

**Greater New Haven Water Pollution Control Authority
Protecting the Environment**



**PROJECT: JAMES STREET SIPHON STATION
UPGRADES PROJECT
NEW HAVEN, CONNECTICUT**

PROJECT NUMBER: SSF 2017-02

BID OPENING: WEDNESDAY, FEBRUARY 26, 2020

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**GREATER NEW HAVEN
WATER POLLUTION CONTROL AUTHORITY
260 EAST STREET
NEW HAVEN, CT 06511
PHONE: 203.466.5280 FAX: 203.772.2027
WEB: WWW.GNHWPCA.COM
EMAIL: ENGINEERING@GNHWPCA.COM**

EMERGENCY NUMBER: 203-466-5260

Greater New Haven
Water Pollution Control Authority

INVITATION

for Constructing

PROJECT: James Street Siphon Station Upgrades Project
New Haven, CT
PROJECT NO.: SSF 2017-02

Sealed bids will be received at the Office of the Director of Finance and Administration of the Greater New Haven Water Pollution Control Authority (Authority) located at 260 East Street, New Haven, Connecticut 06511 for the above referenced project until **10:00 am on Wednesday, February 26, 2020** at which time and place said bids will be opened publicly and read aloud.

A non-mandatory pre-bid meeting will be held at 10:00 am, Wednesday, January 22, 2020 at the James Street Siphon Station, 2 James Street, New Haven, Connecticut.

All questions from Bidders must be received by the Authority by fax or via email in writing before 4:00 p.m. on Monday, February 17, 2020. (send emails to: engineering@gnhwpca.com)

The information for Bidders, Proposal, Form of Contract, and Specifications may be examined at the above address. Any one submitting a bid for this project must have in their possession a copy of the Authority's STANDARD SPECIFICATIONS dated September 12, 2006 (as amended), as well as the plans and bid package. This document can be obtained upon payment of One Hundred Dollars (\$100.00). The plans and a "bid package" containing the Invitation, Proposal, Special Specifications and Notes can be obtained upon a **non-refundable** payment of Fifty Dollars (\$50.00).

A certified check or bid bond in the amount of fifteen percent (15%) of the total bid amount must accompany the bid. Said checks or bid bonds will be returned to the unsuccessful bidders upon Award of the Contract to the selected firm and execution of the Agreement. If any bid is not accompanied by a bid bond or check at the specified time for the bid opening, the incomplete bid will not be read and this action will constitute automatic rejection of the bid.

The successful bidder will be required to furnish a performance bond and a labor and materials

payment bond in the form as attached to the Bid Documents for the amount of the total bid. A certified check cannot be substituted for either bond. The Greater New Haven Water Pollution Control Authority reserves the right to alter quantities and to accept or reject any or all bids or any portion of any bids, for any or no reason, including unavailability of appropriated funds as it may deem to be in its best interests.

All bidders are to note that the award of this Contract is subject to the following conditions and contingencies:

1. The approval of such governmental agencies as may be required by law.
2. The appropriation of adequate funds by the proper agencies.

Gabriel Varca
Director of Finance and Administration

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Greater New Haven Water Pollution Control Authority
JAMES STREET SIPHON STATION
UPRADES PROJECT
NEW HAVEN, CONNECTICUT
Project No. SSF 2017-02

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Note: The Project Plans are bound separately from this
Project Manual.



BIDDER'S CHECKLIST

The following separate documents shall be completed and submitted with each bid:

1. Itemized Proposal
2. Bid Security/Bond (See Section 102-09 of the Standard Specifications and Invitation To Bid
3. Bidder's Qualifications Form

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SECTION 01295**SCHEDULE OF VALUES****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Schedule of Values for all of the Work shall include quantities and prices of items which, when added together, equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve the basis for progress payments during the performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of work.

1.02 SUBMITTALS

- A. Within 10 calendar days after the date of the Notice to Proceed, the Contractor shall submit a preliminary Schedule of Values for all of the Work to the Engineer for review:
1. The Contractor's Schedule of Values will be acceptable to the Engineer as to form and substance if it provides a reasonable allocation of the Contract price to component parts of the Work.
 2. The Engineer may request and require additional detail or documentation to support the values published on the preliminary schedule of values. This additional documentation may consist of, but is not limited to, executed purchase orders, subcontracts, or other agreements.
 3. The Engineer may request and require an additional level of break down to the values published in the preliminary schedule of values.
 4. If the value published for any of the items in the preliminary schedule of values are in the opinion of the Engineer, inappropriate, it shall not be accepted.
 5. If, in the opinion of the Engineer, the preliminary schedule of values is unbalanced as to provide for overpayment on items of Work to be performed first, it shall not be accepted.

END OF SECTION 01295

SECTION 01300**SUBMITTALS****PART 1 – GENERAL****1.01 DESCRIPTION**

- A. This Section specifies the general methods and requirements of submissions applicable to the following Work-related submittals.
1. Shop Drawings
 2. Product Data
 3. Samples
 4. Construction Photographs
 5. Construction or Submittal Schedules
 6. Certifications
- B. Detailed submittal requirements will be specified in the technical specifications section.

1.02 SHOP DRAWINGS, PRODUCT DATA, SAMPLES

- A. Shop Drawings:
1. Shop drawings, as defined in the General Conditions, and as specified in individual Work Sections include, but are not necessarily limited to:

Custom-prepared data such as fabrication and erection/installation (working) drawings of concrete reinforcement, structural details and piping layout, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications as applicable to the Work.
 2. All shop and Working drawings shall be prepared on standard size, 24-in. by 36-in. sheets, except those which are made by changing existing standard shop or Working drawings.
 3. All shop drawings shall be submitted using a transmittal form.
 4. All shop drawings submitted by subcontractor for approval 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.
 5. The CONTRACTOR shall check all subcontractor's shop drawings regarding measurements, size of members, and details to satisfy himself that they conform to the intent of the Drawings and Specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission thereof.

6. All details on shop drawings submitted for approval shall show clearly the relation of the various parts of 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 for approval.

B. Product Data:

1. Product data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and printed installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances including certificates of compliance 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 and recommended spare-parts listing, and printed product warranties, as applicable to the Work.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. The CONTRACTOR shall 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 the Specifications
- 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 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." Shop drawings and product data sheets 11-in. X 17-in. and smaller shall be bound together in an orderly fashion and bear the above Certification Statement on the cover sheet. The cover sheet shall fully describe the packaged data and include a listing of all items within the package. Provide to the ENGINEER a copy of each submittal transmittal form for shop drawings, product data and samples at the time of submittal of said drawings, product data and samples to the ENGINEER.
- C. If a shop drawing shows any deviation from the requirements of the Contract Documents, the CONTRACTOR shall make specific mention of the deviations in the Transmittal Form furnished by the ENGINEER and provide a description of the deviations in a letter attached to the submittal.
- D. The review and approval of shop drawings, samples or product data by the ENGINEER shall not relieve the CONTRACTOR from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the CONTRACTOR and the ENGINEER will not have responsibility therefor.

- E. 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 be at the CONTRACTOR'S risk. The OWNER will not be liable for any expense or delay due to corrections remedies required to accomplish conformity.
- F. Project Work, materials, fabrication, and installation shall conform with approved shop drawings, applicable samples, and product data.
 - 1. Manufacturer's printed installation instructions, a part of product data submitted to the ENGINEER will not be reviewed and are for informational purposes only.

