational Safety and Health (NIOSH) for use in Regulated Abatement Work Areas where the abatement or disturbance of ACM, PACM, or asbestos wastes will occur. At a minimum, provide each individual within a Regulated Abatement Work Area with a half-face, negative pressure, air purifying respirator equipped with HEPA/P-100 filter cartridges, until exposure monitoring results indicate that respiratory protection can be modified. The Contractor's CIH shall make all determinations regarding respiratory protection modifications that will be implemented for the work. All modifications shall be in accordance with the OSHA Asbestos Standard for the Construction Industry (29 CFR 1926.1101) and the Contractor's Asbestos Management Plan.
- B. PPE: Provide personnel who have a potential to be exposed to asbestos, with appropriate PPE as prescribed by the Contractor's CIH.
- C. HEPA Filters: HEPA/P-100 filters used in vacuuming equipment and negative air pressure equipment (i.e., microtraps) must meet or exceed any manufacturer's specifications and recommendations, as well as specifications presented in the Standard for Safety High Efficiency, Particulate, Air Filter Units (UL 586).
- D. Materials and Equipment: Materials and equipment shall be designed to be non-combustible or fire retardant in accordance with NFPA Standards 701 and 255.

PART 3 - EXECUTION

3.01 - SAFE WORK PRACTICES FOR TRACE ASBESTOS MATERIALS

- A. During the disturbance, cleanup, and disposal of Trace Asbestos Materials (i.e., building materials containing less than or equal to 1% of asbestos), the Contractor shall adhere to the following standards:
 - A negative exposure assessment shall be performed in accordance with 29 CFR 1926.1101(f)(2)(i) to determine if workers disturbing, handling, or performing cleanup activities involving Trace Asbestos Materials, must wear PPE or respiratory protection.
 - 2. Wetting agents or special work methods shall be utilized to control potential employee exposures to asbestos during the handling, mixing, removing, cutting, application, or

cleanup, of Trace Asbestos Materials, except if the use of these wetting agents/work methods is not feasible (e.g., using them may create electrical hazards or equipment malfunctions).

- Asbestos-contaminated wastes and debris shall be cleaned-up immediately and disposed of in leak-tight containers. The handling, disposal, and transport of Trace Asbestos Material wastes is not regulated since the wastes are not ACM (i.e., they do not contain greater than 1% asbestos).
- 4. The use of high-speed abrasive saws that are not equipped with "point-of-cut" ventilators or enclosures with HEPA-filtered exhaust air shall be prohibited.
- 5. The use of compressed air to cleanup or remove Trace Asbestos Materials shall be prohibited.

2.02 - PREPARATION

- A. Utilities: The temporary use of any on-site utilities shall be subject to the approval of the Owner. Furnish all water and hoses needed for the Asbestos Project, as well as any temporary hookups. Also, supply all necessary heating equipment and water filtration devices needed for the work. In addition, all temporary lighting and temporary electrical service to a Regulated Abatement Work Area or a Restricted Area shall be provided by the Contractor, and shall be in weather-proof enclosures and be ground fault protected
- B. Scaffolding: Furnish all scaffolding of whatever type is necessary to perform the work of this Section, subject to the OSHA Safety Requirements for Scaffolding (29 CFR 1910.28) and the approval of the Owner. Scaffolding shall be inspected after its construction, but prior to use by any Contractor employees, by an individual qualified as a Competent Person to inspect scaffoldings, as defined by OSHA.
- C. Signs: Post conspicuous warning signs at all approaches to Regulated Abatement Work Areas, Restricted Areas, and waste storage areas. The signs shall be located at such a distance so that personnel may read the sign and take necessary precautions before entering a Regulated Abatement Work Area, Restricted Area, or waste storage area. Signs shall comply with the requirements of federal, state, and local regulations. Once clearance air monitoring results indicate that a Regulated Abatement Work Area is in compliance with the provisions for re-occupancy set forth in 12 NYCRR 56, the signs shall be removed. At a minimum, each sign shall bear the following information in English and the predominant language that is spoken by the Contractor's employees if English is not spoken:

DANGER



ASBESTOS CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING

ARE REQUIRED IN THIS AREA

NO SMOKING

D. Fire Extinguishers: Maintain at least two functional fire extinguishers in each Restricted Area. The fire extinguishers shall have a minimum rating of 2-A:10-B:C, and each fire extinguisher shall be checked daily by the Asbestos Handler Supervisor to ensure that it remains functional throughout the duration of the Asbestos Project.

2.03 - AIR MONITORING

- A. Exposure Monitoring: Air monitoring for airborne concentrations of asbestos fibers shall be conducted by the Asbestos Handler Supervisor (or by a qualified air monitoring firm) in accordance with OSHA and Article 1.05.DD of this Section. Assume that exposure monitoring will be conducted on all Asbestos Projects (regardless of the project type or project size) unless the Owner makes a determination that exposure monitoring for a specific project is not necessary.
 - 1. Collect personal air samples from employees who are anticipated to have the greatest risk of exposure, as determined by the Contractor's CIH and Asbestos Handler Supervisor. Personal air samples shall be collected during each phase of the Asbestos Project (i.e., background, pre-abatement, abatement, and cleanup) for one work shift from at least one (1) employee that is representative of each type of work task that is being performed. Each personal air sample will "run" for the employee's entire work shift in order to ensure that enough volume (of air) is collected and an accurate 8-hour TWA can be calculated. Documentation regarding the sample numbers, specific shift when the sampling was conducted, the work tasks that were sampled, the dates of sampling, the employee hours that were worked during the shift, and the total sampling times, shall accompany each laboratory COC form.
 - 2. Complete documentation of all exposure monitoring activities shall be in accordance with Article 1.06.B.1.
 - 3. Submit all exposure monitoring results to the Owner within 24 hours from when the air samples were collected.

- B. Area Monitoring: Air monitoring for airborne concentrations of asbestos fibers shall be conducted by the Independent Third Party Monitor. Assume that area monitoring will be conducted on all Asbestos Projects (regardless of the project type, the project size, or any conflicting applicable variance) unless the Owner makes a determination that area monitoring for a specific project is not necessary.
 - 1. All clearance air monitoring results shall be below background ambient air levels or 0.01 f/cc of air, prior to the breakdown of the containment. If clearance air monitoring results indicate a fiber count greater than background ambient air levels or 0.01 f/cc of air in any area, the Contractor will be required to re-clean that area. Repeated cycles of cleaning and clearance air monitoring will be performed until a fiber count is achieved that is below background ambient air levels or 0.01 f/cc of air e-cleaning and additional clearance air monitoring will be at the Contractor's expense.
- C. If at any time, Phase Contrast Microscopy (PCM) analysis of any air sample (i.e., from exposure monitoring performed by the Contractor, or area monitoring performed by the Independent Third Party Monitor) in any phase of the Asbestos Project (i.e., background, pre-abatement, abatement, cleanup, or clearance) indicates that the filter was "overloaded" and a fiber count cannot be obtained, the sample shall immediately undergo Transmission Electron Microscopy (TEM) analysis. All costs of the additional TEM analysis will be at the Contractor's expense.

2.04 - BULK REMOVAL

- A. Protection of Existing Work to Remain: All work involving the abatement or disturbance of ACM, PACM, or asbestos wastes, must be conducted without damage to, or contamination of equipment or surfaces within the Regulated Abatement Work Areas, Restricted Areas, or other areas adjacent to these areas. All such damage or contamination shall be immediately corrected and cleaned up by the Contractor at the Contractor's expense.
- B. Containments and Negative Air Pressure Equipment: Pressure differential readings for each workday shall be obtained by Asbestos Handler Supervisor, and shall be reviewed by the Contractor's CIH on a daily basis. All readings shall be documented and kept in the Contractor's Project Record, as defined in Article 1.06 B.4 of this Section. The CIH shall notify the Contractor and the Owner immediately, if any variations in the pressure differential readings could lead to the migration of asbestos fibers outside of a Regulated Abatement Work Area.
- C. Personal Decontamination Enclosure System: Ensure that employees do not leave a Regulated Abatement Work Area wearing any potentially contaminated protective work clothing or PPE.
 Employees are required to shower prior to leaving the Regulated Abatement Work Area.

2.05 - CLEANUP AND DISPOSAL

- A. Cleanup: Progress cleaning work from the point most remote from the intakes of the negative air pressure equipment, towards the intakes of the equipment, as well as from the highest point of the surfaces to be cleaned towards the lowest point of the surfaces. Maintain all surfaces, including protective tarps, polyethylene sheeting, and coverings within each Regulated Abatement Work Area and each Restricted Area, free of accumulations of dusts, wastes, and debris. Perform housekeeping activities daily throughout each work shift and at the end of each work shift, in order to prevent any accumulation of dusts, wastes, and debris in these areas. Dry sweeping and using compressed air to cleanup a Regulated Abatement Work Area or a Restricted Area shall be strictly prohibited. Instead, HEPA-filtered vacuums and wet cleaning methods shall be used to ensure that these areas remain free of visible dust and debris. In addition, only cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the materials or as approved by the Owner, shall be used.
- B. Collection, Containerization, and Filtration of Wastes: Collect and containerize asbestos waste (solid and liquid), debris, PPE, and containment materials on a daily basis in accordance with the Asbestos Management Plan. Using chutes to move construction debris or waste (bagged or not bagged) will not be permitted at any time.
 - 1. Prior to containerizing asbestos wastes, the wastes shall be "adequately wetted," in accordance with Article 1.05.B of this Section, and double-bagged in 6-mil (0.006") polyethylene bags. The bags shall be "goose necked" and sealed air tight with duct tape, and each bag will be labeled in accordance with Article 3.05.C of this Section before being placed in an appropriate container (i.e., dumpster, trailer, or roll-off) for disposal.
 - 2. Corrugated cartons or drums may be used in conjunction with polyethylene bags for the disposal of asbestos wastes that have sharp-edged components (e.g., nails, screws, or tin sheeting) which may tear the bags. The waste within these drums or cartons must be double-bagged in accordance with Article 3.05.B.1 of this Section. In addition, the cartons/drums must be labeled in accordance with Article 3.05.C of this Section.
 - 3. Wastewater derived from the Asbestos Project shall be collected and filtered through a system with at least a 5.0 micron particle size collection capability. A system containing a series of several filters with progressively smaller pore sizes shall be used to avoid the rapid clogging of the filtration system by large particles. Contaminated filters shall be disposed of as asbestos waste. Filtered wastewater shall be discharged in accordance with all applicable federal, state, and local regulations.
 - 4. Store all bagged asbestos wastes in DOT-approved container systems (e.g., a roll-off or trailer). No container shall be filled in excess of the capacity marked on the container, and

all containers shall be lined with 6-mil (0.006") polyethylene sheeting, have a hard top, and shall be locking in addition to meeting any other federal, state, and local asbestos waste storage requirements. In addition, all containers shall have an intact and legible label affixed to it in accordance with Article 3.05.C of this Section. No bagged asbestos waste shall be stored in a Regulated Abatement Work Area or decontamination enclosure system for longer than the current work shift that generated the waste.

- 5. Non Asbestos Waste: Store non asbestos wastes separately from asbestos wastes, shall provide all non-asbestos waste containers, and shall make all transportation and disposal arrangements for non-asbestos wastes in accordance with federal, state, and local regulations.
- C. Labeling: Affix warning labels to all asbestos waste disposal bags and containers (i.e., drums, dumpsters, trailers, or roll-offs). Labels shall comply with the requirements of federal, state, and local regulations. At a minimum, each label on disposal containers/bags shall bear the following information in English:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

[Generator Name, Address, and Telephone Number]

- D. Final Visual Inspection and Clearance Air Monitoring: Do not conduct clearance air monitoring until the Regulated Abatement Work Area has been inspected by the Asbestos Handler Supervisor and the Project Monitor has performed the Final Visual Inspection. During this inspection, the Asbestos Supervisor and the Project Monitor shall determine if the following has been achieved: (a) all ACM, PACM, and asbestos wastes have been abated and removed from the area; (b) the area is clean and dry; (c) critical barriers are intact; (d) negative air pressure equipment is turned on and functioning. If any of these items have not been achieved, perform the necessary corrective actions to achieve compliance before conducting the clearance air monitoring.
- E. Breakdown of the Regulated Abatement Work Area: Critical barriers shall not be removed and negative air pressure equipment shall not be turned off until clearance air monitoring results meet the criteria specified in this Section and 12 NYCRR 56.

- F. Disposal of Wastes: All materials resulting from the work performed under this Section, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified herein. The Contractor shall notify the Owner at least 14 business days prior to the removal of any waste containers, so that the Owner can inspect the containers and the waste manifests. Asbestos wastes shall be disposed of to ensure that containers do not remain on the job site for longer than necessary. Containers that have reached their storage capacity shall not remain on site and transportation arrangements shall be made for their immediate removal.
- G. Disposal Documentation: Submit written evidence that the landfill receiving asbestos wastes is approved by federal, state, and local regulatory agencies to receive the wastes. If regulated PCBs (as defined in Section 13284 PCB Management) were detected in the wastes, also ensure that the landfill is approved by federal, state, and local regulatory agencies to receive PCB-regulated wastes. Submit one (1) copy of the completed manifest that has been signed and dated by the initial transporter and landfill in accordance with 6 NYCRR 372 and 40 CFR 262, to the Owner. All manifests and Land Disposal Restrictions (LDRs) must be signed by a Owner employee per Section 01355 Hazardous Material Control.

+ + END OF SECTION + +



+ + END OF SECTION + +


PART1 GENERAL

1.01 SUMMARY

- A. This Section covers the handling, waste disposal and training requirements of working with materials coated with lead containing paint.
- B. Perform work in accordance with applicable local, state and federal guidelines for impacting leadcontaining paint.

1.02 REFERENCES

- A. State Department of Transportation (DOT): Follow all regulations of 49CFR Part 100 through 199.
- C. Occupational Safety and Health Administration (OSHA): Lead Exposure in Construction: Interim Final Rule 29 CFR 1926.62.
- D. U.S. Department of Housing and Urban Development (HUD): Guidelines for evaluation and control of Lead based paint hazards: Title Ten of Housing and Community Act of 1992.
- U.S. Environmental Protection Agency (EPA): Resource Conservation and Recovery Act (RCRA)
 Section 3004 Hazardous and Solid Waste Amendments.
- F. U.S. Environmental Protection Agency (EPA): Toxicity Characteristics Leaching Procedure EPA Method 1311.

1.03 DEFINITIONS

- A. Authorized Personnel: Owner or the Owner's Representative, and all other personnel who are authorized officials of any regulating agency, be it State, Local, Federal or Private entity who possess legal authority for enforcement or inspection of the work.
- B. Containment: The enclosure within the building which establishes a contaminated area and surrounds the location where lead remediation is taking place and establishes a Lead Control Work Area.
- C. Floor Surface Clearance Criteria: Shall be determined and established by an independent testing lab hired by the Owner, conforming to all standards set forth by all authorities having jurisdiction,

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mentioned in the references, and issue the certification of cleaning. At a minimum no single post work lead wipe sample test values shall have reading levels greater than the levels established by pre-work wipe sampling test values, or greater than 40 mg/ft². Record levels in mg/ft².

- D. Fixed Object: Mechanical equipment, electrical equipment, fire detection systems, alarms, and all other fixed equipment, furniture, fixtures or other items which cannot be removed from the work area.
- E. HEPA: High Efficiency Particulate Absolute filtration efficiency of 99.97 percent down to 0.3 microns. Filtration provided on specialized vacuums and air filtration devices to trap particles.
- F. Lead Based Paint (LBP): Paints or other surface coatings that contain lead equal to or greater than 1.0 milligrams per square centimeter or 0.5 percent of lead by weight.
- G. Lead Dust Control Work Area: A cordoned off area with drop clothes or an enclosed area or structure with containment to prevent the spread of lead dust, paint chips, or debris from lead-containing paint disturbance operations.
- H. PPE: Personal Protective Equipment.

1.04 ABBREVIATIONS

- A. ASTM: American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103
- B. CFR: Code of Federal Regulations, Government Printing Office, Washington, DC 20402
- C. DOT: Department of Transportation
- D. NIOSH: National Institute for Occupational Safety and Health, Building J, N.E. Room 3007, Atlanta, Georgia 30333
- E. OSHA: Occupational Safety and Health Administration, 200 Constitution Avenue, Washington, DC 20210
- F. USEPA: United States Environmental Protection Agency, 401 M Street SW, Washington, DC 20460

1.05 SUBMITTALS



- A. Quality Control Submittals: Submit the entire Lead Abatement submittal package at the same time.
 - 1. Worker' Qualifications: Persons removing lead containing/coated material and their Supervisors shall be personally experienced in this type of work and shall have been employed by a company with a minimum of one year experience in this type of work. Submit a copy of documentation of completion of the EPA lead renovators training program. Submit Evidence that all personnel working on the removal of materials coated with lead containing paint have been trained in accordance with OSHA Standard 29 CFR 1926.62.
 - 2. Name of lead supervisor on site during the work.
 - 3. Submit one copy of the detailed work plan required under Quality Assurance Article.
 - 4. Waste Transporter Permit: One copy of transporter's current waste transporter permit.
- B. Contract Closeout Submittals:
 - 1. Copies of OSHA compliance monitoring results or current objective data that indicates such tasks did not cause exposure above the PEL.
 - 2. Assessment Report compiled by a testing lab certifying that the work area has lead concentrations below the levels specified under the cleaning criteria.
 - 2. Disposal Site Receipts: Copy of waste shipment record and disposal site receipt showing that the lead-containing materials have been properly disposed of.

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the referenced standards.
- B. Pre-Work Conference: Before the Work of this Section is scheduled to commence, a conference will be held by the Owner at the Site with the contractor and the lead handling subcontractor (if any) for the purpose of reviewing the Contract Documents, discussing requirements for the Work, and reviewing the Work procedures.
- C. Detailed Lead-Containing Material Removal Work Plan: Before the physical Work begins, prepare and submit a detailed lead-containing material removal work plan.

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1. The work plan shall indicate it complies with state, federal and local requirements for removing and disposing lead-containing materials during demolition activities. The plan shall include engineering controls, personal protective equipment, air-monitoring methods, signage, location of handwashing facilities, work practices, waste-handling and disposal, and any other pertinent information.

1.07 PROJECT CONDITIONS

A. Cut and alter existing materials as required to perform the work. Limit cutting to the smallest amount necessary. Flame cutting, high speed grinding or welding is prohibited on lead painted surfaces.

1.08 HEALTH AND SAFETY

- A. Where in the performance of the work, workers, supervisory personnel or sub-contractors may encounter, disturb, or otherwise function in the immediate vicinity of contaminated items and materials, all personnel shall take appropriate continuous measures as necessary to protect all ancillary building occupants from the potential lead exposure. Such measures shall include the procedures and methods described herein and shall comply with all applicable regulations of Federal, State and Local agencies.
- B. Workers shall receive training (29 CFR 1926.21) that includes the following:
 - 1. Information about the potential adverse effects of lead exposure.
 - 2. Information about the early recognition of lead intoxication.
 - 3. Instruction about heeding signs that mark the boundaries of lead-contaminated work areas.
 - 4. Discussion of the importance of personal hygiene in reducing lead exposure.
 - 5. Instruction about the use and care of appropriate protective equipment (including protective clothing and respiratory protection).
 - 6. Information about specific work practices for working safely with lead-based paints
 - 7. Information on the OSHA "Lead in Construction" Standard 29 CFR 1926.62 and an employee's right to access 29 CFR 1910.20.

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8. Contents of compliance plan in effect.

1.09 PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

- A. Workers shall wear protective suits, protective gloves, and eye protection. Respiratory protection shall be in accordance with OSHA regulation 1910.134 and ANSI Z88.2.
- B. Workers shall be trained in accordance with EPA requirements, have medical clearance and have recently received pulmonary function test (PFT) and respirator fit tested by a trained professional.
 - 1. A personal air sampling program shall be in place as required by OSHA.
 - 2. The use of respirators must also follow a complete respiratory protection program as specified by OSHA.

PART 2 PRODUCTS

2.01 **RESPIRATORS**

A. Type: Approved by the Mine Safety and Health Administration (MSHA), Department of Labor, or the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

2.02 VACUUM CLEANERS

A. Type: Vacuums equipped with new HEPA filters.

2.03 PLASTIC SHEETS

- A. Type: Minimum 6 mil., clear, fire retardant polyethylene sheets.
- B. Floor Protective Layer: Minimum 10 mil., reinforced polyethylene sheets.

2.04 DISPOSAL BAGS

A. Type: Minimum 6 mil thick, clear polyethylene bags with preprinted Caution Label. Properly containerize/drum prior to disposal.

2.05 EQUIPMENT



- A. Temporary lighting, heating, hot water heating units, ground fault interrupters, and all other equipment on site shall be UL listed and shall be safe, proper, and sufficient for the purpose intended.
- B. All electrical equipment shall be in compliance with the National Electric Code, Article 305 Temporary Wiring.

PART 3 EXECUTION

3.01 PREPARATION

- A. Comply with all applicable Occupational Safety and Health Administration (OSHA) Requirements.
- B. Employees shall wear the respiratory protection provided when it is required.

3.02 LEAD-CONTAINING/COATED MATERIAL HANDLING AND DISPOSAL

- A. Handle and dispose of lead-containing materials in accordance with OSHA 1926.62 and the approved lead-containing material work plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when material containing or coated with lead containing paint is handled and disposed of in accordance with referenced standards.
- B. Dispose of demolition debris with lead-based paint attached at a permitted demolition debris landfill.
- C. Test results indicating a value greater than 5 ppm lead or 5mg/L classifies the removed material as Hazardous Waste.

3.03 RESTORATION

- A. Remove temporary decontamination facilities and restore area designated for these facilities to its original condition or better.
- B. Where existing construction is damaged or contaminated during the course of performing this project, restore area to its condition or better.

+ + 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 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 Influent Pump Station Main Control Panel (IPCP) 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.
- 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 OIT 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 Contact 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.

1.02 – RELATED SECTIONS

- A. Section 13402 Process Control System Factory Testing
- B. Section 13403 Process Control System Start-up and Field Testing
- C. Section 13404 Process Control System Training
- D. Section 13420 Primary Sensors and Field Instruments
- E. Section 13430 Process Control Panels and Enclosures
- F. Section 13440 Panel Mounted Instruments and Devices
- G. Section 13451 PLC Hardware and Software
- H. Section 13480 Input Output Point List
- I. Section 13491 Process Control Descriptions

1.03 – 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.
 - 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.
 - 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.

1.04 – 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.

- 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.
- 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.

1.05 – 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.
- Proposed layouts and sizes of operator interface graphic display panels and alarm annunciator panels.
- i) Calculations for heating and cooling of panels
- Subpanel layouts and mounting details for items located inside control panels.
- 2) Product information on panel components including:
 - 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.
 - 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.
- Functional name and manufacturer's designation for components to which wiring and piping are connected.
- g) Lightning and surge protection grounding.
- 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 crossreference 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:



- 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.
- 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.
- 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:
 - 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:
 - Documents to be submitted prior to pre-submittal conference, in accordance with Article
 1.3 of this specification.
 - 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 OIT 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 portable digital media 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:
 - 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 startup.
- 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 fivepoint 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 01730, 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.
 - Two copies of each revised Shop Drawings and documentation to replace outdated 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 outdated 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.
 - Submit CADD drawings of the point-to-point interconnection wiring diagrams updated to reflect final as-built equipment information and asinstalled field installation information.
- D. Maintenance Materials Submittals: Submit the following:
 - 1. Spare Parts and Test Equipment
 - a. General
 - 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:
 - 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.



1.06 – 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:
 - 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:
 - 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 Influent Pump Station Main Control Panel (IPCP).
 - 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.
 - 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 1.01-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.
 - 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.
 - 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 OIT 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:
 - During factory test, demonstrate overall display structure, including environment configurations, passwords, security, and other parameters and functions.
 - 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 2.01-B-1 of this Section, failure or nonfunctioning 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 databaseaddressing 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 1.01-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. Influent Pump Station
 - 2. Washwater Booster Pump 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 1.04-E, below:
 - 1. Failure of any of the pumps.
 - 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:

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 1.02-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 01812 – Commissioning Summary, 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:
 - 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 01812 – Commissioning Summary. 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 1.04-A and Paragraph 1.04-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 Process Control Systems General Provisions.
- 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:
 - Provide primary sensors and field instruments in accordance with the applicable general design requirements specified in Section 13401 – Process Control Systems General Provisions, 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 Process Control Systems General Provisions and Section 01610 Transportation and Handling of Materials and Equipment.
- 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 01300 – Submittals and Section 13401 – Process Control Systems General Provisions.

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:
 - 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:
 - 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.
 - 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 – ULTRASONIC LEVEL MEASUREMENT SYSTEM

- A. The ultrasonic level system shall consist of a transmitter to generate pulse signal to separate transducer, receive echo signal back from transducer, calculate distance based on time for signal return; transmit a linear 4-20mA signal proportional to distance measured, and provide local indication.
- B. Pulse Time of Flight transducer emits a high frequency pulse and receives echo signal back which is transferred to transmitter via provided standard twisted shielded cable.
- C. The temperature limits of the sensor shall be -40 degrees F to 176 degrees F; relative humidity 0 to 100 percent. The transducer shall be provided with automatic built in air temperature compensation.
- D. The beam angle of the transducer shall be 12° or less.
- E. Transducer shall be completely encapsulated in a hermetically welded PVDF housing. Transducers shall be rated for NEMA 6P submergence.
- F. Sensor shall have mechanical decoupling between sensor membrane and outer housing. Sensors shall be provided with automatic build up compensation to provide self-cleaning when condensation may occur. Sensors shall be provided with internal heating elements and power supplies for these elements when freezing condensation may occur.
- G. The transmitter type shall be sonic pulse, 4 wire, remote mounted microprocessor electronics package.
- H. The output of the transmitter shall be one 4 to 20 mA. Built-in features to include interference echo suppression and adjustable blocking distance; sludge detection; and integral keypad with each transmitter.
- There shall be at least 3 integral totalizers and 3 daily counters with the ability for simultaneous measurement of level and flow in storm water overflow basin with only 1 sensor; EEPROM memory backup; temperature compensation; average, difference and sum calculations.

- J. The output alarm relays shall have up to 6 SPDT contacts with individually adjustable set points. The contacts shall be freely configurable for alarms, pump control, high and low limit alarms, flow counting pulse, or diagnostics.
- K. The transmitter shall have a temperature range of minus 40 to 140 degrees Fahrenheit.
- L. The field mounted enclosure shall be rated NEMA 4X. A local indicator with 6 line plain text and an illuminated LCD display scaled to read in engineering units of flow, level and volume.
- M. The transmitter shall operate using 90 to 253 VAC, or 10.5 to 32 VDC power input.
- N. The measuring uncertainty of the transmitter shall not be more than +/- .2% of maximum sensor span per NAMUR EN 61208-2.
- O. Products and Manufacturers: Provide one of the following:
 - 1. Endress + Hauser, Prosonic S FMU90 transmitter with a Prosonic S FDU91.
 - 2. Siemens HydroRanger 200 transmitter with a Siemens ST-H transducer.
 - 3. Or approved equal.

2.03 – LEVEL FLOATS

- A. Type: Direct acting, non-mercury, pear shaped, eccentric weighted, displacement type liquid level sensor.
- B. Construction Features:
 - 1. Float Body: Hollow hermetically sealed, rigidly molded of polypropylene containing mechanical switch and eccentric metal weight.
 - 2. Mechanical Switch: SPDT switch rated 16 amps resistive at 120 VAC and five amps resistive at 30 VDC.
 - 3. Weight: Weight to cause sensor to hang straight down from cable when not immersed and only allow float to pivot when immersed in liquid.
 - 4. Electrical Cable:
 - a. Heavy duty, three conductor, flexible and submersible cable, sheathed in PVC and connected to float and switch with watertight seal.



- b. Length furnished to be sufficient to extend to junction box.
- C. Products and Manufacturers: Provide one of the following:
 - a. Flygt, Model ENM-10.
 - b. Anchor Scientific, Eco-Float.
 - c. Or approved equal.

2.04 - 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. 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

 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 + +



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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 Influent Pump Station Main Control Panel (IPCP).
- 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 13404 Process Control Systems Training
 - 6. Section 13420 Primary Sensors and Field Instruments
 - 7. Section 13440 Panel Mounted Instruments and Devices.
 - 8. Section 13451 PLC Hardware and Software.
 - 9. 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. Glen Cove WWTP Influent Pump Station Main Control Panel 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 3-point latch system with handle on front 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.
- 2. Communication Cabinet shall be NEMA 4X rated.
 - 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. Wall Mounted (to be mounted on stainless steel channel rack)
- C. Electrical Systems:
 - 1. Control of Environment:
 - a. Indoor Panels:
 - 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 thermoplastic 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 2.02-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.
- 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 8x20µs impulse waveform) of at least 8 kA. Ground wires for all instrumentation device surge protectors shall be connected to a low resistance ground.
 - 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.
 - 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 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:
 - 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.
 - 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:
 - 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.
 - 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:
 - 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 ±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.

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- 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: 4¹/₂ 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.
 - 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: minimum of 100dB at 10 feet from panel.
- 2. Enclosure Rating: NEMA 4X or NEMA7 in classified areas.
- 3. Horn Diaphragm: Stainless steel.
- 4. Power: 120 VAC.
- 5. Operating Temperature: 32 to120°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: LED, 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.
- NCDP 1701

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- 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.

2.10 - INDUSTRIAL MANAGED ETHERNET SWITCH (FOR COMMUNICATION CABINET)

- A. General:
 - 1. Provide an industrial managed Ethernet switch for connection to the control network as shown in the Drawings and specified herein.
- B. Physical Features:
 - 1. Minimum copper ports: 8 x 10/100 TX RJ45 ports. The final quantity of copper ports shall be based on the equipment connected to each switch, and must include a minimum of 3 ports designated for spare.
 - 2. Operating temperature: 0 to 130 °F.
 - 3. Power: 24 VDC redundant power supply inputs.
 - 4. Enclosure: Metal case, DIN-rail mountable.
- C. Network Features:
 - 1. Layer 2 switching.
 - 2. Full duplex on all port.
 - 3. Auto negotiation and manual configurable speed and duplex.
 - 4. Wire speed switching fabric.

- 5. IEEE 802.1w Rapid Spanning Tree Protocol.
- 6. IGMP snooping.
- 7. IGMP filtering.
- 8. Configuration password protected.
- 9. Configuration backup capability required.
- 10. SNMP V3.
- 11. 802.1Q VLAN
- 12. Port-Based VLAN
- 13. Lock port function for blocking unauthorized access based on MAC address.
- D. Manufacturers:
 - 1. Moxa.
 - 2. Hirschmann.
 - 3. Phoenix Contact.

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 + +



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 13420 Primary Sensors and Field Instruments
- 5. Section 13430 Panels and Enclosure.
- 5. Section 13440 Panel Mounted Instruments and Devices
- 6. Section 13480, Input/Output Point List.
- 7. 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.

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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.
- 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 OIT's or engineering workstation.
 - Errors and/or failures shall be indicated locally by Light Emitting Diode (LED) and reported at the OIT. 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:
 - 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.

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- 2) Or approved equal.
- 9. Redundancy System:
 - 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 an 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 10, 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.
- 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. Display resolution shall be a minimum 1024 x 768.
- 2. 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.

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. Al 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 + +

					Abbreviations	
Specification 13480 - Input Output Point List						Digital Input
Appendix A - PLC Inputs/Outputs						Digital Output
Nassa County Department of Public Works						
Clon Cove Waste Water Treatment Data Dealining Treatment System Improvements						Analas Output
Gien Cove waste water Treatment Plant Preliminary Treatment System Improvements						Analog Output
						Modbus
						Etternet
No	Description	Siddye Dewatering Facility I/O List	Quantity	Panga	Linito	Notos
1	RSP1 Dry Pit Submersible Pump H-O-A switch		Quantity	N/A	N/A	Notes
2	RSP1 Dry Pit Submersible Pump Drive/Bypass Selector Switch	DI	2	N/A	N/A	
3	RSP1 Dry Pit Submersible Pump RSP1 Overload	DI	1	N/A	N/A	
4	RSP1 Dry Pit Submersible Pump Fault	DI	1	N/A	N/A	
5	RSP1 Dry Pit Submersible Pump Reset	DI	1	N/A	N/A	
6	RSP1 Dry Pit Submersible Pump Run Aux, Relay	DI	1	N/A	N/A	
7	RSP1 Dry Pit Submersible Pump Start/Stop	DO	1	N/A	N/A	
8	RSP1 Dry Pit Submersible Pump Speed Reference	AO	1	4-20	ma	From Influent Pump Station CP to RSP1 VED
9	RSP1 Dry Pit Submersible Pump Running	DO	1	N/A	N/A	
10	RSP1 Dry Pit Submersible Pump Local/Remote	DI	1	N/A	N/A	For allowing the pump to be run by local control station
11	RSP1 Dry Pit Submersible Pump Remote Start/Stop	DI	1	N/A	N/A	Start/Stop signal from local control station when RSP1
12	RSP1 Dry Pit Submersible Pump Seal Leak	DI	1	N/A	N/A	
13	RSP1 Dry Pit Submersible Pump Over Temperature	DI	1	N/A	N/A	
14	RSP2 Dry Pit Submersible Pump H-O-A switch	DI	3	N/A	N/A	
15	RSP2 Dry Pit Submersible Pump Drive/Bypass Selector Switch	DI	2	N/A	N/A	
16	RSP2 Dry Pit Submersible Pump RSP1 Overload	DI	1	N/A	N/A	
17	RSP2 Dry Pit Submersible Pump Fault	DI	1	N/A	N/A	
18	RSP2 Dry Pit Submersible Pump Reset	DI	1	N/A	N/A	
19	RSP2 Dry Pit Submersible Pump Run Aux, Relay	DI	1	N/A	N/A	
20	RSP2 Dry Pit Submersible Pump Start/Stop	DO	1	N/A	N/A	
21	RSP2 Drv Pit Submersible Pump Speed Reference	AQ	1	4-20	ma	From Influent Pump Station CP to RSP2 VFD
22	RSP2 Dry Pit Submersible Pump Running	DO	1	N/A	N/A	
23	RSP2 Dry Pit Submersible Pump Local/Remote	DI	1	N/A	N/A	For allowing the pump to be run by local control station
24	RSP2 Dry Pit Submersible Pump Remote Start/Stop	DI	1	N/A	N/A	Start/Stop signal from local control station when RSP1 is in Remote
25	RSP2 Dry Pit Submersible Pump Seal Leak	DI	1	N/A	N/A	
26	RSP2 Dry Pit Submersible Pump Over Temperature	DI	1	N/A	N/A	
27	RSP3 Dry Pit Submersible Pump H-O-A switch	DI	3	N/A	N/A	
28	RSP3 Dry Pit Submersible Pump Drive/Bypass Selector Switch	DI	2	N/A	N/A	
29	RSP3 Dry Pit Submersible Pump RSP1 Overload	DI	1	N/A	N/A	
30	RSP3 Dry Pit Submersible Pump Fault	DI	1	N/A	N/A	
31	RSP3 Dry Pit Submersible Pump Reset	DI	1	N/A	N/A	
32	RSP3 Dry Pit Submersible Pump Run Aux. Relay	DI	1	N/A	N/A	
33	RSP3 Dry Pit Submersible Pump Start/Stop	DO	1	N/A	N/A	
34	RSP3 Dry Pit Submersible Pump Speed Reference	AO	1	4-20	ma	From Influent Pump Station CP to RSP3 VFD
35	RSP3 Dry Pit Submersible Pump Running	DO	1	N/A	N/A	
36	RSP3 Dry Pit Submersible Pump Local/Remote	DI	1	N/A	N/A	For allowing the pump to be run by local control station
37	RSP3 Dry Pit Submersible Pump Remote Start/Stop	DI	1	N/A	N/A	Start/Stop signal from local control station when RSP1 is in Remote
38	RSP3 Dry Pit Submersible Pump Seal Leak	DI	1	N/A	N/A	
39	RSP3 Dry Pit Submersible Pump Over Temperature	DI	1	N/A	N/A	
40	RSP4 Dry Pit Submersible Pump H-O-A switch	DI	3	N/A	N/A	
41	RSP4 Dry Pit Submersible Pump Drive/Bypass Selector Switch	DI	2	N/A	N/A	

					Abbreviations	
Specification 13480 - Input Output Point List						Digital Input
Appendix A - PLC Inputs/Outputs Nassa County Department of Public Works					DO:	Digital Output
					AI:	Analog Input
Glen Cove Waste Water Treatment Plant Preliminary Treatment System Improvements						Analog Output
						Modbus
						Ethernet
Sludge Dewatering Facility I/O List						
No.	Description	Signal Type	Quantity	Range	Units	Notes
42	RSP4 Dry Pit Submersible Pump RSP1 Overload	DI	1	N/A	N/A	
43	RSP4 Dry Pit Submersible Pump Fault	DI	1	N/A	N/A	
44	RSP4 Dry Pit Submersible Pump Reset	DI	1	N/A	N/A	
45	RSP4 Dry Pit Submersible Pump Run Aux. Relay	DI	1	N/A	N/A	
46	RSP4 Dry Pit Submersible Pump Start/Stop	DO	1	N/A	N/A	
47	RSP4 Dry Pit Submersible Pump Speed Reference	AO	1	4-20	ma	From Influent Pump Station CP to RSP4 VFD
48	RSP4 Dry Pit Submersible Pump Running	DO	1	N/A	N/A	
49	RSP4 Dry Pit Submersible Pump Local/Remote	DI	1	N/A	N/A	For allowing the pump to be run by local control station
50	RSP4 Dry Pit Submersible Pump Remote Start/Stop	DI	1	N/A	N/A	Start/Stop signal from local control station when RSP1 is in Remote
51	RSP4 Dry Pit Submersible Pump Seal Leak	DI	1	N/A	N/A	
52	RSP4 Dry Pit Submersible Pump Over Temperature	DI	1	N/A	N/A	
53	East Wet Well High Level Float	DI	1	N/A	N/A	For high level alarm
54	East Wet Well Level Transducer	AI	1	4-20	ma	For monitoring actual level in wet well
55	West Wet Well High Level Float	DI	1	N/A	N/A	For high level alarm
56	West Well Level Transducer	AI	1	4-20	ma	For monitoring actual level in wet well
57	General Alarm	DO	1	N/A	N/A	
58	General Alarm Reset	DI	1	N/A	N/A	
59	SCADA	EN	1	N/A	N/A	



PART 1 - GENERAL

1.01 - DESCRIPTION

- A. Scope:
 - 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.
 - 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.
 - 3. Section 13420 Primary Sensors and Field Instruments
- 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:
 - 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 mADC circuit).
- b. Individual PLC fault indications.
- c. Indication of a communications failure.
- d. Indication of an Input/Output module failure.
- e. Indication of an 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.
- 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, training 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 characteristics 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 - INFLUENT PUMP STATION MAIN CONTROL PANEL

- A. Control of four (4) influent sewage pumps and the associated equipment shall be by the Influent Pump Station Main Control Panel. The main control protocols shall be as following:
 - Each pump is to be controlled by its dedicated "RUN-OFF-AUTO" selector switch. In the "RUN" position, the pump shall be activated by the operator until the low level shut off level is reached, as measured by the applicable wet well level probe. In the "AUTO" position, the pump shall be controlled and be operated as specified hereinafter.
 - 2. When in the "RUN" or "AUTO" mode, a manual pump speed adjustment, in percent of full speed with corresponding hertz indicated, shall be used by the operator to select a pump speed. The PLC shall generate a corresponding 4-20 mA signal that will be sent to the VFD controller. Speed adjustment shall be provided for each pump.
 - 3. Provide a lead pump selector function in the PLC that allows the operator to select the "LEAD" pump via the operator interface.
 - The operator shall be able to designate any of the installed pumps as the "LEAD"
 pump by inputting the pump number into the appropriate input fields. Provide a set-up screen via the interface to allow the operator to make these selections.
 - b. The operator shall also be able to select lead pump selection as "ALTERNATE" which will automatically alternate the lead pump selection after a "PUMPS OFF" level indication (LEVEL 1).
 - c. Control logic shall be provided such that the "LEAD" pump shall first be automatically adjusted to full motor speed before the "LAG" pump starts.
 - d. The "LEAD" pump shall run at the operator set minimum motor speed when the water level in the wet well reaches an operator set water level (LEVEL 2).
 - e. The "LEAD" pump motor shall be automatically and linearly increased to full speed (60 Hz) as the wet well level increases to an operator set water level (LEVEL 3) where it will remain at full speed until LEVEL 4 is reached. The "LAG" pump shall also be turned off at LEVEL 3.
 - f. The "LAG" pump shall be activated if the wet well level increases to an operator set water level (LEVEL 4). The "LAG" pump shall automatically start at the operator set pump motor speed that shall be input by the operator via the



interface.

- g. The "LAG" pump motor speed shall be automatically and linearly increased to full speed (60 Hz) if the wet well level increases to an operator set water level (LEVEL 5). The "LAG-LAG" pump shall also be turned off at LEVEL 5.
- h. The "LAG-LAG" pump shall be activated if the wet well level increases to an operator set water level (LEVEL 6). The "LAG-LAG" pump shall automatically start at full speed (60 Hz). A "LAG-LAG PUMP REQUIRED" alarm condition shall be indicated.
- i. All settings will reset back to the operator inputs after each "PUMPS OFF" (LEVEL 1) indication.
- j. HIGH WATER ALARM shall be indicated when the wet well water level reaches the high level.
- k. Initial wet well level set points:
 - 1. LEVEL 0 LOW WATER 60" AFF
 - 2. LEVEL 1 PUMPS OFF 78" AFF
 - 3. LEVEL 2 LEAD PUMP ON 84" AFF
 - 4. LEVEL 3 LEAD PUMP SPEED INCREASE 90" AFF
 - 5. LEVEL 4 LAG PUMP ON 96" AFF
 - 6. LEVEL 5 LAG PUMP SPEED INCREASE 96" AFF
 - 7. LEVEL 6 LAG-LAG PUMP ON, HIGH WATER ALARM 114" AFF
- 4. Provide a WET WELL LEVEL TRANSDUCER selector switch to allow the operator to select either the level probe in the East Wet Well or the West Wet Well.
- 5. Provide control logic such that in the event the "LEAD" pump fails to start, then the "LAG" pump shall run; if the "LAG" pump fails to start, then the "LAG-LAG" pump shall run; if the "LAG-LAG" pump fails to start, then the "LAG-LAG" pump shall run.
- 6. Provide control logic such that if any pump selector switch is in the OFF position, the program will not include that pump in the automatic lead pump alternation or lag pump



activation.