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. All submittals shall be submitted sufficiently in advance of construction requirements to provide no less than ten days, including Saturdays, Sundays and legal holidays for review from the time received at the ENGINEER'S reviewing office. For submittals of major equipment, that require more than ten days to review, due to its sheer complexity and amount of detail and also requiring review by more than one engineering discipline, a letter will be sent by the Project Manager or his/her designee to the CONTRACTOR informing him/her of the circumstances and the date it is expected the submittal will be returned to the CONTRACTOR.
- C. Number of submittals required:
 - 1. Shop Drawings: Unless otherwise stated in the respective Specifications Sections, submit four (4) copies.
 - 2. Product Data: Unless otherwise stated in the respective Specifications submit four (4) copies.
 - 3. Samples: Submit the number stated in the respective Specification Sections.
- D. Submittals shall contain:
 - 1. The date of submission and the dates of any previous submissions.
 - 2. The Project title and number.
 - 3. CONTRACTOR identification.
 - 4. The names of:
 - a. CONTRACTOR
 - b. Supplier
 - c. Manufacturer

5. Identification of the product, with the specification section number, page and paragraph(s).
 6. Field dimensions, clearly identified as such.
 7. Relation to adjacent or critical features of the Work or material
 8. Applicable standards, such as ASTM or Federal Specification numbers.
 9. Identification of deviations from Contract Documents.
 10. Identification of revisions on resubmittals.
 11. An 8-in. x 3-in. blank space for CONTRACTOR and ENGINEER stamps.
- E. Each shipment of drawings shall be accompanied by a transmittal form acceptable to the ENGINEER giving a list of the drawing numbers and the names mentioned above.
- 1.05 REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES
- A. The ENGINEER'S review is for general conformance with the design concept and Contract drawings. Markings or comments shall not be construed as relieving the CONTRACTOR from compliance with the Contract plans and specifications or from departures therefrom. 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.
- B. The review of shop drawings, data, and samples will be general. 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.
- C. If the shop drawings, data or samples as submitted describe variations and show a departure from the Contract requirements which the 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 time for performance, the ENGINEER may return the reviewed drawings without noting an exception.
- D. Two (maximum) copies of shop drawings or product data will be returned to the CONTRACTOR via First Class United States Postal Service. Samples will not be returned.
- E. Submittals will be returned to the CONTRACTOR under one of the action codes indicated and defined on the transmittal form furnished by the ENGINEER.

- F. Resubmittals will be handled in the same manner as first submittals. On resubmittals the CONTRACTOR shall direct specific attention, in writing, on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the ENGINEER, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the CONTRACTOR. The CONTRACTOR shall make corrections to any Work done because of this type revision that is not in accordance to the Contract Documents as may be required by the ENGINEER.
- G. 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 "Rejected" until resubmitted. The ENGINEER may at his option provide a list or mark the submittal directing the CONTRACTOR to the areas that are incomplete.
- 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 seven Working days prior to release for manufacture.
- 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.

1.06 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 6.

1.07 GENERAL PROCEDURES FOR SUBMITTALS

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

1.08 CERTIFICATION FORMS

- A. If specified in other Sections of these Specifications, the CONTRACTOR shall submit the applicable certification form for each item required, and in the form attached to this Section, completely filled in and stamped.

1.09 CERTIFICATION OF COMPLIANCE

- A. Certificates of Compliance specified in the specifications shall include and mean certificates, manufacturer's certificates, certifications, certified copies, letters of certification and certificate of materials.

- B. The CONTRACTOR shall be responsible for providing Certificates of Compliance requested and specified in the technical specifications. Certificates are required for demonstrating proof of compliance with specification requirements and shall be executed in 4 copies unless otherwise specified. Each certificate shall be signed by an official authorized to certify on behalf of the manufacturing company and shall contain the name and address of the Supplier, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Supplier from furnishing satisfactory material, if after tests are performed on selected samples, the material is found not to meet the specific requirements.

END OF SECTION 01300

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SECTION 01752**STARTUP AND COMMISSIONING****PART 1 - GENERAL****1.01 SYSTEM DESCRIPTION:**

- A. To establish a basis of understand for system description for this project, the Contractor shall observe the following:
1. Definition: A system is defined as an arrangement of items of equipment, components, piping, wiring materials, or incidentals so related or connected as to form a function and operational unit.
 2. Project Classified Systems: for this project, system classifications shall include but not necessarily be limited to the following:
 - Mechanical Bar Screens
 - Instrumentation and Process Control
 - Electrical System

1.02 SYSTEM STARTUP AND DEMONSTRATION REQUIREMENTS:

- A. Pre-Startup Requirements
1. Prior to startup, the Contractor shall undertake the following procedures, in the order listed:
 - a. Ensure that all required written statements and/or guarantees from manufacturers by individual Specification Sections comply with Contract Documents. Contractor shall use a checklist to identify all such requirements, by Specification Section, and shall submit a copy of the completed checklist to the Engineer. All such written statements and/or guarantees from manufacturers shall be submitted to the Engineer.
 - b. Ensure Work is complete before startup of any unit or system. Certify to Owner that specifically required services or respective equipment manufacturers' representative by individual section of specification have been performed in accordance with Contract Documents.
 - c. Ensure systems are tested hydraulically, mechanically, and electrically. Ensure systems which require calibration, commissioning, and balancing are fully certified as complete in performance, in accordance with Contract Documents. Ensure required tagging, identification, and/or stenciling is complete.

- d. Schedule startup a minimum of 30 days prior, with written notice issued to but not necessarily limited to: Owner, Engineer, Subcontractors, and applicable Regulator Agencies.
- e. Provide all labor, supervision, utilities, chemicals, equipment, tools, materials, vehicles or any other items necessary to startup, operate and demonstrate the system.
- f. Gauges, meters, recorder and monitors shall be provided by the Contractor, as required by the Engineer, to supplement or augment the instrumentation system provided under this Contract to properly demonstrate that all equipment fully satisfies the requirements of the Contract Documents. All devices employed for the purpose of measure the performance of the facility's equipment and systems shall be specifically selected to provide a level of certainty consistent with the variable to be monitored. All instruments shall be recently calibrated, and the Contractor shall be prepared at all times to demonstrate, though recalibration, the certainty of all instruments employed for testing purposes. Calibration procedures shall be in accordance with applicable standards of ASTM, ISA and IEEE. The adequacy of all gauges, meters, recorders and monitors shall be subject to review of the Engineer.
- g. The Contractor shall provide sign off forms for all installed and operation testing to be accomplished under this contract. Sign off forms shall be provided for each item of mechanical, electrical and instrumentation equipment provided or installed under this contract and shall contain provisions for recording relevant performance data for original testing, and not let than three retests. Separate sections on the form shall be provided to record values for pre-operation checkout, initials of representatives of the equipment manufacturers, the Contractor and the Engineer.
- h. The Contractor shall maintain a master file of all equipment sign off forms, which shall be available for inspection by the engineering. Upon completion of all equipment testing, the contactor shall furnish the Engineer with the original and two copies of the sign off forms for each equipment item.

B. System Startup and Demonstration

1. The Contractor shall startup, operate and demonstrate specified performance of each item of equipment and each system at full operation without interruption of equipment or system or need of adjustment or repair until the satisfaction of the

Engineer has been met.

2. During startup of equipment, the Contractor shall provide knowledgeable and experienced person(s) to instruct owner's designated personnel on the Operation and Maintenance of each system. This service shall be in addition to services provided by equipment manufacturer's authorized representative(s) prescribed by individual Sections of this specification. Instructions during the startup period shall be in the form of a comprehensive "overview", and not simply a repeat of previous Operation and Maintenance instructions on each system per the specific section in the contract Documents.
3. The Contractor shall pay for all chemicals used during startup.

1.03 EQUIPMENT START-UP AND PERFORMANCE TEST PROTOCOL

A. Start-up shall consist of the following items, in the order shown:

1. Equipment Pre-start-up Check
2. Equipment Start-up and Performance Testing
3. Manufacturer's Equipment Testing

B. Pre-Equipment Start-Up

1. Contractor shall check out each item of equipment in the presence of the Engineer, to show that it is properly installed, and is functioning and ready for equipment start-up and performance testing.
2. As a minimum, The Contractor shall do the following:
 - a. Assure that equipment is property installed, painted, leveled, wired and/or insulated.
 - b. Assure that all equipment is property lubricated.
 - c. Assure that all safety related accessories are property installed.
 - d. Bump or momentarily jog equipment to establish operation and proper rotation.
3. Contractor shall arrange for equipment manufacturers to be present, or verify that these procedures may be done without the manufacturer's representatives being present.

C. Equipment Start-up

1. Prior to testing any equipment, the Contractor shall obtain written certification, from the manufacturer, that the equipment is properly installed, calibrated and ready for safe and efficient operation as intended by the Engineer and manufacturer.
2. Prior to start-up and testing of any item of equipment, the equipment and all associated piping channels, basins, wetwells, etc. shall be thoroughly cleaned and flushed.
3. The Contractor, with assistance from the manufacturer's factory trained service engineer, and in the presence of the Engineer, shall start-up and operate each item of equipment to show that it is performing according to the requirements of the specifications. With this step, the Contractor shall assure that the equipment is ready for performance testing.