- 7. Provide control logic such that the low speed set point of the pump is based on values determined by the pump manufacturer. This low speed set point shall not be operator adjustable in any mode ("RUN" or "AUTO") but shall be set via programming of the PLC.
- 8. Provide separate graphical running history display screen of the wet well levels as monitored by the wet well level probes over the past 24 hours, with the time in one hour increments.
- 9. Provide a pump running history screen over the past 48 hours that shows which pump was called to run between each PUMPS OFF call. Each pump running shall be shown in the order and time they were called to run by the program (i.e. Lead pump (#1 -11:00 am), Lag Pump (#2 12:30 pm)), Pumps Off (1:00 pm) etc.)
- B. "LOW LEVEL" alarm shall shut down the pump in "RUN" or "AUTO" mode.
- C. The following alarm conditions shall be annunciated using the operator interface and a signal generated by the PLC for remote monitoring:
 - 1. "EAST WET WELL HIGH WATER LEVEL FLOAT"
 - 2. "WEST WET WELL HIGH WATER LEVEL FLOAT"
 - 3. "PUMP FAIL TO START"
 - 4. "PUMP FAIL TO STOP"
 - 5. "SEAL LEAK/MOTOR OVERTEMPERATURE"
 - 6. "LAG-LAG PUMP REQUIRED"
 - 7. "LAG-LAG-LAG PUMP REQUIRED"

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.
- 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. 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 deenergized 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.
- K. 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)
- 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.
- L. Digital Alarms
 - Digital alarms shall be programmed to alarm after a time setpoint expires to eliminate nuisance alarming. Time setpoints to be part of submittal for review by Engineer

+ + END OF SECTION + +



PART 1 - GENERAL

1.01 – SECTION INCLUDES

A. Furnish all labor, materials, equipment and services to furnish and install shaftless screw conveyors with motors, including all conveyor transitional fittings and inlet chutes and discharge chutes 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 here in 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 compacted screenings 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 Article GC17 contained within the General Conditions of the contract.
- 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 manufacturer 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 shaftless screw conveyors 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 manufacturer 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 performance information.
 - 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 manufacturer 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 01300 - 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 MLM Conveying Systems. 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



day

the operational experience of the manufacturer with shaftless screw conveyors, and not standards developed for shafted screw conveyors.

	CONVEYOR (C-1 & C-2)
Min. Required Solids Transport Rate (cubic ft per day)	10
Material	Compacted Screenings
Material Density (lbs per cubic ft)	60
Length (C-1/C-2)	32'-0" / 24'-6"
Orientation	Horizontal
Max. Screw Speed (RPM)	15
Max. Trough Fill	50%
Min. Flight O.D.	11.2"
Min. Spiral Weight (lb per ft)	27
Min. Trough Width	12.5"
Min. HP	2
Drive Location	inlet
Motor type	TEFC
Reversing screw	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 ____

(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 01300:
 - 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 conveyor motor. Provide field-wiring diagram for each size 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:
 - 1. MLM Conveying Systems,
 - 2. Atara Equipment Limited,
 - 3. Or approved equal.
- B. 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

E. 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, 18-8
2.	Troughs, End Plates, Covers	AISI 304, 18-8
3.	Supports	1/4" AISI 304, 18-8
4.	Hoppers	AISI 304, 18-8
5.	Spiral Flighting	Cold formed, High Strength Micro Alloy Carbon Steel with a minimum hardness of 220 Brinell
6.	Wear Liner	Ultrahigh molecular polyethylene (4.02.04A)
7.	Bolts, Nuts, and Washers for Conveyor Supports, Trough, Lids, and Drive	AISI 316, 18-8

2.03 – SHAFTLESS SCREW CONVEYORS

- A. The shaftless screw conveyor equipment shall include, but not be limited to the following:
 - 1. Spiral flighting

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- 2. Troughs and Liners
- 3. Double turn down flanges
- 4. Removable trough stays
- 5. Chutes
- 6. Covers
- 7. Gear drive adapter complete with packing gland and labyrinth seal
- 8. Motor Reducer
- 9. Mounting and Support Structure
- 10. Electrical Controls
- 11. Safety Accessories
- B. Standard screw conveyors with shafts and intermediate bearings will not be acceptable.
- C. Shaftless Screw Conveyor Construction
 - 1. Spiral Flighting
 - a. Spiral flighting 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 flighting 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 flighting, 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. Manufacturer shall maintain a certified factory quality control program which shall include certification of spiral flighting as described herein
- e. The spiral flighting shall be formed in sections from one continuous flat bar and shall be concentric to within 2mm +/-. Sectional flighting formed from plate shall not be permitted.
- f. Spiral flighting 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
 - Troughs shall meet 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 inlet and discharge openings as required by the Contract drawings. If required, each inlet 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 drain complete with blanking flange shall be provided with each conveyor to facilitate cleaning.
- e. The portion of each trough that is not covered by the inlet chute shall be covered by a bolted cover of a material identical to the trough. The covers shall be manufactured in maximum 4-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. 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, 1/2" minimum thickness, to provide ease of replacement. The liner shall be held in place with clips; no fasteners will be allowed.
- 4. 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.
- 5. 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 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 contraction others. 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.
- 6. 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.
- 7. Drive Units
 - a. Each spiral conveyor shall be driven by a constant-speed integral gear reducer/motor drive unit mounted to a gear drive adapter complete with packing gland and seal 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.
 - 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.
- 8. Gear Reducers


- 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 an 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.
- 9. 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.
- 10. Motion Failure Alarm Unit
 - a. Each conveyor drive unit shall be equipped with a motion failure a larm 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.
- 11. Electrical Controls
 - a. A separate control panel shall be provided for each conveyor located inside a NEMA 4X stainless steel enclosure. The control panel shall consist of all controllers, switches, lights, relays and other control devices required for a complete operable system. The control panel and all components shall be industrial duty. All equipment specific electrical components interconnected to the control panel shall terminate at numbered and labeled terminal blocks. The terminal blocks shall be sized for 14-gauge wire. Wires shall be neatly run through wire raceway 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 the front of the control panel per related NFPA requirements.
 - b. Power: 460 VAC, 3Ph, 60 Hz.
 - c. Panel face shall include the following features as a minimum:
 - 1) Conveyor forward run light
 - 2) Conveyor reverse run light



- 3) Zero speed light
- 4) Motor overload light
- 5) E-Stop active light
- 6) Close light
- 7) Open light
- 8) Alarm reset pushbutton
- 9) Start pushbutton
- 10) Stop pushbutton
- 11) E-stop switch
- 12) Local/Remote switch
- 13) Forward/Reverse switch
- d. Coordinate remote operation with Section 11332 Sewage Bar Screen and Screenings Washing and Compacting Equipment main control panels.
- 12. Emergency Shutdown
 - 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 Manufactures 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, stainles s 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 09900. 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 flighting shall receive a minimum of one coat of Themec "66-1211 Epoxoline primer" or equal, and one coat of "46H-413 Hi-Build Themec-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.

2.04 - SOURCE QUALITY CONTROL

A. Conveyors shall be inspected and operated in the shop with the actual drive unit for this project in its entire length. Conveyor longer then 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 ap art 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.

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. 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.

+ + END OF SECTION + +

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 duct size shown on the Drawings does not match the connection size of the equipment that it is connected to, provide the necessary transition pieces 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

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SECTION 15010 - GENERAL MECHANICAL REQUIREMENTS

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	
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.	SMACNA	Sheet Metal and Air Conditioning Contractor's National Association	
21.	F.S. or FED	Spec. Federal Specification	
22.	ASA	Acoustical Society of America	
23.	NACE	National Association or Corrosion Engineers	
24.	ASSE	American Society of Sanitary Engineers	
25.	Building Code of New York State		

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- 26. Fire Code of New York State
- 27. Fuel Gas Code of New York State
- 28. Plumbing Code of New York State
- 29. Energy Conservation Construction Code of New York State
- 30. Mechanical Code of New York State
- 31. New York State Sanitary Code
- 32. New York State Industrial Code Rules

33.	IRI	Industrial Risk Insurers
34.	AGA	American Gas Association
35.	AABC	American Air Balance Council
36.	NEBB	National Environmental Balancing Bureau
37.	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
 - 4. H & V Heating and Ventilating

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SECTION 15010 - GENERAL MECHANICAL REQUIREMENTS

5.	AWG	American Wire Gauge
6.	BWG	Birmingham Wire Gauge
7.	USS	United States Standard
8.	PSIG	Pounds per Square Inch Gauge
9.	MBH	Thousand BTU per hour
10.	BTU	British Thermal Units
11.	WG	Water Gage
12.	LB	Pound (Also shown as: #)
13.	ASME	American Society of Mechanical Engineers
14.	ASTM	American Society for Testing Materials
15.	ASA	American Standards Associates
16.	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.

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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. 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 no 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. Automatic temperature control equipment, diagrams and control sequences
 - 3. Equipment, fixtures, and appurtenances
 - 4. Insulation
 - 5. 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 duct testing reports.
- 6. Field operating test results for equipment.
- 7. Performance report on the balancing of air systems.
- 8. 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 – SAFETY DATA SHEETS

A. Submit safety data sheets (SDS) 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).

1.15 – 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 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.
- E. 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

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- 14. Efficiency at Full Load.
- F. Provide motors whose sound power levels do not exceed that recommended in NEMA MG 1-12.49.
- G. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned and balanced.
- H. Protect motor starters on equipment located outdoors in weatherproof NEMA 4X enclosures.
- I. Provide weatherproof NEMA 4X disconnect switches when located outdoors.
- J. Motor Characteristics:
 - 1. 120V/1/60 Hz, 208V/1/60 Hz or 240V/1/60 Hz. Capacitor start, open drip-proof type, ball bearing, rated 40 C. continuous rise.
 - 208V/3/60 Hz, 240V/3/60 Hz or 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.

1.16 - 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.
 - 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.



1.17 - 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.

1.18 - 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.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 - CLEANING AND ADJUSTING

- A. Cleaning
 - 1. Clean all materials and equipment; leave in condition ready to operate and ready to receive final finishes where required.

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- 2. Clean the operating equipment and systems to be dust free inside and out.
- 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.
- 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 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 ductwork.
- B. Upon completion, remove all temporary equipment, scaffolds, etc., and leave all areas clean and free from material and debris resulting from the work performed under this Section. Provide 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
 - V-belt drives a driving and driven sheave grooved for belts of trapezoidal crosssection. 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.
 - 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 - 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

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- 6. Identification systems
- 7. Control sequences
- 8. Hazards
- 9. 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)	
Roof Top Units	8 hrs.	
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.

+ + END OF SECTION + +



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PART 1 - GENERAL

1.01 - DESCRIPTION OF WORK

A. This Section describes the draining, disconnecting, dismantling, demolition, removal, relocation, rerouting and reconnection of existing mechanical facilities, in a neat and workmanlike manner, of mechanical systems, materials and accessories as required, as shown on the Drawings and specified herein, to accomplish alteration, restoration and to accommodate the Work.

1.02 – RELATED WORK

A. General Mechanical Requirements – Section 15010

1.03 - REFERENCES

- A. BOCA Building Code
- B. International Building Code (IBC)
- C. NFPA Fire Code
- D. ANSI A10.6 Safety Requirements for Demolition
- E. National Association of Demolition Contractors (NADC) Demolition Safety Manual
- F. NFPA 51B Cutting and Welding Processes
- G. NFPA 70 National Electrical Code
- H. NFPA 241 Safeguarding Building Construction and Demolition Operations
- I. OSHA 29 CRF 1910 Occupational Safety and Health Standards
- J. US EPA Clean Air Act Amendment of 1990.

1.04 - SUBMITTALS

- A. Demolition Schedule
- B. Fire Watch Procedures
- C. 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.

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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

2.01 – PERFORMANCE/DESIGN CRITERIA

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. 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, 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 to avoid entry of dirt and debris
- 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 – 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.

3.04 – 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.

3.05 – 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 blankoff panels.
- C. Remove all ductwork supports and miscellaneous steel with ductwork to be demolished.

3.06 – 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 + +



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 01300 Submittals.
- B. Submit the following:
 - 1. Product data and installation instructions.

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- 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 $1/_2$ through 24-inch diameter.
 - 2. Insulated galvanized steel pipe 1/2 through 24-inch diameter.
 - 3. Insulated copper pipe $1/_2$ 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 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:

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- 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.



- 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.
- 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)
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 + +



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PART 1 - GENERAL

1.01 - DESCRIPTION OF WORK

- A. Use only tested firestop systems in specific locations as follows:
 - 1. Penetrations for the passage of duct, piping, conduit and other mechanical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
 - 2. Repetitive plumbing penetrations in fire-rated floor assemblies.
 - 3. Penetrations for the installation of tubs, showers, aerators and other plumbing fixtures.

1.02 - RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work specified in this Section.

1.03 - DEFINITIONS

A. Firestopping: 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 fire rated wall and floor assemblies.

1.04 - RELATED WORK

- A. Coordinate work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the Work of other Sections, including:
 - 1. General Mechanical Requirements Section 15010
 - 2. Ductwork Insulation Section 15258

1.05 - REFERENCES

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops" UL Fire Resistance Directory:
 - 1. Firestop Devices (XHJI)



- 2. Fire Resistance Ratings (BXRH)
- 3. Through-Penetration Firestop Systems (XHEZ)
- 4. Fill, Voids, or Cavity Material (XHHW)
- 5. Forming Materials (XHKU)
- C. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- D. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
- E. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
- F. Building Code of New York State
- G. Fire Code of New York State
- H. NFPA 101 Life Safety Code

1.06 - QUALITY ASSURANCE

- A. Provide onsite training by a manufacturer's direct representative (not distributor or agent) during initial installation of firestop systems to train personnel in proper selection and installation procedures in accordance with the manufacturer's written recommendations published in their literature and details.
- B. Install Firestop System to meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Provide firestop materials and methods to conform to applicable governing codes and local authorities having jurisdiction.
- D. Consult the Architect/Engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, submit a manufacturer's engineering judgment derived from similar UL system designs or other tests to local authorities having jurisdiction for their review and approval prior to installation. Follow the requirements set forth by the International Firestop Council when preparing the engineering judgment drawings.



1.07 - SUBMITTALS

- A. Submit 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 to comply with Division 1.
- B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Include both project name and contractor's name who will install firestop system as described in engineering judgment drawing.
- C. Submit safety data sheets provided with materials delivered to job-site.

1.08 - INSTALLER QUALIFICATIONS

A. 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 manufacturer'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.

1.09 - DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

1.10 - PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Scheduling

- 1. Schedule installation of Cast in Place firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
- 2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: 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.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 - FIRESTOPPING, GENERAL

- A. 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.
- B. 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.

2.02 - ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
 - 1. Hilti, Inc., Tulsa, Oklahoma 800-879-8000/www.us.hilti.com

2.03 - MATERIALS

A. Use only firestop products that have been UL 1479 or ASTM E 814 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. Install cast-in place firestop devices prior to concrete placement for use with noncombustible and combustible pipes (closed and open systems), and conduit penetrating concrete floors, the following products are acceptable:
 - 1. Hilti CP 680 Cast-In Place Firestop Device
 - a. Add Aerator adaptor when used in conjunction with aerator ("sovent") system.
 - 2. Hilti CP 681 Tub Box Kit for use with tub installations.
 - 3. Hilti CP 682 Cast-In Place Firestop Device for use with noncombustible penetrants
- C. 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
 - 5. Hilti CP 601s Elastomeric Firestop Sealant
- D. 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
 - 3. Hilti FS-ONE Intumescent Firestop Sealant
- E. 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
- F. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:



- 1. Hilti FS-ONE Intumescent Firestop Sealant
- 2. Hilti CP 620 Fire Foam
- 3. Hilti CP 601s Elastomeric Firestop Sealant
- 4. Hilti CP 606 Flexible Firestop Sealant
- G. Non curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti CP 618 Firestop Putty Stick
 - 2. Hilti CP 658T Firestop Plug
- H. 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
- I. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
 - 1. Hilti CP 643N Firestop Collar
 - 2. Hilti CP 644 Firestop Collar
 - 3. Hilti CP 645/648 Wrap Strips
- J. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - 1. Hilti FS 637 Trowelable Firestop Compound
 - 2. Hilti FS 657 FIRE BLOCK
 - 3. Hilti CP 620 Fire Foam
 - 4. Hilti CP 675T Firestop Board



- K. Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - 1. Hilti FS 657 FIRE BLOCK
 - 2. Hilti CP 675T Firestop Board
- L. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

PART 3 - EXECUTION

3.01 - PREPARATION

- A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.
 - 1. Verify penetrations are properly sized and in suitable condition for application of materials.
 - 2. Make surfaces to which firestop materials will be applied 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 - COORDINATION

- A. 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.
- B. Assure that the responsible trade has provided adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 - INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of throughpenetration joint materials.
 - 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
 - 2. Do not install firestop systems in a manner that hampers the performance of fire dampers, coordinate with the requirements for ductwork and fire damper installation.
 - 3. Protect materials from damage on surfaces subjected to traffic.

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 authorities.
- C. Inspect through-penetration firestopping 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 areas 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 - SECTION INCLUDES

A. Small piping, valves and accessories

1.02 – RELATED SECTIONS

A. Section 11318 – Booster Pump

1.03 - SUBMITTALS

- A. Submit under provisions of Section 01300. 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 rips 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 patter 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 – 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. 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 + +



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1.01 - SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for piping systems.
 - 1. Reinforced flexible tubing and accessories
 - 2. Caps
 - 3. Corporation stops
 - 4. Curb stops
 - 5. Escutcheons
 - 6. Pressure gauges
 - 7. Pressure regulating valves
 - 8. Relief valves
 - 9. Solenoid valves

1.02 - RELATED SECTIONS

- A. Section 15060 Pipe Hangers and Supports
- B. Section 15075 Mechanical Identification

1.03 - REFERENCES

- A. Section 01450 Quality Control: Requirements for references and standards.
- B. ASME B16.3 Malleable Iron Threaded Fittings.
- C. ASME B31.3 Process Piping.
- D. ASTM D2737 Standard Specification for Polyethylene (PE) Plastic Tubing.
- E. AWWA C800 Underground Service Line Valves and Fittings
- F. AWWA C901 Polyethylene Pressure Pipe and Tubing, 1/3" to 3", for Water Service.



1.04 - SUBMITTALS FOR REVIEW

- A. Section 01300 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. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. 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 01610 Transportation and Handling of Materials and Equipment: 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 01610 – Transportation and Handling of Materials and Equipment: Environmental conditions affecting products on site.



PART 2 - PRODUCTS

2.01 - 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

2.02 - CAPS

- A. Vent caps
 - 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
 - Dual outlet, cast iron air relief vent, 2" NPT, with 16 mesh brass screen by McMaster-Carr Model No. 4815K15

2.03 - 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.

2.04 - 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.

2.05 - ESCUTCHEONS

A. Provide chrome plated escutcheons where uninsulated pipes penetrate walls of finished spaces.

2.06 - 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

2.07 - 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.



2.08 - 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.

2.09 - 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.

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 15060.
- 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. 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.
- K. 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.



- L. All fittings, except couplings, shall be supported and valves shall be braced to resist torque during valve manipulation.
- M. All piping shall be free of traps and graded to permit complete drainage.

3.02 - 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.

3.03 - 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.

3.04 - TESTING

A. All small piping shall be tested for pressure and leakage, in accordance with AWWA Specification C600.

+ + END OF SECTION + +



+ + 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 01300.
- 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)			
Group Tests Required: Hydrostatic Test (51-9) Tensile Test (51-12.1) Impact Test (51-12.2) Low Temperature Impact Test (51-13)	Transcripts & Certification:	51-5.2	
Group Tests Required: Tensile Test (51-12.1) Impact Test (51-12.2) Low Temperature Impact Test (51-13)		Hydrostatic Test (51-9)	
Impact Test (51-12.2)	Group Tests Required:	Tensile Test (51-12.1)	
Low Temperature Impact Test (51-13)		Impact Test (51-12.2)	
		Low Temperature Impact Test (51-13)	
Number of Specific Group Tests	Number of Specific Group Tests		
Required in Addition to General One (1) per pipe size per 2,000 linear feet of pipe.	Required in Addition to General	One (1) per pipe size per 2,000 linear feet of pipe.	
Certification:	Certification:		

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..

NCDP 1701



- 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 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.
 - 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 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.
- 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.
 - 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.
- 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.
- 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 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.

3.02 - 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.

3.03 - 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.

3.04 - 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 + +



PART 1 - GENERAL

1.01 - SECTION INCLUDES

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required for the correct installation of non-penetrating, recycled rubber rooftop supports for mechanical piping and ductwork systems.

1.02 - REFERENCES

- A. ASTM A653 G90 SS Gr. 33 Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dipped Process
- B. ASTM B633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel
- C. ASTM C531 Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, Monolithic Surfaces, and Polymer Concretes
- D. ASTM C642 Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete
- E. ASTM C672 Test Methods for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals
- F. ASTM D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension
- G. ASTM D395 Standard Test Methods for Rubber Property Compression Set
- H. ASTM D573 Test Method for Rubber Deterioration in an Air Oven
- I. ASTM D746 Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
- J. ASTM D2240 Test Method for Rubber Property Durometer Hardness
- K. NFPA 70 National Electrical Code

1.03 - QUALITY ASSURANCE

- A. Rubber rooftop supports shall be manufactured under a strict quality control program assuring quality product delivered to the jobsite. Supports that are damaged shall not be installed.
- B. Workmanship: All rooftop supports to be installed by a qualified contractor and installed in accordance with manufacturer's recommendations.
 - 1. All work shall comply with all applicable federal, state, and local codes and laws having jurisdiction.



2. All work shall conform to accepted industry and trade standards for pipe and ductwork support.

PART 2 - PRODUCTS

2.01 - ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with these specifications, rooftop support systems shall be Dura-Blok™design as supplied by Cooper B-Line, Inc. or approved equal.

2.02 - MATERIALS

- A. Curb base shall be made of 100% recycled rubber and polyurethane prepolymer with a uniform load capacity of 500 pounds per linear foot of support*. In addition, each base to have a reflective stripe.
- B. Steel frame: Steel, 14ga strut galvanized per ASTM A653 or 12ga strut galvanized per ASTM A653 for bridge series.
- C. Attaching hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633.
- D. Physical and performance characteristics:

1.	Density		0.52 oz/cu in	ASTM C642
2.	Durometer Hardness		67.2A ± 1	ASTM D2240
3.	Tensile Strength		231 psi minimum	ASTM D412
4.	Compression Deformation		5% at 70psi and 72°F	ASTM D395
5.	Brittleness at Low Temp		-50°F	ASTM D746
6.	Freeze and thaw when exposed to deicing chemicals		No loss after 50 cycles	ASTM C672
7.	Coefficient of Thermal Expansion		8 x 10 ⁻⁶ in/in/ºF (min)	ASTM C531
8.	Weath	nering, 70 hours at 120ºF		ASTM D573
	a.	Hardness retained	100% (±5%)	
	b.	Compressive strength	100% (±5%)	
	C.	Tensile strength	100% (±5%)	



d. Elongation retained 100% (±5%)

2.03 – ROOFTOP DUCTWORK SUPPORTS

A. Channel supports with 12 ga. galvanized steel risers (SH style) – Dura-Blok[™] DB_DS-Series: Overall dimensions of duct support to be coordinated in field.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
- B. Consult roofing manufacturer for roof membrane compression capacities. Install a compatible sheet or roofing material (rubber pad) under rooftop support to disperse concentrated loads and add further membrane protection as necessary

+ + END OF SECTION + +



+ + NO TEXT ON THIS PAGE + +



PART 1 – GENERAL

1.01 – DESCRIPTION OF WORK

A. This section describes piping and ductwork sleeves and seals required where piping and ductwork passes through non fire rated floor slabs, interior walls, and exterior wall applications.

1.02 – QUALITY ASSURANCE

A. Modular Seal components and systems shall be domestically manufactured at a plant with a current ISO-9001:2000 registration. Copy of ISO-9001:2000 registrations shall be a submittal item.

1.03 – SUBMITTALS

A. Submit manufacturer's data sheets on all products. Data sheets shall include dimensions, material, temperature rating, and installation instructions.

PART 2 – PRODUCTS

2.01 - INTERIOR WALL DUCT SLEEVES AND SEALS

- A. Box in rectangular or round sleeve openings for ductwork with No. 20 gauge galvanized sheet metal. Metal sleeve to be 0.5 to 0.75 inches larger than outside dimensions of duct.
- B. Flange out edges of sheet metal a minimum of 1 ¹/₂ inches to secure sleeve to wall.
- C. Pack annular space between ductwork and sleeve completely with mineral fiber. Recess fibrous material into sleeve 0.5 inches.
- D. Caulk openings from wall surface to duct with nonhardening acoustical sealant both sides of wall.
- E. Grout metal sleeve into concrete or cmu wall or seal metal sleeve to gypsum board wall.

2.02 - EXTERIOR WALL AND FLOOR PENETRATIONS

- A. Furnish and install a complete Link-Seal modular seal assembly, manufactured by PSI-Thunderline/Link-Seal. For clarification, complete assembly is defined as a combined:
 - Wall opening (i.e. steel sleeve, Thermoplastic (HDPE) sleeve, cored hole or formed hole). The wall opening size and/or type shall be selected according to recommendations found in the most recent Link-Seal modular seal catalog.
 - 2. Sufficient quantity and type of Link-Seal modular seals required to effectively provide a hydrostatic and/or fire-rated seal.



- 3. Each individual link shall be conspicuously and permanently identified with the name of the manufacturer and model number.
- B. Modular Seal Rubber Links: Shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM. Coloration shall be throughout elastomer for positive field inspection. Each link shall have a permanent identification of the size and manufacturer's name molded into it.
 - For Standard Service Applications = Model C -40 to +250°F (-40 to +121°C) EPDM = ATSM D2000 M3 BA510 Color = Black
 - 2. For Thin Walled Pipe Applications = Model L -40 to +250°F (-40 to +121°C) EPDM = ATSM D2000 M3 BA510 Color = Blue
 - 4. For Hydrocarbon Service Applications = Model O -40 to +210°F (-40 to +99°C) Nitrile = ASTM D2000 M1BF510 Color = Green
 - 5. For High Temperature or Fire Seal Applications = Model T -67 to +400°F (-55 to +204°C) Silicone = ASTM D2000 M1GE505 Color = Gray Reference shall always be made to the latest published Link-Seal modular seal selection guide for the service intended.
- C. Pressure Plates:
 - 1. Link-Seal modular seal pressure plates shall be molded of glass reinforced Nylon Polymer with the following properties:
 - a. Izod Impact Notched = 2.05ft-lb/in. per ASTM D-256
 - b. Flexural Strength @ Yield = 30,750 psi per ASTM D-790
 - c. Flexural Modulus = 1,124,000 psi per ASTM D-790
 - d. Elongation Break = 11.07% per ASTM D-638
 - e. Specific Gravity = 1.38 per ASTM D-792
 - Models LS200-275-300-315 shall incorporate the most current Link-Seal Modular Seal design modifications and shall include an integrally molded compression assist boss on the top (bolt entry side) of the pressure plate, which permits increased compressive loading of the rubber sealing element. Models 315-325-340-360-400-410-425-475-500-



525-575-600 shall incorporate an integral recess known as a "Hex Nut Interlock" designed to accommodate commercially available fasteners to insure proper thread engagement for the class and service of metal hardware. All pressure plates shall have a permanent identification of the manufacturer's name molded into it.

- 3. For fire and Hi-Temp service, pressure plates shall be steel with 2-part Zinc Dichromate Coating.
- D. Seal Hardware: All fasteners shall be sized according to latest Link-Seal modular seal technical data. Bolts, flange hex nuts shall be either:
 - Mild Steel with a 60,000 psi minimum tensile strength and 2-part Zinc Dichromate coating per ASTM B-633 and Organic Coating, tested in accordance with ASTM B-117 to pass a 1,470 hour salt spray test.
 - 2. 316 Stainless Steel per ASTM F593-95, with a 85,000 psi average tensile strength.
- E. Wall Opening:
 - 1. Century-Line Sleeves for openings to 24.81" diameter. Where pipes must pass through exterior walls of new structures, unless otherwise shown or specified, install molded non-metallic high density polyethylene Model CS Century-Line sleeves as manufactured by PSI-Thunderline/Link-Seal. Model CS sleeves shall have integrally formed hollow water stop sized having a minimum of four inches larger than the outside diameter of the sleeve itself and allowing 1/2" movement between wall forms to resist pour forces. Each sleeve assembly shall have end caps manufactured of the same material as the sleeve itself and installed at each end of the sleeve so as to prevent deformation during the initial concrete pour, and to facilitate attaching the sleeve to the wall forms. End caps shall remain in place to protect the opening from residual debris and rodent entry prior to pipe insertion.
 - 2. Cell-Cast Disks for openings from 29.25" to 64.74" diameter. The contractor shall install Cell-Cast disks, providing a round hole in conformance with Link-Seal modular seal sizing data. Cell-Cast disks shall consist of 3" and/or 4" lightweight interlocking polyethylene cells stacked to form the thickness of the poured concrete wall. Molded into each cell shall be a cavity to accept a 2" x 4" nailer.

2.03 – ACOUSTICAL SEALANTS

- A. Acoustical sealants shall be non-hardening type.
- B. Acoustical sealants shall be one of the following products:



- 1. Acoustical Sealant Tremco
- 2. Approved Equal

PART 3 – EXECUTION

- A. Provide sleeves at all penetrations.
- B. After installation of the sleeve, completely seal around sleeve to the wall or floor material.
- C. Install pipe sleeves and seals as per the manufacturers instructions.
- D. Pipe sleeves shall not support weight of the pipe. Provide pipe supports on both sides of the seal.
- E. Provide escutcheon plates for all exposed penetrations.

+ + END OF SECTION + +



PART 1 - GENERAL

1.01- DESCRIPTION OF WORK

- A. This Section describes the marking and identification materials for identifying mechanical equipment, ductwork and piping systems.
- B. Mark and identify all mechanical equipment, ductwork and piping systems described herein, and as shown and specified in the Contract Documents.

1.02 - REFERENCES

- A. ANSI A13.1 Scheme for the Identification of Piping Systems.
- B. Z53.1 Safety Color Code for Marking Physical Hazards.
- C. OSHA 29 CFR 1910 Subpart J, General Environmental Controls

1.03 - SUBMITTALS

- A. Identification Scheme Submit scheme of identification codes.
- B. Valve Schedules Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Samples Submit samples of tags, attachments, labeled and identified.
- D. Equipment Schedules Submit mechanical equipment schedules, listing proposed equipment numbers, and their location and function.
- E. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 - PRODUCTS

2.01 – APPROVED MANUFACTUERS

- A. Seton
- B. Bunting
- C. W.H. Brady Company



2.02 – VALVE TAGS

- A. Provide valve tags for all valves installed for this project. Valve tags shall be constructed of brass with stamped letters and service designation tag size minimum 1-1/2 inches (38 mm) diameter with smooth edges, brass S hook.
- B. Valve tags shall be permanently stamped and marked with a service designation, normal valve position, and an identifying number as large as possible. Each valve shall have a separate and distinct number coordinated with the service designations shown on the Drawings and the Owners existing valve numbering system. Coordinate with the Architect/Engineer and Owner before finalizing the valve tag numbering system.

2.03 - PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1
- B. All accessible piping installed indoors for this project, insulated and uninsulated shall be identified with wraparound pipe markers. Pipe markers shall be factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. "Accessible" piping shall include exposed piping, and piping located above lay-in ceilings. Markers shall include system name, flow arrow, and color code and pipe diameter.
- C. All piping installed outdoors for this project, insulated and uninsulated, shall be identified with wraparound pipe markers. Pipe markers shall be factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. The marker shall be printed with weather-resistant ink.
- D. Where pipes are too small or not readily accessible for application of pipe markers, a brass identification tag at least 1 ½ inches in diameter, with depressed ½ inch high black letters and numerals, shall be securely fastened at locations specified for pipe markers.
- E. See pipe marker schedule for size requirements of pipe markers.

2.04 – MECHANICAL EQUIPMENT MARKERS

A. Identify all mechanical equipment, bare or insulated, installed in the rooms or on the roof, by means of lettered and numbered nameplate (not stenciled) identifying the equipment and service. Refer to the Drawings for equipment identifications. Nameplates shall be aluminum with permanent 1 ½ inch high white letters on a black background, mechanically affixed and installed in a readily visible location on the equipment. Coordinate the final equipment designation with the Owner.


B. In addition to markers, all mechanical equipment shall be furnished with the manufacturer's identification plate showing the name of equipment, manufacturer's name and address, date of purchase, model number and performance data.

2.05 - DUCT WORK IDENTIFICATION

- A. Provide full air distribution system identification at each side of a wall penetration, in a mechanical room, at all changes in direction and at no more than 50 foot intervals. Provide arrows identifying direction of flow.
- B. Fire damper or Smoke damper access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch in height reading: SMOKE DAMPER or FIRE DAMPER.
- C. Identification shall be preprinted labels.
- D. Letter Size: 1-1/2 inches in height.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Apply piping system markers and valve tags in the following locations:
 - 1. Adjacent to each valve and fitting.
 - 2. At each branch location and riser take-off
 - 3. At each side of a pipe passage through floors, walls, ceiling and partitions.
 - 4. At each pipe passage to and from underground areas.
 - 5. Every 20 feet on all horizontal and vertical pipe runs.
- B. Provide arrow markers showing direction of flow incorporated into or adjacent to each piping system marker. Use double-headed arrows if flow is in both directions.
- C. Apply all piping system markers where view is unobstructed; markers and legends shall be clearly visible from operating positions.
- D. Apply all tags and piping system markers in accordance with the manufacturer's instructions. Do not attach tags to valve handle such that the normal or emergency operation of the valve will be hindered.



3.02 – VALVE CHART

- A. Provide valve identifying each valve's and steam trap's number, size of valve and service.
- B. Frame the chart and locate the schedule in the Mechanical Equipment Room. (Aluminum Frame with plastic window).
- C. Provide a compact disc that has the valve chart schedule in a spreadsheet format. The spreadsheet software to be used for the schedule shall be identified by the Owner.

3.03 – LAY IN CEILING TILES AND ACCESS DOORS

- A. Provide a lettered and numbered nameplate for each access door indicating the mechanical equipment that the door provides access too.
- B. Where VAV boxes, hot water reheat coils, or other mechanical devices are installed above a layin ceiling tile system, provide and install color coded thumb tabs to mark the location of the equipment above the ceiling.

3.04 - SCHEDULES

A. Pipe Marker Letter Size Schedule:

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 - 1/4	12
8 to 10	2 - 1/2	24
Over 10	2	24

+ +END OF SECTION + +



PART 1 – GENERAL

1.01 – DESCRIPTION OF WORK

A. 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 – ELECTRIC UNIT HEATERS

- A. Electric unit heater shall be Model 233 Ultra-Safe™ Explosion Proof Unit Heater series as manufactured by INDECCO or approved equal. Heater shall be suitable for horizontal mounting.
- B. Heater to be of the KW rating, voltage and phase specified in the schedule. They shall be forced fan type, cCSAus Approved for:
 - 1. Class I, Divisions 1 and 2, Groups C & D; Class II, Divisions 1 and 2, Groups F & G
 - 2. Class I, Zone 1 and 2, Group IIB
 - 3. Ignition Temperature Code No. T3C, 320°F (160°C) (Standard construction)
- C. Electrical: Unit heaters shall have an automatic and a manual reset thermal cutouts for overtemperature protection, controlling magnetic contactor, and 120 volt control circuit.
- D. Heating Elements: The heat exchanger shall be liquid-to-air design, utilizing nontoxic, inhibited, propylene glycol heat transfer fluid that provides freeze protection down to -49°F (-45°C). Pressure relief valve setting to be 70 psig. The heat exchanger shall include industrial grade electric heating elements.
- E. Air Deflectors: Cabinet shall be provided with adjustable outlet louvers having minimum opening safety stops.
- F. Motor and Fan: Fan motor shall include permanently lubricated ball bearings and built-in thermal overload protection. Motor to operate at line voltage and be prewired to the control enclosure to



eliminate the need for separate field wiring to the motor.

- G. Supports: The heater shall be provided with an accessory wall mounting kit designed to bear the weight of the heater assembly. The wall mounting kit shall be constructed of corrosion resistant material.
- H. Unit Construction: Unit shall have 316 Stainless Steel Corrosion-Resistant Construction (Waste Water Treatment Plants) with 316 stainless steel heat exchanger with aluminum fins, 316 stainless steel cabinet; aluminum fan blade; cast aluminum NEMA 4X, 7, 9 terminal box; epoxy-coated motor; aluminum fittings; stainless steel conduit and hardware.
- I. 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.

+ + END OF SECTION + +



PART 1 — GENERAL

1.01 - DESCRIPTION OF WORK

A. This section describes the insulation, jackets and insulating accessories for sheet metal ductwork.

1.02 - REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 255 Surface Burning Characteristics of Building Materials.

B. Greenguard

- C. 2018 International Energy Conservation Code
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
- E. SMACNA HVAC Duct Construction Standards Metal and Flexible.
- F. Underwriters Laboratories, Inc. (UL):
 - 1. UL 723 Surface Burning Characteristics of Building Materials.
- G. American Society for Testing and Materials (ASTM):
 - 1. ASTM B209 Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. ASTM C177 Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 3. ASTM C518 Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 4. ASTM C553 Mineral Fiber Blanket and Felt Insulation.
 - 5. ASTM C612 Specification for Mineral Fiber Block and Board Thermal Insulation.
 - 6. ASTM C795 Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
 - 7. ASTM C921 Properties of Jacketing Materials for Thermal Insulation.
 - 8. ASTM C1136 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation



- 9. ASTM D1056 Flexible Cellular Materials Sponge or Expanded Rubber.
- 10. ASTM E84 Surface Burning Characteristics of Building Materials.
- 11. ASTM E96 Water Vapor Transmission of Materials.

1.03 - DEFINITIONS

- A. Greenguard: Greenguard Environmental Institute
- B. IAQ: Indoor Air Quality
- C. EPA: Environmental Protection Agency
- D. WHO: World Health Organization
- E. ASJ: All Service Jacket
- F. SSL: Self-Sealing Lap
- G. FSK: Foil-Scrim-Kraft; jacketing
- H. PSK: Poly-Scrim-Kraft; jacketing
- I. PVC: Polyvinyl Chloride
- J. FRP: Fiberglass Reinforced Plastic
- K. Cold Piping/Ductwork/Surfaces: Pipes or surfaces where the normal operating temperature is 60 degrees F or lower.

1.04 - SUBMITTALS

- A. Product data: To include product description, manufacturer's installation instructions, types and recommended thicknesses for each application, and location of materials.
- B. Provide samples and mock-ups of systems as required.

1.05 - ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient conditions required by manufacturers of tapes, adhesives, mastics, cements, and insulation materials.
- B. Follow manufacturer's recommended handling practices.



- C. Supply fiberglass products that assure excellent IAQ (Indoor Air Quality) performance through Greenguard Certification.
- D. Mold: Carefully inspect any insulation that has been exposed to water. If it shows any sign of mold growth remove it from the Site. If the material is wet but shows no sign of mold, dry rapidly and thoroughly. If it shows signs of facing degradation from wetting remove it from the Site. Discard air handling insulation used in the air stream if exposed to water.

1.06 - QUALITY ASSURANCE

- A. Qualifications:
 - Manufacturer: Company specializing in manufacturing Products specified with minimum 3 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 3 years documented experience.
- B. Materials:
 - 1. Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255 and UL 723.
 - 2. Certify insulation for duct, pipe and equipment for above grade exposed to weather outside building as being self-extinguishing for 1" thickness in less than 53 seconds when tested in accordance with ASTM D1692.

PART 2 – PRODUCTS

2.01 – FIBERGLASS RIGID BOARD

- A. Rigid Fiber Glass Board insulation meeting ASTM C 612 Type IA and IB.
- B. Mean temperature by ASTM C 177 and a maximum service temperature of 450° F.
- C. Factory Applied Vapor Retarder Jacket: ASJ conforming to ASTM C 1136 Type I, or FSK or PSK conforming to ASTM C 1136 Type II.
- D. Density:
 - 1. Concealed areas: Minimum 3 PCF
 - 2. Exposed areas: Minimum 6 PCF



- E. Approved Products:
 - 1. Insulation Board by Knauf

2.02 - INTERNAL DUCT LINING

- A. Conforming to ASTM C 1071 Type 1 and NFPA 90A & 90B.
- B. Noise Reduction Coefficient (NRC): ASTM C 423 Type A Mounting, 0.40 or higher for 1/2" product,
 0.60 or higher for 1" product.
- C. Rated for a maximum air velocity of 6000 Feet per minute.
- D. Approved Products:
 - 1. Textile Duct Liner with Hydroshield[™] Technology by Knauf.

2.03 – FIBERGLASS INSULATION ACCESSORIES

- A. Aluminum Jacket 0.016-inch (0.406 mm) thick in smooth, corrugated, or embossed finish with factory applied moisture barrier. Overlap 2-inch (50 mm) minimum.
- B. Laminated Self-Adhesive Water and Weather Seals apply per manufacturers' recommendations.
- C. Tapes Vapor barrier type, self-sealing, non-corrosive, fire-retardant. Approved Manufacturer: Compac Corporation
- D. Adhesives Approved Manufacturer: Foster
- E. Mastic Approved Manufacturer: Foster
- F. Vapor Barrier Coating Approved Manufacturer: Foster

2.04 – SHEET WATERPROOFING MEMBRANE

- A. Prefabricated, self-adhering, sheet-type waterproofing membrane shall be FlexClad-400 by MFM Building Products Corp. or approved equal.
- B. Description:
 - 1. Top Layer: Stucco-embossed, UV-resistant aluminum weathering surface.
 - 2. Middle Layer: Multiple layers of high-density cross-linked polymer film.

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- 3. Bottom Layer: Uniform layer of rubberized asphalt adhesive, protected by disposable silicone release paper.
- C. Color: As selected by Architect/Engineer.
- D. Material Thickness: ASTM D 1970, 40 Mils Nominal
- E. Flexibility: ASTM D 1970, Pass.
- F. Vapor Permeance: ASTM E 96, 0 perms.
- G. Nail Sealability: ASTM D 1970, Pass.
- H. Heat Aging: ASTM D 794, Pass.
- I. Tear Resistance: ASTM D 1424, Average: 660 grams.
- J. Ultimate Elongation MD: ASTM D 412, 434 percent.
- K. Ultimate Elongation CMD: ASTM D 412, 246 percent.
- L. Low Temperature Flexibility: 1,000,000 Cycles at -10 Degrees F, 1,200 Cycles at -20 Degrees F, No cracking.
- M. Flame Spread Index: ASTM E 84, 0.
- N. Smoke Density Index: ASTM E 84, 5.
- O. Wind-Driven Rain: SFBC TAS-110-95, 100 mph, No leakage or failure.
- P. UV Stability: Excellent.
- Q. Accessories: MFM Spray Adhesive

PART 3 — EXECUTION

3.01 - EXAMINATION

- A. Verify that all ductwork is tested and approved prior to insulation installation.
- B. Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.