D. Performance Tests

1. General

- a. Full tests shall be made at the Site on each item of equipment after it has been properly installed, started and certified ready for operation. These tests shall demonstrate that each item of equipment will operate properly by itself and in conjunction with all other facility equipment, in accordance with the performed specification and manufacturer performance specifications.
- b. The Contractor shall furnish all necessary labor, tools, equipment, power, chemicals and clean water, to perform field tests to determine that the supplied equipment, including controls and alarms meet hydraulic, electric, mechanical and performance requirements in accordance with the Contract Documents and manufacturer specifications.
- c. All incomplete and/or unsuccessful tests shall be done over, to the satisfaction of the Engineer.

2. Process Equipment, Instrumentation, and Controls

- a. Calibrate and/or verify calibration and property operation and function of all process and analytical instruments, and documents results, for the following:

1. Level monitors and controls

2. Indicating controllers
3. Indicators
4. Electrical relays and current trips
5. Annunciator and alarm horn
6. PLCs and/or RTUs and transmitting and receiving equipment
7. Power supplies and UPS systems
8. dp cells
9. Selector switches
10. Electrically actuated process control valves
11. Misc. Equipment

E. Manufacturer's Training

1. Contractor shall refer to specifications for requirement of manufacturer's training.
2. The Contractor shall note the following:
 - a. No training can be conducted until the owner has received approved Manufacturer's Operation & Maintenance Manuals.
 - b. Owner will not accept any item of equipment prior to receiving approved manufacturer training for the equipment. This applies only to equipment requiring manufacturer's training in accordance with the specifications.
 - c. Engineer shall approve the completeness of all training and verify completion by completing a "verification of Manufacturers Equipment Training form.
 - d. Training shall be conducted in addition to, and exclusive of startup and performance testing.

PART 2 – PRODUCTS (not applicable)

PART 3 – EXECUTION (no applicable)

END OF SECTION 01805

SECTION 01760**OPERATION AND MAINTENANCE MANUALS****PART 1 - GENERAL****1.1 SCOPE OF WORK:**

- A. This section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

1.2 RELATED WORK:

- A. General Requirements in their entirety (Section 00700 through Section 01770)
- B. Individual Technical Specification Sections Specific for Operation and Maintenance Data.
- C. Section 01300, SUBMITTALS
- D. Section 01770, PROJECT CLOSEOUT

1.3 FORMAT:

- A. Prepare data in form of an instructional manual.
- B. Binders: Commercial quality 1/2 x 11 inch three-ring binders with hardback, washable, plastic covers; two-inch maximum ring size. When multiple binders are used, correlate data into related, consistent groupings. Provide a table of contents in each binder.
- C. Cover: Identify each binder cover and spine with typed or printed title OPERATION AND MAINTENANCE INSTRUCTION; list title of Project facility; identify subject matter of contents.
- D. Arrange contents by systems under section numbers and sequence of Table of Contents.
- E. Provide tabbed flyleaf for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: Manufacturer's printed data, or typewritten data - on 20-pound paper.
- G. Drawings: Provide with reinforced punched, binder tab. Bind in with text; fold larger drawings to size of text pages.
- H. Submit certification that the data and drawings provided pertain exactly to the model, size, and series product and equipment installed in the work.
- I. All documents will be electronically scannable.

J. All products, systems, and drawings must be cross-referenced with tag ID numbers.

K. The manual for each piece of equipment shall be a separate document with the following specific requirement:

1. Contents:

Table of Contents and Index

Brief description of each system and components

Starting and stopping procedures

Special operating instructions

Recommended inspection and maintenance procedures and schedule (i.e. weekly, monthly, yearly, etc.)

Manufacturer's printed operating and maintenance instructions, parts list, illustrations, and diagrams

One copy of each wiring diagram

One copy of each approved shop drawing and each Contractor's coordination and layout drawing

List of spare parts, manufacturer's price, and recommended quantity

Name, address and telephone number of local service representatives.

Completed GNHWPCA Asset Summary and Maintenance Summary Forms

All Manufacturers Warranties

2. Material

Loose leaf on 60-pound, punched paper

Holes reinforced with plastic cloth or metal

Page size, 8 ½ x 11 inches

Diagrams, illustrations and attached foldouts as required, of original quality, reproduced by dry copy method

Covers: oil, moisture and wear resistant 9 x 12 size

1.4 QUALITY ASSURANCE:

- A. Prepare instructions and data by personnel experienced in maintenance and operations of described products.

1.5 CONTENTS, EACH VOLUME (BINDER):

- A. Table of Contents: Provide title of Contract, schedule of products and systems, indexed to content of the volume. A listing of all relevant tag ID numbers for each volume shall be placed immediately after the Table of Contents.
- B. For each product or systems: List names, addresses, and telephone numbers of subcontractors and suppliers, including local source of suppliers and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- E. Text: As required to supplement product data, provide logical sequence of instructions for each procedure incorporating manufacturer's instructions.
- F. Warranties, Guarantees, and Bonds: Bind copy of each
- G. See O&M Manual Review Checklist at end of this specification section.

1.6 MANUAL FOR MATERIALS AND FINISHES:

- A. Building Products, Applied Materials, and Finishes: Include product data with catalog number, size composition, and color and texture designations. Provide information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: As specified in individual product specification sections.

1.7 MANUAL FOR EQUIPMENT AND SYSTEMS:

- A. Each Item of Equipment and Each System: Include description of unit or system and component parts. Identify function, normal operating characteristics and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- B. Data submitted on all equipment shall include complete maintenance instructions (including preventive and corrective maintenance) and parts lists in sufficient detail to facilitate ordering replacements.
- C. All products, systems, equipment, electrical wiring, interconnection diagrams, instrumentation wiring, personnel protection systems wiring, presented in this manual will have tag numbers corresponding to contract drawings and specifications. In the event, numbers do not exist; the Engineer will specify a series of numbers.
- D. Panelboard Circuit Directories: Provide electrical service characteristics, controls and communications.
- E. Include color-coded wiring diagrams as installed.
- F. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequence. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter and any special operating instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required. Cross-reference lubricants to products offered by at least three major lubricant suppliers.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color-coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

- O. Include test and balancing reports, calibration data, alignment records, and other information.
- P. Additional Requirements: as specified in individual product specification sections.
- Q. Provide a listing in table of Contents for design data with tabbed flysheet and space for insertion of data.
- R. Incorporation of all Physical Checkout information obtained through the field-testing and correction phases of the Work. Input must be specific to the actions and information obtained during those phases.

1.8 SUBMITTALS:

- A. The Contractor shall submit to the Engineer, prior to substantial completion of the project, four (4) printed and bound copies each of Operation and Maintenance Manual required as noted in the technical specifications sections for this Contract. Also submit (1) Electronic file of draft and final O&M Manuals.
- B. The Contractor shall be responsible for the prompt submittal and resubmittal, as necessary, of all manuals so that there will be no delay in the startup operation of the facility due to the absence of such manuals.
- C. Manuals shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawings.
- D. All manuals shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining manuals from his subcontractors and returning reviewed manuals to them. A shop drawing transmittal form with a description of the manual shall accompany each shipment of manuals.
- E. The Engineer will review the manuals as to their general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections of comments made in the manuals during the review does not relieve the Contractor from compliance with requirements of the Contract Documents.
- E. O&M Manuals will be reviewed and returned to the Contractor within 30 days of submittal.
- F. Where reference is made in technical specification sections to operating and maintenance manuals and/or spare parts lists, the Contractor shall submit four copies to the Engineer for review in accordance with the following instructions:

1. Four (4) complete sets of operation and maintenance instructions covering all equipment furnished under Sections 11, 13, 14, 15 and 16 requiring operation and maintenance manuals shall be delivered directly to the Owner.
 2. Submission and approval of each set of manuals is considered an integral part of furnishing and installing respective equipment or systems.
 3. Submit four (4) copies of first draft volumes as required herein. This first draft shall contain all currently available product data. One copy will be returned with comments.
 4. Submit four copies of completed second draft volumes in final form 90 days prior to startup and after Physical checkout to include the additional requirements set forth in paragraph 1.07.R of Section 01760 OPERATION AND MAINTENANCE MANUALS.
 5. Submit four copies of the Final Operation and Maintenance Manuals as required in Section 01770 PROJECT CLOSEOUT.
- G. If the submittal is complete and does not require any changes, an acknowledgement (copy of transmittal) will be returned noting status. If the submittal is incomplete or does require changes, corrections, additions, etc., one copy of the submittal will be returned with a copy of transmittal noting status.
- H. For systems requiring field adjustment and balancing, such as heating and ventilating, the Contractor shall submit separate test results and adjustment data on completion of the work to be incorporated into the system manual.
- I. The information included in the manual shall be as described in the individual specification sections, but as a minimum shall contain clear and concise instructions for operating, adjusting, lubricating and maintaining the equipment, an exploded assembly drawing, identifying each part by number and a listing of all parts of the equipment, with part numbers and descriptions required for ordering spare parts. Spare parts lists shall include recommended quantity and price.