3.02 – DUCTWORK REQUIRING INSULATION

- A. Insulate Ductwork as specified in the DUCTWORK INSULATION SCHEDULE.
 - 1. Insulate any additional ductwork or plenums indicated to be insulated on the Drawings.

3.03 – INSTALLATION (GENERAL)

- A. Install all materials using skilled labor regularly engaged in this type of work. Install all materials in strict accordance with manufacturer's recommendations, building codes, and industry standards.
- B. Locate insulation and cover seams in the least visible location. Extend all surface finishes in such a manner as to protect all raw edges, ends and surfaces of insulation.
- C. On cold surfaces where a vapor retarder must be maintained, apply insulation with a continuous, unbroken moisture and vapor seal. Insulate and vapor seal all hangers, supports, anchors, or other projections secured to cold surfaces to prevent condensation.
- E. Install insulation neatly, accurately and without voids, in accordance with manufacturer's instructions and NIAC National Commercial and Industrial Insulation Standards.
- F. Install ductwork hanger supports on the outside of the insulation. Where vertical ducts are supported to the building structure, insulate the ductwork supports to prevent condensation.
- G. Insulate ductwork using insulation of the type and thickness scheduled at the end of this Section.
- H. If specified insulation board thickness does not cover ductwork standing seams and reinforcing angles, insulate them by adhering a grooved strip of fiberglass board with a thickness at least 1 ¹/₂ inches greater than the height of the seam or angle covered over the standing seam or angle.

3.04 – FIBERGLASS INTERNAL DUCT LINING

- A. Apply Duct Lining in strict accordance with the latest edition of SMACNA's "HVAC Duct Construction Standard Metal & Flexible" and NAIMA's "Fibrous Glass Duct Liner Standard".
- B. Select length of mechanical fasteners in accordance with the manufacturer's recommendation as listed on each product. Install mechanical fasteners perpendicular to the duct surface, and such that the pin does not compress the liner more than ¹/₈" relative to the nominal thickness of the insulation.



- C. Adhesive shall conform to ASTM C 916. Apply adhesive to the sheet metal with a 90% minimum coverage. Coat all exposed edges of the duct liner with the same adhesive. Repair all rips and tears using an adhesive that conforms to ASTM C 916.
- D. Cover all internal duct areas with duct liner. Firmly butt transverse joints with no gaps and coat with adhesive. Overlap and compress longitudinal corner joints.
- E. When air velocities are 4000 to 6000 FPM, apply metal nosing to all upstream transverse edges to additionally secure the insulation.

3.05 – FIBERGLASS BOARD INSULATION

- A. Fit insulation by scoring, cutting and mitering to fit the contour of the ductwork.
- B. Attach insulation to ductwork in thickness scheduled by brushing adhesive uniformly on all sides of ductwork covering 100 percent of ductwork surface. Press insulation into place, making complete contact with adhesive. Butt edges of insulation board tightly together without gaps.
- C. Additionally, hold insulation in place by impaling on pins welded to all four sides of the ductwork. Locate and weld pins a minimum 12 inch on center with a minimum of 2 rows per side of duct and no less than 3 inches from the edges of the ductwork. Secure insulation to pins with 1 inch diameter hold-down washers. As an alternate to welded pins, provide "Gripnail" mechanical surface fasteners by Gripnail Corporation using pneumatic hammer designed for this work.
- D. Seal all joints, seams, breaks, and punctures in facing with adhesive and cover with 3 inch wide sealing tape. Flash supports with vapor barrier coating.
- E. For rectangular ducts and plenums exposed to weather, pitch ductwork or insulation board minimum ¼ inch per foot to prevent rainwater from accumulating on top of duct or plenum. Cover insulation board with Sheet Waterproofing Membrane.

3.06 - SHEET WATERPROOFING MEMBRANE

- A. Surface Preparation:
 - 1. Prepare surfaces in accordance with manufacturer's instructions.
 - 2. Ensure tops of ducts have sufficient slope to eliminate ponding water.
 - 3. Ensure bottoms of ducts have foil-faced rigid insulation boards installed.
 - 4. Ensure surfaces are clean and dry.

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- 5. Remove dirt, dust, oil, grease, hand oils, processing lubricants, moisture, frost, and other contaminants that could adversely affect adhesion of waterproofing membrane.
- 6. Prime metal, concrete, and masonry surfaces with primers approved by waterproofing membrane manufacturer.
- B. Application:
 - 1. Apply waterproofing membrane in accordance with manufacturer's instructions on all exterior insulated ductwork and at locations indicated on the Drawings.
 - 2. Apply membrane to clean, dry, primed metal ductwork and foil-faced rigid insulation boards. Do not apply over wet or non-rigid insulation.
 - 3. Apply membrane in accordance with manufacturer's air, material, and surface temperature requirements.
 - 4. Apply firm, uniform pressure with hand roller to entire membrane to ensure proper adhesion. Concentrate pressure at seams and on underside of ductwork.
 - 5. Apply membrane to ducts in accordance with manufacturer's instructions.
 - 6. Apply membrane shingle fashion to shed water over, not against laps.
 - 7. Do not terminate membrane on bottom of duct.
 - 8. Apply minimum 3-inch laps and minimum 6-inch end laps for ductwork applications.
 - 9. Embed membrane to bottom of ducts over 24 inches wide in light continuous layer of adhesive applied to insulation face.
 - Apply membrane to bottom of insulated ducts over 36 inches wide using mechanical attachment, in addition to adhesive, in accordance with manufacturer's instructions. Install pints on 12-inch centers with rows staggered.
 - 11. Apply adhesive to areas where special adhesion requirements exist, including duct bottoms, flashings, transitions, joints, elbows, valves, tees, and other fittings.
- C. Protection:
 - 1. Protect applied waterproofing membrane and fabric flexible duct connections from damage during construction.



3.07 - DUCTWORK INSULATION SCHEDULE

A. Fiber Glass Insulation Schedule:

Ductwork System	Туре	Minimum R- Value
Supply and Return Ducts and Plenums, Exposed In The Space Served	Uninsulated	NA
Ducts Located Outdoors	Fiberglass Rigid Board	8
Ductwork 20 Feet Upstream of Air Handling Units and Supply and Return Fans, Located Outdoors	Fiberglass Internal Duct Lining	Note 1
General Exhaust Ducts Except As Noted	Uninsulated	NA

Notes:

1. Ductwork to be provided with 1-inch internal lining in addition to externally applied insulation in accordance with the table above.

+ + END OF SECTION + +



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PART 1 - GENERAL

1.01 - DESCRIPTION OF WORK

A. Outdoor, roof curb mounted, electronically controlled, heating only unit utilizing electric for heating duty and an integral energy recovery device. Unit shall have horizontal duct connections as shown on contract drawings.

1.02 – RELATED SECTIONS

- A. Section 15890 Sheet Metal Work.
- B. Division 16.

1.03 - SUBMITTALS

- A. Shop Drawings: Submit drawings for each size of factory fabricated roof curb.
- B. Product Data: Manufacturer's catalog sheets, brochures, performance charts, standard schematic drawings, specifications and installation instructions for each size unit.
- C. Contract Closeout Submittals Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Director's Representative.

1.04 – QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Unit shall be factory tested and the design, construction and installation shall be in accordance with the following:
 - a. Unit shall be ETL certified per UL 1995 and bear an ETL sticker.
 - b. Blowers shall be AMCA certified for air flow.
 - c. Energy wheel shall be AHRI certified per standard 1060.

1.05 – PRODUCT DELIVERY

- A. Unit shall be stored and handled per manufacturer's recommendations.
- B. Unit shall only be stored or positioned in the upright position.
- C. Deliver each unit as an integral factory packaged assembly.

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1.06 – WARRANTY

- A. Unit Warranty: The manufacturer shall warrant the equipment to be free from defects in material and workmanship for a period of one (1) year from the shipment date.
- B. Energy Wheel Warranty: The energy wheel shall be warranted to be free from defects in material and workmanship for a period of five (5) years from the shipment date.

PART 2 - PRODUCTS

2.01 - HEATING ONLY PACKAGED ROOFTOP VENTILATOR WITH ENERGY RECOVERY WHEEL

- A. Description
 - 1. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, exhaust air blower, energy wheel, phase and brownout protection, motorized dampers, curb assembly, filter assembly intake air, supply air blower assembly, exhaust/relief blower assembly, filter assembly for exhaust air, and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection.
- B. Unit Cabinet
 - 2. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
 - a. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.
 - Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
 - a. Materials: Rigid urethane foam
 - 1) Thickness: 2 inch (50 mm)
 - 2) Meets UL94HF-1 flame requirements.
 - Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.



- 4. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18 gauge galvanized G90 steel or painted galvannealed steel.
- 5. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.
- 6. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.
- 7. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch.
- 8. Energy wheel: Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt with a five-year warranty. The wheel media shall be a polymer film matrix in a stainless-steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and is designed and constructed to permit cleaning and servicing. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.
- 9. Modulating frost control. Control system shall include an outdoor air thermostat and pressure sensor on the wheel assembly to initiate frost control sequence.
- 10. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.
- 11. Motorized dampers / Intake Air, Exhaust Air, Motorized dampers of low leakage type shall be factory installed.



- 12. Curb Assembly: A curb assembly made of 14-gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 14 in.
- Service receptacle: 120 VAC GFCI service outlet shall be factory-provided and field installed. Service outlet requires a dedicated single phase electric circuit. Unit contains a 120 VAC transformer to provide power to service outlet.

C. Blower

- 1. Blower section construction, Supply Air: direct drive motor and blower shall be assembled on a 14-gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.
- 2. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
- 3. Fan: Direct drive, airfoil plenum fan with steel wheels statically and dynamically balanced and AMCA certified for air and sound performance.
- 4. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

D. Motors

- General: Blower motors greater than 3/4 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.
- E. Unit Controls.



- The unit shall be constructed so that it can function as a stand-alone heating and ventilating system controlled by factory-supplied controllers, thermostats and sensors. This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.
- 2. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.
- 3. Unit supply fan shall be configured for Constant Volume (ON/OFF).
- 4. Unit exhaust fan shall be configured for Constant Volume (ON/OFF).
- 5. Outside Air / Return Air damper control shall be configured open when unit is in operation and closed when the unit is off.
- 6. Dirty filter sensor shall be factory installed.
- 7. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for balancing of the supply and exhaust air blower assemblies. The VFD shall be factoryprogrammed for unit-specific requirements and shall not require additional field programming to operate. The VFD's shall be configured for constant volume (on/off)
- F. Filters
 - 1. Unit shall have permanent metal filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream. MERV 8 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Roof Curbs:
 - 1. Install curbs in accordance with the manufacturer's printed instructions, and as indicated.



- B. Packaged Energy Recovery Units:
 - 1. Install units on roof curbs in accordance with the manufacturers' printed instructions, and as indicated.

3.02 – FIELD QUALITY CONTROL

- A. Preliminary Requirements: Employ the services of a Company Field Advisor of the unit's manufacturer for the following:
 - 1. Inspect installations prior to start-up.
 - 2. Supervise initial start-up of equipment.
 - 3. Instruction of Owner.
 - 4. Service.
- B. Pre-Start-Up, Start-Up and Instruction: Upon completion of the installation of the unit, to the satisfaction of the Company Field Advisor, start-up and preliminary testing shall be accomplished under the Company Field Advisor's supervision. When all necessary adjustments have been made and unit is properly operating, the Company Field Advisor shall instruct Owner in the operation and maintenance of the unit and accessories.

+ + END OF SECTION + +



PART 1 - GENERAL

1.01 – DESCRIPTION OF WORK

A. Provide fans, as specified herein, of sizes and capacities scheduled and in locations shown on drawings.

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 - 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.

1.04 – 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.

1.05 – 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 is not a limitation of, other rights Owner may have under Contract Documents.
 - 1. The warranty of this equipment is to be free from defects in materials and workmanship for a period of 1 Yr (Standard) from the purchase date.
 - 2. Motor Warranty is warranted by the motor manufacturer for a period of one year.

PART 2 - PRODUCTS

2.01 BELT DRIVEN BACKWARD INCLINED CENTRIFUAL FAN

- A. General Description:
 - 1. Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.
 - 2. Each fan shall be belt drive in AMCA arrangement 10, according to drawings.
 - 3. Fans shall be equipped with lifting lugs.
 - 4. After fabrication, all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to insure proper removal of grease, oil, scale, etc. Fan shall then be coated with a minimum of 2-4 mils of Hi-Pro Z, electrostatically applied and baked. Finish



color shall be Concrete Gray-RAL 7023. Coating must exceed 1,000-hour salt spray under ASTM B117 test method.

- 5. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.
- 6. Fan shall be Greenheck model CSW or approved equal.
- B. Wheel:
 - 1. The fan wheel shall be of the non-overloading single width backward inclined flat blade centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.
 - Fan wheel shall be manufactured with aluminum blades and coated with a minimum of 2-4 mils of Hi-Pro Z, electrostatically applied and baked. Finish color shall be Concrete Gray-RAL 7023.
 - 3. The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.
- C. Motors:
 - 1. AC Induction Motor
 - a. Motor Enclosure: totally enclosed fan cooled (TEFC) no opening in the frame or brackets. Equipped with an external fan to blow air over the motor.
 - Motors shall meet or exceed EISA (Energy Independence and Security Act) efficiencies. Motors to be NEMA T-frame, 690, 870, 1170, 1770 or 3500 RPM in 60 Hz, with a 1.15 service factor.
 - c. Accessible for maintenance
- D. Shaft and Bearings:
 - 1. Fan shaft to be Polished Steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
 - 2. Fan shaft bearings shall be Air Handling Quality, bearings shall be heavy-duty grease lubricated, self-aligning or roller pillow block type.



- 3. Bearings shall be selected for a basic rating fatigue life (L-10) of 80,000 hours at maximum operating speed for each pressure class.
- 4. Air Handling Quality bearings to be designed with low swivel torque to allow the outer race of the bearing to pivot or swivel within the cast pillow block. Bearings shall be 100% tested for noise and vibration by the manufacturer. Bearings shall be 100% tested to insure the inner race diameter is within tolerance to prevent vibration.
- 5. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
- 6. Bearings shall have Zerk fittings to allow for lubrication.
- E. Isolation:
 - 1. Isolation Type: Isolation Base
- F. Drive Assembly:
 - 1. Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower and shall be readily and easily accessible for service.
 - 2. Belts: static free and oil resistant.
 - 3. Fully machined cast iron type, keys and securely attached to the wheel and motor shafts.
 - 4. The motor pulley shall be adjustable for final system balancing.
- G. Fan Housing and Outlet:
 - 1. Fan Construction: Steel
 - 2. Fan housing is to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
 - 3. The housings on all fan sizes shall be of continuously welded heavy gauge steel. Panels shall be coated with a minimum of 2-4 mils of Hi-Pro Z, electrostatically applied and baked. Finish color shall be Concrete Gray-RAL 7023. No uncoated metal fan parts will be allowed.
 - 4. Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.

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H. Refer to schedules for Options/Accessories.

2.02 DIRECT DRIVE ROOF DOWNBLAST CENTRIFUGAL EXHAUST FA

- A. General Description:
 - 1. Downblast fan shall be for roof mounted applications
 - 2. Performance capabilities up to 4,300 cubic feet per minute (cfm) and static pressure to 1 inches of water gauge
 - 3. Fans are available in sixteen sizes with nominal wheel diameters ranging from 8 inches through 18 inches (071 180 unit sizes)
 - 4. Maximum continuous operating temperature: 180 Fahrenheit (82.2 Celsius)
 - 5. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.
 - 6. Fan shall be Greenheck model G or approved equal.

B. Wheel:

- 1. Constructed of aluminum
- 2. Non-overloading, backward inclined centrifugal
- 3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
- 4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
- C. Motors:
 - 1. Electronically Commutated Motor
 - 2. Motor enclosure: ODP
 - Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors



- 4. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase
- 5. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor
- 6. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal
- 7. Motor shall be a minimum of 85% efficient at all speeds
- D. Housing:
 - 1. Motor cover, shroud, curb cap, and lower windband shall be constructed of heavy gauge aluminum
 - 2. Shroud shall have an integral rolled bead for extra strength
 - 3. Shroud shall be drawn from a disc and direct air downward
 - 4. Lower windband shall have a formed edge for added strength
 - 5. Motor cover shall be drawn from a disc
 - 6. All housing components shall have final thicknesses equal to or greater then preformed thickness
 - 7. Curb cap shall have pre-punched mounting holes to ensure correct attachment
 - 8. Rigid internal support structure
 - 9. Leak proof
- E. Housing Supports and Drive Frame:
 - 1. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators
- F. Disconnect Switches:
 - 1. NEMA rated: NEMA 3R: outdoor application falling rain water.
 - 2. Positive electrical shut-off

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- 3. Wired from fan motor to junction box installed within motor compartment
- 4. Refer to schedules for Options/Accessories.

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. 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 + +



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PART 1 - GENERAL

1.01 - DESCRIPTION OF WORK

- A. This Section describes the galvanized steel, flexible, and stainless steel ductwork for HVAC duct systems in accordance with SMACNA Duct Construction Standards, except as otherwise specified.
- B. The construction material for each ductwork system shall be as listed in the "Ductwork Material Schedule" at the end of this Section.
- C. This Section also describes the fittings, access doors, hangers and supports, manual volume dampers and sealants for each ductwork system as required.

1.02 - RELATED WORK

A. Section 15990 – Balancing of Air Systems.

1.03 - REFERENCES

- A. ASHRAE Handbook Fundamentals; Latest Edition.
- B. SMACNA HVAC Duct Construction Standards Metal And Flexible (latest issue)
- C. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- D. ASTM B 209 Specifications for Aluminum and Aluminum-Alloy Sheet and Plate.
- E. NFPA 90A Installation of Air Conditioning and Ventilating Systems.
- F. UL 555 S Fire Dampers & Smoke Dampers.
- G. NFPA 96 Standard for Commercial Cooking Operations
- H. New York State Mechanical Code.

1.04 - REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A and New York State Mechanical Code standards.

1.05 - SUBMITTALS

- A. Ductwork shop drawings for approval:
 - 1. Coordinate layout duct drawings that differ from ductwork shown on the Drawings.

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- 2. The review of deviations will be for pressure drop only. The review will not address clearances or accessibility to maintain or balance the air systems. No dimensional or coordination check of the shop drawings will be made. The Contractor has the sole responsibility to review the Drawings, coordinate ductwork fabrication, and provide clearances and access for installation, maintenance and balancing of this work, and work of other trades. Unless specifically dimensioned, Drawings indicate approximate locations only. The Contractor has the sole responsibility to locate and route the ductwork.
- 3. Deviations such as changing direction or transforming or dividing ductwork must maintain ductwork cross-sectional area and not exceed transformation taper of 15 degrees.
- 4. Plans and section showing all equipment and accessories.
- 5. Minimum 3/8 in. scale, double line, showing sizes, transverse joints, transitions, elevations, clearances and accessories; sections where required.
- B. Shop details and catalog cuts of:
 - 1. Ductwork construction, including gauge and bracing schedule.
 - 2. Supports.
 - 3. Dampers.
 - 4. Turning vanes.
 - 5. Fire dampers.
 - 6. Access doors.
 - 7. Flexible connections.
 - 8. Other accessories.

1.06 – QUALITY ASSURANCE

- A. Construct all ductwork in accordance with referenced SMACNA Standards, except as otherwise stated. Ductwork pressure classifications shall be in accordance with referenced SMACNA Standards, except as otherwise specified.
- B. For all uninsulated ductwork casings and plenums located outdoors, the reinforcement members shall be galvanized steel or stainless steel.



- C. Construction pressure classification of ductwork are shown on the Drawings. If not shown, the pressure classification shall be greater than or equal to the maximum operating static pressure (minimum 2" w.c. pressure classification).
- D. All ductwork shall be free from pulsation, chatter, vibration and objectionable noise. If any of these defects appear after a system is in operation, correct by removing and replacing, or reinforcing the ductwork, at no additional cost to the Owner.
- E. For all galvanized steel ductwork, zinc coating shall be minimum G90 per ASTM A 653.

PART 2 - PRODUCTS

2.01 - GALVANIZED STEEL RECTANGULAR DUCTS AND FITTINGS

- A. Construct ducts of galvanized sheet steel meeting ASTM A 653 with G90 coating designation, and in accordance with the latest SMACNA HVAC Duct Construction Standards Metal And Flexible and pressure classifications as stated on the Drawings (minimum 2" w.c. pressure classification).
- B. No ducts shall be less than No. 22 U.S. Gauge.
- C. Piping, conduit and structure shall not penetrate ductwork. Where this condition cannot be avoided and with the written permission of the Architect/Engineer, follow SMACNA HVAC Duct Construction Standards Metal and Flexible, except that sides of transition sections shall slope a maximum of 15 degrees.
- D. Provide 90-degree full-radius elbows with a centerline radius 1.5 times the duct width in the plane of the bend.
- E. For elbows with centerline radius less than 1.5 times the width of the duct in the plane of the bend, provide turning vanes.
- F. Provide square throat elbows with manufactured turning vanes.
- G. 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.
- H. For split fittings, the split shall be proportional to the air flow. Construct per SMACNA HVAC Duct Construction Standards- Metal and Flexible.
- I. Transitions and Offsets shall follow SMACNA HVAC Duct Construction Standards Metal and Flexible, except that sides of transitions shall slope a maximum of 15 degrees.

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- J. All branch take-offs perpendicular to the main shall be a 45 degree entry.
- K. Longitudinal seams shall be of the Pittsburgh Lock type outlined in the SMACNA HVAC Duct Construction Standards Metal and Flexible.
- L. 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 22 GA.
 - 3. The Ductmate '25' system shall not be used for application with duct gauges heavier than 20 GA. or lighter than 22 GA.

2.02 - TURNING VANES

- A. Manufactured with same material as ductwork that it is installed in and to the same pressure classification as ductwork that they are installed in.
- B. Provide turning vanes in all square duct elbows and as noted on the Drawings.
- C. Vanes shall be single thickness Small Vane as detailed in SMACNA HVAC Duct Construction Standards Metal and Flexible.
- D. Where a rectangular duct changes in size at a square-throat elbow fitting, use single thickness turning vanes with trailing edge extensions aligned with the sides of the duct.

2.03 - ACCESS DOORS

- A. Fabricate access doors in accordance with SMACNA Duct Construction Standards Metal And Flexible 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 doors with watertight gaskets in shower room exhaust ductwork. Doors shall be of extra-heavy stainless construction.
- 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. Smoke detection heads.
 - 3. On both sides of ducts where necessary to provide maintenance accessibility to equipment on either side.
 - 4. Other items requiring access for service/maintenance

2.04 - MANUAL VOLUME DAMPER

- A. Fabricate in accordance with SMACNA Duct Construction Standards Metal And Flexible, 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.

2.05 - 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.

2.06 - 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 in which the project is to be constructed to submit a structural design for review.



2.07 – 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.

2.08 - FIRE DAMPERS

- A. Fabricate and install in accordance with NFPA 90A and UL Safety Standard 555, and AMCA Standard 500.
- B. Fire Resistance: For penetrations through construction rated less than 3 hours, 1 ½ hours. For penetrations through construction rated for 3 hours or more, 3 hours.
- C. Pressure Differential Rating: 4 in. w. g.
- D. Velocity Rating: 2000 fpm
- E. Fabricate curtain type dampers of galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades in air stream. Fabricate fire dampers for vertical and horizontal position.
- F. Fabricate multiple blade fire dampers with 16 gage galvanized steel frame and blades, oilimpregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- G. Fusible links, UL 33, shall separate at 165 degrees F.
- H. Acceptable Manufacturers:
 - 1. Greenheck Model DFD 150, 200 and 350
 - 2. Ruskin Mfr. Co.
 - 3. Arrow Damper & Louver.
 - 4. Imperial Damper Co.

2.09 – STAINLESS STEEL DUCTWORK

A. Fabricate ducts 20 gage AISI Type 316 stainless steel sheet metal.



- B. Use stainless steel with a No. 4 finish where installed exposed in finished rooms and No. 2B finish in other locations. Use stainless steel fasteners for ductwork installed exposed in finished rooms and where fastener penetrates duct. Galvanized fasteners may be used in unfinished spaces for non-penetrating service.
- C. Use stainless steel reinforcing members for ducts in finished spaces and galvanized steel in unfinished spaces.
- D. Construct ductwork as per "GALVANIZED STEEL RECTANGULAR DUCTS AND FITTINGS" section above unless otherwise noted in this section.

2.10 – STANDARD FLEXIBLE CONNECTIONS

- A. Provide fabric flexible duct connections.
- B. Fabric shall be UL approved, fire-retardant, closely-woven glass, double coated 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.

PART 3 - EXECUTION

3.01 – INSTALLATION - GENERAL

- A. Install ductwork in accordance with applicable SMACNA Duct Construction Standards Metal And Flexible and approved submittals, and as shown on the Drawings. Duct sizes shown are inside clear dimensions. Where internal duct liners are used, duct sizes shown are inside clear of liner. For ductwork located outside, provide reinforcing sufficient to support wind and snow loads.
- B. The Drawings indicate general locations of ducts. Provide additional offsets or changes in direction as required at no additional cost to the Owner.
- C. Wherever ductwork is divided, maintain the cross-sectional area.
- D. Do not exceed 15-degree taper when constructing duct transitions.
- E. Close the open ends of ducts during construction to prevent debris and dirt from entering.


- F. Secure casings and plenums to curbs according to the requirements of the SMACNA HVAC Duct Construction Standards Metal and Flexible.
- G. Make changes in direction with long radius bends.
- H. All welded and scratched galvanized steel surfaces shall be touched up with zinc-rich paint.
- I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- J. Patch and repair all wall penetrations.
- K. Insulation: Where Drawings and 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 - FITTING INSTALLATION

- A. Use minimum of four sheet metal screws per joint.
- B. Apply approved sealant on duct-to-duct joint before assembly. Apply additional sealant after assembly to make joint airtight.

3.03 – HANGER AND SUPPORT INSTALLATION

- A. Support ductwork hung from building structure using trapeze, strap or angle iron hangers conforming to SMACNA HVAC Duct Construction Standards Metal and Flexible. Provide supplemental structural steel to span joists where required.
- B. Do not support ductwork from furring, hung ceilings, metal floor deck, metal roof deck or from another duct or pipe.
- C. Do not hang lighting fixtures or piping from ductwork.
- D. Do not use perforated band iron.
- E. Support ductwork at each change in direction.
- F. Where duct connects to or terminates at masonry openings or at floors where concrete curbs are not used, provide a continuous 1 ½ inch by 1 ½ inch by 3/16 inch galvanized steel angle support around the ductwork. Bolt and seal the supports to the building construction using expansion



bolts and caulking compound. Seal shall be watertight at floor or wall and duct such that a spill will no pass down through the opening.

- G. Fasten plenums and casings connected to concrete curbs using continuous 1 ½ inch by 1 ½ inch by 1¼ inch galvanized steel angle support. Set the angle support in a continuous bead of caulking compound and anchor it to the curb with 3/8 inch diameter anchors on 16 inch centers. Terminate sheet metal at curb and bolt to angle support. Seal sheet metal to curb with a continuous bead of caulking.
- H. For insulated ductwork, install hangers on the outside of the insulation. To maintain the insulation value, inset a piece of 1 inch thick, 6 pcf fiberglass board with a foil/scrim/kraft (FSK) jacket at these supports.

3.04 – SEALING

- A. Where ductwork is not continuously welded, soldered or gasketed, make seams and joints airtight with sealants.
- B. Install the sealants in accordance with the sealant manufacturer's instructions and recommendations.
- C. Seal all ductwork seams, joints, fastener penetrations and fittings connections with sealants in accordance with SMACNA Seal Classifications as required by SMACNA Duct Pressure Classification. All ductwork, regardless of pressure classification, shall have a minimum Seal Class B.
- D. Completely fill all voids when liquid sealing ductwork. Several applications may be necessary to fill voids caused by shrinkage or runout of sealant.

3.05 – DUCT-MOUNTED DEVICES AND ACCESS DOORS

- A. Install all dampers, coils, airflow measuring stations, humidifiers and other duct-mounted devices, specified in other sections of the specifications or as shown and provide transformations to dimensions as required. Install devices in accordance with manufacturer's recommendations. Install dampers and coils a minimum of 4 feet away from changes indirection or transitions. Allow five (5) equivalent diameters of straight ductwork upstream and one (1) equivalent diameter of straight ductwork downstream of airflow measuring devices.
- B. Install access doors in ductwork, plenums and where specified and as shown. Provide access doors for inspection and cleaning automatic dampers, at fire dampers, and elsewhere as indicated. Provide minimum 18 x 18 inch size for shoulder access and as indicated. Install



access doors in the bottom of the ductwork unless they are inaccessible in this location; then install the access doors in either the side or top of the ductwork, whichever is more accessible.

- C. Provide fire damper at locations indicated, and where outlets pass through fire rated components and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway, duct connections, corrosion resistant springs, bearings, bushings and hinges.
- D. Demonstrate re-setting of fire dampers to authorities having jurisdiction and Engineer.
- E. 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.
- F. Pilot Ports: Locate pilot ports for measuring airflow in each main supply duct at the downstream end of the straightest run of the main and before the first branch take-off. Form pilot ports by drilling 7/16 inches holes in the duct, lined up perpendicular to airflow on maximum 8-inch centers and at least three to a duct, evenly spaced. Plug holes with plastic. Provide access to these for future rebalancing.

3.06 – DUCTWORK AND EQUIPMENT LEAK TESTING

- A. Leak test each ductwork system within ten working days of ductwork installation and before ductwork is insulated and concealed.
- B. Test all HVAC ductwork. Follow general procedures and use apparatus as outlined in the SMACNA HVAC Air Duct Leakage Test Manual.
- C. Test all ductwork at 100 percent of the pressure classifications indicated.
- D. 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.
- E. Use Appendix C in the SMACNA HVAC Air Duct Leakage Test Manual to determine allowable leakage rates for each duct section tested.
- F. All devices, including access doors, airflow measuring devices, sound attenuators, damper casings, sensors, test ports, etc. that are furnished and/or installed in duct systems shall be included as part of the duct system leakage allowance. 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	

G. Total system leakage shall not exceed 10 percent of the scheduled design capacity of the system when tested as per SMACNA testing methods.

3.07 – DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	DUCTWORK MATERIAL
Dry Well Side Supply & Exhaust Ductwork	Galvanized Steel
Wet Well Side Supply and Exhaust Ductwork	Type 316 Stainless Steel

+ + END OF SECTION + +



PART 1 - GENERAL

1.01 – SECTION INCLUDES

A. This Section describes the air terminals as specified herein, with capacities, distribution patterns and connection sizes as scheduled on the Drawings.

1.02 - RELATED WORK

A. Section 15890 - Sheet Metal Work

1.03 – REFERENCES

- A. ADC 1062 GRD Test Code for Grilles, Registers and Diffusers
- B. ASHRAE 70 Method of Testing for Rating the Airflow Performance of Outlets and Inlets.
- C. ASHRAE 113 Method of Testing Room Air Diffusion
- D. ASTM C423 Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- E. ARI 880 Air Terminals
- F. ARI 885 Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.
- G. NFPA 90A Installation of Air Conditioning and Ventilation Systems
- H. SMACNA HVAC Duct Construction Standards Metal and Flexible.
- I. Mechanical Code of New York State

1.04 - QUALITY ASSURANCE

A. Air Terminals will not be accepted until acoustical test results have been submitted and approved.

1.05 - SUBMITTALS

- A. Product data Submit catalog cuts and installation instructions for all products specified, including standard color samples.
- B. Submit published manufacturer's performance data for all of the different types of diffusers, registers and grilles, based on testing in accordance with ASHRAE Standard 70-2006.

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- C. Performance data For each size and type of air terminal , submit the following:
 - 1. Inlet static pressure in inches w.g.
 - 2. Maximum and minimum airflow in cfm.
 - 3. Throw in feet at maximum cfm (and 25 percent of cfm) for terminal velocities of 50 and 100 fpm.
 - 4. Noise Criteria (NC) curve at maximum air terminal cfm rating with blades in full-open and closed positions.

PART 2 - PRODUCTS

2.01 – RETURN GRILLES

- A. Furnish and install return grilles of the type and size as shown on the Drawings. Construct the grilles with 45 degree deflection fixed blades and frames that have reinforced mitered corners.
- B. Provide an opposed blade damper operable from the face of the grille for grilles connected to ductwork.
- C. Manufacture grilles with trim to allow for recessed mounting into ceiling grids or for surface mount in other ceiling types. Provide concealed mounting using concealed mounting straps or concealed screw holes in neck. Countersunk screw holes in the frame face are not acceptable or frame face-mounting screws.
- D. Nailor Industries Inc, Model Series 6145H-O, dry well side, extruded aluminum or corrosion resistant steel as shown on the Drawings.
- E. Coordinate color with Owner.
- F. Nailor Industries Inc, Model Series 6745H-O, wet well side, Type 316 Stainless Steel as shown on the Drawings.

2.03 – SUPPLY GRILLE

A. Furnish and install supply grilles of the type and size as shown on the Drawings. Construct the grilles with a dual set of streamlined shaped, roll-formed, corrosion-resistant blades that are adjustable, and spaced on ³/₄" centers and frame with reinforced mitered corners.



- B. Nailor Industries Inc., Model Series 61DH-O, dry well side, extruded aluminum or corrosion resistant steel as shown on the Drawings.
- C. Coordinate color with Owner.
- D. Nailor Industries Inc., Model Series 67DH-O, wet well side, Type 316 Stainless Steel as shown on the Drawings.

PART 3 - EXECUTION

3.01 – GRILLE APPLICATION

A. See the Drawings for types, sizes, materials and installation requirements.

3.02 - INSTALLATION

- A. Consult the Drawings for type of ceiling in which the terminals are to be installed and match air outlet edge trim to the requirements of the ceiling type in which they are installed.
- B. Install in accordance with manufacturer's published recommendations as well as applicable sections of SMACNA manual and as specified above.
- C. Install ceiling mounted grilles and registers with the blade deflection facing away from the line of sight.
- D. Coordinate with other work, including ductwork and ductwork accessories, as necessary to interface installation of air outlets and inlets with other work

+ + END OF SECTION + +



+ + NO TEXT ON THIS PAGE + +



PART 1- GENERAL

1.01 - DESCRIPTION OF WORK

A. The work specified as part of this Section consists of the integration of equipment controls supplied as part of manufactured items, materials and equipment required by the Drawings and under Divisions 15 and 16 to achieve operational and coordinated Sequences of Operation as Specified. Work shall include management of the system start up and operational check out, coordination of functions of controllers supplied as part of equipment packages, interconnection of systems, provision and installation of all accessory devices required for complete system operation including actuators not provided as part of equipment, coordination of start up and testing and demonstration of the operation of Sequences of Operation to the Owner and his representatives.

1.02 - RELATED SECTIONS

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are a part of these Specifications and shall be used in conjunction with this Section as a part of the Contract Documents. Consult them for further instructions pertaining to this work.
- B. The following Sections constitute related work:
 - 1. Section 15010 General Mechanical Requirements
 - 2. Equipment and Systems specified under Division 15
 - 3. Division 16

1.03 - QUALITY ASSURANCE

- A. System Installer Qualifications
 - 1. The Integrator shall have a minimum of five years experience in the integration of systems of a similar nature to those of this Project.
 - 2. The Integrator shall have an office within 50 miles of the project site and provide 24-hour response in the event of a customer call.
- B. Codes and Standards: Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section.
 - 1. Underwriters Laboratories: Products shall be UL-916-PAZX listed.



- 2. National Electrical Code NFPA 70.
- C. All products used in this installation shall be new, currently under manufacture, and shall have been applied in similar installations for a minimum of 2 years. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner's representative in writing prior to bid date. Spare parts shall be available for at least 5 years after completion of this Contract.

1.04 - SUBMITTALS

- A. Submit the name and qualifications of the firm that will be responsible for the Integration function along with the qualifications of the specific personnel proposed. The Owner and Architect/Engineer may choose to interview the personnel proposed for the project.
- B. Provide shop drawings and manufacturer's standard specification data sheets on all materials and hardware to be provided. No work may begin on any segment of this project until the Architect/Engineer and Owner have reviewed submittals for conformity with the Drawings and Specifications. Submit shop drawings electronically as .dwg or .dxf file formats.
- C. Submit a written sequence of operation for each system indicating which functions are to be controlled by controls provided as part of manufactured equipment and which functions will be under control of devices provided as part of this Section.
- D. Submit interconnecting wiring diagrams for all systems. These diagrams may rely on diagrams for controls of manufactured equipment provided that the interface points are clearly identified and copies of the manufactured item's control diagrams are submitted for information as part of the submittal package.
- E. Submit any additional information or data which is deemed necessary to determine compliance with these specifications or which is deemed valuable in documenting the system to be installed.
- F. Submit the following within 30 days of contract award:
 - 1. A work plan and schedule for the start up and check out of all systems including time requirements and resources required from all Sub-Contractors involved.
 - 2. A complete list of equipment to be used indicating quantity, manufacturer and model number.
 - 3. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each



submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover.

4. The submittals required under this Section shall be considered as For Information Only. Review by the Architect/Engineer shall not relieve the Contractor from the responsibility of providing fully operational systems.

1.05 - WARRANTY

- A. Warrant all work as follows:
 - 1. Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during customary business hours.
 - 2. At the end of the final start-up/testing, if equipment and systems are operating in a manner satisfactory to the Owner and Architect/Engineer, the Owner shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this Specification. The date of Owner's acceptance shall be the start of warranty.

PART 2 - PRODUCTS

2.01 - STANDARD OF QUALITY AND PERFORMANCE

A. Products specified are not intended to form a complete scope of supply. They are intended to set a level of quality for items that the Contractor may need to supply to implement a complete Sequence of Operation. Products of a comparable quality and performance may be submitted for approval by the Architect/Engineer.

2.02 - TEMPERATURE SENSORS

- A. Temperature sensors shall be Resistance Temperature Device (RTD) or Thermistor.
- B. Space sensors shall be equipped with set-point adjustment, display, and communication port.
- C. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.2 F.

2.03 - FLOW SWITCHES

- A. Flow-proving switches shall be differential pressure type.
- B. Differential pressure type switches shall be UL listed, SPDT snap-acting, pilot duty rated ,NEMA 1 Type enclosure, with scale range and differential suitable for intended application, or as specified.
- C. Current sensing relays may be used for flow sensing or terminal devices.

2.04 - RELAYS

- A. Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.
- B. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.

2.05- TRANSFORMERS AND POWER SUPPLIES

- A. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.
- B. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.
- C. Unit shall operate between 0 C and 50 C.

2.06 - CURRENT SWITCHES

A. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the control system.

2.07 - LOCAL CONTROL PANELS

A. All outdoor control cabinets shall be fully enclosed NEMA-3R type. Provide cabinet with hinged door, key-lock latch, and removable sub-panels. A single key shall be common to all field panels and sub-panels.



- B. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
- C. Provide on/off power switch with over-current protection and main air gauge for control power sources to each local panel.

PART 3 - EXECUTION

3.01 - GENERAL WORKMANSHIP

- A. Install equipment, piping, wiring/conduit parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install all equipment in readily accessible location as defined by Chapter 1 Article 100 part A of the NEC. Control panels shall be attached to structural walls unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.02 - WIRING

- A. All control and interlock wiring shall comply with the national and local electrical codes and Division 16 of these Specifications. Where the requirements of this Section differ with those in Division 16, the requirements of this Section shall take precedence.
- B. Do not install Class 2 wiring in conduit containing Class 1 wiring. Do not use boxes and panels containing high voltage for low voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).
- C. Control wiring located in a plenum space that is not installed in a conduit shall be plenum rated.
- D. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to wire connections shall be at a terminal blocks, or with a crimped connector. All wiring within



enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

- E. Maximum allowable voltage for control wiring shall be 120V. Provide and install step down transformers.
- F. All wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.
- G. Maintain fire rating at all penetrations in accordance with other Sections of this Specification and local codes.
- H. Size of conduit and size and type of wire shall be the design responsibility of the Contractor, in keeping with the manufacturer's recommendations and the NEC.
- I. Locate control and status relays in designated enclosures only. These relays may also be located within packaged equipment control panel enclosures. These relays shall not be located within Class 1 starter enclosures.
- J. Follow manufacturer's installation recommendations for all communication and network cabling. Network or communication cabling shall be run separately from other wiring.
- K. Adhere to Division 16 requirements for installation of raceway.
- L. Maintain an updated (as-built) wiring diagram with terminations identified at the job site.
- M. Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 3 feet in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture liquid tight, flexible metal conduits shall be used.

3.03 - INSTALLATION OF SENSORS

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequate for the environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- D. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor readings.
- E. Install duct static pressure tap with tube end facing directly down-stream of air flow.

- H 2 M
- F. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
- G. Wiring for space sensors shall be concealed in building walls. EMT conduit is acceptable within mechanical and service rooms.

3.04 - FLOW SWITCH INSTALLATION

- A. Install in accordance with manufacturers' instructions.
- B. Assure correct flow direction and alignment.

3.05 - WARNING LABELS

A. Affix plastic labels on each starter and equipment automatically controlled. Label shall indicate the following:

CAUTION

This equipment is operating under automatic control and may start at any time without warning.

3.06 - IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2 inches of termination with a cable identifier and other descriptive information.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served.
- C. Identify control panels with minimum 1-cm letters on laminated plastic nameplates.
- D. Identify all other control components with permanent labels. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.07 - CLEANING

A. Clean up all debris resulting from activities daily. Remove all cartons, containers, crates, etc. as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Construction Manager or General Contractor.



- B. At the completion of work in any area, the Contractor shall clean all of his/her work, equipment, etc., making it free from dust, dirt and debris, etc.
- C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.08 - FIELD QUALITY CONTROL

- A. All work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Section.
- B. Continually monitor the field installation for code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.
- C. Arrange for field inspections by local and/or state authorities having jurisdiction over the work.

3.09 - ACCEPTANCE

- A. The control systems will not be accepted as meeting the requirements of completion until all tests described in this Specification have been performed to the satisfaction of both the Engineer and Owner.
- B. The full range of operation for all Sequences of Operation shall be demonstrated. Where sequences are dependent on season or outside conditions these conditions may be simulated for the purpose of demonstration if approved by both the Architect/Engineer and the Owner. If simulations cannot be acceptably created the Contractor shall perform the demonstration during the proper period.
- C. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's representative. Such tests shall then be performed as part of the warranty.