1.9 ASSET AND MAINTENANCE SUMMARY FORMS:

- A. The Contractor shall submit to the Engineer, prior to substantial completion of the project, printed and bound copies of each GNHWPCA Asset Summary Form and Maintenance Summary Form for all equipment provided. Asset Summary and Maintenance Forms are attach along with sample completed forms.
- B. Also submit (1) Electronic file of draft and final forms.

PART 2 – PRODUCTS

Not used.

PART 3 –EXECUTION

Not used.

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REFERENCE COPY ONLY

**OPERATION AND MAINTENANCE MANUAL
REVIEW CHECKLIST**

1. Name, address, telephone/fax number of the manufacturer ☐
2. Name, address, contact name, telephone/fax of local representative ☐
3. Name, address, telephone/fax number of the contractor ☐
4. Exploded view/general arrangement of materials of construction ☐
5. Description of operation/operating principal ☐
6. Project specific Operating parameters ☐
7. Wiring Diagrams, to include Interconnection Diagrams ☐
8. Troubleshooting checklist ☐
9. Recommended spare parts list with prices, and ordering instructions ☐
10. Model number and the serial number of the model provided ☐
11. Performance curves or tabulated data ☐
12. Routine Maintenance instructions/service instructions with recommended Intervals ☐
13. Assembly and disassembly instructions ☐
14. Recommended lubricates and lubrication schedule ☐
15. Approved copies of Shop Drawings are to be included in the manual ☐
16. Startup/break-in and adjustment instructions ☐
17. Warranty information ☐
18. GHNWPCA Asset Summary Forms ☐
19. GNHWPCA Maintenance Summary Forms ☐

Reviewed By: _____
Weston & Sampson Engineers

Date: _____

\\\\wse03.local\\WSE\\Projects\\CT\\GNHWPCA\\2190262 New Haven HMGP\\4 Working Documents\\4.2 Specifications\\Division 1\\01760 - O&M Manuals.docx

END OF SECTION 01760

ASSET SUMMARY FORM

Owner Name: GNHWPCA **Project Number/Name:** _____

General:

Description: _____ Tag #: _____

Type: _____

Area: _____

Building/Room: _____

Vendor: _____ Website: _____

Manufacturer: _____ Website: _____

Model #: _____ Serial #: _____ Mfg Job #: _____

if serial # is unavailable

Install Date: _____ Purchase Date: _____

Start-up Date: _____ Warranty End Date: _____

Specification(s):

Pump Size/Size	Pump Flow	Pump Head	Pump Media

HP	Frame	RPM	Voltage

Component(s):

Component(s)		Specifications (if applicable)			
ID	Component Name - Mfg.	HP	Frame	RPM	Voltage
1					
2					
3					
4					
5					

ASSET SUMMARY FORM cont.

Attachment(s):

ID	Attachment Name
1	
2	
3	

Existing Asset(s):

If replacing existing asset, record the tag and description of each existing asset:

Tag	Description

Contact Information:

General Contr.: _____

Email: _____

Phone: _____

Design Engineer: _____

Email: _____

Phone: _____

Sub-Contractor: _____

Email: _____

Phone: _____

For Owner Use Only:

Representative: _____

CMMS Upload Date: _____

CMMS Asset ID: _____

MAINTENANCE SUMMARY FORM

Manufacturer's Local Rep: _____

Name: _____

Address: _____

Telephone: _____

Weight of Individual Components (Over 100 Pounds): _____

Maintenance Requirements:

Maintenance Task	Frequency	Lubricants
List each maintenance operation required and refer to specific information in the manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation required.	Refer by symbol to lubricant required.

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Lubricant List:

[illegible]

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REFERENCE COPY ONLY

Part No.	Description	Unit	Qty	Unit Cost	Stored Location

Note: Identify parts provided by this Contract with two asterisks.
Stored Location is recorded by Owner

ASSET SUMMARY FORM - EXAMPLE 1 - ATTACHMENT A

Owner Name: GNHWPCA Project Number/Name: CWF2010-01

General:

Description: Return Activated Sludge Pump 6 Tag #: P-32-1-06

Type: Centrifugal Pump Horizontal

Area: North Basement

Building/Room: Facility 52 Activated Sludge Pump Station

Vendor: Rodnev Co.

Website: www.rodnevco.com/

Manufacturer: GNH Pumps

Website: www.gnhpumps.com/

Model #: K250-400/G-3-F

Serial #: 315707

Mfg Job #: _____

If serial # is unavailable

Install Date: 1/1/2016

Purchase Date: 12/1/2014

Start-up Date: 3/5/2016

Warranty End Date: 3/5/2017

Specification(s):

Pump Size/Size	Pump Flow	Pump Head	Pump Media
10" X 10"	3475 gpm	40	RAS

HP	Frame	RPM	Voltage
50		1180	460

Component(s):

Component(s):		Specifications (if applicable)			
ID	Component Name	HP	Frame	RPM	Voltage
1	Horizontal Motor - WEG	50	365T	1180	460
2	Coupling Drive				
3	Check Valve - Surge Buster				
4	Discharge Plug Valve - Milliken				
5	Suction Plug Valve - Milliken				

ASSET SUMMARY FORM cont.

Attachment(s):

ID	Attachment Name
1	RAS Pump O&M Manual
2	Electronic Photo - Pump 6
3	Start up/COPI

Existing Asset(s):

If replacing existing asset, record the tag and description of each existing asset:

Tag	Description
Ex29765	Auma Centrifugal Pump Horizontal

Contact Information:

General Contr.: _____

Email: _____

Phone: _____

Design Engineer: _____

Email: _____

Phone: _____

Sub-Contractor: _____

Email: _____

Phone: _____

For Owner Use Only:

Representative: _____

CMMS Upload Date: _____

CMMS Asset ID: _____

ASSET SUMMARY FORM - EXAMPLE 2 - ATTACHMENT B

Owner Name: GNHWPCA **Project Number/Name:** CWF2010-01

General:

Description: Air Flow Control Valve Tag #: FCV-21-4 - 1

Type: Flow Control Valve

Area: BRB Basin 1 - Zone 3

Building/Room: Facility 50 - BRB Basins

Vendor: Rodnev Co.

Website: www.rodnevco.com/

Manufacturer: GNH Autovalve

Website: www.gnhvalve.com/

Model #: Series 400

Serial #: AH145900

Mfg Job #: _____

if serial # is unavailable

Install Date: 7/27/2015

Purchase Date: 5/27/2015

Start-up Date: 7/27/2015

Warranty End Date: 7/27/2016

Specification(s):

Pump Size/Size	Pump Flow	Pump Head	Pump Media
6"			

HP	Frame	RPM	Voltage

Component(s):**Specifications (if applicable)**

ID	Component Name	HP	Frame	RPM	Voltage
1	Electric Valve Actuator - GNH				460
2					
3					
4					
5					

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REFERENCE COPY ONLY

ASSET SUMMARY FORM cont.

Attachment(s):

ID	Attachment Name
1	Valve O&M Manual
2	Electronic Photo - ABZ Valve
3	Start up/COPI

Existing Asset(s):

If replacing existing asset, record the tag and description of each existing asset.

Tag	Description

Contact Information:

General Contr.: _____

Email: _____

Phone: _____

Design Engineer: _____

Email: _____

Phone: _____

Sub-Contractor: _____

Email: _____

Phone: _____

For Owner Use Only:

Representative: _____

CMMS Upload Date: _____

CMMS Asset ID: _____

MAINTENANCE SUMMARY FORM - Example 1 - ATTACHMENT A

Manufacturer's Local Rep: Rodnev Co.