+ + END OF SECTION + +



PART 1- GENERAL

1.01 – DESCRIPTION OF WORK

- A. The Work specified as part of this Section consists of the work required to achieve operational and coordinated Sequences of Operation as described. Work includes coordination of functions of controllers supplied as part of equipment packages, interconnection of systems, provision and installation of all accessory devices required for complete system operation including devices not provided as part of equipment, coordination of start up and testing and demonstration of the operation of Sequences of Operation to the Owner and his representatives.
- B. The control system operation of all equipment shall be subject to the operational modes, conditions and logic described in this Section and the controlled equipment manufacturer's recommendations.
- C. Training of the Owner's personnel in the operation, trouble shooting, adjustment and repair of all system controls.

1.02 - RELATED SECTIONS AND WORK

- A. Section 15950 Instrumentation and Control Integration
- B. Division 16

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 – GENERAL

- A. General
 - 1. Conform to the requirements of the Owner's standards for all electrical work and devices.

3.02 - SEQUENCE OF OPERATION - ELECTRIC UNIT HEATER, UH-1 & UH-2

- A. General:
 - 1. The unit heaters shall be provided with one (1) remote, wall mounted 60-minute spring wound timer to operate both unit heaters.
- B. Heating:
 - 1. Both unit heaters shall operate when the associated spring wound timer is "On".



3.03 – SEQUENCE OF OPERATION – EXHAUST FANS, EF-13

- A. General:
 - 1. The exhaust fan shall run when the associated light switch is turned on.

3.04 - SEQUENCE OF OPERATION - EXHAUST FAN EF-1 AND SUPPLY FAN SF-1

- A. General:
 - Push button switches shall be located on the building exterior at the locations shown on the plans. The exhaust fan and supply fan shall both operate when any of the switches is in the "On" position. A red pilot light on the switch shall be illuminated when the fans are not in operation.

3.05 – SEQUENCE OF OPERATION – PACKAGED, ENERGY RECOVERY UNIT, HV-2

- A. General:
 - 1. The unit shall be provided with a factory mounded DDC controller.
 - 2. The unit shall be provided with one (1) thermostat and two (2) remote temperature sensors. Thermostat shall have an LCD display and temperature adjustment capabilities. Temperature sensors shall be of the blank plate type. Thermostat and temperature sensors shall be located in the locations shown on the plan. Unit shall average the space temperatures to determine unit operation.
 - 3. The unit shall be provided with a DDC remote interface. DDC remote interface shall be factory provided and field mounted and wired to the main controller for monitoring and remote adjustments of set points. Field mount remote interface in location shown on plans.
- B. Run Conditions:
 - 1. "On"
 - a. The unit shall operate continuously. The unit's fans, energy wheel, and heater shall operate as noted below.
 - b. The unit shall maintain a 50°F (adjustable) heating set point. The unit shall average the space temperatures of the remote thermostat and temperature sensors.
 - c. The energy wheel shall be disabled when the outdoor air temperature rises above 55°F (adjustable) and the unit shall provide general ventilation. When disabled, the



wheel shall be periodically operated to prevent moisture accumulation on the wheel via the factory provided controller.

- 2. "Off"
 - a. Supply fan and exhaust fan shall be off.
 - b. Electric heater shall be off.
 - c. Energy wheel shall be off.
 - d. Outdoor air and return air damper shall be closed.
- C. Supply Fan:
 - 1. The supply fan shall be provided with a factory mounted variable frequency drive. The supply fan shall operate continuously at a constant speed when the unit is "On".
 - 2. The supply fan shall be off when the unit is "Off".
- D. Exhaust Fan:
 - 1. The exhaust fan shall be provided with a factory mounted variable frequency drive. The exhaust fan shall operate continuously when the unit is "On".
 - 2. The exhaust fan shall be off when the unit is "Off".
- E. Outdoor Air Damper:
 - 1. The outdoor air damper shall be open when the unit is "On". A damper end switch shall ensure the supply fan does not enable until the damper is proven open.
 - 2. The outdoor air damper shall be closed when the unit is "Off".
- F. Exhaust Air Damper:
 - 1. The exhaust air damper shall be open when the unit is "On". A damper end switch shall ensure the exhaust fan does not enable until the damper is proven open.
 - 2. The exhaust air damper shall be closed when the unit is "Off".
- G. Electric Heater:



- 1. The controller shall modulate the electric heater to maintain the space temperature set point of 50°F (adjustable).
- 2. The heater shall be disabled when the outside air is above 55°F (adjustable) or the unit is "Off".
- H. Energy Recovery Wheel:
 - 1. The energy wheel shall operate at constant speed when the outside air temperature is below 55°F (adjustable).
 - 2. The energy wheel shall be disabled when the outdoor air temperature rises above 55°F (adjustable) and the unit shall provide general ventilation.
- I. Building Freeze Protection:
 - 1. The controller shall de-energize the unit and activate an alarm if the supply air temperature drops below 35°F (adjustable) for 300 seconds (adjustable).
- J. Frost Control:
 - Frost control for the energy wheel shall be enabled when frost is present on the wheel; based on the configured outside air temperature set point (adjustable) and the pressure drop across the wheel set point (adjustable).
 - 2. VFD shall modulate the wheel down to a slow rotational speed to defrost the wheel. Once either the pressure drop decreases below the pressure switch set point, or the outdoor air temperature increases above the temperature set point, the unit shall resume normal operation.
- K. Alarms:
 - 1. The controller shall display alarms and shall have a digital output for remote indication of an alarm condition. Alarms shall include:
 - a. Dirty filter alarm: The controller shall monitor the pressure across the supply and exhaust filter(s) and generate an alarm when the pressure drop rises above the preconfigured set point to indicate a dirty filter.
 - b. Dirty wheel alarm: The controller shall monitor pressure across the wheel and generate an alarm in the case of an increased pressure drop.



- c. Wheel rotation alarm: The controller shall monitor wheel rotation. If the wheel does not rotate for a set period of time (adjustable) an alarm shall be generated.
- d. Supply and exhaust air alarm: The controller shall monitor the proving switch on each blower and send an alarm in the case of either blower proving switch not engaging.
- e. Temperature sensor alarm: The controller shall send an alarm in the case of a failed temperature sensor.

+ + END OF SECTION + +



+ + NO TEXT ON THIS PAGE + +



PART 1 - GENERAL

1.01 – DESCRIPTION OF WORK

- A. This section specifies requirements for testing, adjusting, and balancing of all air distribution systems, including the equipment and devices associated with each system.
- B. The work includes setting speed and flow, adjusting equipment and devices installed for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to the mechanical installations specified in other Sections of the Specifications.

1.02 – RELATED WORK

A. Drawings and general provisions of the Contract, including General Conditions, any Supplemental Conditions and Division 1 Specification Sections, govern the work of this section.

1.03 - SUBMITTALS

- A. Submit proof that the testing, adjusting and balancing agency meets the requirements of Section
 1.04 "Quality Assurance", and all other specified requirements.
- B. Prior to performing the work, submit sample blank forms of the test reports that will be submitted by the entity performing work of this Section, indicating all data and parameters included.
- C. Submit certified test reports, signed by the authorized representative of the testing and balancing agency. Certify the reports to be proof that the systems have been tested, adjusted and balanced in accordance with the selected reference standards (NEBB or AABC); are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at completion of the testing, adjusting and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Submittal of test report shall be in the following format:
 - Draft Report: Upon completion of testing, adjusting and balancing procedures, prepare draft reports on the approved forms. Draft report may be handwritten, but must be complete, factual, accurate and legible. Organize and format draft reports in the same manner specified herein for the final reports. Submit two complete sets of draft reports. Only one complete set of draft reports will be returned.
 - 2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written and organized and formatted as described herein. Submit two complete sets of final reports.



- a. Report Format: Submit reports using the standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted and balanced. Include schematic systems diagrams. Enclose the report contents in a 3-ring binder. Divide the contents into the below listed divisions, separating them by divider tabs with titles descriptive of the contents:
 - 1) General Information and Summary.
 - 2) Air Systems.
- b. Report Contents: Provide the following minimum information, forms and data:
 - 1) General Information and Summary: Identify the testing, adjusting and balancing Agency, Contractor, Owner, Architect/Engineer, and Project on the inside cover sheet. Include addresses, and contact names and telephone numbers. Include a certification sheet containing the seal and name, address, telephone number and signature of the Agency's responsible certified Test and Balance Engineer. Include in this division a listing of the instrumentation used for the procedures, along with the proof of calibrations.
 - 2) Include in the remainder of the reports the appropriate forms containing, as a minimum, the information indicated on the standard report forms prepared by AABC or NEBB, for each item of equipment and system. Prepare a schematic diagram for each item of equipment and system, to accompany each respective report form.
- c. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards within a period not exceeding six months prior to conducting the test procedures.
- d. Existing Systems: Where existing systems are to be added to or modified include in the report results of operational tests taken prior to modifications including but not limited to existing fan curves, pressure readings and flow measurements. Include in the report copies of the equipment and motor nameplate data along with equipment performance curves indicating operating points prior to any modifications and, where existing equipment is retained, operating points after system balance. Where terminals are adjusted or modified include terminal performance curves/data and final readings.



1.04 - QUALITY ASSURANCE

- A. Test, adjust and balance systems and equipment by using competent mechanics regularly employed by a testing, adjusting and balancing Subcontractor whose primary business is the testing, adjusting and balancing of building mechanical systems. The testing, adjusting and balancing Subcontractor shall be a business established for a minimum of 10 years.
- B. The testing, adjusting, and balancing Subcontractor shall be certified by the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).
- C. Instrumentation type, quantity, and accuracy shall be as described in AABC's "National Standards for Field Measurement and Instrumentation, or Total System Balance, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- D. All instrumentation shall be calibrated at least every 6 months or more frequently if required by the instrument manufacturer.

1.05 - PERFORMANCE REQUIREMENTS

- A. Comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards including, but not limited to the entities listed below for procedures, measurements, instruments and test reports for testing, adjusting and balancing work:
 - 1. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - 2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
 - 3. National Environmental Balancing Bureau (NEBB)
 - 4. Associated Air Balance Council (AABC)
- B. Set the air delivery or intake of each diffuser, grille and register to be as designed or within five percent of the air flow rates shown on the Drawings.
- C. Set the fan air flow rate and static pressure rise across the fan to be within 10 percent above the design value at design speed.

1.06 - JOB CONDITIONS

A. Require the testing and balancing specialist to review his work with the respective manufacturers of the equipment and devices involved, and coordinate and schedule all work.



- B. Furnish and install balancing dampers, pressure taps, gauges, and other components as required for a properly balanced system, whether or not specified herein or shown on the Drawings, all at no additional cost to the Owner. Make all adjustment or replacement parts recommended by the testing and balancing specialist in strict accordance with the respective equipment manufacturer's recommendations.
- C. Coordinate with the control manufacturer's representative to set the adjustment of the automatically operated dampers to operate as required.

1.07 - GENERAL

- A. The Owner will occupy the building during the entire testing, adjusting, and balancing period. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.
- B. Complete all tests specified herein to the satisfaction of the Architect/Engineer before final acceptance.
- C. The Architect/Engineer, or his representative, is the sole judge of the acceptability of the tests. The Architect/Engineer may direct the performance of any such additional tests, as he deems necessary in order to determine the acceptability of the systems, equipment, material and workmanship. No additional payment will be made for any test required by the Architect/Engineer.

PART 2 - PRODUCTS

Not Used.

PART 3 – EXECUTION

3.01 - EXAMINATION

- A. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
- B. Obtain copies of approved shop drawings of all air handling equipment, air outlets (supply, return and exhaust), and the temperature control diagrams, including intended sequence of operations.
- C. Existing Systems: Where existing systems are to be added to or modified perform operational tests prior to modifications including but not limited to existing fan curves, pressure readings and flow measurements.



- 1. Obtain copies of the equipment and motor nameplate data along with equipment performance curves indicating operating points prior to any modifications. Where terminal units are to be adjusted or modified obtain performance data for these units.
- D. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned, and is operable. Do not proceed with testing, adjusting and balancing until unsatisfactory conditions have been corrected in a manner approved by the testing and balancing specialist.
- E. Examine the air systems to see that they are free from obstructions. Determine that all dampers and registers are open, moving equipment is lubricated, clean filters are installed, and automatic controls are functioning; and perform other inspections and maintenance activities necessary for proper operation of the systems.
- F. Where existing systems are to be modified or added to ensure that all filters are clean and any operational problems that will prevent system balance have been brought to the attention of the Owner and repaired.

3.02 - TESTING, ADJUSTING AND BALANCING

- A. Notify the Owner 48 hours in advance of starting any tests. Do not perform any tests until acknowledgment of notification and approval has been received from the Owner.
- B. Provide all necessary instruments and personnel for the tests. If, in the opinion of the Architect/Engineer, the results of such tests show that the Work has not complied with the requirements of the Contract Documents, make all additions or changes necessary to put the system in proper working condition and pay all expenses for all subsequent tests which are necessary to determine whether the Work is satisfactory. Any additional work or subsequent tests shall be carried out at the convenience of the Architect/Engineer.
- C. Test all packaged equipment in strict accordance with the equipment manufacturer's requirements.
- D. Perform any and all other tests that may be required by the local municipality or other governing body, board or agency having jurisdiction.
- E. Perform testing, adjusting, and balancing after leakage and pressure tests on air distribution systems have been satisfactorily completed.
- F. Actuate all safety devices in a manner that clearly demonstrates their workability and operation.



- G. Cut insulation and ductwork for installation of test probes to the minimum extent necessary to allow adequate performance of test procedure.
- H. Perform tests and compile test data for all air systems.
- I. Include a schematic diagram locating the air inlets, outlets, fans, equipment, dampers and regulating devices for air systems.
- J. All instruments used shall be provided by the entity performing the Work of this Section, and shall be accurately calibrated and maintained in good working order.

K. Air Systems

Perform the testing, adjusting and balancing of air systems in accordance with the detailed procedures outlined in the referenced standards; including but not be limited to the following:

- 1. Test, record and adjust fan rpm to design requirements.
- 2. Test and record motor full load amperes.
- 3. Make a pitot tube traverse of main supply ducts and obtain design flow rate at fans.
- 4. Test and record system static pressure, velocity pressure and total pressure.
- 5. Test and adjust system for design supply, transfer and return air flow rate.
- 6. Test and adjust system for minimum and maximum design flow rates of outside air.
- 7. Test and record return air temperatures.
- 8. Test and record coil and fan leaving air temperatures.
- 9. Adjust all main supply, return, relief, and exhaust air ducts to proper design flow rate.
- 10. Adjust all zones to proper design flow rate for supply, return, transfer, relief and exhaust air.
- 11. Test and adjust each diffuser, grille and register.
- 12. Identify each grille, diffuser and register as to location and area on the schematic diagram.
- 13. Identify and list in the final report size, type and manufacturer of diffusers, grilles and registers and all tested equipment. Use manufacturer's data on all equipment to make

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required calculations for testing, adjusting and balancing. Include design required velocity and test resultant velocity, required flow rate and test resultant flow rate after adjustment as part of readings and tests of diffusers, grilles and registers.

- 14. Adjust all diffusers, grilles and registers to minimize drafts in all areas.
- 15. Permanently mark all dampers after air balance is complete so that they can be restored to their correct position, if disturbed later.
- 16. Seal openings in ductwork for pitot tube insertion with snap-in plugs after air balance is complete.

+ + END OF SECTION + +



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PART 1 - GENERAL

1.01 – DESCRIPTION OF WORK

- A. This section describes the tools, procedures and performance required for cleaning of the existing HVAC system.
- B. NADCA Standards: The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).
 - 1. All terms in this specification shall have their meaning defined as stated in the NADCA Standards.
 - 2. NADCA Standards shall be followed with no modifications or deviations being allowed.
- C. Scope: This section defines the minimum requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.
- D. The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.
- E. The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The grilles, air ducts, turning vanes, and diffusers are all considered part of the HVAC system. The HVAC system may also include other components such as dedicated exhaust and ventilation components.

1.02 - QUALITY ASSURANCE

- A. Contractors' personnel shall have OSHA Certification for OSHA 40-hour HAZWOPER, OSHA Lockout Tagout Procedures and OSHA Permit required, Confined Space Entry. Certifications shall be included with bid, in order for the bid to be considered.
- B. Contractor shall have at least two (2) years experience in air duct cleaning. Three (3) commercial references, including contract name and telephone number shall be submitted with submittal to be considered.
- C. Membership: The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized



non-profit industry organization dedicated to the cleaning of HVAC systems.

- D. Certification: The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
- E. Supervisor Qualifications: A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.
- F. Experience: The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the Owner. Work shall be done by only by firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.
- G. Equipment, Materials and Labor: The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials and labor to adequately perform the specified services.
 - 1. The contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., contractors shall comply with applicable national safety codes and standards.
 - 2. The contractor shall maintain a copy of all current SDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification.
 - 3. Contractor shall submit to the Owner and Engineer/ Architect, all Safety Data Sheets (<u>SDS</u>) for all chemical products proposed to be used in the cleaning process.
- H. Licensing: The HVAC system cleaning contractor shall provide proof of maintaining the proper license(s), if any, as required to do work in this state. Contractor shall comply with all Federal, state and local rules, regulations, and licensing requirements.

1.03 – REFERENCES

A. National Air Duct Cleaners Association (<u>NADCA</u>): "Assessment, Cleaning & Restoration of HVAC



Systems (ACR 2005)," 2004.

- B. National Air Duct Cleaners Association (<u>NADCA</u>): "Understanding Microbial Contamination in HVAC Systems," 1996.
- C. National Air Duct Cleaners Association (<u>NADCA</u>): "Introduction to HVAC System Cleaning Services," 2004.
- D. National Air Duct Cleaners Association (NADCA): Standard 05 "Requirements for the Installation of Service Openings in HVAC Systems," 2004.
- E. Underwriters' Laboratories (<u>UL</u>): UL Standard 181.
- F. American Society of Heating, Refrigerating and Air Conditioning Engineers (<u>ASHRAE</u>): Standard 62-89, "Ventilation for Acceptable Indoor Air Quality".
- G. Environmental Protection Agency (<u>EPA</u>): "Building Air Quality," December 1991.
- H. Sheet Metal and Air Conditioning Contractors' National Association (<u>SMACNA</u>): "HVAC Duct Construction Standards Metal and Flexible," 1985.
- I. North American Insulation Manufacturers Association (<u>NAIMA</u>): "Cleaning Fibrous Glass Insulated Air Duct Systems," 1993.

1.04 – LABORATORY SERVICES

A. Provide testing and analysis of contaminants such as Legionella, asbestos, microbials or any other hazardous airborne particulates using the (Air Conveyance System) as a pollutant pathway should such testing be deemed necessary. Swipe samples of the ACS shall be used to determine what contaminates are present. Laboratory results shall be included as part of the prepared Mechanical Hygiene Report.

1.05 - SCOPE OF WORK – EXISTING AIR CONVEYANCE SYSTEM CLEANING

- A. The entire air distribution system in the building shall be cleaned as per this specification this shall include all supply, exhaust ductwork, and all air outlets and inlets.
- B. Existing Air Duct Cleaning
 - Access points shall be strategically placed throughout the duct systems, as required. SMACNA approved insulated access doors shall be used upon closure to prevent heat loss/gain, and to facilitate inspection.



- 2. Interior surfaces of the ductwork, dampers, turning vanes, shall be cleaned by using HEPA filtered vacuums, rotary brush and air whip dislodging systems, and contact cleaning as required.
- C. Sanitizing Existing Ductwork:
 - 1. Upon completion of cleaning, sanitizing shall be performed throughout the entire air conveyance system. This process shall eliminate mold, bacteria, odors and viruses, plus retard their growth.

1.06 - NOTIFICATION

A. The Contractor shall notify the Owner that prior to commencing of the cleaning work, the Owner shall remove the smoke detectors and other safety devices from the ductwork.

1.07 – HEALTH AND SAFETY REQUIREMENTS

- A. Safety Standards: Cleaning contractors shall comply with applicable federal, state, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.
- B. Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.
- C. Disposal of Debris: All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

PART 2 - PRODUCTS

2.01 - GENERAL

A. Provide all necessary material and tools to provide access doors in the ductwork to reach the areas around dampers and turning vanes, bends, coils, smoke detectors, etc.

2.02 - ACCESS DOORS

- A. Sandwich access door shall be as manufactured by:
 - 1. DUCTMATE INDUSTRIES, INC.
 - 2. Approved Equal.

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- B. Composition and material
 - 1. The sandwich access door shall consist of three layers of precision stamped hot-dipped galvanized steel.

The inside door shall combine two layers of metal which be shall spot welded together along the rim, encapsulating high density fiberglass insulation – UL classified FHC25/50.

The inside surface of the access door shall be smooth to minimize friction.

- Gasket: Closed cell neoprene gasket shall be UL94HF1 listed with a service temperature range of (ASTM D746) -20°F to 200°F. The gasket shall be permanently bonded to the inside of the door to eliminate leakage.
- 3. Springs: Zinc plated conical springs shall be installed over the bolts, between the inner and outer door, to facilitate opening.
- 4. Knobs: Knobs shall have threaded metal inserts to eliminate thread stripping. Knobs shall be easily turned by hand without wrenches. UL94HB listed.
- 5. Bolts: Zinc plated carriage bolts shall be clinched and sealed to the inner door.
- 6. Template: Self-adhesive cut-around template shall be provided for the exact size of cut opening required.
- 7. Technical Data: Each door shall be tested to 20" WG with no leakage noted.
- 8. Guarantees: The Sandwich Access Door shall be guaranteed against defective material.

2.03 – TOOLS AND EQUIPMENT

- A. Contractor, shall utilize HEPA filters and vacuums meeting the following minimum requirements:
 - 1. Vacuum: CFM minimum 6,000
 - 2. HEPA filter: 99.97% collection efficiency for particulates 0.3 microns or greater

2.04 - SANITIZING

A. Upon completion of cleaning, sanitizing will be performed throughout the entire air conveyance system. Sanitizer will be fogged into ACS using a portable fogging system. Envirocon or other EPA Registered sanitizer will be used.



PART 3 - EXECUTION

3.01 – INSPECTION/PREPARATION

- A. HVAC System Component Inspections: Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. The cleanliness inspection should include air handling units and representative areas of the HVAC system components and ductwork.
- B. The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification or other debris. In cases where contamination is suspected, and/or in sensitive environments where even small amounts of contaminant may be of concern, implement environmental engineering control measures.
- C. Damaged system components found during the inspection shall be documented and brought to the attention of the Owner.
- D. Site Evaluation and Preparations: Conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.
- E. Protect all furniture and flooring in the work area using clean protective coverings. Perform cleanup of these areas by use of HEPA filtered vacuums, to avoid recontamination of occupied space.
- F. Prior to work check if the smoke detectors were removed from the ductwork.
- G. Insulation: Identify areas of internally lined air conveyance systems that are deteriorated and negatively impacting air quality. Notify the Owner of these conditions so that he may correct them.
- H. Inspector Qualifications: Qualified personnel should perform the HVAC cleanliness inspection to determine the need for cleaning. At a minimum, such personnel should have an understanding of HVAC system design, and experience in utilizing accepted indoor environmental sampling practices, current industry HVAC cleaning procedures, and applicable industry standards.

3.02 – GENERAL DUCT CLEANING REQUIREMENTS

A. Install filter material over all terminal diffusers to protect surrounding areas during cleaning operation. Remove all filter material from diffusers after cleaning is complete.


- B. Wherever grilles and/or diffusers are removable, they shall be removed, vacuum cleaned, washed, dried, and then replaced. Welded or fixed grilles shall be cleaned in place.
- C. Interior surfaces of the ductwork, dampers, and turning vanes shall be cleaned by using HEPA filtered vacuums, rotary brush and air whip dislodging systems, and contact cleaning as required. All removable diffusers shall be removed for cleaning, while others shall be done in place.
- D. All internally lined ductwork and flex duct shall be cleaned using soft nylon brushes for dislodging, to avoid damage to fibrous insulation.
- E. Containment: Debris removed during cleaning shall be collected and precautions shall be taken to ensure that debris is not otherwise dispersed outside the HVAC system during the cleaning process.
- F. Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.
- G. Controlling Odors: Measures shall be employed to control odors and/or mist vapors during the cleaning process.
- H. Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards).
 Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.
- I. Air-Volume Control Devices: Dampers and any air-directional mechanical devices inside the HVAC system shall have their position marked prior to cleaning and, upon completion, must be restored to their marked position.
- J. Service Openings: The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.
 - 1. Contractor shall utilize the existing service openings already installed in the HVAC system where possible.



- 2. Other openings shall be created where needed and they shall be created so they can be sealed in accordance with industry codes and standards.
- 3. Closures shall not significantly hinder, restrict, or alter the airflow within the system.
- K. Closures shall be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.
 - 1. Openings shall not compromise the structural integrity of the system.
 - Construction techniques used in the creation of openings shall conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.
 - 3. Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.
 - 4. All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the Owner in project report documents.
- L. Ceiling sections (tile): The contractor may remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.
- M. Air distribution devices (registers, grilles & diffusers): The contractor shall clean all air distribution devices.
- N. Duct Systems:
 - 1. Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.
 - 2. Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Tests (see NADCA Standards).

3.03 – DUCT CLEANING METHODOLOGY

A. Source Removal Cleaning Methods: The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select Source Removal methods that will render the HVAC system Visibly Clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified tests, in



accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.

- 1. All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device shall be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.
- 3. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.
- 4. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.
- 5. All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those, which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.
- B. Methods of Cleaning Fibrous Glass Insulated Components
 - Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.
 - Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards).
- C. Damaged Fibrous Glass Material
 - 1. Evidence of damage: If there is any evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture such that fibrous glass materials



cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.

- 2. Replacement: When requested or specified, Contractor must be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.
- Replacement material: In the event fiber glass materials must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMACNA.
- E. Antimicrobial Agents and Coatings
 - 1. Antimicrobial agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.
 - 2. Application of any antimicrobial agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.
 - 3. When used, antimicrobial treatments and coatings shall be applied in strict accordance with the manufacturer's written recommendations and EPA registration listing.
 - 4. Antimicrobial coatings shall be applied according to the manufacturer's written instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces.

3.04 – CLEANLINESS VERIFICATION

- A. General: Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.
- B. Visual Inspection: The HVAC system shall be inspected visually to ensure that no visible contaminants are present.
 - If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the Owner reserves the right to further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA standards.
 - 3. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for



cleanliness.

4. NADCA vacuum test analysis shall be performed by a qualified third party experienced in testing of this nature.

3.05 - HVAC SYSTEM REPORT

- A. At the conclusion of the project, the Contractor shall provide a bound report to the Owner indicating the following:
 - 1. Success of the cleaning project, as verified through visual inspection (before and after photographs) and gravimetric analysis.
 - 2. Areas of the system found to be damaged and/or in need of repair

3.06 – PROTECTION/ CLEANUP OF PROPERTY

A. Protect all furniture, wood flooring, and equipment in the work area using clean protective coverings. Cleanup of these areas shall be performed by use of the HEPA filtered vacuums, to avoid recontamination of occupied space. The contractor shall perform clean up and remove the protective coverings on a daily basis.

3.07 - REPAIRING OF DAMAGED DUCTWORK, ACCESSORIES AND THERMAL INSULATION

A. Contractor shall repair all damages resulted by his work to the ductwork, thermal insulation and vapor barrier.



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1.01 - SECTION INCLUDES

- A. General:
 - 1. The Contractor shall provide a complete electrical installation including all labor, equipment, materials, machinery, tools, transportation, procurement of all necessary permits, certificates, and other incidental services, whether described in these Contract Documents or not, to provide a satisfactorily operating electrical installation.
 - 2. The Contractor shall perform all operations necessary to install, equip, adjust, and place into satisfactory operation all electrical equipment. The Contractor shall connect the various elements of the project to form a complete and properly operating system.
- B. The principal items of electrical work include, but are not necessarily limited to the following:
 - 1. Demolition and removal of associated components of existing equipment scheduled to be demolished.
 - 2. Furnishing and pulling all cables, furnishing and installing all conduit grounding and related fittings for completing the installation of all electrically operated equipment.
 - 3. Furnishing and installing all switches, conduit, grounding and related fittings as well as certain cables for completing the installation of all electrically operated equipment, controls, safety devices, alarms, instrumentation, heating, ventilating and air conditioning equipment.
 - 4. Furnishing and installing all lighting fixtures including conduit, wiring, receptacles, switches, and lamps as required to complete these installations. Structural steel supports and frames for mounting and supporting all pullboxes, junction boxes, transformers, panelboards, switches and similar equipment required.
 - 5. Furnishing and installing exit lighting, emergency lighting units, conduit, wiring, batteries and as required to complete these installations.
 - 6. Furnishing and installing dry type power and lighting transformers and constant voltage transformers where indicated.
 - 7. Furnishing and installing lighting and power distribution panelboards.
 - 8. Furnishing and installing 480V switchgear.



- 9. Furnishing and installing motor control centers.
- 10. Short circuit and relay coordination study and adjustment of all protective and metering devices for the electrical system.
- C. Refer to Section 011010 for supplemental information concerning the extent of work required under this contract.

1.02 - RELATED WORK

- A. Concrete slabs, foundations, pads, and miscellaneous metal work required for equipment furnished under this contract.
- B. Flashing and sealing of conduits through outside and interior walls, floors and ceilings.

1.03 - QUALITY ASSURANCE

- A. It is understood that the rights and benefits given the Owner by the guarantees found in the technical specifications are in addition to and not in derogation of any rights or benefits found in the general conditions of the Contract.
- B. Electrical equipment provided under this Contract shall be turned over in a sustained and proper operating condition. Instruction on further operation and maintenance shall be included in the operating and maintenance instructions.

1.04 - REFERENCES

- A. Perform work in accordance with standards listed below. Where these specifications are more stringent, they take precedence. In case of conflict, obtain a decision from the Engineer.
 - 1. ANSI/NFPA-70: National Electrical Code
 - 2. NFPA-101: Life Safety Code
 - 3. NFPA-820: Fire Protection in Wastewater Treatment and Collection Facilities
 - 4. NECA Standard of Installations.
 - 5. New York State Energy Code
 - 6. New York State Building Code
 - 7. Applicable New York State Administrative Code

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- 8. Applicable City of Glen Cove Ordinances.
- 9. Long Island Power Authority rules and regulations.
- 10. I.S.A.: Instrument Society of America
- 11. U.L.: Underwriters Laboratories.
- 12. N.E.M.A.: National Electrical Manufacturers Association
- 13. O.S.H.A.: Occupational Safety and Health Administration
- 14. A.N.S.I.: American National Standards Institute
- 15. J.I.C.: Joint Industrial Council
- 16. I.E.E.E.: Institute of Electrical and Electronic Engineers.
- 17. F.M.: Factory Mutual.
- 18. Telephone Utility Company

1.05 - EXISTING CONDITIONS AND RELOCATIONS

- A. Fully examine all the drawings, including drawings of other contracts related to this project and relating to the work and become completely informed as to the extent and character of the work required and prevailing existing conditions. No consideration or allowance will be made for the Contractor's failure to avail himself of such information.
- B. 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 demolition drawings and allow for the rerouting or relocation of wiring systems and devices to remain that must be relocated or rerouted. This Contractor shall allow for and accomplish these rework items to suit field requirements and conditions.
- C. 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, examine existing conditions and review with the Engineer prior to altering existing systems.
- D. Where new construction involves connecting to or using existing equipment, include all 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.

E. 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.

1.06 - ELEMENTARY WIRING DIAGRAMS AND POINT- TO-POINT FIELD WIRING DIAGRAMS

- A. Prior to the manufacture of equipment to be furnished under this Contract, submit for approval complete elementary, internal and interconnecting wiring diagrams for all switchgear, branch motor protection, and circuit breaker distribution panels required under this Contract. The elementary diagrams shall completely describe the circuit in which the component is to be used and shall be drawn using standard JIC/NEMA electrical symbols and ANSI C37.2 device function numbers. The diagrams shall be CADD drafted.
- B. Point-to-point field wiring diagrams are required for all equipment furnished as work of this Contract. Point-to-point field wiring diagrams shall be complete and shall contain all details including all items provided under other construction contracts and sections. As a minimum, all diagrams shall indicate:
 - 1. Color-coding and wire numbers.
 - 2. Wire sizes and insulation types.
 - 3. Designation of conduit in which wiring is to be run.
 - 4. Panel terminal strip numbers.
 - 5. Location, functional name and manufacturer's designation of items to which wiring is to be connected, including all items provided under other sections and construction contracts.
 - 6. Include diagrams for controls and power. Power diagrams to include interconnections with switchgear, motor control centers, panelboards, motors control panels, and field devices.
- C. Use shop drawings of equipment to prepare point-to-point field wiring diagrams. Coordinate the fabrication of power distribution devices with the control panels and equipment being provided under this contract.



PART 2 - PRODUCTS

2.01 - MATERIALS AND EQUIPMENT

A. All materials and equipment used in carrying out these specifications shall be new and be UL listed and labeled.

PART 3 - EXECUTION

3.01 - COORDINATION

- A. Examine specifications, Contract Drawings, the project site, and existing electrical system to become thoroughly familiar with items that require electrical connections and coordination. Electrical drawings are diagrammatic and shall not be scaled.
- B. No other contractors of any deviations or special conditions necessary for the installation of work. The Engineer prior to installation will resolve interferences between work of various contractors. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to the Owner.
- C. Install in accordance with manufacturer's recommendation. Where conflicts occur between Contract Documents and these recommendations, request clarification from the Engineer for decision before proceeding with such work.
- D. Place all outlets, anchors, sleeves, and supports prior to pouring concrete. Should the Contractor neglect doing this, any cutting and/or patching required to be done is at this Contractor's expense.

3.02 - CUTTING AND PATCHING

- A. Repair or replace routine damage caused by cutting in performance of work under this contract.
- B. Correct unnecessary damage caused due to installation of electrical work, brought about through carelessness or lack of coordination.
- C. Holes cut through floor slabs shall be core drilled with drill designed for this purpose. All openings, sleeves, and holes in slabs shall be properly sealed, fire proofed and waterproofed.
- D. Repairs shall be performed with materials that match existing materials and to be installed in accordance with appropriate sections of these specifications.



3.03 - CONCRETE SLABS, FOUNDATIONS AND PADS & MISCELLANEOUS METALS

- A. Concrete slabs, foundations and pads required for the emergency generator facility and other equipment (furnished under this Contract) shall be constructed in accordance with the details shown on the Drawings and as specified in Section 03300 Cast-In-Place Concrete.
- B. Gratings, handrailing, and other miscellaneous metal work shall be as shown on the drawings in accordance with the requirements contained in Divisions 5 and 6 if such specifications are provided.

3.04 - TESTS

- A. On completion of work, installation shall be completely operational and entirely free from ground, short circuits, and open circuits. Perform a thorough operational test in presence of the Engineer. Balance all circuits so that feeders to panels are not more than 7% out of balance between phases with all available load energized and operating. Furnish all labor, materials, and instruments for above tests.
- B. Furnish Engineer with a copy of such tests including identification of each circuit and readings recorded, also the main service ground resistance test as described in Section 16060– Grounding and Bonding of these specifications. Test information to include ampere readings of all panel circuit breakers, and isolation resistance reading of motors and transformers.

3.05 - IDENTIFICATION OF EQUIPMENT

- A. Properly identify the following in accordance with the details on the Drawings and the requirements contained in Section 16075 Electrical Identification:
 - 1. Motor Control Centers including all individual devices
 - 2. Circuit breaker panels and individually mounted circuit breakers
 - 3. Disconnect switches
 - 4. Telephone pull boxes
 - 5. Power / Control pull stations
 - 6. Existing power distribution panels used for this project

3.06 - INSTALLATION

A. Carefully move and replace equipment, appliances and all related items, as required to conduct

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proposed work.

- B. Install and conduct all work in accordance with applicable NEC, State and local codes.
- C. Conduits for power and controls shall be run in masonry walls or embedded in or below concrete slabs and foundation walls where such work is inside a new building. Exposed conduits in process type areas will only be allowed for joist mounted lighting distribution and unit heaters. Exposed conduits in pipe trenches may be allowed with the prior approval of the Engineer.



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1.01 - SECTION INCLUDES

A. Electrical demolition.

1.02 - SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of temporary work.

1.03 - REGULATORY REQUIREMENTS

- A. Conform to applicable code for demolition work, safety of structure and dust control.
- B. Obtain required permits from authorities.
- C. Notify affected utility companies before starting work and comply with their requirements.
- D. Do not close or obstruct egress width to exits.
- E. Do not turn off electric equipment without authorization from Owner.
- F. Conform to procedures applicable when discovering hazardous or contaminated materials.
- G. Obtain a utilities mark-out of all buried underground utilities for telephone, electric, gas, sewer and water, including all customer owned utilities.

1.04 - SCHEDULING

A. Schedule Work to coincide with new construction.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 - EXAMINATION

A. Verify field circuiting arrangements at the Nassau County Department of Public Works.



- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation. Report discrepancies to the Engineer before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing condition.

3.02 - PREPARATION

- A. Coordinate utility service outages with Utility Company.
- B. Provide power, wiring and connections to maintain all existing power, control and telemetry systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.03 - DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Remove, relocate, and extend existing installations to accommodate new construction, as indicated on drawings.
- B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. For all wiring device removals, provide stainless steel blank covers for all exposed openings.
- D. Repair adjacent construction and finishes damaged during demolition and extension work.
- E. Provide caps and filler plates/plugs for all openings in equipment and enclosures after removal of conduits.
- F. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- G. Remove demolished materials from site as work progresses.
- H. Completely remove and dispose of all electrical power, control, and data feeds including conduits, conductors, boxes and supports not scheduled to remain after new construction is tested and operational.



I. Where existing devices and equipment are called to be removed, Maintain circuit continuity to all existing devices and equipment remaining on that circuit. Provide required conduit, conductors and boxes as required.

3.04 - CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Remove temporary work.



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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 – REFERENCES

- A. NETA International Electrical Testing Association.
- B. IEEE Institute of Electrical and Electronics Engineers.
- C. ANSI American National Standards Institute.

1.03 – 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.

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- 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 16200 Arc Flash Hazard Analysis and Short Circuit Coordination Study), all medium and low voltage equipment testing, including low 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.

1.04 – 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.

1.056 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)



1.01 - SECTION INCLUDES

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

1.02 - REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

PART 2 - PRODUCTS

2.01 - COMPONENTS

- A. Ground clamps: OZ ELECTRICAL MANUFACTURING COMPANY, Type "CG", or equal by STEEL CITY or APPLETON.
- B. Raceways, conductors, outlet boxes, pull and junction boxes to be furnished in accordance with applicable sections of these specifications.
- C. Rod Electrode: Copper, 3/4-inch diameter, 10 feet long.
- D. Wire: Copper, sized to meet NFPA 70 requirements.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. General:
 - 1. Clean all conductive surfaces on equipment to be grounded, to assure good electrical continuity.
 - 2. Effectively bond all grounding conductors to grounding rod electrodes, equipment enclosures and ground busses.
 - 3. Locate all grounding attachments away from areas subject to physical damage. Provide protective covering as required.



- 4. Install service entrance building ground and grounding systems for new service in accordance with NEC and LIPA requirements.
- 5. Service entrance shall be bonded to street side of first flange or coupling of incoming main water line with heavy duty ground clamp. Bonding conductor to be sized in accordance with NFPA 70.
- 6. Building steel shall be bonded to ground bus on main service with a conductor the same size as in B.1 below.
- B. Feeder/Branch Circuits:
 - 1. All circuits shall have a separate green grounding conductor in conduit sized in accordance with NFPA 70. Minimum size of conductor shall be No. 12 AWG.
 - 2. Flexible conduit will not be approved as achieving continuity of ground. All flexible conduit to have a jumper wire sized to ampacity of branch breaker and to be connected to conduit system on both ends; this applies to fixtures, motors, controls, etc.
- C. Transformers: Transformers shall be grounded and grounding conductors and conduits sized in accordance with NFPA 70.

3.02 - TEST

A. Test ground on main service. Ground system resistance shall be no greater than 10 ohms using test equipment similar to a "Biddle" test. Test data to be submitted to the Engineer for approval and such approved test data to become a part of the Record Documents.



1.01 - SECTION INCLUDES

- A. System of supporting devices and hangers for support or bracing for conduit, electrical equipment, fixtures, panel boards, outlet boxes, junction boxes and cabinets.
- B. All exposed hardware, hangers, supports, rods, frames, angles, channels, brackets, and any other system, regardless of application, location, or purpose shall be stainless steel.
- C. Mounting of electrical devices to handrailing shall not be permitted. All local disconnect switches, pull boxes, transmitters, panels, and junction boxes shall be frame mounted.
- D. Hardware used to anchor supports to concrete or masonry shall be stainless steel.
- E. Conduit sleeves set in concrete shall be carbon steel with bitumastic coating, inside and outside.
- F. Minimum size of threaded rod shall be ¹/₄-inch diameter. All threaded rod shall be type 316 stainless steel.
- G. Definitions:
 - 1. Exterior locations shall be locations defined as exposed to outside conditions, located outdoors, located within process tanks, channels, wells, pits and the like.
 - 2. Interior locations shall be areas located within buildings, lean-to structures or the like.
 - 3. Exposed locations are locations that are not concealed within walls and slabs.
- H. Under this Section, provide all labor, equipment and material necessary to furnish, and install supporting devices complete, in place, as shown on the Contract Drawings, specified herein and approved by the Engineer.
- I. In general, the supporting devices included under this Section shall include, but not be limited to the following:
 - 1. Channels, fittings, and brackets
 - 2. Conduit supports
 - 3. Concrete inserts
 - 4. Beam clamps and hanger rod or threaded rod supports

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1.02 - SUBMITTALS

 A. Submit product catalog cuts in accordance with the requirements contained in Section 01300 – Submittals.

PART 2 – PRODUCTS

2.01 - GENERAL

A. The following sections describe typical supporting devices such as channels, fittings, and brackets. Not all possible components are listed. Furnish and install all required items based on the specification of products listed below.

2.02 - CHANNELS, FITTINGS AND BRACKETS

- A. Channels shall be type 316 stainless steel. Channels shall have a minimum thickness of 12 gauge. The cross sectional width dimension shall be 1-1/2" minimum. The depth shall be as required to satisfy load requirements.
- B. Attachment holes, when required, shall be factory punched on hole centers approximately equal to the cross sectional width and 9/16" in diameter.
- C. Fittings and brackets shall have 9/16" 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" thick minimum. All fittings and brackets shall be type 316 stainless steel. Fittings and brackets shall mate properly with the channel.