Name: John Daley

Address: 345 Main St. New Haven, CT 06511

Telephone: 203-555-5555

Weight of Individual Components (Over 100 Pounds): 2850 lbs

Maintenance Requirements:

Maintenance Task	Frequency	Lubricants
List each maintenance operation required and refer to specific information in the manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation required.	Refer by symbol to lubricant required.
Inspect Coupling Rubber inserts for wear	1/yr	NA
Grease Motor Bearings	1-2 years or 15,000 hrs	mobil polyrex em
Change seal oil	1-2 years or 10,000 hrs	Vegetable oil or any SAE 30 non detergent oil

MAINTENANCE SUMMARY FORM cont.

Lubricant List:

Reference Symbol	Shell	Exxon Mobile	Chevron Texaco	BP Amoco	Or Equal
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				
Bearing Grease		Mobile Polyrex EM			
Seal Oil					Vegetable

Recommended Spare Parts for Owners Inventory:

Part No.	Description	Unit	Qty	Unit Cost	Stored Location
**433.01	Inner Seal		2		
433.02	Outer Seal		2		
502	Case Wear Ring		2		
932,01-4	Circlip	4	2		
421.01,421.02	Lip Seals	2	2		
411	O-ring Kit		4		
Note: Identify parts provided by this Contract with two asterisks. Stored Location is recorded by Owner					

MAINTENANCE SUMMARY FORM - Example 2 - ATTACHMENT B

Manufacturer's Local Rep: Rodnev Co.Name: John DaleyAddress: 345 Main St. New Haven, CT 06511Telephone: 203-555-5555Weight of Individual Components (Over 100 Pounds): N/A**Maintenance Requirements:**

Maintenance Task	Frequency	Lubricants
List each maintenance operation required and refer to specific information in the manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation	Refer by symbol to lubricant required.
Verify position feed back to actual valve position	1/yr	NA

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REFERENCE COPY ONLY

Lubricant List:

[illegible]

Recommended Spare Parts for Owners Inventory:

Part No.	Description	Unit	Qty	Stored Location

Note: Identify parts provided by this Contract with two asterisks.
Stored Location is recorded by Owner

ASSET SUMMARY FORM

Owner Name:Project Number/Name:

General Contractor:Email:Phone:Design Engineer:Email:Phone:Sub-Contractor:Email:Phone:

Tag #	Description	Type	Area	Building/Room	Vendor

For Owner Use Only:

Representative:

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REFERENCE COPY ONLY

ASSET SUMMARY FORM

Owner Name: _____

Project Number/Name: _____

General Contractor: _____

Email: _____

Phone: _____

Design Engineer: _____

Email: _____

Phone: _____

Sub-Contractor: _____

Email: _____

Phone: _____

Website	Manufacturer	Website	Model #	Serial #	Mfg Job #

CMMS Upload Date: _____

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REFERENCE COPY ONLY

ASSET SUMMARY FORM

Owner Name: _____

Project Number/Name: _____

General Contractor: _____

Email: _____

Phone: _____

Design Engineer: _____

Email: _____

Phone: _____

Sub-Contractor: _____

Email: _____

Phone: _____

Install Date	Start-up Date	Purchase Date	Pump Size	Pump Flow	Pump Head	Pump Model	HP	Frame	RPM	Voltage

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REFERENCE COPY ONLY

ASSET SUMMARY FORM

Owner Name: _____

Project Number/Name: _____

General Contractor: _____

Email: _____

Phone: _____

Design Engineer: _____

Email: _____

Phone: _____

Sub-Contractor: _____

Email: _____

Phone: _____

Component(s)	HP	Frame	RPM	Voltage	Existing Asset(s)	Attachment(s)

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SECTION 01770**PROJECT CLOSEOUT****PART 1 - GENERAL****1.1 WORK INCLUDED:**

- A. This Section covers administrative and procedural requirements for closing out the project, including, but not limited to:

1. Project as-built documents
2. Checkout and Certification
3. Startup and Testing
4. Final Cleaning
5. Substantial Completion
6. Closeout Procedures
7. Final Completion
8. Correction/Warranty Period

- B. Closeout checklist to be completed by the Engineer.

1.2 RELATED WORK:

- A. General Requirements in their entirety.
- B. Section 01752, STARTUP AND COMMISSIONING
- C. Section 01760, OPERATION AND MAINTENANCE MANUALS

1.3 AS-BUILT DOCUMENTS:

- A. Contractor shall maintain on site, separate from the documents used for construction, one set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.
1. Contract Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other Modifications to the Contract.
 5. Reviewed shop drawings, product data, and samples.
 6. Written interpretations and clarifications.
 7. Field Orders.
 8. Field test reports properly verified.
- B. The completed set of as-built documents shall be submitted to the Engineer with the final Application for Payment.

1.4 CHECKOUT AND CERTIFICATIONS

- A. Prior to checkout and certifications, the following tasks shall be completed:
1. Construction shall be complete. For this purpose, completion of construction is defined as follows:
 - a. The Contractor has completed construction and erection of the work in conformance with the Contract Drawings and Specifications.
 - b. The Contractor has installed and adjusted operating equipment, systems, or facilities, as applicable, as defined by the manufacturers' erection, installation, operation and maintenance instructions.
 2. All shop drawings shall have final approval.
 3. All shop tests shall be complete and approved test results submitted to the Engineer.

1.5 START-UP AND TESTING:

- A. Prior to start-up the following tasks shall be complete:
 - 1. All checkout and certifications shall be satisfactorily completed,
 - 2. All operations and maintenance manuals shall be approved,
 - 3. All preliminary training by the manufacturer's representative shall be completed,
 - 4. An approved start-up procedure shall be in place.
- B. Refer to Section 01752 for start-up and testing requirements.

1.6 FINAL CLEANING:

- A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - 1. Clean the site, including landscape development areas of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to smooth, even textured surfaces.
 - 2. Remove waste and surplus materials, rubbish, fencing equipment, temporary utilities and construction facilities from the site, unless otherwise required by the Engineer.

1.7 SUBSTANTIAL COMPLETION:

- A. Substantial Completion is officially defined in the General and Supplementary Conditions. The date of substantial completion will be certified by the Engineer. This date will not be certified until the following requirements have been satisfied by the Contractor:
 - 1. All Contract requirements are coordinated into a fully operational system. All individual units of equipment and treatment are fully operative and performing at specified efficiencies. Where efficiencies are not specified, performance shall meet acceptable standards for the particular unit.
 - 2. All field tests have been satisfactorily completed and reports forwarded to the Engineer.
 - 3. All final training has been completed by the manufacturers' representatives.

4. All spare parts and lubricants have been satisfactorily delivered to the Owner. Spare parts are for the exclusive use of the Owner when the facility has been turned over. Contractor is responsible for all maintenance and repair materials required until the facility is accepted by the Owner.

1.8 CLOSEOUT PROCEDURES:

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and is complete in accordance with Contract Documents and ready for Engineer's and Owner's inspection.
- B. Accompany Engineer and Owner on inspection to verify conformance with the Contract Documents. Prepare a punch list of work items that have been determined by inspection to not conform to Contract Documents. Punch list items shall include work items that are missing, incomplete, damaged, incorrect items, or improperly installed or constructed. The Contractor shall correct the punch list deficiencies by re-work, modifications, or replacement, as appropriate, until the items conform to the Contract Documents. The initial punch list shall be produced by the Contractor, with copies to the Engineer and Owner. When the Contractor has reduced the number of deficient items to a reasonable level, the Engineer will develop a definitive punch list for the use of the Contractor.
- C. Provide submittals to Engineer that are required by governing or other authorities.
- D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due. The Contractor shall submit the following documents with or prior to Final Application for Payment: Set of as-built documents, Contract Completion and Acceptance Certificate, Consent of Surety to Final Payment, Release and Waiver of Liens and Claims, Affidavit of Payment of Debts and Claims, and remaining releases, waivers, warranties/guarantees, and all other data required by the Contract Documents.

1.9 FINAL COMPLETION:

- A. Prior to final completion, the following tasks shall be completed:
 1. All items in the punch list shall be completed.
 2. All Contract closeout documentation shall be submitted to and accepted by the Engineer.

1.10 CORRECTION/WARRANTY PERIOD:

- A. During the correction period, the Contractor shall correct all deficiencies in equipment and materials.
- B. During the warranty period, the Contractor shall perform all corrective work on warranty deficiencies.