2.03 - CONDUIT SUPPORTS

A. All conduit supports shall securely attach the conduit to the structure or to the channel as required.

2.04 - CONCRETE INSERTS

- A. Concrete inserts shall be continuous slot or spot type, as required. Concrete inserts shall be 12 gauge steel.
- B. Concrete insert finish shall have an electro-plated zinc finish in accordance with ASTM B633.

2.05 - BEAM CLAMPS AND HANGER ROD SUPPORTS

A. Beam clamps, threaded rod, and hanger rod supports shall be type 316 stainless steel regardless of location.



2.06 - HARDWARE AND THREADED COMPONENTS

- A. Hardware and threaded components shall include all miscellaneous items to complete the assembly of the support system. This includes nuts, bolts, springs, washers, etc.
- B. All hardware, regardless of the location, shall be type 316 stainless steel.

2.07 - MANUFACTURERS

- A. The equipment described in the proceeding paragraphs is to form a complete support system associated with a single manufacturer, as different manufacturers have slight variations in dimensions, parts, etc. It is the intention of these specifications that all required parts be furnished and installed for a complete support system.
- B. Manufacturers for the supporting devices shall be as follows: ALSTRUT, B-LINE, or KINDORF.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. General:
 - 1. Furnish and install all required supporting devices required to properly mount and secure all electrical equipment furnished under this Contract.
 - 2. 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.
 - 3. Actual designs of the support system shall be the responsibility of the Contractor. Submit support design details to the Engineer for approval before proceeding with fabrication if requested by the Engineer.
 - 4. Wherever equipment to be supported exceeds 50 pounds in weight, a Professional Engineer registered in the State of New York shall prepare a design for the proposed support system for Engineer's receipt.
 - 5. In all instances, furnish and install the proper sized rods, channels, fittings, brackets, etc. necessary to adequately support the equipment.
 - 6. 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.
- B. Channels, Fittings and Brackets Support System:



- 1. Furnish and install channels, fittings, brackets and related hardware for mounting, supporting and installing all electrical equipment furnished under this Contract and for devices furnished by others for installation under this Contract.
- 2. The support system shall be rigidly bolted together and braced to make a substantial supporting framework.
- 3. All frameworks that support operator devices, such as control stations, shall be fabricated such that the top of the equipment to be mounted is four (4) feet above finished floor.
- 4. Final mounting heights shall be as approved by the Engineer.
- C. Conduit Supports: All exposed conduits shall be supported with a conduit support system consisting of channels, nuts, bolts and screws, threaded rod, conduit straps and anchors, as required. Each conduit shall be properly supported every six (6) feet, maximum.
- D. Concrete and Masonry Inserts:
 - 1. Furnish and install all anchor bolts, masonry inserts and similar devices, as required, for proper installation of support equipment furnished under this Contract.
 - 2. Where motor control centers, switchgear, unit substations and other electrical equipment is being installed on concrete pads, provide leveling channels.
- E. Beam Clamps and Hanger Rod Support:
 - 1. All equipment fastenings to steel columns, beams and trusses shall be by beam clamps.
 - 2. In lieu of beam clamps, equipment may be welded to steel structures, subject to Engineer approval.
 - 3. No holes shall be drilled in any steel columns, beams, and trusses.
 - 4. Hanger rod supports shall be installed such that threaded rod is parallel and perpendicular to building walls and floors.



1.01 - SECTION INCLUDES

- A. Nameplates and labels
- B. Wire and cable markers
- C. Conduit markers
- D. Install conduit markers immediately after installation. Conduit markers shall be installed on all exposed and buried conduits. Conduits in duct banks or embedded in concrete shall not be marked.
- E. Wire and cable markers shall be installed immediately after the wire has been pulled through the conduit and before termination.
- F. The conduit and wire installation shall not be considered complete until the conduit and wire/cable has been properly identified. An amount equal to 50% of the scheduled value for the conduit and/or cable installation shall be withheld until the identification has been installed.
- G. Furnish and install nameplates for equipment furnished and installed as work of this Contract.

1.02 - SUBMITTALS

- A. Submit under provisions of Section 01300 Submittals.
- B. Product Data: Provide catalog data for nameplates, labels, markers, and warning tape.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Underwriters Laboratories, Inc. Include instructions for storage, handling, protection, examination, preparation and installation of product.

PART 2 - PRODUCTS

2.01 - HIGH VOLTAGE SIGNS

- A. High voltage signs shall be 20 gauge steel with baked enamel finish. 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 visibility.
- B. High voltage signs shall read; "DANGER HIGH VOLTAGE".
- C. High voltage sign mounting screws shall be stainless steel.

2.02 - EQUIPMENT NAMEPLATES

- A. Electrical equipment nameplates shall be laminated plastic with black letters on a white background. Nameplates shall be 2-inches by 6-inches, unless a larger size is required to adequately display the required information. The Engineer shall approve all nameplates. Nameplates for electrical equipment such as MCC's, panelboards, switchgears, etc. shall have the following information:
 - 1. Equipment name and number
 - 2. Voltage
 - 3. Phases and number of wires
- B. Typical nameplate is as follows: "MCC No. 2A 480Y/277V 3 PH, 4W"
- C. All control pullboxes and junction boxes shall have a nameplate similar to the following: "SBR TANKS CONTROL CONDUITS PULL STATION"
- D. Nameplates for all electrical equipment shall have similar and additional information as required for proper identification.
- E. Nameplate mounting screws shall be stainless steel. Adhesives shall not be used.

2.03 - WIRE MARKERS

- A. Manufacturers:
 - 1. 3M ELECTRICAL SPECIALTY DIV., Product Scotch Code.
 - 2. THOMAS & BETTS CORP., Product E-Z Code.
- B. Description: Epoxy film tape type wire markers.
- C. Locations: Each conductor at panelboards, auxiliary gutters, pull boxes, outlet and junction boxes, circuit breakers and each load connection.



- D. The Contractor shall tag all wires as follows:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on the Contract Drawings.
 - 2. Control Circuits: Control wire number as indicated on the interconnection point-to-point diagrams required to be furnished as work of Section 26000 –Electrical.

2.04 - CONDUIT MARKERS

- A. Manufacturers: THOMAS & BETTS CORP or equal.
- B. Description: Self-sticking vinyl; black letters on orange background.
- C. Location: Furnish markers for each conduit longer than 6 feet (1.8 m).
- D. Spacing: 20 feet (6 m) on center.

PART 3 - EXECUTION

3.01 - PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 - APPLICATION

- A. Install all nameplate and labels parallel to equipment lines. Center labels on door front.
- B. Secure nameplates to all equipment using stainless steel screws.
- C. Secure nameplate to inside surface of door on every panelboard that is recessed in finished locations.
- D. Apply conduit markers at 20-foot (6 m) intervals.
- E. Install high voltage sign at every device equal to or greater than 480 volts as directed by the Engineer.

3.03 - ELECTRICAL EQUIPMENT IDENTIFICATION

A. Identify every existing circuit in the work area and new distribution panels, switchboards and disconnect switches.



- B. Label all circuits identifying the load served including all individual circuit breakers.
- C. Label all new and existing circuit breakers and switches used for new and existing feeder and branch circuits. Label all equipment as "spare" for removed electrical equipment.



1.01 - SECTION INCLUDES

- A. Provide all labor, equipment and material necessary to furnish, install, and test the wires and cables complete, in place, as shown on the Contract Drawings, specified herein and approved by the Engineer.
- B. In general, the wires and cables included under this Section shall include, but not be limited to, the following:
 - 1. 600V power and control cable
 - 2. 600V lighting and receptacle cable
 - 3. Instrumentation wires
- C. All conductors to be continuous from origin to panel or equipment termination without splices. Where splices and taps are necessary or are required, notify the Engineer prior to installation.
- D. All splices shall be in made in stainless steel terminal boxes unless otherwise indicated.

1.02 – QUALITY ASSURANCE

- A. Qualifications of Manufacturers:
 - 1. Products 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 the General Conditions.
 - 2. Submit the following information pertaining to the manufacturer(s):
 - a. Complete literature, performance, and technical data describing the proposed equipment and listing of items made by the manufacturer.
 - b. Location of closest service office from which this equipment shall be serviced.
 - c. Location of closest parts inventory for item installation.
 - 3. Field Testing:
 - a. Wires and cables shall be tested before being connected to motors, devices or terminal blocks.



- b. If tests reveal defects or deficiencies, make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.
- c. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment.
- 4. Continuity Tests:
 - a. All cables, wires and shields shall be tested for continuity. Testing for continuity shall be by test light or buzzer.
- 5. Insulation-Resistance Tests:
 - a. 600V power and control cables and wires shall be tested for their insulationresistance values. Test shall utilize a megohmeter with applied voltage to be 1000VDC for one (1) minute. Insulation-resistance test shall be performed on each conductor with all other conductors grounded. The resistance value shall be 20 megohms or greater.
 - b. 300V instrumentation signal cable shall be tested from conductor to conductor, conductor to ground, and conductor to shield using a digital volt-ohm meter. The resistance valve shall be 10 megohms or greater.

1.04 - REFERENCES

- A. ANSI/NFPA 70 National Electric Code.
- B. NECA Standard of Installations.

1.04 - SUBMITTALS

A. Submit product data under provisions of Section 01300.

1.05 - COORDINATION

- A. Coordination:
 - 1. Coordinate wire and cable required with the equipment being provided for the satisfactory operation of the equipment or system.
 - 2. Review installation procedures under other sections and coordinate with the work specified herein.



B. Work Not Included: Work under this Section specifically excludes wires and cables in conduits that are not part of this Contract. This only includes HVAC automatic environmental controls. Certain cables are being provided by others and installed under this Contract, as shown in the Cable and Conduit Schedule or as noted elsewhere on the Drawings.

1.06 - PROJECT CONDITIONS

- A. Verify that embedded conduit, in masonry and concrete, is installed as shown on the Drawings prior to the work being enclosed by others.
- B. Conductor sizes are based on copper at 75°C.
- C. Wire and cable routing shown on Drawings is approximate unless dimensioned or specifically called for such as where conduit is to be embedded in concrete or masonry. Route wire and cable as required to meet project conditions and shall be routed above ceilings, directly under joists, in pipe trenches, where available, and in masonry. Where exposed conduit is permitted, it shall be run to maximize wall space.
- D. Field verify destination location to determine cable routing.
- E. Where wire and cable routing is not shown for proposed destination, determine exact routing and lengths required. Routing shall be reviewed with the Engineer.

PART 2 - PRODUCTS

2.01 - CONDUCTORS

- A. Install products in accordance with manufacturer's recommendations.
- B. Single copper conductors with 600-volt insulation.
- C. Minimum size of feeder conductors and grounds shall be No. 12 AWG.
- D. Insulation: No. 12 AWG and No. 10 AWG, provide ANSI/NFPA 70, Type THWN. For all conductors No. 8 AWG and larger, provide ANSI/NFPA 70, Type THW, or THWN.
- E. Use solid conductor for feeder and branch circuits, 10 AWG and smaller.
- F. All conductors shall include complete set of manufacturer's markings for insulation and conductor size.
- G. Manufacturers shall be ANACONDA, TRIANGLE, ROME, or approved equal.

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H. Provide white colored neutral conductors; provide black, color coded phase conductors; provide green colored ground conductors.

2.02 - 300 VOLT INSTRUMENTATION SIGNAL CABLE

- A. Indoor Application:
 - 1. The 300-volt instrumentation signal cable for indoor use shall consist of single or multiple twisted pairs or triads of coated, stranded copper conductors with polyvinyl chloride (PVC) insulation and nylon jacket. Each individual pair or triad of wires shall have an aluminum/polyester tape shield with a tinned copper drain wire. For multiple pair or triad cables, an overall aluminum/polyester tape shield with a tinned copper drain wire shall enclose the individual wire assemblies. The overall jacket shall be PVC. Cables shall have a 105°C rating.
 - The conductors shall be annealed, tin-coated copper with Class B stranding per ASTM B 8. Minimum size conductor shall be AWG No. 16.
 - 3. The insulation shall be PVC. The insulation thickness shall be 15 mils.
 - 4. Individual Conductor Insulation: The jacket over each individual wire shall be nylon and shall have a thickness of 4 mils.
 - 5. The shield for each individual pair or triad shall be an aluminum/polyester tape. The shield shall be 1.35 mils thick and shall be overlapped to provide 100% coverage. The shield shall also contain a 7-strand tinned copper drain wire which shall be a maximum of two sizes smaller than the conductors. All individual shields shall be completely isolated from each other.
 - The overall shield for multiple pair or triad cables shall be an aluminum/polyester tape. The shield shall be 2.35 mils thick and shall be overlapped to provide 100% coverage. The shield shall also contain a 7-strand tinned copper drain wire which shall be the same size as the conductors.
 - 7. The overall jacket shall be PVC and shall meet the requirements of UL 13.
 - 8. The jacket thickness shall be as follows:

Wire Size	No. of Pairs	No. of Triads	Jacket Thickness
16 AWG	1		35 Mils
16 AWG	2,4		50 Mils
16 AWG	8,10,12		60 Mils
16 AWG		1	35 Mils
16 AWG		2,4	50 Mils
16 AWG		8	60 Mils
16 AWG		12	70 Mils

- 9. Manufacturers and their products shall be equal to:
 - a. Cablec APVIC
 - b. Okonite A Type P-OS and Type SP-OS
 - c. Belden
- B. In Underground Ducts and Outdoor Use in Conduits:
 - 1. The 300-volt instrumentation signal cable for outdoor use in conduits shall consist of single or multiple twisted pairs or triads of coated, stranded copper conductors with polyvinyl chloride (PVC) insulation and nylon jacket. Each individual pair or triad of wires shall have an aluminum/polyester tape shield with a tinned copper drain wire. For multiple pair or triad cables, an overall aluminum/polyester tape shield with a tinned copper drain wire shall enclose the individual wire assemblies. The overall jacket shall be chlorinated polyethylene (CPE). Cables shall have a 105°C rating.
 - The conductors shall be annealed, tin-coated copper with Class B stranding per ASTM B 8. Minimum size conductor shall be AWG No. 16.
 - 3. The insulation shall be PVC. The insulation thickness shall be 15 mils.
 - 4. The jacket over each individual wire shall be nylon and shall have a thickness of 4 mils.
 - 5. The shield for each individual pair or triad shall be an aluminum/polyester tape. The shield shall be 1.35 mils thick and shall be overlapped to provide 100% coverage. The shield shall also contain a 7-strand tinned copper drain wire which shall be a maximum of two sizes smaller than the conductors. All individual shields shall be completely isolated from each other.
 - 6. The overall shield for multiple pair or triad cables shall be an aluminum/polyester tape.



The shield shall be 2.35 mils thick and shall be overlapped to provide 100% coverage. The shield shall also contain a 7-strand tinned copper drain wire which shall be the same size as the conductors.

- 7. The overall jacket shall be CPE and shall meet the requirements of UL 13.
- 8. The jacket thickness shall be as follows:

Wire Size	No. of Pairs	No. of Triads	Jacket Thickness
16 AWG	1,2		35 Mils
16 AWG	4		50 Mils
16 AWG	8,10,12		60 Mils
16 AWG		1	35 Mils
16 AWG		2,4	50 Mils
16 AWG		8	60 Mils
16 AWG		12	70 Mils

- 9. Manufacturers and their products shall be as follows:
 - a. Cablec APZIC
 - b. Okonite AOkobon Type P-OS and Type SP-OS

2.03 - 4-PAIR CATEGORY 6E UNSHIELDED TWISTED PAIR CABLE

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Belden Corporation, Carmel, IN (800) 246-2673.
 - 2. Avaya, Basking Ridge, NJ (800) 344-02232.
 - 3. Berk-Tek, Incorporated, New Holland, PA (800) 237-5835.
 - 4. CommScope, Hickory, NC (800) 982-1708.
 - 5. Draka Comteq, Franklin, MA (888) 541-7100.
 - 6. General Cable, Highland Heights, KY (800) 424-5666.
 - 7. Mohawk/CDT Leominster, MA (978) 537 9961.


- 8. NORDX/CDT, Worcester, MA (800) 331-0779.
- 9. Superior Essex, Atlanta, GA. (800) 685-4887.
- 10. Tyco Electronics, Harrisburg, PA (800) 522-6752.
- B. Conductors: 4 twisted pair 24 AWG, solid copper w/ RJ-45 connector ends
 - 1. Individually insulated plenum rated conductors under common plenum rated sheath unless entire cable is installed within conduit/EMT or if area where cable is installed is not considered a return air plenum according to any applicable codes.
 - 2. Complies with individual characteristics established in ANSI/TIA/EIA-568-B, and all addendums for Category 6E cable performance specification.
 - 3. Overall Nominal Diameter: .365 x .165 in.
 - 4. Nominal Impedance: 100 ohms plus or minus 15 percent.
 - 5. Certified capable of performing to minimum 350 MHz.
- C. Mechanical Characteristics
 - 1. Operating temperature: -20°C to +80°C
 - 2. Bulk cable weight: 29 lbs./1000 ft.
 - 3. Maximum recommended pulling tension: 45 lbs.
 - 6. Minimum bend radius: 1 in.
- D. Flame test: UL1666 Riser
- E. Electrical Characteristics:
 - 1. Nom. Mutual Capacitance @ 1 KHz 15.0 pF/ft
 - 2. Maximum Capacitance Unbalance (pF/100 m) 49.2 pF/100 m
 - 3. Nominal Velocity of Propagation 70 %
 - 4. Maximum Delay (ns/100 m) 510 @ 100MHz ns/100 m
 - 5. Maximum Delay Skew (ns/100m) 25 ns/100 m

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- 6. Maximum Conductor DC Resistance @ 20 Deg. C 9 Ohms/100 m
- 7. Maximum DCR Unbalance @ 20 Deg. C 3 %
- 8. Max. Operating Voltage UL 300 V RMS

2.04 - MECHANICAL CONNECTORS

- A. Conductor tapping connectors shall be BURNDY Servit split bolt, Series KS and KS3, or approved equal.
- B. Split bolt connectors shall use BURNDY Type SC Servit cover on indoor applications.
- C. Terminal lugs shall be BURNDY Universal Terminal Series. Terminal lugs shall be sized for proper ampacity and proper number of conductor holes. Each conductor shall occupy only one hole on a terminal lug.
- D. Conductor tapping connectors for multiple conductors shall be BURNDY Series V-Tap with V-Tap covers, and V-Blok mounting platforms.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. General:
 - 1. The cables and wires shall be installed as shown on the Contract Drawings. Make terminations in accordance with cable manufacturers instructions for the particular type of wire and cable.
 - 2. Splices are not allowed in the underground duct, manhole and handhole systems. If splices are required, the Contractor shall obtain approval in writing from the Engineer prior to splicing.
 - 3. All low voltage cable shall be installed in metallic conduit.
- B. Wire and Cable Sizes: The sizes of wire and cable shall be as shown on the Contract Drawings, or if not shown, as approved by the Engineer. Minimum size wire shall be No. 12 AWG for all power, lighting and receptacle circuits. Wires for control circuits shall be No. 14 AWG minimum. Wire for instrumentation circuits shall not be smaller than No. 16 AWG. If due to field routing the voltage drop exceeds 2.5%, the size of conductors shall be increased such that 2.5% is the maximum voltage drop incurred.



- C. Number of Wires: The number of wires indicated on the Contract Drawings for the various control, indications, and metering circuits were determined for general schemes of control and for particular indication and metering systems. The actual number of wires installed for each circuit shall, in no case, be less than the number required; however, the Contractor shall add as many wires as may be required for control and indication of the actual equipment selected for installation at no additional cost to the Owner.
- D. Wiring Identification: All wiring shall have a unique wire number and be labeled at both ends. Wire numbers shall correspond with the equipment terminal wire numbers. Where no wire numbers are indicated, the Contractor shall assign wire numbers. Wire numbers shall not be duplicated.
- E. Cable Identification Tags: Furnish all labor and materials and affix in a permanent way to each cable in manholes, cable compartments and vaults, junction boxes, pull boxes and points of termination, a laminated plastic tag, bearing clearly printed, the cable number indicated on the Contract Drawings or some other approved identification number or symbol. All cables shall be temporarily tagged with its full ID number immediately after it has been pulled.
- F. Cable Installation: All interior cable shall be run in metallic conduit.
- G. Wiring Supplies: Only electrical wiring supplies manufactured under high standards of production and meeting the approval of the Engineer shall be used. Friction tape shall be in accordance with ASTM D69.
- H. Training of Cable: Furnish all labor and material required to train cables around cable vaults within buildings and in manholes in any outdoor underground duct system. Sufficient length of cable shall be provided in each manhole and vault so that the cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. All manhole cables shall be arc and fireproofed.
- I. Connections at Control Panels, Limit Switches and Similar Devices:
 - 1. Where stranded wires are terminated at panels, and/or devices connections shall be made by solderless lug, crimp type ferrule or solder dipped.
 - Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches, and other devices make 7-strand, No. 12 AWG, wire terminations impractical, terminate external circuits in an adjacent junction box of proper size and shall install No. 14 AWG stranded wires to the junction box in a conduit.



- J. Pulling Temperature: Cable shall not be flexed or pulled when the temperature of the insulation or of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature within a three day period prior to pulling of 40°F or lower, cable reels shall be stored during the three day period prior to pulling in a protected storage with an ambient temperature not lower than 55°F and pulling shall be completed during the work day for which the cable is removed from the protected storage.
- K. Color Coding:
 - 1. Conductor jacket shall be color coded as follows:

AC Power

480V/277 and above	208Y/120V System
Phase A - Brown	Phase A - Blue
Phase B - Orange	Phase B - Black
Phase C - Yellow	Phase C - Red
Neutral - White	Neutral – White

2. Control (Per ICEA Method 1, K-2):

Wire Number	Color
1	Black
2	Red
3	Blue
4	Orange
5	Yellow
6	Brown
7	Red With Black
8	Blue With Black
9	Orange With Black
10	Yellow With Black
11	Brown With Black
12	Black With Red
13	Blue With Red
14	Orange With Red
15	Yellow With Red
16	Brown With Red
17	Black With Blue
18	Red With Blue
19	Orange With Blue

- 3. DC Power
 - a. Positive Lead RED



- b. Negative Lead BLACK
- 4. Instrumentation Signal

Pairs	Triads
Black and White	Black, Red and White

- 5. Equipment Ground GREEN
- L. Instrumentation Cable Installation:
 - 1. Install all cable or conductors used for instrumentation wiring (4-20 madc, etc.) in a grounded metal raceway.
 - 2. The use of asbestos cement or plastic conduit will not be permitted.
 - 3. Analog signal wires shall exclusively occupy these conduits.
 - 4. Where instrumentation cables are installed in panels, etc., the Contractor shall arrange wiring to provide maximum clearance between cables and other conductors.
 - 5. Instrumentation cables shall not be installed in same bundle with conductors of other circuits.
 - 6. Grounding of cable shield shall be accomplished at one point only, unless otherwise required by instrumentation systems manufacturer.
 - 7. Special instrument cable shall be as specified or recommended by the vendor of the equipment or instruments requiring such wiring.
 - 8. Installation, storage, terminations, etc., shall be per manufacturer's recommendations.

3.02 - IDENTIFICATION

- A. Identify wire and cable under provisions of Section 16075.
- B. Identify each conductor with its circuit number.

3.03 - FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 01660.
- B. Inspect wire and cable for physical damage and proper connection.



- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit conductor.

+ + END OF SECTION + +



PART 1 - GENERAL

1.01 - SECTION INCLUDES

- A. Conduit.
- B. In general, the conduit system included under this Section shall include, but not be limited to the following:
 - 1. PVC coated rigid hot dipped galvanized steel conduits
- C. Flexible Liquid Tight Metal Conduit
 - 1. Connecting motors and other equipment subject to vibration, maximum length 3 feet.
 - 2. Passing through building expansion joints.
- D. Conduit fittings: Conduits to be mechanically and electrically continuous from one electrical device to another.
- E. In general, the boxes included under this Section shall include, but not be limited to the following:
 - 1. Outlet, switch, and device boxes
 - 2. Junction boxes (with and without terminals)
 - 3. Pull boxes
 - 4. Refer to the Schedule at the end of this Section for locations of box classes

1.02 - REFERENCES

- A. ANSI C80.1 Rigid Steel Conduit, Zinc Coated.
- B. ANSI/NFPA 70 National Electric Code.
- C. NECA Standard of Installation.
- D. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- E. NEMA RN 1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.



- F. NEMA TC 2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- G. NEMA TC 3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- H. ANSI/NEMA OS1 Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
- I. NEMA 250 Enclosures for Electrical Equipment (1000 volts maximum)

1.03 - SUBMITTALS

- A. Submit product data under provisions of Section 01300.
- B. Manufacturers specifications and other data required demonstrating compliance with the specific requirements.
- C. Materials list showing all items to be furnished and installed under this Section.
- D. Complete shop drawings of all work of this Section showing dimensions and locations of all items including supporting structures and clearance requirements.
- E. Submit two (2) samples of each type conduit, 2 feet in length.
- F. Submit sample of expansion/deflection fitting.

1.04 - REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc.
- B. Conform to requirements of ANSI/NFPA 70.

1.05 - DELIVERY, STORAGE AND HANDLING

- A. Deliver and store all products in accordance with the manufacturers recommendation, as approved by the Engineer, with all labels and seals intact and legible.
- B. Provide off-site storage and protection when site does not permit on-site storage or protection.
- C. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- D. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.



- E. In case of damage to a product during transportation, handling or storage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.
- F. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- G. Each length of conduit shall be shipped with one coupling on one end, a threaded protector at the other end.

1.06 - PROJECT CONDITIONS

- A. Verify all conduit routings by field measurements.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system. Provide all required sweeps, boxes, and fittings.

PART 2 - PRODUCTS

2.01 - PVC COATED STEEL CONDUIT

- A. 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. The conduit shall be coated on the interior and exterior.
- B. Conduits, elbows and couplings shall include a PVC coating for all areas.
- C. 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 – HAZARDOUS LOCATION FITTINGS CLASS I, DIV. I

- A. Conduit Unions: Class 1, Div. 1 Types UNF and UNY as manufactured by O-Z/Gedney or approved equal.
- B. Sealing Fittings: Class 1, Div. 1 types EYA and EYAM as manufactured by O-Z or approved equal.
- C. Sealing Hub: Class 1, Div. 1 type EYHSG with Sealing Gasket and Locknut as manufactured by



O-Z/Gedney or approved equal.

- D. Explosion proof sealing compound systems for fittings and hubs shall consist of a fiber material (to form a dam for the sealing material) and the sealing compound itself. Both the fiber and sealing compound shall be rated for use in the classified area and shall be compatible with the fitting or hub being sealed.
 - 1. Manufacturers and their particular products shall be as follows:
 - a. Appleton Electric Co., "Kwiko Sealing Cement & Fiber Filler"
 - b. Crouse-Hinds, "Chico A Sealing Compound & Chico X Fiber"
 - c. O-Z/Gedney, "Type EYC and Type EYF"
- E. Conduit Fittings:
 - Conduit fittings shall be furnished and installed as required and shall include unions, threaded hubs, nipples, enlargers, reducers, couplings, locknuts, bushings, etc. All fittings shall be steel with zinc electroplate finish or malleable iron with zinc electroplate finish. All fittings shall have insulated throats (where applicable).
 - 2. Conduit fittings shall be manufactured by the following: Appleton Electric Company, Crouse-Hinds, O-Z/Gedney
- F. Expansion couplings for use in conduit runs shall be the expansion/deflection type. Expansion couplings shall have iron or bronze ends, neoprene sleeves, stainless steel bands and tinned flexible copper braid bonding jumper. Couplings shall be watertight, corrosion resistant and concrete tight.
 - 1. Manufacturers and their particular products shall be as follows: Appleton Electric Company; "Type DF", Crouse-Hinds; "Type XD", O-Z/Gedney; "Type DX".
 - 2. For explosive areas, expansion unions shall be utilized. Expansion unions shall be steel with zinc electroplate finish and have copper or bronze grounding spring or jumper.
 - a. Manufacturers and their particular products shall be as follows:
 - 1) Appleton Electric Company; "Type UN"
 - 2) Crouse-Hinds; "Type UN"



3) O-Z/Gedney; "Type UN"

- G. Grounding Bushings: Grounding bushings shall be insulated, shall be constructed of malleable iron or steel with zinc plated finish, and shall have a tin plated copper saddle. Insulating material shall have a 150° rating. Grounding bushing shall be O-Z/Gedney, "Type BLG", or approved equal.
- H. Liquid-tight Fittings: Liquid-tight fittings shall be furnished and installed wherever liquid-tight conduit is used. Liquid-tight fittings shall be constructed of steel or malleable iron. Fittings shall be zinc coated. Fittings shall be liquid, rain and oil tight. Sealing rings shall be neoprene. All throats shall be insulated. Liquid-tight fittings shall be Appleton Electric Company, "Type ST"; O-Z/Gedney "Type 4Q", or approved equal.
- I. Explosion-Proof Fittings: Explosion-proof fittings shall be constructed as described above except fittings shall be listed for use in classified areas.
 - 1. Manufacturers and their particular products shall be as follows:
 - a. Appleton Electric Co., "Types BR, EC, EL, ES, EX, EY, and PLG"
 - b. Crouse-Hinds, "Types EC, EL, ES, EY, PLG and RE"
 - c. O-Z/Gedney, "Types EC, EL, EY, PLG, RB and RE"
 - d. The above products are meant as a guide and products from the above manufacturers not specifically mentioned do not exclude their use, if they comply with these specifications.
- J. PVC Coated Fittings: PVC coated fittings shall be as described in the paragraphs above except the fittings shall be PVC coated.
- K. Conductive Compound: Conductive compound shall be a grease metallic type and shall be Thomas & Betts, "KOPR-SHIELD", or equal.
- L. Conduit Bodies:
 - 1. Conduit bodies shall be cast type with threaded hubs and shall be made of copper-free aluminum or malleable iron. Copper-free aluminum bodies shall have an aluminum enamel finish. Malleable iron bodies shall have a zinc electroplate and aluminum enamel finish. Finishes shall be applied after all machining has been completed.
 - 2. Conduit body covers shall be of the same material and finish as the conduit body. All



screws shall be stainless steel. All covers shall come with rubber or neoprene gaskets.

- 3. Manufacturers and their particular products shall be as follows:
 - a. Appleton Electric Company; "Form 35 and Form 85"
 - b. Crouse-Hinds; "Mark 9"
 - c. O-Z/Gedney; "Malleable iron/copper-free aluminum conduit bodies"
- M. Mogul Conduit Bodies:
 - All conduit bodies 2" and larger and where physically necessary, shall be of the "mogul" type. Mogul type conduit bodies shall conform to the specifications above as to materials, finish, covers, etc.
 - 2. Manufacturers and their particular products shall be as follows:
 - a. Appleton Electric Company; "Mogul Unilets"
 - b. Crouse-Hinds; "Mogul Conduit Outlet Bodies"
- N. Explosion-Proof Conduit Bodies:
 - 1. Explosion-proof conduit bodies shall be constructed as indicated, except the conduit bodies shall be listed for use in the particular classified area.
 - 2. Manufacturers and their particular products shall be as follows:
 - a. Appleton Electric Company; "CPU, ELB, ER, GU and GR Series"
 - b. Crouse-Hinds; "CPS, EAB, GU and OE Series"
 - c. O-Z/Gedney; "GU and LBH Series"
 - d. The above products are meant as a guide and products from the above manufacturers not specifically mentioned do not exclude their use, if they comply with these specifications.
- 0. Explosion Proof Flex:



2.03 - FLEXIBLE LIQUID-TIGHT METAL CONDUITS AND FITTINGS

- A. Liquid-tight flexible metal conduit shall be ANACONDA or approved equal.
- B. Description: Interlocked steel construction with PVC jacket.
- C. Provide flexible liquid-tight conduits and fittings as manufactured by THOMAS & BETTS CORP., O.Z. GEDNEY CO. or approved equal. Catalog numbers used below are those of the THOMAS & BETTS CORP., based on 3/4" size and are to be considered as standards by which equivalents are to be judged. All conduit shall be liquid-tight flexible type, UL type UA, or suitable for exposure to continuous or intermittent moisture.
- D. Flexible liquid-tight connectors shall be Series 5333 or equal.
- E. For all non-hazardous areas, indoor and outdoor, flexible liquid tight metal conduits shall be used.
- F. For hazardous areas flexible conduit shall explosion proof rated and include a brass inner core with a bronze outer braid and protective neoprene plastic coating. End fittings shall be steel, brass or bronze.

2.04 - BOXES

- A. General Purpose:
 - 1. General purpose outlet, switch and device boxes shall be constructed of stamped sheet steel. Minimum box size shall be 4" x 4" x 2-1/8".
 - 2. Box sizes shall have standard industry and manufacturer dimensions. Gangable boxes are not allowed. Conduit knockouts are allowed on these boxes.
 - 3. Box covers, partitions, screws, etc. shall be of the same material as the box, and shall be furnished and installed as required for a complete installation.
 - 4. General purpose outlet, switch and device boxes shall be as manufactured by: Appleton Electric Company, Raco, Steel City, or approved equal
 - 5. Masonry boxes shall be as in paragraph 2.01 (A) (1) but shall be constructed specifically for installation in masonry block or tile walls.
- B. Cast Boxes (Non-Explosion Proof):
 - 1. Cast outlet, switch and device boxes shall be constructed of copper-free aluminum or malleable iron, shall have an epoxy powder or zinc electroplate with aluminum enamel



coat finish, threaded hubs and integral mounting lugs.

- a. Covers shall be malleable iron or aluminum. Screws shall be stainless steel. Neoprene or rubber gaskets shall be provided for all boxes.
- 2. PVC coated cast outlet, switch and device boxes shall be constructed as in 1. above except boxes and covers shall be PVC coated.
 - a. Cast box manufacturers and their particular products shall be as follows:
 - 1) Appleton Electric Company, "Type FS & FD"
 - 2) Crouse-Hinds, "Type FS & FD"
 - 3) O-Z/Gedney, "Type FS & FD"
 - 4) Or approved equal
- 3. Covers for cast boxes shall mate with the device installed as required and shall match the environment, that is, PVC coated, non-corrosive, weatherproof, etc.
 - a. Cover manufacturers and their particular products shall be as follows:
 - 1) Appleton Electric Company, "Type FSK"
 - 2) Crouse-Hinds, "Type DS, S and WLR"
 - 3) O-Z/Gedney, "Type FS-1 and FS-2"
 - 4) Or approved equal
- 4. Above model types do not exclude cover types not shown, but in general will be the types used in the majority of applications. Special applications may require covers not shown above.
- C. Explosion Proof Boxes:
 - Explosion proof outlet, switch, and device boxes shall be cast type with threaded hubs. Bodies and covers shall be iron with zinc electroplate finish or copper-free aluminum with epoxy powder coat finish. Screws shall be stainless steel. Boxes shall be PVC coated where required.
 - 2. Boxes, covers and devices in explosion proof areas are many times provided by



manufacturers as a complete unit in either factory sealed or non-sealed models. The quantity and type required shall be as shown on the Contract Drawings and as needed for a complete installation.

- 3. The switches, receptacles and devices mounted within these boxes shall be as specified in other sections of this Specification.
- 4. The box/cover/device manufacturers shall be as follows:
 - a. Appleton Electric Co.; "EDS, EFS, EPS and GUSC Series"
 - b. Crouse-Hinds; "EDS, EFD, EFS, FSPC and GUSC Series"
 - c. O-Z/Gedney; "EFS and EFD Series"

2.05 - JUNCTION AND PULL BOXES

- A. General Purpose:
 - General-purpose junction and pull boxes shall be constructed of stamped sheet steel. Minimum box size shall be 4" x 4" x 2-1/8". Box sizes shall have standard industry and manufacturer dimensions. Gangable boxes are not allowed. Conduit knockouts are allowed on these boxes.
 - a. Box covers, partitions, screws, etc. shall be of the same material as the box and shall be furnished and installed as required for a complete installation.
 - b. General purpose junction, pull and terminal boxes shall be as manufactured by: Appleton Electric Company, Raco, Steel City, or equal.
 - 2. Masonry boxes shall be as specified above, but shall be constructed specifically for installation in masonry block walls.
- B. NEMA 1 Boxes:
 - NEMA 1 boxes shall be used when stamped steel boxes are not available in the sizes required. NEMA 1 boxes shall be sized as shown on the Contract Drawings or, if not specifically dimensioned, as required per NEC requirements.
 - 2. Boxes shall be constructed of steel without conduit knockouts. Boxes shall be constructed as follows:

Maximum Dimension USS Gauge



Up to 24 inches	No. 16
Greater than 24 up to 36 inches	No. 14
Greater than 36 inches	No. 12

- 3. Box covers with weights of 10 pounds or greater shall have two (2) handles welded to the cover. Boxes may also be furnished with a door instead of a cover. If provided with a door, box door shall open 180° and shall have quarter turn or flush handle latches.
- 4. Box covers, doors, screws, partitions, etc., shall be of the same material as the box and shall be furnished and installed as required for a complete installation.
- 5. Boxes shall have ANSI 61 gray polyester powder finish inside and out.
- C. NEMA 12 Boxes:
 - 1. NEMA 12 boxes shall be sized as shown on the Contract Drawings or, if not specifically dimensioned, as required per NEC requirements.
 - 2. Boxes shall be constructed of steel without conduit knockouts and shall be gasketed.
 - 3. Boxes shall be constructed as follows:

Maximum Dimension	USS Gauge
Up to 24 inches	No. 16
Greater than 24 up to 36 inches	No. 14
Greater than 36 inches	No. 12

- 4. Box covers with weights of 10 pounds or greater shall have two (2) handles welded to the cover. Boxes may also be furnished with a door instead of a cover. If provided with a door, box door shall open 180° and shall have door clamps. Door shall be continuously hinged.
- 5. Boxes shall have ANSI 61 gray polyester powder finish inside and out.
- D. NEMA 4 Boxes:
 - 1. Cast junction and pull boxes shall be malleable iron or copper free aluminum with threaded hubs and integral mounting lugs. Copper-free aluminum boxes shall have an aluminum enamel finish. Malleable iron boxes shall have a zinc electroplate and aluminum enamel finish or epoxy powder coat. Finishes shall be applied after all machining.



- a. Covers shall be of the same material and finish as the box. All screws shall be stainless steel. All covers shall come with rubber or neoprene gasket. PVC coated boxes and covers shall be provided where required.
- b. Manufacturers and their particular products shall be as follows:
 - 1) Appleton Electric Co.; "GS, JB and SEH Series"
 - 2) Crouse-Hinds; "ARB, GRF, GS, VGR and VXF Series"
- c. It is the intention of these specifications to limit the use of cast junction and pull boxes to the types listed above. These types of boxes are generally used for lighting, receptacle, fire alarms, etc. type of circuits which usually have a conduit size of 1" or smaller. Where larger size pull or junction boxes are required in NEMA 4 areas, boxes as described below shall be used.
- 2. Non-Cast type NEMA 4 junction and pull boxes shall be sized as shown on the Contract Drawings or, if not specifically dimensioned, as required for NEC requirements.
 - a. Boxes shall be constructed of steel without conduit knockouts and shall be gasketed. Boxes shall be continuously welded.
 - b. Boxes shall have doors which open 180°, have stainless steel clamps and stainless-steel continuous hinge.
- E. NEMA 4X Boxes:
 - 1. 304 Stainless Steel
 - a. NEMA 4X junction and pull boxes shall be constructed of 304 stainless steel.
 - Boxes shall be continuously welded with no holes or knockouts. Boxes shall have seamless foam-in-place gasket, body stiffeners where required, stainless steel door clamps and continuous hinge.
 - c. Box doors and all exterior hardware shall be 304 stainless steel.
 - d. Boxes shall be unpainted. Boxes shall have smooth brushed finish.
- F. Explosion Proof Boxes:
 - 1. Explosion proof junction and pull boxes shall be constructed of cast iron or cast aluminum



with covers or doors of same material. Screws and bolts shall be stainless steel. Boxes shall be PVC coated where required.

- a. Boxes shall be rated for use in the hazardous area it is to be installed in
- b. Boxes shall be sized as shown on the Contract Drawings or, if not specifically dimensioned, as required per NEC requirements.
- c. Boxes, covers and doors shall have a polymer enamel finish.
- 2. PVC coated cast explosion proof boxes shall be as specified above except boxes, covers and doors shall be PVC coated. All boxes shall contain a neoprene gasket.
 - a. Cast explosion proof box manufacturers shall be as follows:
 - 1) Appleton Electric Co.; "DER, EJB, EXB, GUB and JBE Series"
 - 2) Crouse-Hinds; "DHE, EJB, EJH, and GU Series"
 - 3) O-Z Gedney; "IG, OFB and YG Series"
- G. Terminal Boxes:
 - Terminal boxes shall be identical to junction and pull boxes specified above for the following: NEMA 1 Boxes, NEMA 12 Boxes, NEMA 4 Boxes, NEMA 4X Boxes, Explosion Proof Boxes, or approved equal
 - 2. In addition to the above description, each terminal box shall have a steel panel with terminal blocks installed on mounting studs within the box.
 - 3. The steel panel shall be painted with white enamel and shall be at least one USS gauge size thicker than the box thickness.
 - 4. The terminal blocks shall be screw type, rated 600V, 20A minimum. Terminal blocks shall be phenolic, accept up to a #10 AWG wire and have a marking strip.

2.08 - WIRE TROUGH

- A. Wire trough shall be manufactured by SQUARE D or equal.
- B. Wire trough shall be completely enclosed with removable sealed front cover.
- C. Construction: Less than 8-inch square shall not be used. All wire troughs shall be 14-gauge.



D. Finish: ANSI-49 epoxy paint applied by cathodic electro-deposition paint process over a corrosion resistant phosphate preparation or stainless steel, as indicated in the schedule.

2.09 – ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT THREAD COMPOUND

A. KOPR-SHIELD or approved equal.

PART 3 - EXECUTION

3.01 – INSTALLATION OF CONDUITS

- A. Except as shown on the Contract Drawings, the minimum size conduit permitted is $\frac{3}{4}$ inch.
 - 1. Each length of conduit installed shall be free from blisters and other defects. Each piece installed shall be cut square, taper reamed, and a coat of sealing compound applied to threads. Threads on conduits shall be painted with a conducting compound prior to assembly. Conduit connections shall be screwed tight with only incomplete threads exposed. All conduit joints shall be made with standard couplings and the ends of the conduit shall butt tightly into the couplings. In exposed work only, where standard couplings cannot be used, only Erickson couplings are permitted, or as otherwise acceptable to the Engineer.
 - 2. Conduit threaded in the field shall have standard sizes and lengths. Conduit joints shall be cut square, threaded, reamed smooth, and drawn up tight so conduit ends will butt in couplings, connectors, and fittings.
 - 3. Secure conduits to all boxes and cabinets with double locknuts and bushings so system will be electrically continuous from service to all outlets.
 - 4. Install conduit in accordance with NECA Standard of Installation.
 - 5. Cap ends of conduits to prevent entrance of water and other foreign material during construction.
 - 6. Complete all conduit systems before pulling conductors.
 - 7. Minimum conduit depth shall be 18" below grade, measured to the top of the conduit on exterior underground installations.
- B. Support conduits under provisions of Section 16070, unless specifically described herein.
 - 1. Provide cable supports in conduits rising vertically in accordance with the National Electric



Code.

- 2. Provide No. 12 AWG copper pull wires or 250-lb tested polyethylene line in all empty conduits. Steel wire not acceptable as pull wire. Provide two foot slack at each end.
- 3. Install conduit to preserve fire resistance rating of partitions and other elements.
- C. Ground and bond conduit under provisions of Section 16060.
- D. Where neither length of conduit can be rotated, ERICKSON couplings Series 676 shall be used.
- E. Provide steel, or malleable iron nylon insulated bullet hub, Series 370-379, complete with recessed sealing "O" ring, in areas:
 - 1. Where enclosed and gasketed fixtures and weatherproof devices are specified;
 - 2. Where rigid conduit enters a sheet metal enclosure, junction box and outlet box, and not terminated in a threaded hub.
 - 3. Do not use die cast material.
- F. Where exposed conduits running overhead pass through building expansion joints, install flexible liquid tight conduit of same size with sufficient slack to allow conduits on either side of expansion joint to move a minimum of 3-inches in any direction. Provide supports as required on each side of expansion joint, all in accordance with seismic requirements of specific area.
 - 1. Failure to route conduit through building without interfering with other equipment and construction shall not constitute a reason for an extra charge. Equipment, conduit and fixtures shall fit into available spaces in building and shall not be introduced into building at such times and manner as to cause damage to structure. Equipment requiring servicing shall be readily accessible.
 - 2. Factory bent elbows or field bent elbows with approved tools may be used. Heating of conduit to facilitate bending is prohibited.
 - 3. Install exposed conduit either parallel or perpendicular to structural members, unless impractical. Group conduit wherever possible. Conduit shall be attached to structural components with approved supports spaced a maximum of six (6) feet apart and shall form a neat rigid installation. Conduit supported from building walls shall be installed with at least ¹/₄-inch clearance from the walls to prevent the accumulation of dirt and moisture behind the conduit.

- G. Conduit and/or conduit fittings shall not be welded together or to any steel structure; however, conduit supports may be welded to flanges of steel beams and columns in accordance with approved welding techniques and engineering practice in locations acceptable to the Owner.
- H. All conduits extending through the floor behind panels or into control centers or similar equipment shall extend a minimum of 6 inches above the floor elevations, with no couplings at floor elevation.
- I. All exposed conduits rising above finished floor elevation, excluding those encompassed by an equipment pad, shall be provided with a 4-inch high curb. Three (3) inches of cover shall be provided horizontally around the conduit.
 - Conduit installed in concrete or masonry walls shall be so arranged that a minimum of 3inches of covering be obtained. Spacings between conduits shall be sufficient to permit a complete filling with concrete or mortar without voids.
 - 2. Install conduit runs in such location as to avoid steam or hot water pipes. Provide a minimum separation of 12 inches where conduit crosses or parallels hot water or steam pipes.
- J. Install conduits containing instrumentation cable to provide the following clearances: Conduits installed parallel to conductors energized at 480 volts shall have a clearance of 18 inches and 208/120 volts shall have a clearance of 12 inches.
- K. Conduits installed at right angles to conductors energized at 480 Volts or 120/208 Volts shall have a clearance of six (6) inches.
- L. Where practicable, conduits containing instrumentation cable shall cross raceway-containing conductors of other systems at right angles.
- M. The cutting of walls or floors for conduit shall be kept to a minimum. Where such cutting is necessary, care shall be taken so as not to weaken the walls or floor involved. Beams or other structural supports shall not be cut under any condition.
- N. Protect conduit 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 and pull wire and cable. Before wire or cable is pulled, insulated bushings shall be installed at each end of the conduit.
- O. Conduit installation shall be arranged to minimize cleaning. No horizontal runs of conduit will be permitted on brick or masonry walls.



- P. When installing PVC coated rigid galvanized steel conduit use only a vise approved for PVC coated conduit. The use of a chain vise will not be permitted. Where PVC coated rigid galvanized steel conduit and fittings are specified, PVC coating damaged during transportation, loading, installation, etc. or cut during threading shall be repaired with the same type of covering obtained from and in accordance with the manufacturers recommendations.
- Q. Connections from rigid conduit to motors, limit switches, solenoid valves, level controls, etc. and all devices subject to vibration shall be made with short lengths of flexible metal conduit. These lengths shall be provided with appropriate connectors with devices that will provide an excellent electrical connection between equipment and the rigid conduit for the flow of ground current.
- R. Conduit Bodies and Fittings:
 - Install conduit bodies and fittings as necessary and where required, to complete the electrical conduit system. Conduit bodies and fittings shall also be installed wherever a pull point is necessary to keep the number of 90° bends in a conduit run to the maximum specified previously.
 - 2. Paint the threads of all conduit bodies and fittings with a conductive compound prior to assembly.
 - 3. Where all-thread nipples are used between fittings and electrical equipment, install nipples such that no threads are exposed.
 - 4. All conduit bodies and fittings shall be compatible in the environment installed.
 - 5. Seal fittings in explosion-proof areas where required in accordance with the NEC.
 - 6. The use of two (2) locknuts and a grounding bushing will be required at all conduit terminations where hub type fittings are not required.
 - 7. Provide weatherproof insulated throat Meyers hubs on all conduit entries to boxes and devices without integral hubs.
- S. Expansion Fittings: Install Expansion fittings in conduit runs wherever conduit crosses structural expansion joints, wherever conduits are attached between the two (2) separate structures, and wherever a conduit run is 100 feet or more in a single straight length.
- T. Grounding Bushings: Install grounding bushings wherever conduits enter equipment or enclosures without integral hubs. All grounding bushings within an enclosure or piece of equipment shall be bonded together with a ground cable.



- U. Support conduit using lay-in adjustable hangers, clevis hangers, and split hangers.
 - 1. Group related conduits and support using conduit rack. Provide space on each rack for 25 percent additional conduits.
 - 2. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 - 3. Do not attach conduit to ceiling support wires.
 - 4. Arrange conduit to maintain headroom and present neat appearance.
 - 5. Avoid moisture traps; provide junction box with drain fitting or breather at low points in conduit system.
- V. Conduits for submersible pump seal leak and motor overtemperature control wires shall be installed in separate conduits than the power conductors for the pump.
- W. Accurately record actual routing of all conduits.
- X. Do not use dissimilar strap or clamp support. Provide dielectric tape, fittings, straps, and bushings where dissimilar metals are used.
- Y. Where fittings for liquid-tight flexible conduit are brought into an enclosure with a knockout, a gasket assembly, consisting of one piece "O" ring, with a BUNA-R sealing material, Series 5200, shall be installed on outside of box. Fittings shall be made of either steel or malleable iron only, and shall have insulated throats or insulated bushings.
- Z. A copper ground wire sized in accordance with NEC shall be installed on the inside of the conduit as a jumper around flexible conduit to assure a continuity of ground.
- AA. Install a copper jumper across all flexible conduit including motors, fixtures, controls and other utilization equipment.
- BB. Install liquid-tight flexible conduit in such a manner as to prevent liquids from running on surface toward fittings.
- CC. Allow sufficient slack conduit to reduce the effect of vibration.
- DD. Complete all conduit systems before pulling the conductors.
- EE. Support in accordance with requirements of National Electric Code.



FF. All threaded conduits and fittings shall have KOPR-SHIELD compound applied to all threads prior to assembly.

3.02 – INSTALLATION OF BOXES

- A. General:
 - Mount all boxes rigidly and securely to the building structure or to supporting devices, which are rigidly and securely supported to the building structure. Boxes shall not be supported from suspended ceiling systems.
 - All boxes and supports, regardless of the location, shall be fastened with 304 stainless steel bolts and expansion shields on concrete or brick, with 304 stainless steel toggle bolts on hollow masonry units, and with stainless steel machine screws or welded studs on steelwork.
 - 3. Mount boxes with sides parallel or perpendicular to walls or equipment, such that the box is installed in a neat and professional manner.
 - 4. Install all boxes such that wiring within are accessible.
 - 5. Install blanking devices or threaded plugs in all unused holes.
 - 6. Install all boxes concealed in finished walls when possible.
 - 7. Set boxes so that front edges are flush with finished surfaces
- B. Locations and Sizes:
 - Box locations shown on the Contract Drawings are approximate. Box sizes shall be as dimensioned on the Contract Drawings, or, if not specifically dimensioned, as required by the NEC. Additional boxes required but not specifically shown shall be furnished and installed under this Contract.
 - 2. The equivalent number of 90 degree bends in a single conduit run is limited to the following:
 - a. Runs in excess of 300 feet: 0
 - b. Runs of 300 feet to 201 feet : 1



- c. Runs of 200 feet to 101 feet : 2
- d. Runs of 100 feet and less: 3
- 3. Boxes shall be furnished and installed wherever necessary to satisfy the above criteria.
- 4. Review all box sizes and locations with the Engineer prior to installation.
- C. Grounding:
 - 1. All boxes shall be grounded in accordance with NEC requirements.
 - 2. The use of two (2) locknuts and a grounding bushing will be required at all conduit terminations where hub type fittings are not required. Conduit grounding bushings within boxes shall be bonded together with jumper cables where box size or number of conduits warrants their use per NEC requirements.
- D. Terminal Boxes: In addition to all box requirements described above, terminal boxes shall have terminal blocks for boxes that contain control or signal wires which must be interconnected. Approximately 20 percent space terminals shall be provided (minimum of two [2]). Terminals shall be lettered or numbered to conform to the wiring diagrams.

SCHEDULE 16132-1 BOX & TROUGH SCHEDULE

- A. Box Classification For Glen Cove Wastewater Treatment Plant:
 - 1. General Purpose: Masonry walls.
 - 2. Cast: Masonry walls.
 - NEMA 1: The following areas fall under this classification: emergency generator enclosure, control room in Operations Building, MCC room in Operations Building, and Rest Room in Operations Building.
 - 4. NEMA 12: Not used.
 - 5. NEMA 4: Not used.
 - NEMA 4X Stainless Steel: Used in areas subject to weather, sunlight, humidity, moisture, or other areas defined by the Engineer. The following areas fall under this classification: All other interior and exterior locations, not specifically specified elsewhere in this paragraph.



- 7. NEMA 4X Fiberglass: Not Used.
- 8. PVC Coated Boxes: Where PVC is preferred over stainless steel by the Engineer.
- 9. NEMA 6P: Hazardous Areas, Class 1 Div. 1
- B. Identification: All pull boxes, junction boxes, and terminal boxes shall have a nameplate attached, which properly identifies the box. Nameplates shall be installed as specified in Section 16075 – Electrical Identification.

+ + END OF SECTION + +

PART 1 - GENERAL

1.01 - SCOPE

- A. Submit short-circuit and protective device coordination studies as prepared by the equipment manufacturer being furnished on the project. Third Party Studies Shall Not Be Acceptable.
- B. Furnish an Arc Flash Hazard Analysis Study in accordance with the requirements set forth in NFPA 70E *Standard for Electrical Safety in the Workplace*. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584-2002, the IEEE *Guide for Performing Arc-Flash Calculations*.
- C. The scope of the studies shall include new distribution equipment supplied under this Contract.

1.02 - REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 1. IEEE 141 Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
 - 2. IEEE 242 -Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
 - 3. IEEE 399 Recommended Practice for Industrial and Commercial Power System Analysis
 - 4. IEEE 241 -Recommended Practice for Electric Power Systems in Commercial Buildings
 - 5. IEEE 1015 Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
 - 6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations
- B. American National Standards Institute (ANSI):
 - 1. ANSI C57.12.00- Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
 - 2. ANSI C37.13- Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures



- 3. ANSI C37.010- Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
- 4. ANSI C 37.41-Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
- C. The National Fire Protection Association (NFPA)
 - 1. NFPA 70 -National Electrical Code
 - 2. NFPA 70E- Standard for Electrical Safety in the Workplace

1.03 - SUBMITTALS FOR REVIEW/APPROVAL

A. The studies shall be submitted to the Design Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the study may cause delays in equipment shipments, approval from the Engineer may be obtained for a preliminary submittal of data to ensure that the selection of device ratings and characteristics will be satisfactory to properly select the distribution equipment. The formal study will be provided to verify preliminary findings.

1.04 - SUBMITTALS FOR CONSTRUCTION

- A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. Submit electronic PDF copies of the report.
- B. The report shall include the following sections:
 - 1. Executive Summary including Introduction, Scope of Work and Results/Recommendations.
 - 2. Short-Circuit Methodology Analysis Results and Recommendations
 - 3. Short-Circuit Device Evaluation Table
 - 4. Protective Device Coordination Methodology Analysis Results and Recommendations
 - 5. Protective Device Settings Table
 - 6. Time-Current Coordination Graphs and Recommendations
 - 7. Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc



Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.

- 8. Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images.
- 9. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current a each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

1.05 - QUALIFICATIONS

- A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer (RPEE) skilled in performing and interpreting the power system studies.
- B. The RPEE shall be an employee of the equipment manufacturer or an approved engineering firm.
- C. The RPEE shall have a minimum of five (5) years of experience in performing power system studies.
- D. The engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analyses it has performed in the past year.
- E. The engineering firm shall have a minimum of twenty-five (25) years of experience in performing power system studies.
- F. The vendor supplying the Arc Flash Hazard Analysis shall offer instructor led and online NFPA 70E training classes.

1.06 - COMPUTER ANALYSIS SOFTWARE

A. The studies shall be performed using SKM Systems Analysis Power*Tools for Windows (PTW) software program.

PART 2 - PRODUCT

2.01 - STUDIES

A. Furnish an Arc Flash Hazard Analysis Study in accordance NFPA 70E -Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D. This study shall also include short-circuit and protective device coordination studies.

2.02 - DATA

- A. Furnish all data required for the power system studies. The RPEE performing the short circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the Contract. Expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
- B. Source combination may include present and future motors and generators.
- C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.
- D. If applicable, include fault contribution of existing motors in the study. Obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.03 - SHORT-CIRCUIT ANALYSIS

- A. Transformer design impedances shall be used when test impedances are not available.
- B. Provide the following:
 - 1. Calculation methods and assumptions
 - 2. Selected base per unit quantities
 - 3. One-line diagram of the system being evaluated that clearly identifies individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis
 - 4. The study shall include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios,



motor contributions, and other circuit information as related to the short-circuit calculations.

- 5. Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings and notes regarding adequacy or inadequacy of the equipment rating.
- 6. Results, conclusions, and recommendations. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.
- C. For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.
- D. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to short circuit ratings
 - 2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short circuit stresses
 - 3. Square D shall notify Owner in writing, of any circuit protective devices improperly rated for the calculated available fault current.

2.04 - PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

- A. Protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.
- B. Include on each TCC graph, a complete title with descriptive device names.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
- D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the TCC graphs, where applicable:
 - 1. Electric utility's overcurrent protective device
 - 2. Medium voltage equipment overcurrent relays

- 3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
- 4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
- 5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
- 6. Medium voltage conductor damage curves
- 7. Ground fault protective devices, as applicable
- 8. Pertinent motor starting characteristics and motor damage points, where applicable
- 9. Pertinent generator short-circuit decrement curve and generator damage point
- 10. The largest feeder circuit breaker in each motor control center and applicable panelboard.
- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.
- G. Provide the following:
 - 1. A One-line diagram which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
 - 2. A sufficient number of log-log plots to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
 - 3. Computer printouts shall accompany the log-log plots and contain descriptions for each of the devices shown, settings of the adjustable devices, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
 - 4. The study shall include a separate, tabular printout containing the recommended settings of all adjustable overcurrent protective devices, the equipment designation where the device is located, and the device number corresponding to the device on the system oneline diagram



- 5. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
- 6. A discussion of any significant deficiencies in protection and/or coordination. Provide recommendations for improvements.

2.05 - ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04)
- B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- C. Circuits 240V or less fed by single transformer rated less than 125 kVA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E.
- D. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.
- E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations
- F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

- G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:
 - 1. Fault contribution from induction motors should not be considered beyond 5 cycles.
- H. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.
- I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.
- L. Provide the following:
 - Submit results of the Arc-Flash Hazard Analysis in tabular form, and include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
 - 2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
 - 3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.



PART 3 - EXECUTION

3.01 - FIELD ADJUSTMENT

- A. Complete field adjustments under the Startup and Acceptance Testing contract portion of project specifications.
- B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- C. Notify Owner in writing of any required major equipment modifications.

3.02 - ARC FLASH LABELS

- A. Provide 4.0 in. x 4.0 in. Brady thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. The labels shall be designed according to the following standards:
 - 1. UL969 Standard for Marking and Labeling Systems
 - 2. ANSI Z535.4-Product Safety Signs and Labels
 - 3. NFPA 70 (National Electric Code)-Article 110.16
- C. The label shall include the following information:
 - 1. System Voltage
 - 2. Flash protection boundary
 - 3. Personal Protective Equipment category
 - 4. Arc Flash Incident energy value (cal/cm²)
 - 5. Limited, restricted, and prohibited Approach Boundaries
 - 6. Study report number and issue date
- D. Labels shall be printed by a thermal transfer type printer, with no field markings.
- E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:

- Floor Standing Equipment Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
- 2. Wall Mounted Equipment-Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
- General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.
- F. The technician installing labels shall have completed an 8-Hour instructor led Electrical Safety Training Course with includes NFPA 70E material including the selection of personal protective equipment.

3.03 - ARC FLASH TRAINING

A. The RPEE that prepared the Arc Flash Hazard Analysis shall train the Owner's qualified electrical personnel of the potential arc flash hazards, associated with working on energized equipment (minimum of 4 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent. The trainer shall be an authorized OSHA Outreach instructor.

+ + END OF SECTION + +


PART 1 - GENERAL

1.01 - SECTION INCLUDES

- A. Provide all labor, equipment and material necessary to furnish, install, and test variable frequency drives complete, in place, as shown on the Contract Drawings, as specified herein and approved by the Engineer.
- B. The following equipment shall be provided with variable frequency drives and shall function as specified herein:
 - Four (4) Dry Submersible Pumps (RSP-1, RSP-2, RSP-3, and RSP-4). Speed control at Dry Submersible Pump Control Panel (remote) and at the VFD enclosure (local position). The control panel will be provided with a PLC program that will allow the operator to vary the speed based on the influent flow. The control panel will generate a proportional 4-20mA signal that shall be used to set the Dry Submersible Pump speed.
- C. Control panel designated as the Dry Submersible Pump Control Panel shall be furnished by the General Contractor for installation by the Electrical Contractor. Prepare point-to-point interconnection wiring diagrams as specified in Section 16010 and coordinate and manage the VFD manufacturer so as to form unified, properly functioning variable speed systems.

1.02 - REFERENCES

- A. 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.
- B. ANSI/NFPA 70 National Electrical Code.
- C. Underwriters Laboratories, Inc. (UL) No. 845, Motor Control Centers, Electric.

1.03 – QUALITY ASSURANCE

- A. Comply with ANSI, IEEE, NEMA, UL, and all applicable Federal, State and municipal codes including revisions to date of Contract.
- B. 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 may such devices as are required to complete the installation.
- C. Qualifications of Manufacturers:



1. 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.

1.04 – COORDINATION

- A. Coordinate the work of this Section as it relates to supplying a complete variable frequency drive system for submersible pumps.
- B. Comply with the requirements contained in Section 013100 and Section 16010.
- C. Review installation procedures under other Sections and contracts and coordinate them with the work specified herein.
- D. Provide VFD manufacturer with shop drawings of the Dry Submersible Pump Control panel for the purposes of providing a complete and functional system. The manufacturer shall be responsible for the design, fabrication and supply of VFD's compatible with the pump equipment and controls.
- E. The VFD supplier shall furnish point-to-point interconnection wiring diagrams for approval by the Engineer prior to fabrication.

1.05 - FACTORY TESTS

- A. Perform all factory testing (shop tests) as specified herein.
- B. Before shipment, perform factory testing at the manufacturer's facility to verify that system components are functioning properly and that they meet the functional and performance requirements of the Contract Documents. All necessary personnel, equipment, facilities, temporary wiring, and incidentals required for testing shall be provided by the Contractor.
- C. Submit information on factory testing procedures to verify that testing will fulfill the requirements as specified herein. Submittal shall be made at least two (2) months in advance of any scheduled testing and shall include dates of scheduled tests.
- D. Notify Engineer in writing at least four (4) weeks before expected initiation of tests. Factory testing of all VFD panels, enclosures, disconnects, VFD software, and communications shall be witnessed by Owner and Engineer, if desired. Cost of lodging, meals, and travel for the Owner and Engineer are not to be included in the bid price. However, if factory tests are not performed satisfactorily on the agreed date as a result of Contractor's or manufacturer's action, those costs will be borne by the Contractor. The presence of Owner and Engineer during testing does not relieve the Contractor from conforming to the requirements of the Contract Documents and shall



in no way imply acceptance of the equipment. The Owner and Engineer reserve the right not to attend factory tests.

- E. The factory test shall not begin until all related VFD Shop Drawings have been submitted and approved.
- F. All system hardware components shall be tested to verify proper operation of the equipment as stand-alone units. Test shall include, but not be limited to, the following:
 - 1. System Checks:
 - a. Input / Output current test.
 - b. Input voltage test.
 - c. Ground fault test.
 - d. Short circuit test.
 - 2. Verify Operator interface communication properties.
 - 3. Verify automatic operation of process trip circuits.
 - 4. Dynamic System Testing:
 - a. Test drive at 110% full load for one (1) hour at ambient temperature.
 - b. Input / Output current unbalance test.
 - VFD's shall not be shipped from the factory until two copies of certified factory test reports indicating satisfactory performance have been submitted to and approved by Engineer. Factory test reports shall include the following information:
 - a. List of tests performed.
 - b. Certified check lists or documentation verifying all sub-systems has been tested, as specified above.
 - c. Documentation verifying all VFD panel wiring has been checked.
 - d. List of required modifications or corrections identified during the Factory Test and corrective action taken.



e. Factory test reports shall be signed and dated by an authorized representative of the VFD drive and the Contractor.

1.06 – SUBMITTALS

- A. Comply with the requirements contained in Section 01300. Submit the following:
 - 1. Product Data: Manufacturer's specifications and other data demonstrating compliance with these specifications.
 - 2. Submit the following information pertaining to the manufacturer(s):
 - a. Certification that manufacturer has been producing the product for a minimum of five (5) years.
 - b. Complete literature, performance and technical data describing the proposed equipment and listing of items made by the manufacturer.
 - c. Location of closest service office from which this equipment shall be serviced.
 - d. Location of closest parts inventory for item installation.
 - 3. Schematic wiring diagrams for drive units.
 - 4. Point-to-point interconnection wiring diagrams.
 - 5. Complete shop drawings of all work of this Section, showing dimensions and locations of all items including supporting structures and clearance requirements.
 - 6. Samples and Test Reports: Submit for review and approval samples of materials, supporting data, and testing methods and results for all materials and tests specified in this Section in accordance with Articles GC 15 and GC 16 of the General Conditions.
 - 7. Operation and Maintenance Manuals: Within thirty (30) days after receiving approved shop drawings, and on a condition of its acceptance, submit the materials compiled in accordance with the provisions of Section 01730.
 - 8. Drive submittal shall include any derating required for the selected carrier frequency and the recommended default frequency. Submittal will be rejected and returned for revision and resubmittal if this information is not provided.



1.08 – MANUFACTURER SUPPLIED FIELD SERVICES

- A. Supply and credit to the Owner the costs for field services as specified in Section 01660 Quality Control.
- B. Provide the following field services in accordance with the requirements contained in Section 017500 Starting and Adjusting:
 - 1. Five (5) days totaling five (5) trips once the system has been installed to check the completed installation, make all necessary adjustments, startup the system, provide operations and maintenance instruction to the Owner, and otherwise place the system into permanent, fault free operation as specified in Section 01700 Starting and Adjusting.
- C. Manufacturer's representative, after initial field startup, shall remove all logic PC boards and install, and adjust, a spare set of PC boards. These boards shall remain in the drives and the initial boards shall be provided as spares to the Owner.

1.09 - WARRANTY

A. Provide a Warranty Certificate 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:

"We, (MANUFACTURER) guarantee all components of the system specified in Section 16260 for the Glen Cove Wastewater Treatment Facility specifications 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.

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 replacement or repair of parts normally consumed in service shall include pilot light bulbs and lubrication. These parts only shall be considered as part of routine maintenance and upkeep and shall not be considered eligible for exchange free of charge under this Warranty.



Agreed upon this	day		
•	(DATE)		
by	of		
(NAME OF AUTHORIZED AGENT)			
	, who,		
(NAME OF MANUFACTURER)			
by signing this document, affirms that he/she is legally authorized to submit this warranty on behalf of the manufacturer.			
AUTHORIZED SIGNATURE	DATE		

NOTARY

1.10 - DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements contained in Section 01610 – Product Storage and Handling Requirements.

1.11 - EXTRA MATERIALS

- A. Provide three of each fuse size and type.
- B. Provide one complete set of spare logic boards for each system provided.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Variable frequency drives shall be Yaskawa IQPump.
- B. Variable frequency drives shown on drawings are based on Yaskawa IQPump
- C. Substitute Manufacturer shall be responsible to fit drive to dimension of MCC detailed on the drawings.

2.02 - 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.

2.03 - 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).

2.04 - VARIABLE SPEED DRIVE RATINGS

- A. Voltage: 460V AC +-10%
- B. Frequency: 57 to 63 Hz
- C. Phase: 3-phase
- D. Motor Horsepower: Provide minimum HP for all drives as indicated on Drawings.
- 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

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- N. Intermittent Overload Capability: Programmable MOPC from 50 to 150% of rated output current for up to 1 minute maximum
- 0. 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. Overtorque 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.

2.05 - 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 phaseto-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
 - 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.

2.06 – DRIVE AND MCC FEATURES

- A. Operator Interface with Display: Each VFD shall include an operator interface with digital display to set VFD parameters and motor speed and to indicate output voltage, output frequency, and output current. Display shall be flush mounted on the MCC section enclosure door containing the VFD unit.
- B. Elapsed Time Meter: LED type flush mounted on the MCC section enclosure door containing the VFD unit.
- C. A separate line voltage monitor shall be included in the motor control center for each motor to interlock motor when either undervoltage, overvoltage phase loss or phase reversal occurs.
- D. Input Signal: All units shall be furnished to accept a 4- 20 mA control signal.
- E. Disconnecting Means: Include integral circuit breaker on the line side of each controller.
- F. Each MCC section containing the VFD unit shall be equipped with the following:
 - 1. 0 to 30 mA D.C. ammeter to monitor 4-20 mA input signal from PID controller, $(3-1/_2)$ square minimum).
 - Two position selector switch marked "DRIVE / BYPASS". When placed in the "DRIVE" position the motor shall start via the VFD. When placed in the "BYPASS" position the motor shall start via a bypass motor starter installed within the same MCC section as the VFD.
 - 3. Ammeter and four position phase selector switch
 - 4. Power on push-to-test white pilot light mounted on the MCC section enclosure door.

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- 5. VFD fault push-to-test amber alarm pilot light mounted on the MCC section enclosure door.
- 6. VFD run push-to-test amber alarm pilot light mounted on the MCC section enclosure door.
- 7. Overload push-to-test amber alarm pilot light mounted on the MCC section enclosure door.
- 8. Overload fault reset pushbutton mounted on the MCC section enclosure door.
- 9. 0-10 units D.C. analog amp meter to represent the motor speed in percent of full speed.
- 10. Isolation contactor, output contactor and bypass contactor (NEMA Rated)
- 11. Auxiliary NO and NC contacts
- 12. Lightning/surge arrestor with individual line-to-line and individual line to ground protection. Clamping voltage levels shall be specifically sized for the applied system voltage.
- 13. Pilot lights and switches shall be door mounted as part of a door mounted control station. The control station shall be removable for the purpose of mounting and wiring the pilot devices. Contact blocks of the pilot devices shall be mounted in a recessed control station housing to minimize the hazard of accidental contact when the unit door is opened.
- 14. Each MCC section equipped with a VFD shall be equipped with a large capacity cooling fan with finger guard to increase air circulation within the section.
- B. Provide solid-state overload relay on load side of bypass contactor and thermal overload relay on load side of output contactor as specified in Section 16455.
- C. Fast acting fuses on load side of main circuit breaker sized in accordance with manufacturers recommendations.
- D. Isolated 4-20 mA input for follower signal input.
- E. 4-20 mA scaled output proportional to drive speed. Input to PLC.
- F. Drive shall have three inputs for preset speeds initiated by remote contacts.
- G. Drive shall have speed contacts to close when speed is reached and be input to the PLC.
- H. Each variable speed drive have the following:

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- 1. Dynamic Braking Module and Resistor. Resistors shall be mounted at the top of the MCC. The dynamic brake module shall be inside the MCC.
- 2. Broad Band Harmonic Filter for compliance with IEEE 519.
- I. A critical speed avoidance circuit shall be included for the selection of three critical speeds with a rejection band centered on that speed. The drive shall ignore any speed signals requiring drive operation within the rejection band.
- J. PID (Proportional-Integral-Derivative) process controller shall be included, and shall be provided with a menu driven selection and programming via door-mounted keypad.
 - 1. Provide Acceleration/Deceleration time separately adjustable from 2 to 60 seconds. Set both initially at 45 seconds.
 - 2. When called upon to stop, the motor shall decelerate to minimum speed before stopping.
 - 3. Auto restarting after controller faults shall function in the "Auto" mode, and shall disable the drive after a pre-determined number of faults have occurred.
 - 4. The number of automatic restarts shall be set based on the on specific experience or equipment manufacturer's recommendations.
- K. Each VFD shall include a comprehensive microprocessor based digital diagnostic system that monitors its own control functions and displays faults and operating conditions.
- L. Microprocessor systems must be products of the same manufacturer as the VFD (to assure single source responsibility, availability of service and access to spare parts).

2.07 – VARIABLE SPEED DRIVE FILTER NETWORK

- A. Interface between the outputs of the PID controllers and the variable speed drive analog inputs shall be provided with custom designed filter networks to attenuate both common mode and normal mode voltage transients induced by the drives.
- B. Filter networks shall be Model No. ECC-0231 as manufactured by Eagle Control Corporation, Yaphank, New York or approved equal.

2.08 - FABRICATION

A. Wiring Terminations: Match conductor materials and sizes indicated.



- B. Enclosure: NEMA 250, Open Type.
- C. Finish: Manufacturer's standard enamel.

2.09 - SOURCE QUALITY CONTROL

- A. Inspect and production-test each product specified in this Section.
- B. Test shall include simulated operation.
- C. Notify Engineer at least five (5) days prior to test. Owner or Engineer may witness test.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Controllers shall be factory installed in the motor control center by the MCC manufacturer. Install controller in accordance with manufacturer's written instructions and NEMA ICS 3.1.
- B. Tighten accessible connections and mechanical fasteners after placing controller. Install fuses in fusible switches.
- C. Select and install overload heater elements in controllers to match installed motor characteristics.
- D. Provide engraved plastic nameplates as specified in Section 16075 Identification for Electrical Systems.
- E. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full, load amperes, code letter, service factor, and voltage/phase rating.

3.02 - ADJUSTING

A. Make final adjustments to installed drive to assure proper operation of system. Obtain performance requirements from installer of driven loads.

3.03 - DEMONSTRATION

- A. Demonstrate operation of controllers in automatic and manual modes.
- B. Provide the services of the manufacturer's trained personnel to completely check the VFD system installations and adjust the drive for operation.



+ + END OF SECTION + +



PART 1 - GENERAL

1.01 – SCOPE OF WORK

A. This Section includes all labor, equipment, and materials necessary to furnish and install solid state reduced voltage motor controllers herein referred to as soft starts.

1.02 - REFERENCES

- A. 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.
- B. ANSI/NFPA 70 National Electrical Code.
- C. Underwriters Laboratories, Inc. (UL) No. 845, Motor Control Centers, Electric.

1.03 – QUALITY ASSURANCE

- A. The soft start motor starter shall be listed by an independent testing laboratory in accordance with Electric Industrial Control Equipment Specification UL508.
- B. The soft start shall carry the CE mark for indication of compliance to low voltage and EMC directives.
- C. The manufacturer shall be a certified ISP 9002 facility.
- D. The equipment shall be manufactured by Siemens/Furnas.
- E. The brand name product specified was chosen based on past performance and constitute a standard for quality and performance for the specific purpose for which it is intended. Products other than that specified will be considered for use under the provisions set forth as follows:
 - The named products constitute the "Base Bid" system. 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 Section 012500 - Product Options regarding product substitutions.
 - 2. If an alternate unit 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 fifteen (15) calendar days prior to the date set for the bid opening. The pre-bid "Evaluation Documentation" shall consist of the following:

- 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. Equipment cuts showing dimensional data for all enclosure components.
- 3. The Supplier shall state if he/she is in compliance 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.
- 4. Failure to submit the above listed information fifteen (15) 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.
- F. The Engineer will issue an addendum of approved products prior to the date set for the bid opening.
- G. 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.
- H. After Contract execution, the Contractor shall submit shop drawings of the system as specified herein and in compliance with the requirements contained in Section 01300 - 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 utilization of substitute equipment. Refer to Section 01600 - Product Options for costs associated with redesigns and/or modifications caused by the use of a substitute product offered by the Contractor.
- I. All costs, including other prime contractor, engineering, and legal costs, associated with accommodating alternate equipment shall be borne by the Contractor.



1.04 - WARRANTY

A. The equipment furnished under this Section shall be free of defects in design, workmanship, and materials for a period of one (1) year commencing on the date that the equipment was placed in fault free operation. The manufacturer shall repair or replace a defective component during the warranty period free of all charges, including labor.

1.05 - SUBMITTALS

- A. Submit product data under provisions of Section 01300.
- B. Technical data including, but not limited to electrical ratings, dimensions, mounting, material, running overcurrent protection, branch circuit overcurrent protection, wiring diagrams and accessories.
- C. Operations and Maintenance Manuals prepared in accordance with the requirements contained in Section 01730.

1.06 – RECORD DRAWINGS

A. Comply with the requirements contained in Section 01720.

1.07 – MANUFACTURER SUPPLIED FIELD SERVICES

- A. The Supplier shall supply and credit to the Owner the costs for field services as specified in Section 01660 Quality Control.
- B. The following field services shall be provided as a minimum in accordance with the requirements contained in Section 01650 Starting a System:
 - 1. Three (3) days totaling three (3) trips once the system has been installed to check the completed installation, make all necessary adjustments, startup the system, provide operations and maintenance instruction to the Owner, and otherwise place the system into permanent, fault free operation as specified in Section 017500 Starting and Adjusting.
 - 2. Two (2) days, two (2) trips, approximately three (3) and six (6) months after system startup to review the operation with the Owner and the Engineer and to make system adjustments, as necessary. Dates shall be selected by the Owner and may be used by the Owner any time within a one-(1) year period from the date of initial startup.



PART 2 – PRODUCTS

2.01 - MANUFACTURERS

- A. Full Voltage Non-Reversing and Reversing (FVNR):
 - 1. SIEMENS, Class 14.
 - 2. Specifically approved equal.

2.02 - MOTOR STARTERS

- A. Motor starters shall have the following features:
 - 1. Enclosed type as shown on the Drawings.
 - Circuit breakers within the motor controller enclosures shall have external operating handles with lock-open padlocking provisions and shall indicate the ON and OFF positions.
 - 3. Motor Control Circuits:
 - a. Shall operate at not more than 120 volts.
 - b. Shall be grounded except as follows:
 - 1) Where isolated control circuits as shown.
 - 2) Where manufacturers of equipment assemblies recommend that the control circuits be isolated.
 - c. Incorporate a separate, heavy duty, control transformer within each motor controller enclosure to provide the control voltage for each motor operating over 120 volts.
 - d. Incorporate overcurrent protection for control power transformers in accordance with NFPA 70.
 - 4. Overload Current Protective Devices:
 - a. SIEMENS, Solid State Model ESP100 overloads for all contactors including bypass contactors. Provide only SIEMENS thermal overloads on all output contactors for variable speed drives.



- b. One for each pole.
- c. Manual reset on the door of each motor controller enclosure to reset Motor from any condition which tripped motor, such as high pressure, overload or incomplete valve cycle.
- d. Correctly sized for the associated motor's rated full load current.
- 5. Provide three (3) N.C. and (3) N.O. auxiliary contacts, H-O-A,O-C-A, sequence selectors selector switches, pilot lights, and other devices and accessories as shown on the Drawings for each starter.
- 6. Elapsed non-resettable time meters as indicated on the Drawings. Manufactured by Fourth Dimension, 2-1/2" diameter minimum.
- 7. Ammeters and 4 position phase selector switch (3-1/2" Square minimum) as manufactured by SIMPSON.
 - a. Well No. 15-1 and 15-2: 0-200 amps.
 - b. Boosters A, B, & C: 0-150 amps.
 - c. Blower A: 0-50 amps.
- 8. Provide current and potential transformers for all three phases for ammeters and voltmeters.
- 9. Voltmeters and seven position selector switch (3 1/2" square minimum) as manufactured by SIMPSON.
- 10. Enclosures:
 - a. NEMA Type 1.
 - b. Where the types of motor controller enclosures are not indicated, they shall be the NEMA types which are the most suitable for the environmental conditions where the motor controllers are being installed.
 - c. Doors mechanically interlocked to prevent opening unless the breaker or switch within the enclosure is open.



- d. Thoroughly clean and paint the enclosures at the factory with manufacturer's prime coat and standard finish.
- 11. LED Pilot lights shall be press-to test 30.5 mm Heavy Duty Oiltight pushbuttons.
- 12. Pushbuttons and selector switches shall be 30.5 mm Heavy Duty Oiltight.
- B. Motor controllers incorporated with equipment assemblies shall also be designed for the specific requirements of the assemblies.

2.03 - FULL VOLTAGE STARTERS

- A. All Full Voltage Starters shall be NEMA rated for the load it serves.
- B. Manufacturers: SIEMENS, Class 14.

2.04 - MISCELLANEOUS CONTROLS AND EQUIPMENT

A. Provide phase failure/phase reversal relays and voltage sensitive relays for undervoltage and overvoltage protection for all phases. Relays shall be SIEMENS, or approved equal. The Contacts for these relays shall be in series with all Motor Starter Control Circuits.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Installation shall be in accordance with NFPA 70 and as shown on the Drawings.
- B. All starters shall be factory installed in the Motor Control Center.

+ + END OF SECTION + +



PART 1 – GENERAL

1.01 – SECTION INCLUDES

A. Magnetic motor starters.

1.02 – REFERENCES

- A. NFPA 70 National Electrical Code.
- B. NECA "Standard of Installation," published by National Electrical Contractors Association.
- C. NEMA ICS 2 Industrial Control Devices, Controllers and Assemblies.
- D. NEMA ICS 6 Enclosures for Industrial Controls and Systems.
- E. NEMA KS 1 Enclosed Switches.

1.03 - SUBMITTALS

- A. Refer to drawing for starter sizes on schedules.
- B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- C. Test Reports: Indicate field test and inspection procedures and test results.

1.04 – QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.05 – RELATED SECTIONS

A. Section 16070 – Supporting Devices.

1.06 – QUALITY ASSURANCE

A. Perform work in accordance with NEMA ICS 2.3.

1.07 – REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.



B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.08 – EXTRA MATERIALS

A. Ten (10) spare LED pilot light bulbs.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. SIEMENS, Class 17.
- B. Substitutions: Under provisions of Section 01600.

2.02 - AUTOMATIC CONTROLLERS

- A. Combination Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- B. Motor starters shall be NEMA rated.
- C. Coil operating voltage: Coordinate voltage required with equipment to be installed and associated contractor(s).
- D. Auxiliary contacts: NEMA N/O Contacts rated up to 10 Amp. SIEMENS Model No. 49AAFO.
- E. Overload Relay: NEMA ICS; melting alloy overload.
- F. Enclosure: As shown in contract drawings.
- G. Circuit Breaker Disconnect Switch with external lockable handle.

2.03 - PRODUCT OPTIONS AND FEATURES

- A. Auxiliary Contacts: NEMA ICS 2, 1 each normally open/closed contacts.
- B. Motor Running and overload indication lights. LED Pilot lights shall be heavy duty 30.5 mm oiltight press-to-test by SIEMENS or equal.
- C. Selector Switches: Hand-off-automatic selector switch shall be heavy duty 30.5 mm oiltight by SIEMENS or equal.



D. Manual reset push button for overload.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Install enclosed controllers size as indicated, on starter schedule, in accordance with manufacturer's instructions.
- B. Install enclosed controllers plumb and level in locations indicated on drawings. Provide supports in accordance with Section 16070.
- C. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- D. Provide engraved plastic nameplates for each starter.
- E. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor and voltage/phase rating.

+ + END OF SECTION + +



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PART 1 - GENERAL

1.01 - SECTION INCLUDES

- A. Disconnect switches.
- B. Fuses.
- C. Enclosed Circuit Breakers.

1.02 - REFERENCES

- A. NEMA KS-1 Enclosed Switches.
- B. ANSI/UL 198C High Intensity Capacity Fuses, Current Limiting Types.
- C. ANSI/UL 198E Class R Fuses.
- D. FS W-S 865 Switch, Box (Enclosed), Surface Mounted.
- E. NEMA AB1 Molded Case Circuit Breakers.

1.03 - SUBMITTALS

- A. Submit product data under provisions of Section 01300.
- B. Include outlet drawings with dimensions and equipment ratings for voltage, capacity, horsepower and short circuit current ratings.

1.04 - RELATED SECTION

A. Section 16075- Electrical Identification.

1.05 - COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 - DISCONNECT SWITCHES

A. Disconnect switches shall be GENERAL ELECTRIC, heavy-duty Type TH or approved equal.

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- B. 75°C conductor ratings.
- C. Ratings: 600VAC
- D. Quick-break, quick-make, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- E. Suitable for use as service entrance equipment.
- F. Class R 200,000 RMS amps, symmetrical IC.
- G. Class R fusing kit.

2.02 - FUSES

- A. Fuses shall be Littlefuse KLNR Class RK1 or approved equal.
- B. Fuses shall be rated for 600 volts AC.
- C. Interrupting Rating: 200,000 RMS amps.