- C. Corrective work will be identified by the Engineer or Owner, as appropriate. The Contractor will be notified of the item(s) requiring corrective work.
- D. The Contractor shall begin work on all corrective work within ten days of being notified of the deficiency by the Engineer and shall then work continuously until the deficiency is corrected. Upon completion of the corrective work, the Contractor shall submit a letter report to the Engineer describing the deficiency and the corrective action that was taken.
- E. The Contractor shall coordinate all corrective work with the Engineer and/or the Owner.

1.11 COMPLETION CHECKLIST:

- A. The Project Completion Checklist, which follows shall be completed as the project nears completion. When the project has been fully completed, Final Payment can be approved.

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REFERENCE COPY ONLY

PROJECT COMPLETION CHECKLIST

Owner _____ Job No. _____

Project _____

As part of the project closeout, all items listed below must be checked off as being complete or otherwise accounted for. The person verifying completion of the item shall list the completion date and his/her initials.

Project Closeout Checklist		
	Date Completion Verified	Verified by
AS-BUILT DOCUMENTS HANDED OVER		
1. Contract Drawings		
2. Specifications		
3. Addenda		
4. Change Orders/Contract Modifications		
5. Reviewed Shop Drawings, Product Data and Samples		
6. Written Interpretations/Clarifications		
7. Field Orders		
8. Field Test Reports		
EQUIPMENT CHECKOUT AND CERTIFICATIONS		
1. Construction Complete per Drawings/Specifications		
2. Equipment Installed and Adjusted		
3. All Shop Drawings have Final Approval		
4. All Shop Tests Complete and Results Submitted		

Project Closeout Checklist		
	Date Completion Verified	Verified By
START-UP AND TESTING		
1. All Checkout and Certifications Complete		
2. All O&M Manuals Approved		
3. All Preliminary Training by Manufacturers Rep. Completed		
FINAL CLEANING		
1. All Construction Facilities Removed		
2. All Construction Debris Removed		
3. All Areas Swept/Cleared		
SUBSTANTIAL COMPLETION		
1. All Items Coordinated Into a Fully Operational System		
2. All Equipment Units Operational at Specified Efficiencies		
3. All Field Tests Completed and Reports Submitted		
4. All Final Training by Manufacturer's Rep. Completed		
5. All Spare Parts and Lubricants Provided		
CLOSEOUT PROCEDURES		
1. Written Certification Submitted that Work is Ready for Owner & Engineer Inspection		
2. Inspection by Owner, Engineer, Contractor completed		
3. Punch List of Nonconforming Items Prepared		
4. Documents Required by Governing or Other Authorities Submitted (List Them)		
5. Final Application for Payment Received		
6. Contact Completion and Acceptance Certificate Submittal		
7. Consent of Surety to Final Payment Submittal		
8. Release and Waiver of Liens and Claims Submitted		
9. Affidavit of Payment of Debts and Claims Submitted		

Project Closeout Checklist		
	Date Completion Verified	Verified By
10. Warranties/Guarantees Submitted		
11. Other Required Releases and Waivers Submitted (List Them)		
12. Permits Submitted (List Them)		
13. Weekly Payrolls Submitted as Required by Law		
FINAL COMPLETION		
1. All Items in Punch List Completed		
2. All Other Required Documentation Submitted (List It)		
CORRECTION/WARRANTY PERIOD		
1. Correction Period Start Date: _____ End Date: _____		
2. Specific Warranties Provided		
<div style="display: flex; justify-content: space-between;"> <div><u>Item</u></div> <div><u>Warranty Duration</u></div> </div>		

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Full name of persons signing their initials on this checklist:

END OF SECTION 01770

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SECTION 02105**SELECTIVE DEMOLITION****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Perform all site demolition work as indicated herein, as shown on the Project Drawings, or as specified elsewhere in the project Specifications.
- B. All selective demolition performed on the site shall be priorly coordinated with the Owner, so as to not disrupt the facility operations, or compromise the security of the facility.
- C. The existing control cabinet and all enclosed within shall remain the property of the GNHWPCHA. Coordination with the GNHWPCHA for receipt of the materials shall be the responsibility of the contractor.

1.02 SUBMITTALS

- A. The Contractor shall submit a Waste Management Plan to the Engineer for review within seven (7) calendar days after the date of the Notice to Proceed. The Waste Management Plan shall contain the following:
 - 1. Quantified list of the proposed job site waste to be generated. This list shall include the anticipated rough quantity and primary and backup disposal or recycling facility for each type of waste.
 - 2. The names of the landfills where job waste will be disposed of, as well as a statement of verification that these landfills are licensed for the type of waste to be deposited, and have sufficient capacity to receive waste from this Project.
 - 3. A description of the means of transportation of all job waste materials.

1.03 JOB CONDITIONS

- A. Conduct selective demolition work in a manner that will minimize need for disruption of Owner's normal operations. Provide minimum of seven (7) days advance notice to Owner of demolition activities which will impact Owner's normal operations.
- B. The Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at the time of commencement of the Contract will be maintained by the Owner insofar as practicable. However, variations within the structure may occur by Owner's removal and salvage operations prior to start of selective demolition work, if applicable.

- C. Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from the site as they are removed. Storage or sale of removed items on site will not be permitted.
- D. Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition work.
 - 1. Provide protective measures as required to provide free and safe passage of Owners personnel and general public to and from occupied portions of the facility.
 - 2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure of element to be demolished, and adjacent facilities or work to remain.
 - 3. Protect from damage existing finish work that is to remain in place which will become exposed during demolition operations.
 - 4. Protect floors with suitable coverings when necessary.
 - 5. Remove protections at completion of work.
- E. Promptly repair damages caused to adjacent facilities by demolition work at no additional cost to the Owner.
- F. Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
- G. Do not close, block or otherwise obstruct roadways, walks or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- H. Use of explosives will not be permitted.
- I. Maintain existing utilities, keep in service, and protect against damage during demolition operations.
- J. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

1.04 REGULATORY REQUIREMENTS

- A. Notify and obtain required approvals from all agencies having jurisdiction over demolition prior to starting work including, but not limited to Health, Building, Fire Departments and local, state and federal agencies.

- B. Comply with all applicable federal, state, and local safety and health requirements regarding the demolition of structures.
- C. Do not close or obstruct roadways, walks, or other facilities without written permission from the Owner and the City of New Haven.
- D. Conform to the appropriate State, Federal, and local procedures if hazardous or contaminated materials are discovered.

PART 2 - PRODUCTS

- A. Not Used.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing structure surfaces, equipment or surrounding properties which could be misconstrued as being damaged from selective demolition work. File with Engineer prior to starting work.

3.02 PREPARATION

- A. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.
 - 1. Cease operations and notify the Owner and the Engineer immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
- B. Of specific concern is the torch cutting of any structural steel. If Contractor intends to torch cut painted steel, the lead paint must be removed from the area to be cut with a chemical stripper or other means. Sufficient paint must be removed to prevent volatilization of lead during the heating of the steel.

3.03 SELECTIVE DEMOLITION

- A. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

1. Locate demolition equipment throughout site and promptly remove debris to avoid imposing excessive loads on concrete or paving.
 2. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
- B. If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Engineer in written, accurate detail. Pending receipt of directive from Engineer, rearrange selective demolition schedule as necessary to continue overall job progress without delay.

3.04 DISPOSAL OF DEMOLITION MATERIAL

- A. Remove debris, rubbish and other materials resulting from demolition operations from site. Transport and legally dispose of materials off-site.
1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution.
 2. Burning of removed materials is not permitted off project site.

3.05 CLEAN-UP AND REPAIR

- A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.
- B. Repair demolition performed in excess of that required. Return structures and surfaces to remain to, at a minimum, the condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02105

SECTION 02210**EARTH EXCAVATION, BACKFILL, FILL AND GRADING****PART 1 – GENERAL****1.01 DESCRIPTION**

A. Perform the following earth excavation, backfill, fill and grading as indicated or specified:

1. Excavating all types of materials to limits indicated or required, including soil, boulders, bedrock, utilities, foundations, pavements, debris, or any other materials to accommodate piping, conduits, foundations and other structures
2. Provide materials for backfilling excavations and constructing embankments and fills as indicated and specified
3. Construct embankments of compacted materials
4. Grade surfaces to meet finished grades indicated and provide for positive drainage of all surfaces.
5. Immediately notify the ENGINEER if suspected hazardous materials are encountered and cease operations in that part of Work.
6. Remove boulders within the excavation limits.
7. Remove from the site and legally dispose of excess materials and materials that are not suitable for re-use.
8. Conducting all Work in accordance with OSHA requirements and other applicable laws and regulations, and with the requirements of all federal, state, and land agencies and authorities having jurisdiction over the Work.