2.03 - MOLDED CASE CIRCUIT BREAKERS

- A. Install molded case circuit breakers for Main Circuit Breaker, Generator Circuit Breaker and Panel Circuit Breakers.
- B. Molded Case Circuit Breaker:
 - 1. Manufacturer: SIEMENS
 - a. 125 Amp, 3 Pole Type ED6.
 - b. 250 Amp, 3 Pole Type HFD6.
 - c. 400Amp, 3 Pole Type HJD6.
 - d. 600Amp, 3 Pole Type HLD6.
 - e. 800Amp, 3 Pole Type HMD6.
 - 2. AIC Rating: 65,000
 - 3. Thermal magnetic with interchangeable trip



C. Enclosure

- 1. Manufacturer: SIEMENS
- 2. Rating: NEMA 1 (for interior use) or NEMA 4X Stainless Steel (for exterior use).
- 3. External Throw.
- 4. Suitable for Service Entrance Equipment (where applicable).

2.04 - EXTRA MATERIALS

A. Provide one complete set based on number of poles of spare fuses for each fused disconnect switch. Provide to Owner.

PART 3 - EXECUTION

3.01 - INSTALLATION REQUIREMENTS

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Removed temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Provide switches/enclosed circuit breakers at locations as indicated on drawings.
- D. Refer to disconnect switch schedule on drawings for ampacity ratings, fuse sizes, number of poles and enclosure ratings.
- E. Install fuses in fusible devices.
- F. Install engraved nameplates on each switch and enclosed circuit breaker identifying the following:
 - 1. Switch designated.
 - 2. Load served.
 - 3. Power origination.
 - 4. Fuse size as indicated on drawings.



3.02 - ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit breaker trip ranges.

+ + END OF SECTION + +



PART 1 - GENERAL

1.01 - SECTION INCLUDES

- A. Motor Control Centers (MCC's).
- B. The MCC's included under this Section shall include, but not be limited to the following: main disconnect device, solid state motor starters and their bypass contactors, variable frequency drives, across the line motor starters, controls, feeder disconnecting devices, control wiring and interlocking.
- C. The MCC shop drawings shall not be submitted until the generator connection cabinet and variable frequency drives submittals have been found to be in general compliance with the Contract Documents. The MCC shop drawings shall be based on the use of the approved equipment. Coordinate the factory fabrication of the MCC by arranging for the factory wiring and installation of all equipment at the MCC manufacturer's factory.

1.02 - REFERENCES

- A. 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.
- B. ANSI/NFPA 70 National Electrical Code.
- C. ASTM D 178 Specification for Rubber Insulating Matting.
- D. Underwriters Laboratories, Inc. (UL) No. 845, Motor Control Centers, Electric.

1.03 - SUBMITTALS

- A. Submit under provisions of Section 01330:
 - 1. Include electrical ratings, dimensions, mounting, material, running overcurrent protection, branch circuit overcurrent protection, wiring diagrams and accessories.
 - 2. Provide detailed control drawings on 24" x 36" sheets for all motor controls that shall include all interface wiring between motor controls.
 - Provide point-to-point wiring diagrams showing interface between motor controls and instrumentation components and control panels furnished as work of other construction contracts. Refer to Section 16010 for additional information concerning the submission of



point-to-point wiring diagrams.

- 4. Provide detailed scaled ½ inch = 1 foot drawings of motor control center including instrumentation and control drawings on 24" x 36" sheets for floor plans showing MCC layout, locations and clearances.
- 5. Provide detailed scaled ³/₄ inch = 1 foot elevation drawings of motor control center including instrumentation and controls. Elevation drawings shall show all switches, pilot lights, timers, keypads, timers and meters including scaled locations of all knockouts and cutouts on exterior of enclosures.
- 6. Provide detailed scaled ³/₄ inch = 1 foot elevation drawings of motor control center including instrumentation and controls for interior mounting of all equipment. Drawings shall show scaled locations of all drives, starters, contactors, relays, protective devices, circuit breakers, fuses, wiring, timers, terminal blocks and cable connection points.
- 7. Provide catalog cuts for every device type, including pilot lights, switches, timers, breakers, fuses, meters, protective devices, located within the MCC.
- B. Submit operations and maintenance manuals prepared in accordance with the requirements contained in Section 01700.
- C. Submit the following information pertaining to the manufacturer(s):
 - 1. Certification that manufacturer has been producing MCCs for a minimum of ten (10) years.
 - 2. Complete literature, performance and technical data describing the proposed equipment and listing of items made by the manufacturer.
 - 3. Location of closest service office from which this equipment shall be serviced.
 - 4. Location of closest parts inventory for item installation.
- D. The MCC supplier shall furnish point-to-point interconnection wiring diagrams for approval by the Engineering prior to fabrication.

1.05 – QUALITY ASSURANCE

- A. Comply with ANSI, IEEE, NEMA, NEC, UL, and all applicable Federal, State and municipal codes.
- B. 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 may such devices as are required to complete the installation.

C. Qualifications of Manufacturers: 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.

1.06 – RECORD DRAWINGS

- A. Comply with the requirements contained in Section 01720.
- B. Final wiring schematics shall be provided in single sided 11 inch x 17 inch format and shall be laminated.

1.07 – MANUFACTURER SUPPLIED FIELD SERVICES

- A. Supply and credit to the Owner the costs for field services as specified in Section 01660 Quality Control. The following field services shall be provided by the MCC manufacturer, as a minimum, in accordance with the requirements contained in Section 01650 Starting and Adjusting:
 - 1. Five (5) days totaling five (5) trips to the project site, once the system has been installed, to check the completed installation, make all necessary adjustments, startup the system, provide operations and maintenance instruction to the Owner, and otherwise place the system into permanent, fault free operation as specified in Section 01650 Starting and Adjusting.
 - 2. Two (2) days, two (2) trips, approximately three (3) and six (6) months after system startup of both MCC groups to review the operation with the Owner and the Engineer and to make system adjustments, as necessary. Dates shall be selected by the Owner and may be used by the Owner any time within a one-(1) year period from the date of initial startup.

1.08 - WARRANTY

A. Provide a Warranty Certificate typed on manufacturer letterhead and signed by an authorized officer of the manufacturer. A notary public in the state in which the company headquarters is located shall witness the certificate. The Warranty Certificate shall be submitted, verbatim and without exception, as follows:

"We, (MANUFACTURER) guarantee all components of the system specified in Section 16445 for the Glen Cove Wastewater Treatment Facility specifications 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.



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 replacement or repair of parts normally consumed in service shall include pilot light bulbs and lubrication. These parts only shall be considered as part of routine maintenance and upkeep and shall not be considered eligible for exchange free of charge under this Warranty.

Agreed upon this		day
	(DATE)	
by		of
	(NAME OF AUTHORIZED AGENT)	

(NAME OF MANUFACTURER)

by signing this document, affirms that he/she is legally authorized to submit this warranty on behalf of the manufacturer.

AUTHORIZED SIGNATURE

DATE

, who.

NOTARY

1.09 - DELIVERY, STORAGE AND HANDLING

- A. Comply with the requirements contained in Section 01610 Product Delivery, Storage and Handling.
- B. The MCC shall be wood crated and be delivered to the site. A truck equipped with a suitably sized lifting mechanism to off load the sections shall be provided.

1.10 – SPARE PARTS

- A. Provide the following spare parts in accordance with the requirements contained in Section 01610:
 - 1. Ten (10) Fuses of each type furnished.
 - 2. One (1) Contactor of each type furnished.
 - 3. One (1) Solid-State Overload Relay for each type furnished.
 - 4. Two (2) Contactor Coils for each type furnished.

- 5. Two (2) Sets of Contact Kits for each type furnished.
- 6. Four (4) Contactor Auxiliary Interlocks for each type furnished.
- 7. Two (2) Relays of each type furnished.
- 8. Two (2) Timing Relays for each type furnished.
- 9. One (1) Circuit Breaker of each type and size furnished.
- 10. Two (2) Phase Failure Undervoltage Relays of each type furnished.
- 11. One (1) Control Circuit Transformer of each type and size furnished.
- 12. One (1) Variable Frequency Drive for each size furnished. The contractor shall have all variable frequency drives furnished operate for a minimum of 30 days. Remove one drive of each size and replace with a spare drive furnished. The original drive operational for 30 days shall be packaged in the "spare drives" factory packing and shall be the furnished spare drive.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. The MCC shall be manufactured by SIEMENS/FURNAS System 89 or Allen-Bradley.
- B. Manufacturer of motor control center shall engage a custom switchgear manufacturer to custom build all incoming switchgear, including cubicles, top hats, corner section and custom bussing. Motor control center is based on SIEMENS/FURNAS System 89 dimensions. Contractor shall be responsible to meet dimension requirements.
- C. Substitute manufacturers shall be responsible to fit MCC line-up to the dimensions detailed on the drawings.

2.02 - MOTOR CONTROL CENTERS

- A. MCC enclosures shall be NEMA Type 1A with gasketed doors.
- B. Motor control center shall be same manufacturer for motor controls and all instrumentation and control cubicles.
- C. Motor control centers shall be complete, floor mounted, metal enclosed, grounded, indoor type. The motor control centers shall be NEMA Standard, Class 11, Type C except where other NEMA

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Standard classes and types are shown on the Drawings.

- D. Ratings shall be 65,000 AIC for all motor control center and all circuit breakers. All ratings shall be stand alone not series rated. All circuit breakers rated 1000 amps or greater shall be equipped with ground fault protection in accordance with utility company requirements.
- E. The equipment shall conform to the arrangements and details of the Drawings and to the spaces designated for installation. All MCC door enclosures shall open 90 degrees with all accessories mounted. All doors shall be hinged left-hand side.
- F. All MCC doors shall be removable with a wiring plug harness for quick removal of doors with disconnecting wire terminations.
- G. Design the centers to withstand the mechanical stresses caused by rough handling during shipment in addition to the electrical and mechanical stresses that will occur during operation of the centers.
- H. Coordinate components of the centers and their arrangements electrically and mechanically. The components and the control wiring shall conform to the shop drawings found in general compliance with the contract documents as furnished for the various applicable electrical and mechanical sections of the specifications.
- I. Assemble, connect and wire the centers at the factory in accordance with the NEMA Standard class and type for each of the centers.
- J. Thoroughly clean, phosphatize, and paint the metal surfaces at the factory with primer and baked enamel or lacquer finishes.
- K. The centers shall have the following features:
 - 1. Standard Vertical Sections:
 - a. Approximately 90 inches high, front and rear line-up, fabricated by a single manufacturer.
 - Rugged steel assemblies with bracing, reinforcing gussets and jig-welding to assure rectangular rigidity. The sections shall be completely metal-enclosed, including their bottoms.
 - c. Steel shall not be less than code gauge, leveled.
 - d. Bolts, nuts and washers shall be stainless steel.



- e. Spaces within the sections shall be suitable and adequate.
- f. Mount the sections on adequate structural steel supports at the factory, front and rear, for the full length of each center. Install the centers so the supports will rest on top of the concrete floor surfaces except where concrete pads are indicated. Anchor the centers with bolts, not less than 1/2-inch diameter.
- g. Each present and future motor controller shall have an individual door with hinges and latches.
- h. End panels shall be screw-removable to facilitate future additions.
- i. Removable panels shall have screws that remain in the panels when the panels are removed. Self-aligning, self-retaining nuts attached within the assemblies shall receive screws.
- j. Isolated vertical full height wiring troughs.
- 2. Bus Bars and Interconnections:
 - a. Shall be copper, rated as indicated on Contract Drawings. Minimum size shall be 600 amps for Operations Building. Bus bars shall be totally enclosed.
 - b. Bus bar joints and interconnection joints shall be plated, constant high-pressure type with high strength copper-silicon bolts and nuts.
 - c. Provide continuous bars through dead corner cubicles to adjoining cubicles.
 - d. Insulation:
 - 1) High strength polyester glass or equal.
 - 2) High track-resistance.
 - 3) High impulse and dielectric strength, especially at elevated temperatures, for withstanding the maximum short circuit currents.
 - 4) High flame-retardant, self-extinguishing.
 - 5) NEMA Standard for 65°C temperature rise shall apply.
 - e. Horizontal main buses and vertical buses for connecting the motor controllers, circuit breakers, and switches shall have an adequate ground bus that extends



across the entire width of each center.

- f. Bus bars shall be designed to extend to additional sections when so shown on the Drawings in addition to extending through dead corner cubicles.
- g. Temperature rises shall not exceed the NEMA Standards.
- 3. Completely equipped spaces for future motor controllers, circuit breakers, and switches.
- 4. Motor Controllers:
 - a. Motor controllers shall be stab-on type except for large ratings that require bolted connections.
 - b. Motor starters shall be as specified in Section 16300 and be the products of a single manufacturer. They shall be interchangeable for the same ratings in all of the motor control centers being installed for this Contract.
 - c. Disconnecting contact devices:
 - 1) Silver-plated copper, full floating, self-aligning, self-coupling, designed for cleaning action during engaging and disengaging movements.
 - 2) Adequate flexibility between the stationary and movable components.
 - 3) Adequate pressure maintained on the contacts.
 - 4) Shall engage silver plated buses.
 - d. Doors mechanically interlocked to prevent their opening unless the disconnect is opened. Incorporate "defeater" mechanisms for inspection by qualified personnel.
 - e. External operating handles with lock-open padlocking provisions and ON and OFF position indicators.
- 5. Identify each motor controller, circuit breaker and switch with a separate nameplate of laminated black phenolic resin with white core and engraved lettering not less than ³/₁₆-inch high. Identify each motor by its number or other designation and indicate function fulfilled by the motor. Identify pilot light with ON and OFF designation.
- 6. Line Monitoring Devices:


- a. The motor control center shall be equipped with a three phase monitoring relay to interlock each starter upon phase failure, phase loss or phase reversal. The phase monitor shall be manufactured by FURNAS, Class 47. Three-phase monitoring shall be provided for each of all three-phase motors including motors controlled via variable frequency drives.
- L. The following control elements and features shall be provided for every motor operated unit powered from the MCC:
 - 1. Power on push-to-test white pilot light mounted on the MCC section enclosure door.
 - 2. Red push-to-test pilot light indicating that the motor is running.
 - 3. Green push-to-test pilot light indicating that the motor is not running.
 - 4. Overload push-to-test amber alarm pilot light mounted on the MCC section enclosure door.
 - 5. Pilot Lights shall be LED type with push-to-test capabilities. No incandescent pilot lights shall be permitted."
 - 6. Overload fault reset pushbutton mounted on the MCC section enclosure door.
 - 7. Elapsed Time Meter: LED type flush mounted on the MCC section enclosure door.
 - 8. Disconnecting Means: Include integral circuit breaker on the line side of each motor controller.
 - 9. Auxiliary NO and NC contacts
 - 10. Provide solid-state overload relay on load side of bypass contactor and thermal overload relay on load side of output contactor as specified in Section 16300.
 - 11. Fast acting fuses on load side of main circuit breaker sized in accordance with manufacturers recommendations.
 - 12. Pilot lights and switches shall be door mounted as part of a door mounted control station. The control station shall be removable for the purpose of mounting and wiring the pilot devices. Contact blocks of the pilot devices shall be mounted in a recessed control station housing to minimize the hazard of accidental contact when the unit door is opened.
- M. Main circuit breaker and other circuit breakers as indicated on drawings shall be ground fault



circuit interrupter in accordance with electric utility NEC requirements. Provide MCP type breakers for motors.

2.03 - POWER MONITOR

- A. Manufacturer: ACCUENERGY
 - 1. Model No: ACUVIM II Series.
 - 2. 480 volt.
- B. Quantity: One (1) required, 480V, 3 phase 4W.
- C. Provide current and potential transformers for all three phases and neutral for digital ammeters/voltmeters.
- D. The power monitor shall incorporate a vacuum display and keypad to allow the user to read the following parameters:
 - 1. Voltage V1, V2, V3.
 - 2. Current I1, I2, I3, In, lavg.
 - 3. Power P1, P2, P3, Psum.
 - 4. Reactive Power Q1, Q2, Q3, Qsum.
 - 5. Apparent Power S1, S2, S3, Ssum.
 - 6. Frequency.
 - 7. Power Factor.
 - 8. Energy.
 - 9. Reactive Energy.
 - 10. Apparent Energy.
 - 11. Demand.
 - 12. Load Features.
 - 13. Four Quadrant Powers.

- 14. Power Quality.
- 15. Voltage Harmonics.
- 16. Current Harmonics.
- 17. Voltage Crest Factor.
- 18. Current K Factor.
- 19. Voltage Unbalance Factor.
- 20. Current Unbalance Factor.
- 21. Max/Min Statistics with Time Stamps.
- E. Power monitor shall have the following features:
 - 1. Alarms
 - 2. I/O Option Module
 - 3. Anti-tampering Seal
 - 4. Data Logging (8mb)
 - 5. Automatic Frequency adaption.
 - 6. Power Quality Event Logging.
 - 7. Communication
 - a. Modbus RTU Protocol and DNP 3.0 via RS485
 - b. Ethernet (Modbus TCP, HTTP, SMTP, SNTP)
 - c. Profibus DP
 - d. BACnet IP, BACnet MS/TP
 - e. Dual RS485 Communication Ports
 - 8. 0.2% accuracy.



F. Power monitors shall be factory installed on the Switchboard enclosure doors as indicated on drawings.

2.04 – WIRING

- A. Control and power wiring shall be flame-retardant (VW-1) moisture, heat and oil resistant thermoplastic insulation rated 600V, 90EC, 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 #12 AWG minimum.

2.05 – SOURCE QUALITY CONTROL

A. Test motor control centers at the factory to assure that the centers do not have defects.

2.06 - ACCESSORIES

 A. Electrical Matting: Dielectric strength 30,000 volts, 3 feet wide, 1/4 inch thick corrugated ASTM D 178 Type 2, Class II.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. General:
 - 1. Verify NEC clearances are met prior to installation.
 - 2. The MCC shall be level, plumb and securely installed. Where MCC is to be installed on a concrete pad, leveling steel channels shall be installed in the concrete.
 - 3. Conduit locations shall be based on manufacturers shop drawings.
 - 4. Follow manufacturers instructions as to lifting requirements, connecting shipping splits and attachment to structure.
- B. Overload Heaters: Furnish and install all overload heaters required, based on motor nameplate data.
- C. Wiring: Wire all equipment in accordance with Contract Drawings and as required.

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- D. Install clear lexan window to allow visual indication of surge protection status.
- E. Install in accordance with NEC and manufacturer's instructions, and as shown on the Drawings.

3.02 - ADJUSTING

- A. Test and adjust all equipment within the MCC. This includes short circuit device settings, electronic trip settings of breakers, MCP settings, timing relay settings, etc. All devices shall be properly adjusted such that the MCC protection and control circuits operate correctly and safely.
- B. The MCCs shall be properly grounded in accordance with NEC requirements. The MCC ground bus shall be connected to ground grid where shown on the Contract Drawings.
- C. Conduits entering the MCC shall have insulated grounding bushings tied together with copper jumper cables.
- D. Provide electrical matting on the floor in front of electrical equipment. Matting shall be trimmed to fit in front of each MCC section. Extra mating shall be turned over to the Owner.
- E. Each MCC shall have identifying nameplates as specified in Section 16075.



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1.01 - SECTION INCLUDES

A. Dry type transformers.

1.02 - REFERENCES

- A. ANSI/NFPA 70 National Electric Code.
- B. NEMA ST20 Dry Type Transformers for General Applications.

1.03 - SUBMITTALS

- A. Submit product data under provisions of Section 01300.
- B. Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage,
 KVA and impedance ratings and characteristics, tap configurations, insulation system type and
 rated temperature rise.

1.04 - REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Dry type transformers shall be manufactured by General Electric Type QL.
- B. Approved equal.

2.02 - EQUIPMENT REQUIREMENTS

- A. Three-phase and Single-phase general purpose dry type transformers be self-cooled, with ratings (KVA) as indicated on the drawings.
- B. Copper windings.
- C. Sound levels not to exceed the following:
 - 1. 0-9 KVA: 40 db.

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- 2. 10-50 KVA: 45 db.
- 3. 51-150 KVA: 50 db.
- 4. 151-300 KVA: 55 db.
- 5. 301-500 KVA: 60 db.
- 6. 501-700 KVA: 62 db.
- D. Three-phase transformers rated above 15 KVA to be insulated with UL listed Class 220 rated materials; and have a maximum average full load temperature rise of 115 degrees C.
- E. Transformers to have voltage ratios as indicated on drawings. Transformers between 15 KVA and 300 KVA to be provided with six 2-1/2% full capacity taps, two above and four below primary rated voltage.
- F. Nameplate: Include transformer connection data.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Install transformers in accordance with manufacturer's recommendations.
- B. Provide both primary and secondary protection as shown on drawings.
- C. Set transformer plumb and level.
- D. Provide grounding and bonding in accordance with provisions of Section 16060.

3.02 - FIELD QUALITY CONTROL

- A. Check for damage and tight connections prior to energizing transformer.
- B. Measure primary and secondary voltage and make appropriate tap adjustments.



1.01 - SECTION INCLUDES

A. Distribution panel boards.

1.02 - REFERENCES

- A. ANSI/NFPA 70 National Electric Code.
- B. NECA Standard of Installation.
- C. NEMA AB1 Molded Case Circuit Breakers.
- D. NEMA PB1 Panel Boards.
- E. NEMA PB1.1 Instructions for Safe Installation, Operation and Maintenance of Panel Boards Rated 600 Volts or Less.
- F. NEMA ICS2 Industrial Control Devices, Controllers and Assemblies.
- G. NEMA KS1 Enclosed Switches.

1.03 - SUBMITTALS

- A. Submit product data under provisions of Section 01300.
- B. Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Panel Boards shall be manufactured by Siemens.
- B. Approved equal.

2.02 - PANELBOARD REQUIREMENTS

A. Provide panel boards of circuit breaker, dead-front safety type, UL labeled, and meeting all applicable requirements of the National Electrical Manufacturers Association.



- B. Provide panel boards with lugs (both main lugs and branch circuit lugs) suitable and UL approved for both aluminum and copper conductors.
- C. Provide electrically isolated neutral bars.
- D. Provide separate ground bars complete with lugs or connectors on bar.
- E. Provide key operated door lock.
- F. Provide panel boards with sequence phased bus bars or distributed phase bussing for voltage and phase as indicated on drawings.
- G. Refer to drawings for numbers of branch circuits, their ratings, number of poles, arrangements, etc.
- H. Provide typed circuit directory cards.
- I. Provide front filler plates for unused breaker knockouts.
- J. All bus bars, including ground bars shall be tin-plated copper.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Ground separate ground bars to panel boxes and to the main service entrance ground bus with a code-sized grounding conductor installed in the same conduit as the phase and neutral conductors under provisions of Section 16060.
- B. Install all circuits using a common neutral bus bay in accordance with the National Electric Code.
 Balance all circuits to achieve not greater than 7% unbalanced neutral current in panel feeders.
- C. Provide six circuit breaker handle lock-on devices for each lighting and miscellaneous power panel board for installation by the contractor on circuits as directed by the Engineer to prevent unauthorized personnel from turning off circuits to controls, unit heaters, autodial alarm system, etc. Provide spare lock-on devices over to the Engineer.
- D. Install panel boards in accordance with NEMA PB 1.1.
- E. Install panel boards plumb.
- F. Height: 6 feet (2 m) to top of panel board.



- G. Provide typed circuit directory for each branch circuit panel board. Handwritten circuit directory cards will not be accepted. Revise directory to reflect circuiting changes required to balance phase loads.
- H. Provide engraved plastic nameplates under the provisions of Section 16075.

3.02 - FIELD QUALITY CONTROL

- A. Maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.



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1.01 - SECTION INCLUDES

- A. Interior and exterior luminaries and accessories.
- B. Emergency lighting and units.

1.02 - REFERENCES

- A. ANSI C78.379 Electric Lamps Incandescent and High-Intensity Discharge Reflector Lamps -Classification of Beam Patterns.
- B. ANSI C82.1 Ballasts for Fluorescent Lamps Specifications.
- C. ANSI C82.4 Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).
- D. NEMA WD 6 Wiring Devices Dimensional Requirements.
- E. NFPA 70 National Electric Code.
- F. NFPA 101 Life Safety Code.

1.03 - SUBMITTALS

- A. Submit product data under provisions of Section 01300.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, performance data and installation instructions.

1.04 - REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc.

1.05 – STORAGE

A. Store all lamps and fixtures indoors and in their original packages until they are to be installed. Do not leave fixtures or lamps outdoors for any period in time.



B. Tarp light poles until they are to be installed.

1.06 – SPARE LAMPS

- A. In addition to relamping all fixture lamps that have failed, supply to the Owner spare lamps equal to 10% of the total amount of each type of lamp.
- B. Supply two (2) fixtures of each type specified for indoor locations and one fixture of each type for outdoor locations.
- C. Deliver the spare lamps and fixtures to the Owner at least two (2) weeks prior to the date of anticipated final completion.

PART 2 - PRODUCTS

2.01 - LIGHTING UNITS

- A. Provide lighting units as listed in schedule(s).
- B. Provide electronic energy saving ballasts where such options are available.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Install fixtures in accordance with manufacturer's instructions.
- B. Use only stainless steel mounting hardware regardless of location.
- C. Mount fixtures in locations as shown on drawings and as called for in schedule on electrical drawings. Determine type of ceiling to be installed in each space from drawings and schedules and furnish fixtures suitable for the exact type.
- D. Joints in fixture wiring shall be made using wire nuts, pre-insulated Scotch locks, or other approved mechanical means of connection.
- E. Adjustable type fixtures shall be adjusted by the Contractor to illuminate special areas designated and selected by the Engineer.
- F. Coordinate fixture locations to clear diffusers, ductwork, piping, beams, monorails, vents, and other ceiling mounted equipment. Coordinate the locations of all fixtures with the Engineer and other prime contractors to avoid conflicts. The work of other trades govern the location of light fixtures.



- G. Maintain integrity of enclosures on all enclosed and gasketed fixtures. Minimize number of enclosure penetrations and make such penetrations water and dust tight with appropriate gasketing and fittings.
- H. Relamp light fixtures that have failed at completion of project then turn over spare lamps to the Owner.



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1.01 - SECTION INCLUDES

- A. Provide all labor, equipment and material necessary to furnish, install and test local control stations, complete, in place, as shown on the Contract Drawings, specified herein and approved by the Engineer.
- B. In general, the local control stations or local operating stations (LOS) included under this Section shall include, but not be limited to the following:
 - 1. Enclosure
 - 2. Terminal Blocks
 - 3. Door Mounted Pushbuttons

1.02 - QUALITY ASSURANCE

- A. Comply with Underwriters Laboratories (UL), National Electrical Manufacturers Association (NEMA) and all applicable Federal, State and municipal codes.
- B. In all cases where a device or part of the equipment is referred to in this Section in the singular (such as switch, box, etc.), it is intended that such references shall apply to as many such devices as are required to complete the installation.

1.03 - COORDINATION

- A. Review applicable equipment op drawings to determine the requirements necessary to provide fully functional local control stations.
- B. Coordinate the work of this Section with the work of other sections to provide fully functional stations.

1.04 - SUBMITTALS

- A. Submit Working Drawings as specified herein, in accordance with Section 01330.
- B. Submit for review and approval the following:
 - 1. Manufacturer's specifications and other data required demonstrating compliance with the



specific requirements. Catalog cuts of every device installed within each control station.

- 2. A completed materials list showing all items to be furnished and installed under this Section.
- 3. Complete shop drawings of all work of this Section, showing dimensions and locations of all items including supporting structures and clearance requirements.
- C. Schematic wiring diagrams for each station.
- D. Panel layout drawings: interior and exterior.

PART 2 - PRODUCTS

2.01 - GENERAL

- A. The local control stations shall consist of an enclosure with door, back plate with terminal blocks and door mounted switches, indicating lights, timer, and similar devices as shown on the Contract Drawings.
- B. Enclosures for the local control stations shall be rated NEMA 6P explosion proof for all class 1 division 1 locations, for all remaining locations, the enclosures shall be rated NEMA 4X stainless steel.

2.02 - TERMINAL BLOCKS

A. Terminal blocks shall be screw type, rated 600V, 20A minimum. Terminal blocks shall be phenolic, accept up to a #10 AWG wire and have a marking strip.

2.03 – PUSHBUTTONS

- A. Each local control station (local operating station-LOS) shall contain door-mounted devices. Each device shall be wired from the door of the local control station to the terminal blocks within the local control station. Wires shall be identified, grouped together and installed such that they do not hamper door operation or are not damaged by the door.
- B. All pushbuttons shall be heavy duty, machine tool service type. Pilot devices shall be size 30 or 30.5MM.
- C. All devices shall have a NEMA rating equal to or greater than the enclosure rating it is being

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installed in.

- D. All devices shall have the proper number of contracts and the proper contact configuration as required for proper operation. All pilot devices shall be rated 600V with contacts rated 10A continuous, and shall be capable of making 7200VA and breaking 720A.
- E. All devices shall have metal nameplates that mount integrally with the device and chrome-plated octagonal rings. Nameplate shall have lithographed markings. The Engineer shall approve all nameplate markings.
- F. Devices shall include all accessories, components and kits required for proper operation and NEMA rating.
- G. Each control station shall be fabricated with red "EMERGENCY STOP" pushbutton and a black "RUN" pushbutton.
- H. Device manufacturers and their particular products for non-XP devices, shall be as follows:
 - 1. Allen-Bradley, "Bulletins 800T and 800H"
 - 2. General Electric, "Type CR140P"
 - 3. Square-D, "Class 9001-Type K"
 - 4. Or approved equal.
- I. In class 1 division 1 areas, manufacturers and their particular products shall be as follows:
 - 1. Allen-Bradley, "Bulletin 800H"
 - 2. General Electric, "Type CR103J"
 - 3. Or approved equal.

2.04 - WIRES

- A. Wires within local control stations shall be 600V, and shall have annealed, uncoated stranded copper conductors with PVC insulation.
- B. Wire shall be type THHN, THWN, VW-1 with a 90°C dry/75°C wet rating. A nylon jacket shall be applied over the insulation.

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C. Minimum wire size shall be #12 AWG.

PART 3 - EXECUTION

3.01 - INSTALLATION

- A. Local control stations shall be fully assembled with all required devices, wiring, nameplates, terminal blocks, and enclosures.
- B. Mount local control stations rigidly and securely to the building structure, or to supporting devices, which are rigidly and securely supported to the building structure. Do not mount to handrailing.
- C. Local control stations shall be fastened with bolts and expansion shields on concrete or brick, with toggle bolts or hollow masonry units, and with machine screws or welded studs on steel work. All mounting hardware shall be stainless steel.
- D. Mount local control stations with sides parallel or perpendicular to walls or equipment, and such that the local control station is installed in a neat and professional manner.
- E. Install all local control stations such that door swing is not hampered.
- F. Locations and Sizes: Local control station locations shown on the Contract Drawings are approximate. Control station sizes shall be as dimensioned on the Contract Drawings, or, if not specifically dimensioned, as required to house all devices, terminal blocks and conduits that enter the control station. All local control station sizes and locations shall be submitted by the Contractor for Engineer's approval.
- G. Grounding:
 - 1. Ground local control stations in accordance with NEC requirements.
 - 2. The use of two (2) locknuts and a grounding bushing will be required at all conduit terminations where hub type fittings are not required. Conduit grounding bushings within local control stations shall be bonded together with jumper cables where control station size or number of conduits warrants their use per NEC requirements.
- H. Terminal Blocks: Terminal blocks shall be installed parallel or perpendicular to the control station 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.



I. Wires:

- 1. The wires within local control stations shall be neatly harnessed to prevent the door damaging the wires and to prevent the wires hampering the door operation.
- 2. All wires shall have identification markers on each end. Marker numbers shall match the terminal block numbers.
- J. Identification: All local control stations shall have a nameplate attached that properly identifies the box as to application. Nameplates shall be installed as specified in Section 16075.



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1.01 - SECTION INCLUDES

- A. Comply with the requirements contained in Section 01330 for the form of submittals specified herein and Section 01780 for submission of closeout documents. Test results specified herein shall be submitted prior to substantial completion.
- B. The tests specified herein shall be conducted on control panels and electrical devices furnished by others for installation by the prime electrical contractor.
- C. Witness Tests:
 - 1. Furnish all instruments and a qualified engineer to properly perform all tests required. Written notice of all tests shall be given the Engineer at least two (2) weeks in advance.
 - 2. 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.
 - 3. All electrical circuits shall be tested to insure circuit continuity, insulation resistance, proper splicing, and freedom from improper grounds.
 - 4. Necessary adjustments and testing shall be made in cooperation with the respective manufacturers and other Contractors when necessary. All tests shall be made in accordance with the latest standards of the ANSI, ICEA, IEEE, and NEMA.
 - 5. During the period of startup and testing of the facility the contractor shall provide labor and supervision to maintain power and light in suitable form to allow all other contractors to complete their testing in a timely manner.
 - 6. When testing by other contractors is required by the contract documents to be conducted outside the normal working hours, the required electrical equipment, manpower and supervision shall be provided by the electrical contractor to make his equipment available to permit testing to be completed at no additional cost.
 - 7. During the course of preliminary and final field testing, provide manpower and equipment to check and document the running amperage and voltage of all equipment in the facility and to make any adjustments necessary to maintain the power for the test.



1.02 – TESTS PROCEDURE - 600V AND BELOW EQUIPMENT

- A. Each panel shall be tested with mains disconnected from the feeder, branches connected, branch circuit breakers closed, all fixtures in place and permanently connected, lamps removed or omitted from the sockets, and all wall switches closed.
- B. Equipment such as Switchboard, Motor Control Center and Buss Ducts shall be tested in accordance with manufacturer's recommendations.
- C. Testing (Insulation Resistance Test) of all incoming and outgoing cables of switchgears, distribution and power panels, motor control centers, etc., shall be done after the cables are in place, and just prior to final terminations. All data shall be recorded, as per Exhibit "A", attached to the end of this section.
- D. Feeders shall be tested with the feeders disconnected from the panels. Each individual power circuit shall be tested at the panel or motor control center with the power equipment connected for proper operation.
- E. Megohmmeter tests of the insulation resistance of rotating machines and power feeders shall be conducted. The results will be accepted when the megger shows the insulation resistance to be not less than one megohm per 100 volts at 10EC using a 1,000-volt megger.
- F. All transformers shall be megohimmeter tested in accordance with the manufacturer's recommendations.
- G. The grounding system shall have a resistance to ground of five (5) ohms or less when measured by a megohmmeter or equivalent device.

1.03 – TEST RECORDS

- A. The equipment shall be given an operational test to determine that all components including motors, controls, protective and switching devices and auxiliary associated equipment are in an operable condition and can function as described and shown on relevant specifications, operating instructions and drawings.
- B. Motor current reading shall be taken at full load or as close to full load as the driven machine will develop. If the ammeter reading is over the rated full load current, determine the reason for the discrepancy and take the necessary corrective action. If discrepancy cannot be corrected, advise the Engineer.
- C. The cause of any motor operating above full load rating shall be removed instead of increasing the overload relay trip rating.



- D. Check the load current in each phase of each distribution panel feeder and make modifications to the circuit loading to correct load unbalance to within one (1) kVA phase to phase for distribution panels.
- E. After completion of the work, thoroughly test the entire electrical system, including electrical work required for HVAC, control, and power, and adjust electrical systems as required.
- F. Submit relay calculations and settings for all protective relays in the entire plant distribution equipment and shall provide a fully coordinated short circuit system.
- G. Provide the necessary factory trained supervision to check over equipment for proper functioning before putting the equipment into operation. This shall include establishing a simulated fault on checking out the coordination of the protective devices.
- H. Documentation Procedures: Signed commitments are required. The transfer of electrical system to the Owner for operation will not proceed until guarantees, warranties, performance certifications, maintenance agreements and similar commitments to be signed by Contractor and other entities have been executed and transmitted to Engineer of placement in the Owner's records. In addition copies of all elementary and point to point field wiring diagrams must be provided to the Owner prior to transfer. The project will not be considered substantially complete until all documentation has been provided.
- I. Closeout Procedures:
 - 1. General coordination is required. Closeout procedures shall be sequenced properly so that work will not be endangered or damaged, and so that every required performance will be fully tested and demonstrated.
 - 2. System performance test runs are required. Test runs of electrical systems shall be coordinated with test runs of equipment served thereby (heating, ventilating and air conditioning, plumbing, elevators, etc.).
 - 3. A check of each item in each system shall be made to determine that it is set for proper operation. With Owner's Representative and Engineer present, operate each system in a test run of appropriate duration to demonstrate compliance with performance requirements. During or following test runs, make final corrections or adjustments of systems to refine and improve performances where possible, including noise and vibration reductions, elimination of hazards, better response of controls, signals and alarms, and similar system performance improvements. Contractor shall provide testing or inspection devices requested for Engineer to permit observation of actual system performances and shall demonstrate that controls and items requiring service or



maintenance are accessible.

- 4. Cleaning and lubrication is required. After final performance test run of each electrical system, clean system both externally and internally, shall comply with manufacturer's instructions for lubrication of both power and hand operated equipment, and shall remove excess lubrication, touch up minor damage to factory-painted finishes and other painting specified as electrical work, and shall refinish work where damage is extensive.
- 5. General operating instructions are required. In addition to specific training of Owner's operating personnel specified in the individual sections, and in addition to preparation of written operating instructions and compiled maintenance manuals specified elsewhere in these specifications, provide general operating instructions for each operational system and equipment item of electrical work, and coordinate instructions with instructions for mechanical work, and other equipment where associated with electrical systems or equipment.
- 6. Describe each basic electrical system, and explain identification system, displayed diagrams, signals, alarms and audio-visual provisions.
- 7. Describe interfaces with mechanical equipment, including interlocks, sequencing, startup, shutdown, emergency, safety, system failure, security and similar provisions.
- 8. Outline maintenance procedures and major equipment turnaround requirements, including adjustments to optimize output and efficiency of electrical systems.
- Display and conduct a "thumb-through" explanation of maintenance manuals, record drawings, spare parts inventory, storage of extra materials, meter readings and similar service items.
- 10. Provide a video in DVD format of all instructions provided both at the project site and those conducted off site in the manufacturer or suppliers facilities.
- 11. The work of this Section is in addition to and does not supersede testing and adjusting specified in other Sections of the Specifications. Test records and reports for all testing in accordance with the requirements contained in Section 01330.

EXHIBIT "A" TEST REPORT

COMPANY	DATE	TIME	LOCATION	CIRCUIT	LENGTH	TYPE
INSULATION TYPE	RATING	AGE	POTED OR	INDOOR OR	TYPE OF JOINTS	
	_	-	TERMINAL	OUTDOOR		
ASSOCIATED EQUIPMENT INCLUDED IN TEST:						
MISCELLANEOUS INFORMATION:						

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1.01 - SECTION INCLUDES

A. Generator Connection Cabinet

1.02 - REFERENCES

- A. NFPA 70 National Electrical Code.
- B. NEMA ICS 1 General Standards for Industrial Control and Systems.
- C. NEMA ICS 2 Standards for Industrial Control Devices, Controllers, and Assemblies.
- D. NEMA ICS 6 Enclosures for Industrial Controls and Systems.

1.03 - SUBMITTALS

- A. Submit product data under provisions of Section 01300.
- B. Submit product data for generator connection cabinets showing overall dimensions, electrical connections, electrical ratings, environmental restrictions, voltage, short circuit ratings, enclosure details and all accessories.
- C. Submit manufacturer's installation instructions. Include instructions for storage, handling, protection, examination, preparation, installation and starting of product.
- D. Submit manufacturer's operation and maintenance manual as part of shop drawing submittal.

1.04 - OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01730.
- B. Include instructions for operating equipment.
- C. Include instructions for operating equipment under emergency conditions.
- D. Document ratings of equipment and each major component.
- E. Include manufacturer's recommended routine preventative maintenance schedule.
- F. List any special tools, maintenance materials and recommended spare parts.



1.05 - REGULATORY REQUIREMENTS

A. Conform to all applicable national, state, city or local codes for standby electrical systems.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. Manufacturer: Trystar, or approved equal.
- B. Generator Connection Cabinet shall comply with the latest NEC 700.3 requirements. Entire cabinet must be listed to ETL or UL 1008 Standards. UL Listing of individual components is not acceptable.
- C. Generator Connection Cabinet shall contain tamper proof 16 series cam-type connections.
- D. Cabinet shall have lockable latches on front door, and independent access panel door. Access panel door shall not open unless main lockable door has been opened.
- E. 4X Two conductor 600-MCM mechanical lugs per phase, neutral, and ground on busbar for permanent load connection.
- F. Construction: All stainless steel construction, silver plated copper busbar, protective caps on all panel mounts to prevent accidental contact, and padlockable swinging front door.
- G. Generator Connection Cabinet shall contain phase rotation monitor.
- H. Generator Connection Cabinet shall include a weatherproof label on the face of the box indicating voltage, phase, and max input rating of 600A.

2.02 - GENERAL REQUIREMENTS

- A. Enclosures:
 - 1. Wall mount, NEMA 3R rain-tight, aluminum enclosure.
 - Pad-lockable front door shall include a hinged access plate at the bottom for entry of cables from portable generator or portable load bank. NEMA 3R integrity shall be maintained with access plate open for cable entry.
 - b) Front, side, and bottom through a front access panel shall be accessible for maintenance.



- c) Top, side, and bottom through a front access panel shall be accessible for permanent cabling.
- 2. Finishes:
 - a) Paint after fabrication. Powder coated Hammer Gray.
- B. Phase, Neutral, and Ground Buses:
 - 1. Material: Silver-plated, Tin-plated or Hard-drawn copper, specified upon order.
 - 2. Equipment Ground Bus: bonded to box.
 - 3. Isolated Ground Bus: insulated from box.
 - 4. Ground Bus: 25%, 50%, or 100% of phase size.
 - 5. Neutral Bus: Neutral bus rated 100 percent of phase bus.
 - 6. Round edges on bus.
 - 7. Entire construction shall be Bussing. Cabling between Camlocks or sections shall not be acceptable.
- C. Generator Connection Cabinets shall be camlock style mounted on gland plate.
 - 1. An additional set of mechanical lugs, accessible from the front of the generator connection cabinet, shall also be required for temporary generator connection on pad mount units.
 - 2. Camlocks are required to have phase color identification paint at their mounting point to the generator connection cabinet. Camlock phase paint shall be as follows.
 - a) A Phase Brown
 - b) B Phase Yellow
 - c) C Phase Purple or Orange
 - d) N Neutral White
 - e) G Ground Green



- 3. Permanent connectors shall be broad range set-screw type, located behind an aluminum barrier.
- 4. Voltage & Phase shall be as shown on project single line diagram. Camlocks shall be color coded as appropriate for the specified for the specified voltage.
- 5. Amperage rating shall be as shown on project single line diagram.
- 6. A remote start terminal shall be provided, so that a temporary generator can be remotely started and stopped in a identical manner as the permanent generator set.