1.02 RELATED WORK

- A. Section 02224: Compacted Gravel
- B. Section 02225: Processed Aggregate Base
- C. Section 02435: Crushed Stone
- D. Section 02500: Bituminous Concrete Pavement
- E. Section 03300: Cast-in-Place Concrete

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. C33: Specification for Concrete Aggregates
2. C136: Sieve Analysis of Fine and Coarse Aggregates
3. D421: Practice for Dry Preparation of Soil Samples for particle Size Analysis and Determination of Soil Constants
4. D422: Test Method for Particle-Size Analysis of Soils
5. D1140: Test Method of Amount of Material in Soils Finer than the No. 200 Sieve
6. D1556: Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
7. D1557: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³)
8. D2167: Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
9. D2922: Test method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
10. D3017: Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depths)
11. D4318: Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
12. D4718: Practice for Correction of Unit Weight and Water Content for Soils Containing Oversized Particles
13. D4832-03: Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders
14. D4944: Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Pressure Tester Method
15. D4959: Test Method for Field Determination of Water (Moisture) Content of Soil by Direct Heating Method
16. D5080: Test Method for Rapid Determination of Percent Compaction

B. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29: Subpart P – Excavations, Trenching and Shoring

1.04 DEFINITIONS

- A. Percentage of compaction is defined as the ratio of the field dry density, as determined by ASTM D1556 to the maximum dry density determined by ASTM D1557 Procedure C, multiplied by 100.
- B. Proof Roll: Compaction with a minimum of 4 passes of a vibratory steel drum or rubber tire roller. Vibratory plate compactors shall be used in small areas where vibratory steel drum or rubber tire roller can not be used.
- C. Acceptable Material: Material that does not contain organic silt or organic clay, peat, vegetation, wood or roots, stones or rock fragments over 6 inches in diameter, porous biodegradable matter, loose or soft fill, excavated pavement, construction debris, or refuse. Stones or rock fragments shall not exceed 40 percent by weight of the backfill material.
- D. Unacceptable Materials: Materials that do not comply with the requirements for the acceptable materials or that cannot be compacted to the specified or indicated density.

1.05 SUBMITTALS

- A. Submit the following in accordance with Section 01300.
 - 1. Qualifications of the CONTRACTOR'S Independent Testing Laboratory as specified in Paragraph 1.06 E, two (2) weeks prior to the execution of any earth excavation, backfilling, filling, or compaction process.
 - 2. Submit an excavation, backfilling, and filling plan at least two weeks prior to start of any earth moving activities. The review will be only for the information of the OWNER and third parties for an overall understanding of the Project relating to access, maintenance of existing facilities and proper utilization of the site. The CONTRACTOR shall remain responsible for the adequacy and safety of the means, methods, and sequencing of construction. The plan shall include, but not limited to the following items:
 - a. Detailed sequence of Work
 - b. General description of construction methods
 - c. Numbers, types, and sizes of equipment proposed to perform excavation and compaction
 - d. Details of dust control measures
 - e. Proposed locations of stockpiled excavation and/or backfill materials
 - f. Proposed surplus excavated material off-site disposal areas and required permits
 - g. Details of erosion and sedimentation control measures that will prevent erosion and sedimentation during the earth moving activities.

3. The following material submittals shall be submitted to the ENGINEER prior to backfilling and filling:
 - a. Compacted Gravel: As specified in Section 02224
 - b. Processed Aggregate Base: As specified in Section 02225.
 - c. Crushed Stone: As specified in Section 02435
 - d. Controlled Low Strength Material: Mix Design and Statement of Compliance (Where applicable)
 - e. Other Acceptable Materials: Laboratory testing results of gradation and moisture-density relationship. Submittal shall include specific location of the source and the date when sample was taken.
4. During construction, submit written confirmation of fill lift thickness, in-place soil moisture content, and percentage of compaction to the ENGINEER before placing the next lift or construction foundations.

1.06 QUALITY ASSURANCE AND CONTROL

- A. Excavations shall be performed in the dry and kept free from water, snow and ice during construction. Bedding and backfill material shall not be placed in water. Water shall not be allowed to rise upon or flow over the bedding and backfill material.
- B. The CONTRACTOR shall be solely responsible for making all excavations in a safe manner. All excavations, trenching, and related shoring, bracing, etc. shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926 Subpart P) and State requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.
- C. Do not excavate, construct embankments, or fill until the ENGINEER has reviewed all the required submittals.
- D. Formulate excavation, backfilling, and filling schedule and procedures to eliminate possibility of undermining or disturbing foundations of partially and completed structures, pipelines, and embankments or existing structures and pipelines.
- E. Employ an independent testing laboratory to perform particle size and gradation analyses in accordance with ASTM D422, and to determine compactibility in accordance with ASTM D1557 or all the proposed backfill and fill materials, and monitoring field compaction operations. The independent testing laboratory shall have the following qualifications:
 1. Be accredited by the American Association of State Highway and Transportation Officials (AASHTO) Accreditation Program
 2. Have three (3) years experience in sampling, testing and analysis of soil and aggregates, and monitoring field compaction operations.
 3. Able to provide references from previous Work.

F. Field Testing and Inspections:

1. By CONTRACTOR'S independent testing laboratory, acceptable to the ENGINEER, at CONTRACTOR'S expense as specified in Paragraph 1.06 E.
2. Location of tests mutually acceptable to testing laboratory and the ENGINEER or as directed by the ENGINEER.
3. In the event compacted material does not meet specified in-place density, recompact material and retest this area until specified results are obtained at no additional cost to the OWNER.

G. Methods of Field Testing:

1. In-Place Density: ASTM D1556, ASTM D2167, or ASTM D2922
2. In-Place Moisture Content: ASTM D3017, ASTM D4944, or ASTM D4959

H. Material Testing Frequency: The following testing frequencies are minimums required for all structural and non-structural fill, grading, and embankment.

1. Field In-Place Density and Moisture Content: Compacted gravel and crushed stone shall be compacted as specified and indicated. For other backfill and fill material minimum test frequency shall be as follows, and no less than one test per:
 - a. Trenches under structures foundation preparation or roadways subbase: Every 100 linear ft. per lift
 - b. Trenches in areas without structures or roadways: Every 200 linear ft. per lift
 - c. Paved Roadways: Every 50 linear ft. per lift
 - d. Paved Areas: 1,500 sq. ft. per lift
 - e. Under Structure: 200 sq. ft. per lift
 - f. Around Structures: 1,500 sq. ft. per lift
 - g. Embankment Fills: 5,000 sq. ft. per lift
2. Moisture-Density – One per source except for compacted gravel and crushed stone. Repeat the moisture density test for every 5,000 cubic yards of material used, and whenever visual inspection indicates a change in material gradation as determined by the ENGINEER.
3. Gradation Analysis – A minimum of one per source and for each moisture density test and whenever visual inspection indicates a change in material gradation.

- I. Construction Tolerances:
1. Construct finished surfaces to plus or minus 1 inch of the elevations indicated.
 2. Grade cut and fill areas to plus or minus 0.20 foot of the grades indicated.
 3. Complete embankment edges to plus or minus 6 inches of the slope lines indicated.
 4. Provide the ENGINEER with adequate survey information to verify compliance with above tolerances.
- J. Cut pavement with a saw or pneumatic tools to prevent damage to remaining pavement without extra compensation. Where pavement is removed in large pieces, dispose of pieces before proceeding with excavation.
- J. Pipes, drains, and other utilities may exist in certain locations not indicated on Drawings. No attempt has been made to show all services. Completeness or accuracy of information given is not guaranteed.
- L. Dig test pits, as required, at no additional compensation.
- M. Carefully support and protect from damage, existing pipes, poles, wires, fences, curbing, property line markers, and other structures, which the ENGINEER determines must be preserved in place without being temporarily or permanently relocated. Should such items be damaged, restore without compensation therefor, to at least as good conditions as that in which they were found immediately before the Work was begun.
- N. Whenever certain existing structures as described below are encountered, and the ENGINEER so directs, change the location, remove and later restore, or replace such structures, or assist the OWNER in doing so; such Work to be paid for under applicable items of Work, otherwise as Extra Work.
- O. In removing existing pipes or other structures, include for payment only those new materials that are necessary to replace those unavoidably damaged as determined by the ENGINEER.
- P. The preceding two paragraphs apply to pipes, wires, and other structures which meet the following: (a) are not indicated on the Drawings or otherwise provided for, (b) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (c) in the opinion of the ENGINEER, will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.
- Q. Restore existing property or structures as promptly as practicable.
- R. If material unacceptable for foundation (in the opinion of the ENGINEER) is found at or below the grade to which excavation would normally be carried in accordance with the Drawings and/or Specifications, remove such material to the required width and depth as directed by the ENGINEER and replace it with crushed stone fill.
- S. Haul away and dispose of surplus excavated materials at no additional cost to the OWNER.