2.03 - RATINGS

- A. Ratings shall be as follows:
 - 1. Voltage: 277/480VAC, three phase, four wire, 60 Hz.
 - 2. Amperage: 600A
 - 3. Enclosure Rating: NEMA 3R

PART 3 – EXECUTION

3.01 - EXAMINATION

- A. Examine elements and surfaces to receive generator connection cabinet for compliance with installation tolerances and other conditions affecting performance of the work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 - INSTALLATION

A. Installation of generator connection cabinet shall be in accordance with manufacturer requirements. Provide applicable U.L. labeling for installed system.

3.03 - POWER OUTAGE

A. After the generator connection cabinet is installed, inspect the installation and field verify that the generator connection cabinet has been installed in accordance with manufacturer's recommendations. Owner's operating personnel shall be instructed on the use and service requirements of the generator connection cabinet by the manufacturer. A minimum of two (2) hours manufacturers training is required.



3.04 - DEMONSTRATION

A. Demonstrate operation of generator connection cabinet.



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1.01 - SECTION INCLUDES

A. Surge protection device.

1.02 - STANDARDS

- A. The specified suppressor shall be designed, manufactured, tested and installed in compliance with:
 - 1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41 and C62.45).
 - 2. Federal Information Processing Standards Publication 94 (FIP PUB 94).
 - 3. National Electrical Manufacturer Association (NEMA LS-1).
 - 4. National Fire Protection Association (NFPA 20, 70, 75 and 78).
 - 5. Underwriters Laboratories (UL 1449).
 - 6. CAN/C22.2 No. 8-M1986; CSA Electrical Certification Notice No. 516.
 - The system individual units shall be UL listed under UL 1449 Standard for Transient Voltage Surge Suppressions (TVSS) and the surge ratings shall be permanently affixed to the TVSS.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

- A. MCG ELECTRONICS, INC., Deer Park, New York.
- B. Approved equal.

2.02 - MANUFACTURED UNITS

A. Surge suppression shall be series Surge Free Model No. 400LS.

2.03 – SYSTEM REQUIREMENTS

A. The specified surge protective device shall provide effective high energy surge diversion for application ANSI/IEEE C62.41-1991 Location Category C3 environments. Testing per ANSI/IEEE



C62.45-1992 using ANSI/IEEE C62.41 Category C3 waveforms and amplitudes. UL 1449 listing. The specified surge protective device shall provide:

- 1. 400,000 transient amps, per phase of surge protection.
- 2. Peak surge current ratings must be independently tested and verified.
- 3. All mode protection, L-N, L-G, L-L, N-G.
- 4. Integral disconnect with safety dead front.
- 5. Each MOV protected from over-current, thermal overload and monitored individually.
- 6. Self diagnostics with comprehensive LED bar graph on front panel showing the exact % level of protection available.
- 7. Audible fault alarm with silence switch.
- 8. Event counter, indication of time and date of last event (battery backup for time and date).
- 9. Remote alarm relay contacts (surge protected), Form C.
- 10. Micro-Z low impedance installation cable.
- 11. Twenty year "NO NONSENSE" warranty on entire system.
- 12. LIFETIME "NO NONSENSE" WARRANTY ON FIELD REPLACEABLE POWER MODULES AND FUSES.
- B. Environmental Requirements:
 - 1. Magnetic Fields: Connection shall be made using low impedance Micro-Z cabling provided with the suppressor for maximum magnetic field cancellation. Unit shall be shunt-installed with no series connected elements.
 - 2. Operating Temperature: Operating temperature range shall be -40° to $+71^{\circ}$ C (-40° to $+160^{\circ}$ F).
 - 3. Storage Temperature: Storage temperature range shall be –40° to +85° C.
 - 4. Relative Humidity: Operation shall be reliable in an environment with 0% to 95% noncondensing relative humidity.


- 5. Operating Altitude: The system shall be capable of operation up to an altitude of 13,000 feet above sea level.
- 6. Operating Voltage: Maximum continuous operating voltage shall be no less than 115% and no greater than 140% of the nominal rated line voltage.
- 7. Power Frequency: The power frequency range shall be 47 to 440 Hertz.
- C. Electrical Requirements:
 - 1. Unit Operating Voltage Requirements:

Voltage	Description	Joules 8/20us	Vpeak L-N 20kV, 10kA	Vpeak L-N 6kV, 500A
277/480 VAC	3 phase, 4W + gnd, wye	93600	1096V	1000V

- 2. Unit shall be installed in parallel with the protected equipment. No series connected protective elements shall be used.
- 3. The maximum surge current capacity per phase of the specified system, based on the standard IEEE 8/20 microsecond waveform, shall be at least: 1 Event at 400 kA. The surge life (8/20us) shall be at least 10,000 @ 15 kA occurrences. The transient suppression capability shall be bi-directional and suppress both positive and negative impulses.
- 4. The suppressor shall be capable of interrupting a 200 kA, short circuit current delivered from the AC power line. The interrupt capability must be confirmed and documented by a recognized independent testing laboratory.
- The suppressor shall be designed so as to minimize the internal surge path impedance.
 Direct point-to-point internal wiring is inherently inductive and not acceptable. Connection to the power service shall be constructed for best performance.
- 6. Equipment shall be as manufactured by MCG Electronics, Inc.: Model: 400LS-Family or engineering department approved equal with supporting test data.
- D. Protection System Components:
 - Replaceable modules: The suppressor shall be constructed using field replaceable protection modules. The suppressor shall have individually fused and monitored 40mm Metal Oxide Varistors (MOV's), including neutral to ground protection mode. Each module



will provide five times (5X) redundant protection, with three modules per each phase and five fuses per module. The status of each module shall be locally monitored with a green LED that becomes red in a fault condition. The transient lpeak rating of the fuse shall be coordinated with the lpeak handling capability of the MOV so that the surge path capability is not limited by the series fusing. In addition, each MOV shall incorporate a thermal disconnect means to remove a shorted MOV safely from the protection system.

- 2. Self-Diagnostics: Red, green and yellow solid state LED indicators shall be provided on the hinged front cover to indicate protection status. An illuminated green LED indicates power is present at the protector on all phases, and an illuminated red LED shall indicate that one or more of the modules have reduced protection. An illuminated yellow LED shall indicate a suppression event. Both front panel and internal LEDs are required to provide power and fault indications in the event of even the loss of a single fuse or MOV. Relay operation shall be in a fail-safe operating mode (i.e., continuously energized so that power failure, reduced protection, or a break in the remote monitoring line will cause a fault indication at the remote monitor).
- Remote Alarm Capability: Relay alarm contacts shall be provided for remote alarm monitoring capability of unit status. Form C normally open and normally closed contacts shall be provided with voltage and current limiting protection.
- 4. Audible Alarm: The specified system shall be equipped with an audible alarm which shall be activated when any one or more of the modules has a reduced protection condition. A mute option shall be provided for the audible alarm.
- 5. Advanced Diagnostic LED Display: A front panel, microprocessor controlled LED display, in the form of a bar graph, will indicate the protection status of each MOV on each phase including neutral to ground. A event counter will display number of suppressed transient events with a time and date stamp.
- 6. Integral Disconnect: Unit shall be provided with dead front disconnect to remove power from protector for maintenance access. The disconnect should not be accessed from the front panel unless the unit meets the minimum clamp voltage requirements.
- 7. NEMA 12 Enclosure: 14 gauge steel, with stainless steel hardware.



PART 3 - EXECUTION

3.01 – INSTALLATION AND MAINTENANCE

- A. The unit shall be factory installed in the motor control center by the Motor Control Center manufacturer, in accordance with the manufacturer's printed instruction to maintain warranty. All local and national codes must be observed.
- B. Units shall be installed as close as possible to the load side lugs of the transfer switch to which it is connected using low impedance Micro-Z cabling.
- C. A 3-pole disconnect shall be provided to ensure safety of maintenance personnel.

3.02 – TWENTY YEAR WARRANTY

A. Manufacturer to provide twenty (20) year warranty to cover repair or replacement with a new device. Manufacturer to provide no cost replacement of fused protection modules for the life of the suppressor.

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290 Broad Hollow Road, Ste 400E Melville, NY 11747 | tel 631.756.8000

December 4, 2018

Commissioner Kenneth Arnold, P.E. Nassau County Department of Public Works 1194 Prospect Avenue Westbury, New York 11590

Re: Limited Lead and Asbestos Inspection Report Glen Cove Wastewater Treatment Plant Preliminary Treatment Improvements H2M Job No.: NCDP1701

Dear Commissioner Arnold:

In accordance with your request, H2M architects + engineers (H2M) conducted a limited asbestos and lead-based paint inspection at the Glen Cove wastewater treatment plant in Glen Cove, NY. Lead based paint testing was conducted throughout the site by EPA certified Lead-based Paint Inspector Kyle P. Vander Schuyt (Certification No. LBT-I-I173781-1). All testing was conducted using an Olympus Innov-X Delta Series XRF (X-Ray Fluorescence) instrument. Provided herein are the results of our findings.

Lead Based Paint Sampling

According to the U.S. Environmental Protection Agency (USEPA) and U.S. Department of Housing and Urban Development (USHUD), lead-based paint means paint or other surface coatings that contain lead equal to or greater than 1.0 milligrams per centimeter square (mg/cm²) or 0.5 percent by weight.

X-Ray Fluorescence (XRF) Testing Results

According to the U.S. Environmental Protection Agency (USEPA) and U.S. Department of Housing and Urban Development (USHUD), paint or other surface coatings that contain lead equal to or greater than 1.0 milligrams per centimeter square (mg/cm²) is considered to be **lead based paint**:

TABLE 1 NCDP1701- 100 MOR L	RIS AV EAD XI	ENUE RF TE	, GLEN STING	N COVE,	NEW	YORK
Screening Disposal Area, Below Grade	Rebar	Fair	Metal	Yellow	1.1	Lead Based Paint
Screening Disposal Area, Below Grade	Rebar	Fair	Metal	Yellow	2.82	Lead Based Paint

(Find full XRF details in table 1, located on page 3 of this report)

Asbestos Sampling

On September 20, 2018, H2M collected limited bulk samples of suspect asbestos containing materials (ACM) that were located within the above referenced property.

On November 07, 2018, H2M returned to the property to sample areas on the roof for suspect asbestos containing materials (ACM). H2M inspected areas of the property that were scheduled to be disturbed due to upcoming renovations



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 Mr. Kyle P. Vander Schuyt (NYSDOL Cert. No. 12-11293).

Asbestos Results

According to the Asbestos Hazard Emergency Response Act (AHERA), 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.

TABLE 2												
1	100 MORRIS AVENUE, GLEN COVE, NEW YORK ASBESTOS RESULTS											
LOCATION	MATERIAL DESCRIPTION	RESULT FINDINGS	APPROXIMATE QUANTITY OF ACM									
Electrical Pump Room	Pipe Elbow Insulation	Non-ACM										
Sewer Screen Room	Pipe Elbow Insulation	Non-ACM										
Sewer Screen Room	Wall Mastic	Non-ACM										
Sewer Screen Room	CMU Mortar	Non-ACM										
Exterior, Roof	Roof Membrane – Bottom (Bottom Layer)	АСМ										
Exterior, Roof	Roof Membrane- Built Up (Bottom Layer)	АСМ										
Exterior, Roof	Roof Membrane- Top (Bottom Layer)	АСМ										
Exterior, Roof	Roof Membrane – Bottom (Top Layer)	ASBESTOS CONTAMINATED	5,500 S.F*									
Exterior, Roof	Roof Membrane- Built Up (Top Layer)	ASBESTOS CONTAMINATED										
Exterior, Roof	Roof Membrane- Top (Top Layer)	ASBESTOS CONTAMINATED										
Exterior, Roof	Roof Tar (Top Layer)	ASBESTOS CONTAMINATED										
Exterior, Roof	Vent Tar	АСМ	15 L.F*									
Exterior, Roof, Doghouse	Vapor Barrier	Non-ACM										

CORPORATE HEADQUARTERS 538 Broad Hollow Road, 4th Floor East | Melville, NY 11747 | 631.756.8000 | h2m.com



TABLE 2	100 MORRIS AVENUE, GL ASBESTOS I	EN COVE, NEW	YORK
LOCATION	MATERIAL DESCRIPTION	RESULT FINDINGS	APPROXIMATE QUANTITY OF ACM
Exterior, Roof, Doghouse	Shingle (Bottom)	Non-ACM	
Exterior, Roof, Doghouse	Shingle (Top)	Non-ACM	
ACM- Asbestos Containing Non-ACM / Trace; Contains *All quantities should be v notification/filings_H2M s	Material <1% or No-Asbestos Detected in Materia rerified on site by the contractor prior hould be notified if there is a change i	al Samples to submitting a cost est n quantities or work scr	imate or abatement

Laboratory analytical data sheets and chain of custody forms are provided in Attachment 1. Copies of H2M's licenses and certifications are provided in Attachment 2. Copies of EMSL's certifications are provided in Attachment 3. Photographic documentation is provided in Attachment 4

H2M certifies that the information contained herein is based on the physical data and visual inspections conducted by H2M and lab data collected during the inspection survey. 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 do not hesitate to contact the undersigned at (631) 756-8000 extension 1621.

Very truly yours, H2M architects + engineers

Kyle P. Vander Schuyt Industrial Hygienist

The following results were obtained from our tests. Walls are labeled A through D with wall "A" being representative of the front entrance to each individual room. (Not applicable on exterior surveys)

				Tabl	e 2			
			NCDP1701-100	MIRRIS AVEN	UE. GLEN COV		ĸ	
				LEAD XRF	TESTING	_,		
							LEAD	
	ROOM						CONCENTRATION	
ASSAY #	DESCRIPTION	WALL	COMPONENT	CONDITION	SUBSTRATE	COLOR	(MG/CM2)	INTERPRETATION
#1							· · · · · ·	
			CA	LIBRATION (CHECK			PASSED
#2	Sewage Pump							Non-Lead Based
	Basement 2		Floor	Fair	Concrete	Grey	0	Paint
	Sewage Pump							Non-Lead Based
#3	Basement 2	A	Wall	Fair	Concrete	Grey	0	Paint
#4			1	ſ	Misfire		T	ſ
	Sewage Pump	_				_		Non-Lead Based
#5	Basement 2	В	Wall	Fair	Concrete	Grey	0.01	Paint
	Sewage Pump	_				_		Non-Lead Based
#6	Basement 2	С	Wall	Fair	Concrete	Grey	0	Paint
	Sewage Pump					_		Non-Lead Based
#7	Basement 2	D	Wall	Fair	Concrete	Grey	0	Paint
	Sewage Pump					_		Non-Lead Based
#8	Basement 2		Sewage Pump	Fair	Metal	Grey	0.46	Paint
#9					Misfire			
	Sewage Pump							Non-Lead Based
#10	Basement 2		Influent Pump 1	Fair	Metal	Grey	0.97	Paint
#11					Misfire			
	Sewage Pump		Sewage Pump					Non-Lead Based
#12	Basement 2		Base	Fair	Concrete	Red	0.01	Paint
	Sewage Pump		Sewage Pump					Non-Lead Based
#13	Basement 2		Riser 1	Fair	Metal	Dark Grev	0.17	Paint
-	Sewage Pump		Sewage Pump			_		Non-Lead Based
#14	Basement 2		Riser 4	Damaged	Metal	Dark Grey	0.26	Paint



Table 2 NCDP1701- 100 MIRRIS AVENUE, GLEN COVE, NEW YORK LEAD XRF TESTING LEAD ROOM CONCENTRATION ASSAY # DESCRIPTION WALL COMPONENT CONDITION SUBSTRATE COLOR (MG/CM2) INTERPRETATION --Sewage Pump Sewage Pump Non-Lead Based 0.29 #15 Basement 2 Riser 4 Dark Grev Paint Damaged Metal Sewage Pump --Fair Non-Lead Based 0 #16 Basement 2 Influent Pump 4 Metal White Paint Sewage Pump Fair Non-Lead Based ---0 Basement 2 Paint #17 Influent Pump 4 Metal Blue Sewage Pump Sewage Pump Non-Lead Based ---0.05 #18 Basement 2 Base 4 Concrete Paint Red Sewage Pump ---Fair Non-Lead Based 0 #19 Basement 1 Floor Concrete Grev Paint Sewage Pump ---Influent Pump 3 Fair Non-Lead Based #20 Basement 1 Base Concrete Red 0.01 Paint ---Floor Stand Non-Lead Based Sewage Pump Fair 0 Basement 1 Paint #21 Operator Metal Grey Sewage Pump ---Discharge Fair Non-Lead Based #22 Valve 3 Grev 0.18 Paint Basement 1 Metal Non-Lead Based Sewage Pump ---Fair 0.2 #23 Basement 1 Influent Pump 4 Metal White Paint Sewage Pump Influent Pump Fair Non-Lead Based --0.02 #24 Basement 1 Base Concrete Red Paint Non-Lead Based Sewage Pump Fair --0.26 #25 Basement 1 Suction Valve 4 Metal Grev Paint Sewage Pump Fair ---Non-Lead Based Basement 1 0.27 #26 Influent Pump 3 Metal White Paint Electrical --Seal Water Unit Fair Non-Lead Based 0.68 #27 Control Room Base Concrete Red Paint Electrical Seal Water Unit Fair Non-Lead Based 0.02 #28 Control Room Pipe Metal Blue Paint ---**Flectrical** Fair Non-Lead Based 0 #29 Control Room В Wall White Paint Concrete Electrical Fair Non-Lead Based #30 в Wall White 0 Control Room Concrete Paint Screening Fair Non-Lead Based 0 #31 **Disposal** Area Floor Concrete Grev Paint

#47

Below Grade



0

Paint

Table 2 NCDP1701- 100 MIRRIS AVENUE, GLEN COVE, NEW YORK LEAD XRF TESTING LEAD CONCENTRATION ROOM COMPONENT ASSAY # DESCRIPTION WALL CONDITION COLOR (MG/CM2) SUBSTRATE INTERPRETATION Non-Lead Based Screening Fair 0 #32 **Disposal** Area А Wall Glazed Block Blue Paint Screening Fair Non-Lead Based 0 #33 **Disposal** Area А Wall Concrete Grev Paint Wall Fair Non-Lead Based Screening Disposal Area В 0 #34 Glazed Block White Paint Wall Non-Lead Based Screening Fair 0 Disposal Area #35 В Concrete Paint Grev Wall Fair Non-Lead Based Screening 0 С #36 **Disposal** Area Glazed Block White Paint Screening Wall Fair Non-Lead Based 0 #37 Disposal Area D Glazed Block White Paint Screening Wall Fair Non-Lead Based 0 #38 **Disposal Area** D Concrete Paint Grev Misfire #39 Non-Lead Based Screening ---Fair 0 Black #40 **Disposal Area** Screen Metal Paint Screening --Fair Metal Non-Lead Based **Disposal Area** Screen 3 0 Paint #41 Black Screening ---Fair Metal Non-Lead Based 0 #42 **Disposal** Area Safety Rail Yellow Paint Non-Lead Based Screening ---Fair Metal 0 Disposal Area Yellow #43 Vent Paint Non-Lead Based Screening ---Fair Metal 0.1 #44 Disposal Area Ladder Yellow Paint Screening Fair Metal --**Disposal Area**, **Below Grade** Yellow 1.1 #45 Rebar Lead Based Paint Screening ---Fair Metal Disposal Area, 2.82 **Below Grade** #46 Rebar Yellow Lead Based Paint Fair Metal Screening ---Disposal Area, Non-Lead Based

Black

Screen 1



i age -								
Table 2			NCDP1701- 100	MIRRIS AVEN	UE, GLEN COV	E, NEW YOF	ĸĸ	
			1			1		
	ROOM						LEAD CONCENTRATION	
ASSAY #	DESCRIPTION	WALL	COMPONENT	CONDITION	SUBSTRATE	COLOR	(MG/CM2)	INTERPRETATION
	Screening			Fair	Metal			
	Disposal Area,							Non-Lead Based
#48	Below Grade		Safety Rail			Yellow	0	Paint
	Screening							
	Disposal Area,							Non-Lead Based
#49	Below Grade		Floor	Fair	Concrete	Grey	0	Paint



ATTACHMENT 1

LABORATORY ANALYSIS & CHAIN OF CUSTODY FORM ----

H2N	/I L50	Site Address	BRRRIC	NUT LI	FAIRA		Date Submitted	: , A
Address:		Work Area	WILKIS F	1 <u>VE, C</u>	<u>CIUCUUE</u>		Turn Around Ti	- / % me:
538 Broad 4 th Flo	Hollow Road oor East	Fax Results to	<u>просси</u> р: Е-mai	I Results to:			Number of San	ples:
Melville,	NY 11747		KVa	InderSchu	iyt@H2M.cor	n		
Analytical Procedur (Circle One)	re: NA-ELAP Me (inable in	NY)	NY ELAP Method	198.6	NY EEAP Method-1	98.4		701
Sample Number	Lo	ocation		Sample	e Description		Commen	nts
4M1-01	FIECTRICE	H. KUMP	RINH	PIPE E	CBO V			
111-07		1						
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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:061819745CustomerID:H2ML50CustomerPO:NCDP1701ProjectID:

Attn:	Kyle Vanderschuyt	Phone:	(631) 756-8000
	H2M Architects and Engineers	Fax:	
	538 Broad Hollow Road	Received:	09/24/18 2:48 PM
	Ath Eloor East	Analysis Date:	9/24/2018
	4111 FIUUI EASL Malailla NIX 44747	Collected:	9/24/2018
	Meiville, NY 11/4/		

Project: 100 Morris Ave., Glen Cove, Throughout / #NCDP1701

Test Report: Asbestos Analysis of Bulk Material

		Analvzed		1	Non Asbestos	
Test	t	Date	Color	Fibrous	Non-Fibrous	Asbestos
Sample ID	HM1-01 <i>0</i> 61819745-0001		Description Homogeneity	Electrical/Pump Rm. Heterogeneous	- Pipe Elbow	
PLM NYS 1	98.1 Friable	9/24/2018	Gray/Blue	4.00% Cellulose 11.00% Min. Wool	30.00% Ca Carbonate 55.00% Non-fibrous (other)	None Detected
PLM NYS 1	98.6 VCM					Not Analyzed
PLM NYS 1	198.6 NOB					Not Analyzed
TEM NYS 1	198.4 NOB					Not Analyzed
Sample ID	HM1-02 061819745-0002		Description Homogeneity	Electrical/Pump Rm. Heterogeneous	- Pipe Elbow	
PLM NYS 1	98.1 Friable	9/24/2018	Gray/Blue	6.00% Cellulose 14.00% Min. Wool	35.00% Ca Carbonate 45.00% Non-fibrous (other)	None Detected
PLM NYS 1	98.6 VCM					Not Analyzed
PLM NYS 1	198.6 NOB					Not Analyzed
TEM NYS 1	198.4 NOB					Not Analyzed
Sample ID	HM1-03 <i>061819745-0003</i>		Description Homogeneity	Electrical/Pump Rm. Homogeneous	- Pipe Elbow	
PLM NYS 1	98.1 Friable	9/25/2018	Gray	8.00% Min. Wool 2.00% Cellulose	30.00% Ca Carbonate 60.00% Non-fibrous (other)	None Detected
PLM NYS 1	98.6 VCM					Not Analyzed
PLM NYS 1	198.6 NOB					Not Analyzed
TEM NYS 1	198.4 NOB					Not Analyzed
Sample ID	HM2-01 061819745-0004		Description Homogeneity	Sewer Screen Rm Homogeneous	Pipe Elbow	
PLM NYS 1	98.1 Friable	9/24/2018	Gray	16.00% Min. Wool	34.00% Ca Carbonate 50.00% Non-fibrous (other)	None Detected
PLM NYS 1	98.6 VCM					Not Analyzed
PLM NYS 1	198.6 NOB					Not Analyzed
TEM NYS 1	198.4 NOB					Not Analyzed
Sample ID	HM2-02 061819745-0005		Description Homogeneity	Sewer Screen Rm Heterogeneous	Pipe Elbow	
PLM NYS 1	98.1 Friable	9/24/2018	Gray/Blue	5.00% Cellulose 7.00% Min. Wool	38.00% Ca Carbonate 50.00% Non-fibrous (other)	None Detected
PLM NYS 1	98.6 VCM					Not Analyzed
PLM NYS 1	198.6 NOB					Not Analyzed
TEM NYS 1	198.4 NOB					Not Analyzed
Initial Repor	t From 09/26/201	8 23:21:27				

Test Report 198VCM-7.30.0 Printed: 9/27/2018 8:11:02 AM



				N	lon Asbestos	
Tes	st		Color	Fibrous	Non-Fibrous	Asbestos
Sample ID	HM2-03 061819745-0006		Description Homogeneity	Sewer Screen Rm Homogeneous	Pipe Elbow	
PLM NYS 1	98.1 Friable	9/25/2018	Gray	10.00% Min. Wool	32.00% Ca Carbonate	None Detected
				2.00% Cellulose	56.00% Non-fibrous (other)	
PLM NYS 1	198.6 VCM					Not Analyzed
PLM NYS	198.6 NOB					Not Analyzed
TEM NYS	198.4 NOB					Not Analyzed
Sample ID	HM3-01 061819745-0007		Description Homogeneity	Sewer Screen Rm Heterogeneous	Wall Mastic	
PLM NYS 1	98.1 Friable					Not Analyzed
PLM NYS 1	198.6 VCM					Not Analyzed
PLM NYS	198.6 NOB	9/25/2018	Tan			Inconclusive: None Detected
TEM NYS	198.4 NOB	9/26/2018	Tan			None Detected
Sample ID	HM3-02 061819745-0008		Description Homogeneity	Sewer Screen Rm Heterogeneous	Wall Mastic	
PLM NYS 1	98.1 Friable					Not Analyzed
PLM NYS 1	198.6 VCM					Not Analyzed
PLM NYS	198.6 NOB	9/25/2018	Tan			Inconclusive: None Detected
TEM NYS	198.4 NOB	9/26/2018	Tan			None Detected
Sample ID	HM4-01 061819745-0009		Description Homogeneity	Sewer Screen Rm Homogeneous	CMU Mortar	
PLM NYS 1	98.1 Friable	9/24/2018	Gray/Tan		55.00% Quartz 25.00% Ca Carbonate 20.00% Non-fibrous (other)	None Detected
PLM NYS 1	198.6 VCM					Not Analvzed
PLM NYS	198.6 NOB					Not Analyzed
TEM NYS	198.4 NOB					Not Analyzed
Sample ID	HM4-02 061819745-0010		Description Homogeneity	Sewer Screen Rm Homogeneous	CMU Mortar	
PLM NYS 1	98.1 Friable	9/24/2018	Gray/Tan		50.00% Quartz 25.00% Ca Carbonate 25.00% Non-fibrous (other)	None Detected
PLM NYS 1	198.6 VCM					Not Analyzed
PLM NYS	198.6 NOB					Not Analyzed
TEM NYS	198.4 NOB					Not Analyzed



					Non Asbestos	
Tes	t		Color	Fibrous	Non-Fibrous	Asbestos
Sample ID	HM4-03		Description	Sewer Screen Rm.	- CMU Mortar	
	061819745-0011		Homogeneity	Homogeneous		
PLM NYS 1	98.1 Friable 9	/25/2018	Gray		55.00% Quartz	None Detected
					19.00% Ca Carbonate	
					26.00% Non-fibrous (other)	
PLM NYS 1	198.6 VCM					Not Analyzed
PLM NYS	198.6 NOB					Not Analyzed
TEM NYS	198.4 NOB					Not Analyzed
Analyst(s)						
Keith McW	illiams					and the
Melvin Ran	nirez					
Steve Jusc	zuk				Dani	el Clarke, Asbestos Laboratory Manager

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

H2N	1 L50	Site Address					Date Subr	nitted:
Address		LLEN	COVE	WASTEN	VATER TI	CLAT.	11-0	7-18
Address: 538 Broad I	Hollow Road	Work Area	lop	•				
4 th Flo Melville, I	or East NY 11747	Fax Results to:		E-mail Results to KVanderSc	: huyt@H2M.c	com	Number of Samples:	
Analytical Procedure (Circle One)	e: NY ELAP M	ethod 198.1	NY ELAP	Mothod 108.6 - riable-NY)	<u>NY ELAP Metho</u> (TEM)	od 198.4	Billing #	71701
Sample Number	Le	ocation		Sam	ple Descriptio	on	Com	ments
<u> ////////////////////////////////////</u>	ROOF			BOTTOM	Membr	ANE	BOTTOP	n CAYE
MMI - Z	1				ſ		1	
4117 -1				BUILT	TUP			
MMZ - Z				1				
HM3 -1	1			TOP	Mimiz	RANG		
4m3-2	1				<u></u>			
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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: CustomerID: CustomerPO: ProjectID:

061822583 H2ML50

Project: Glen Cove Waste Water Treat., Roof

Test Report: Asbestos Analysis of Bulk Material

		Analvzed		Non A		
Tes	t	Date	Color	Fibrous	Non-Fibrous	Asbestos
Sample ID	HM 1-1 061822583-0001		Description Homogeneity	Roof - Bottom Membrane Homogeneous	- Bottom Layer	
PLM NYS 1	98.1 Friable					Not Analyzed
PLM NYS 1	198.6 VCM					Not Analyzed
PLM NYS	198.6 NOB	11/11/2018	Black	<1% Glass		17.2% Chrysotile
						17.2% Total
TEM NYS	198.4 NOB	11/11/2018				Not Analyzed
Sample ID	HM 1-2		Description	Roof - Bottom Membrane	- Bottom Layer	
	061822583-0002		Homogeneity			
PLM NYS 1	98.1 Friable					Not Analyzed
PLM NYS 1	198.6 VCM					Not Analyzed
PLM NYS	198.6 NOB	11/11/2018				Positive Stop (Not Analyzed)
TEM NYS	198.4 NOB	11/11/2018				Not Analyzed
Sample ID	HM 2-1		Description	Roof - Built Up - Bottom La	ayer	
	061822583-0003		Homogeneity	Heterogeneous		
PLM NYS 1	98.1 Friable					Not Analyzed
PLM NYS 1	198.6 VCM					Not Analyzed
PLM NYS	198.6 NOB	11/11/2018	Gray/White/B	<1% Glass		4.0% Chrysotile
			аск			4.0% Total
TEM NYS	198.4 NOB	11/11/2018				Not Analyzed
Sample ID	HM 2-2 061822583-0004		Description Homogeneity	Roof - Built Up - Bottom La	ayer	
PLM NYS 1	98.1 Friable					Not Analyzed
PLM NYS 1	198.6 VCM					Not Analyzed
PLM NYS	198.6 NOB	11/11/2018				Positive Stop (Not Analyzed)
TEM NYS	198.4 NOB	11/11/2018				Not Analyzed
Sample ID	HM 3-1 061822583-0005		Description Homogeneity	Roof - Top Membrane - Bo Heterogeneous	ottom Layer	
PLM NYS 1	98.1 Friable					Not Analyzed
PLM NYS 1	198.6 VCM					Not Analyzed
PLM NYS	198.6 NOB	11/11/2018	Gray/Black	1.2% Glass		10.8% Chrysotile
						10.8% Total
TEM NYS	198.4 NOB	11/11/2018				Not Analyzed

Initial Report From 11/13/2018 09:54:10



			No	n Asbestos	
Test		Color	Fibrous	Non-Fibrous	Asbestos
Sample ID HM	3-2 822583-0006	Description Homogeneity	Roof - Top Membrane -	- Bottom Layer	
PLM NYS 198.1	Friable				Not Analyzed
PLM NYS 198.6	VCM				Not Analyzed
PLM NYS 198.6	NOB 11/11/2018	}			Positive Stop (Not Analyzed)
TEM NYS 198.4	NOB 11/11/2018	}			Not Analyzed
Sample ID HM	4-1 822583-0007	Description Homogeneity	Roof - Bottom Membra Heterogeneous	ne - Top Layer	
PLM NYS 198.1	Friable				Not Analyzed
PLM NYS 198.6	VCM				Not Analyzed
PLM NYS 198.6	NOB 11/11/2018	Brown/Black	4.6% Glass		Inconclusive: None Detected
TEM NYS 198.4	NOB 11/12/2018	Brown/Black			None Detected
Sample ID HM	4-2 822583-0008	Description Homogeneity	Roof - Bottom Membra Heterogeneous	ne - Top Layer	
PLM NYS 198.1	Friable				Not Analyzed
PLM NYS 198.6	VCM				Not Analyzed
PLM NYS 198.6	NOB 11/11/2018	Brown/Black	1.6% Glass		Inconclusive: None Detected
TEM NYS 198.4	NOB 11/12/2018	Brown/Black			None Detected
Sample ID HM	5-1 822583-0009	Description Homogeneity	Roof - Built Up - Top La Heterogeneous	ayer	
PLM NYS 198.1	Friable				Not Analyzed
PLM NYS 198.6	VCM				Not Analyzed
PLM NYS 198.6	NOB 11/11/2018	B Black	1.1% Glass		Inconclusive: None Detected
TEM NYS 198.4	NOB 11/12/2018	B Black			None Detected
Sample ID HM	5-2 822583-0010	Description Homogeneity	Roof - Built Up - Top La Heterogeneous	ayer	
PLM NYS 198.1	Friable				Not Analyzed
PLM NYS 198.6	VCM				Not Analyzed
PLM NYS 198.6	NOB 11/11/2018	B Black	1.9% Glass		Inconclusive: None Detected
TEM NYS 198.4	NOB 11/12/2018	B Black			None Detected
Sample ID HM	6-1 822583-0011	Description Homogeneity	Roof - Top Membrane - Heterogeneous	- Top Layer	
PLM NYS 198.1	Friable				Not Analyzed
PLM NYS 198.6	VCM				Not Analyzed
PLM NYS 198.6	NOB 11/11/2018	B Gray/Black			Inconclusive: None Detected
TEM NYS 198.4	NOB 11/12/2018	B Gray/Black			None Detected



		Non Asbestos	
Test	Color	Fibrous Non-Fibrous	Asbestos
Sample ID HM 6-2 061822583-0012	Description Homogeneity	Roof - Top Membrane - Top Layer Heterogeneous	
PLM NYS 198.1 Friable			Not Analyzed
PLM NYS 198.6 VCM			Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	Gray/Black		Inconclusive: None Detected
TEM NYS 198.4 NOB 11/12/2018	Gray/Black		None Detected
Sample ID HM 7-1 061822583-0013	Description Homogeneity	Roof - Vent / Doghouse - Vapor Barrier Homogeneous	
PLM NYS 198.1 Friable			Not Analyzed
PLM NYS 198.6 VCM			Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	Black		Inconclusive: None Detected
TEM NYS 198.4 NOB 11/12/2018	Black		None Detected
Sample ID HM 7-2 061822583-0014	Description Homogeneity	Roof - Vent / Doghouse - Vapor Barrier Homogeneous	
PLM NYS 198.1 Friable			Not Analyzed
PLM NYS 198.6 VCM			Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	Black		Inconclusive: None Detected
TEM NYS 198.4 NOB 11/12/2018	Black		None Detected
Sample ID HM 8-1 061822583-0015	Description Homogeneity	Roof - Vent / Doghouse - Shingle, Bottom Heterogeneous	
PLM NYS 198.1 Friable			Not Analyzed
PLM NYS 198.6 VCM			Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	White/Black	1.9% Glass	Inconclusive: None Detected
TEM NYS 198.4 NOB 11/12/2018	White/Black		None Detected
Sample ID HM 8-2 061822583-0016	Description Homogeneity	Roof - Vent / Doghouse - Shingle, Bottom Heterogeneous	
PLM NYS 198.1 Friable			Not Analyzed
PLM NYS 198.6 VCM			Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	White/Black	2.7% Glass	Inconclusive: None Detected
TEM NYS 198.4 NOB 11/12/2018	White/Black		None Detected
Sample ID HM 8-3 061822583-0017	Description Homogeneity	Roof - Vent / Doghouse - Shingle, Top Heterogeneous	
PLM NYS 198.1 Friable			Not Analyzed
PLM NYS 198.6 VCM			Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	White/Black	3.4% Glass	Inconclusive: None Detected
TEM NYS 198.4 NOB 11/12/2018	White/Black		None Detected



		I	Non Asbestos	
Test	Color	Fibrous	Non-Fibrous	Asbestos
Sample ID HM 8-4	Description	Roof - Vent / Dogho	use - Shingle, Top	
061822583-0018	Homogeneity	Homogeneous		
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	White/Black	<1% Glass		Inconclusive: None Detected
TEM NYS 198.4 NOB 11/12/2018	White/Black			None Detected
Sample ID HM 9-1	Description	Roof - Vent Pipe - T	ar	
061822583-0019	Homogeneity	Homogeneous		
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	Black			7.9% Chrysotile
				7.9% Total
TEM NYS 198.4 NOB 11/11/2018	}			Not Analyzed
Sample ID HM 9-2	Description	Roof - Vent Pipe - T	ar	
061822583-0020	Homogeneity			
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	5			Positive Stop (Not Analyzed)
TEM NYS 198.4 NOB 11/11/2018	}			Not Analyzed
Sample ID HM 10-1	Description	Roof - Top Roof - Ta	ar	
061822583-0021	Homogeneity	Homogeneous		
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	Black			Inconclusive: None Detected
TEM NYS 198.4 NOB 11/12/2018	Black			None Detected
Sample ID HM 10-2	Description	Roof - Top Roof - Ta	ar	
061822583-0022	Homogeneity	Homogeneous		
PLM NYS 198.1 Friable				Not Analyzed
PLM NYS 198.6 VCM				Not Analyzed
PLM NYS 198.6 NOB 11/11/2018	Black			Inconclusive: None Detected
TEM NYS 198.4 NOB 11/12/2018	Black			None Detected



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: 061822583 CustomerID: H2ML50 CustomerPO: ProjectID:

Test Report: Asbestos Analysis of Bulk Material

		Non Asbestos		
Test	Color	Fibrous No	on-Fibrous	Asbestos
Analyst(s) Soaiful Islam Steve Jusczuk				Jun the
				Daniel Clarke, Asbestos Laboratory Manager or other approved signatory
NOB - Non Eriable Organically Bound	N/A - Not Applicable	VCM – Vermiculite Containing I	Material	

Non Friable Organically Bound N/A = Not ApplicableVCM = 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



ATTACHMENT 2

H2M'S PERSONNEL LICENSES AND CERTIFICATIONS



01213 004527481 87 EYES BRO HAIR BRO HGT 6' 01"

IF FOUND RETURN TO: NYSDOL - L&C UNIT ROOM 161A BUILDING 12 STATE OFFICE CAMPUS ALBANY NY 12240

STATE OF NEW YORK - DEPARTMENT OF LABOR ASBESTOS CERTIFICATE



C ATEC(09/18) D INSP(09/18)

MUST BE CARRIED ON ASBESTOS PROJECTS

CERT# 12-11293 DMV# 879283550

N.Y.S

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

M

Melville, NY 11747

FILE NUMBER: 00-0724 LICENSE NUMBER: 28582 LICENSE CLASS: RESTRICTED DATE OF ISSUE: 11/29/2018 EXPIRATION DATE: 11/30/2019

Duly Authorized Representative - Debra Mattina:

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.

SH 432 (8/12)

Eileen M. Franko, Director For the Commissioner of Labor

United States Environmental Protection Agency

This is to certify that

H2M Architects + Engineers

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

In the Jurisdiction of:

All EPA Administered Lead-based Paint Activities Program States, Tribes and Territories

This certification is valid from the date of issuance and expires July 07, 2019

LBP-1482-1

Certification #

June 23, 2016

Issued On



The Prod

Michelle Price, Chief Lead, Heavy Metals, and Inorganics Branch

1423 of 1438



ATTACHMENT 3

EMSL'S CERTIFICATIONS

NEW YORK STATE DEPARTMENT OF HEALTH WADSWORTH CENTER



Expires 12:01 AM April 01, 2019 道 Issued April 01, 2018

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CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE Issued in accordance with and pursuant to section 502 Public Health Law of New York State

NY Lab Id No: 11469

12

is hereby APPROVED as an Environmental Laboratory for the category ENVIRONMENTAL ANALYSES AIR AND EMISSIONS All approved subcategories and/or analytes are listed below:

NIOSH 7082

40 CFR 763 APX A No. III YAMATE, AGARWAL GIBB **NIOSH 7402** NIOSH 7400 A RULES

12 Serial No.: 57807 A

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Metals L Lead, Total

Miscellaneous Asbestos

Fibers

MR. DANIEL CLARKE

528 MINEOLA AVE. CARLE PLACE, NY

EMSE ANALYTICAL, INC.

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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 depe 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:

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).

2018-07-01 through 2019-06-30

Effective Dates



For the National Voluntary Laboratory Accreditation Program

National Voluntary Laboratory Accreditation Program



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.

528 Mineola Ave. Carle Place, NY 11514 **Daniel Clarke** Phone: 516-997-7251 Email: dclarke@emsl.com http://www.emsl.com

ASBESTOS FIBER ANALYSIS

NVLAP LAB CODE 101048-10

Bulk Asbestos Analysis

<u>Code</u>	<u>Description</u>
18/A01	EPA - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of 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

Airborne Asbestos Analysis

Description Code

18/A02

U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

For the National Voluntary Laboratory Accreditation Program

Page 1 of 1

Effective 2018-07-01 through 2019-06-30

NEW YORK STATE DEPARTMENT OF HEALTH WADSWORTH CENTER



Expires 12:01 AM April 01, 2019 Issued April 01, 2018

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE Issued in accordance with and pursuant to section 502 Public Health Law of New York State

NY Lab Id No: 11469

MR. DANIEL CLARKE EMSL ANALYTICAL, INC. 528 MINEOLA AVE. CARLE PLACE, NY 11514

> 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

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Asbestos in Friable Material Item 198.1 of Manual EPA 600/M4/82/020 Asbestos in Non-Friable Material-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

Item 198.6 of Manual (NOB by PLM)

Sample Preparation Methods 199

EPA 3051A

Serial No.: 57805

Page 1 of 1

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ATTACHMENT 4

PHOTOGRAPHIC DOCUMENTATION



NCDP1701



Lead Based Paint on rebar in screening disposal area, below grade



Non-Lead based paint in screening disposal area



architects + engineers

NCDP1701



Non-Lead based paint in screening disposal area





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NCDP1701



Non-Lead based paint in sewage pump basement 2



Non-Asbestos containing pipe elbow insulation in electrical room


architects + engineers

NCDP1701



Non-Asbestos containing wall mastic in screening disposal center



architects + engineers

NCDP1701



Asbestos containing roof membrane



Asbestos containing vent tar



architects + engineers

NCDP1701



Non-Asbestos containing shingle and vapor barrier

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