- T. During progress of Work, conduct earth moving operations and maintain Work site so as to minimize the creation and dispersion of dust. Furnish and spread calcium chloride if the ENGINEER decides that it is necessary for more effective dust control.
- U. Provide suitable and safe bridges and other crossings where required for accommodations of travel, and to provide access to private property during construction, and remove said structures thereafter.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Use only acceptable materials from excavations or borrows.
- B. Provide geotextile fabric as indicated, meeting the requirements of this Section, when applicable.
- C. Use only products specified in the Project Drawings and Contract Documents, unless otherwise authorized by the ENGINEER.

2.02 USE OF MATERIALS

- A. Unless otherwise specified in the Project Drawings, Specifications, or directed by the ENGINEER, the following material uses shall apply:
 - 1. Common Fill: Use to backfill or raise general site grades outside the building and other structures; beneath sidewalk and pavement base course; in landscaped areas. On-Site materials, which meet the requirements of these Specifications, may be used as Common Fill with the ENGINEER'S approval. On-site materials may be used as Common Fill within the building below the slab base course layer and outside the Zone of Influence of foundations with the ENGINEER'S approval.
 - 2. Compacted Gravel: Use below footings, floor slabs, or other structural elements; for backfill against building/retaining walls; to replace unsuitable materials; and as shown on the Drawings. Compacted Gravel is also acceptable to raise general site grades and backfill trenches. On-Site materials, which meet the requirements of these Specifications, may be used as Compacted Gravel. Material shall meet the requirements of Section 02224.
 - 3. Crushed Stone: Use for drainage applications (e.g., below pools, subdrainage); below footings, slabs, and other structures as a "cushion" layer above bedrock; and as show on the Drawings. A Geotextile is required in conjunction with Crushed Stone to separate crushed stone from other soil materials. Material shall meet the requirements of Section 02435.

4. Non-woven Geotextile: for use in underdrain and separation applications shall be non-rotting, acid and alkali resistant, unsusceptible to sunlight damage, non-woven, fabric with the following properties:

Physical Property	ASTM Test Method	Units	Requirements
Grab Tensile Strength	ASTM D4632	lbs.	200
Grab Tensile Elongation	ASTM D4632	%	50
Mullen Burst	ASTM D3786	psi	380
Puncture	ASTM D4833	lbs.	130
Trapezoid Tear	ASTM D4533	lbs.	80
UV Resistance	ASTM D4355	%@ hrs.	70/500
Apparent Opening Size (AOS)	ASTM D4751	US Sieve	80
Permittivity	ASTM D4491	sec. -1	1.2
Flow Rate	ASTM D4491	Gal/min/ft	95

5. Processed Aggregate Base: Use below pavements and as shown on Drawings. Material shall meet the requirements of Section 02225.
6. Sand: Use as shown on the Drawings.
7. Bedding Material: Use for utility bedding unless specified otherwise.

2.03 CONTROLLED LOW STRENGTH MATERIAL (CLSM OR FLOWABLE FILL)

- A. Description: Control Low Strength material (CLSM) is a self-consolidating, rigid setting material to be used in backfills, fills, structural fills and elsewhere as indicated on the plans, or as directed by the ENGINEER. The flow and set time characteristics of CLSM shall be designed to meet the specific job conditions. All CLSM material covered by this specification shall be designed to be hand excavatable at any time after placement. It shall be composed of a mixture of Portland cement, aggregate, and water with the option of using fly ash, air-entraining agents, and other approved admixtures.
- B. Materials: All materials utilized in the CLSM mix design shall be in accordance with the applicable requirements of Article M.03.01 of the Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, and the physical properties of Article M.01.20 of Standard Specifications Form 817.
- C. Composition:
- The composition of the CLSM shall be in accordance with the requirements set forth in Article M.03.01-General Composition of Concrete Mixes, of the Connecticut Department of Transportation Standard Specification, as well as the applicable sections of ACI 229R. The CONTRACTOR shall submit each proposed mix design, with all supporting data, to the ENGINEER for review and approval at least two weeks prior to its use.
 - The setting time of CLSM materials shall be designed so as to achieve the strength necessary to comply with the time constraints called for under the Maintenance and protection of Traffic requirements of the Project Specifications. The use of chloride accelerators is not permitted.

3. The minimum compressive strength of the CLSM material shall be 30 pounds per square inch (psi) and the maximum compressive strength of the CLSM shall be 150 pounds per square inch (psi) when tested in accordance the ATSM D4832 after 56 days.
4. The CLSM mix design shall utilize a nominal maximum size of No. 8 aggregate as specified in M.01.01 of the Connecticut Department of Transportation Standard Specifications.
5. CLSM mixes that are designed with high entrained air shall have a minimum of 25% entrained air when tested in accordance with AASHTO T152.

2.04 TOP SOIL

- A. Top Soil shall be obtained from processed and conditioned site excavations or off-site borrow sources and shall be fertile, friable, natural loam and surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stone larger than 1" in any dimension, and other extraneous or toxic matter harmful to plant growth that satisfies the following criteria:

PH - 5.3 - 6
 No stones greater than 1"
 Less than 2% gravel greater than 1/2" to 1"
 Less than 3% gravel 1/4 to 1"
 Less than 5% gravel 1/8" to 1/4"
 80 - 90% sand
 5 - 10% silt
 2.0% - 5.0% organic Matter
 Less than 2% clay

It is anticipated that generated topsoil will satisfy these criteria.

2.05 COMMON FILL

<u>Sieve</u> <u>(ASTM D422)</u>	<u>Percent Finer</u> <u>by Weight</u>
10-inch **	100
No. 4	20-90
No. 40	10-80
No. 200	0-30

“**” when used in trenches within 2 feet of utilities, or within 2 feet of foundation walls the largest particle dimension shall be 3 inches. The size of the largest particle shall be less than 2/3 of the lift thickness.

2.06 BEDDING MATERIAL

- A. Sand or sandy soil free of debris, waste, frozen materials and organics with 100 percent passing a 3/8 inch sieve and not more than 10 percent passing a no. 200 sieve.

2.07 SAND

- A. ASTM C 33; fine aggregate, natural or manufactured sand.

2.08 EQUIPMENT

- A. The compaction equipment shall be selected by the CONTRACTOR, and shall be capable of consistently achieving the specified compaction requirements. The selected compaction equipment shall meet the following minimum requirements:
 - 1. Manually operated vibratory plate compactors weighing no less than 200 pounds with vibration frequency no less than 1,600 cycles per minute.
 - 2. Vibratory steel drum or rubber tire roller weighing at least 12,000 pounds.

PART 3 – EXECUTION

3.01 SITE MAINTENANCE

- A. Roadway and sidewalks: Grade roadway to maintain it in a level unrutted condition and to eliminate puddling of surface water.

3.02 EXCAVATION

- A. Execution of any earth excavation shall not commence until the requirements of related dewatering, excavation support systems, and backfill and fill materials submittals have been satisfied.
- B. Carry out program of excavation, dewatering, and excavation support systems to eliminate possibility of undermining or disturbing foundations of existing structures of or Work previously completed under this contract.
- C. Excavate to widths that give suitable room for building structures or laying and jointing piping.
- D. Do not plow, scrape, or dig by machinery near to finished subgrade in a manner that would result in disturbance of subgrade.
- E. Excavate to lines and grades indicated in an orderly and continuous program.
- F. Establish limits of excavation to allow adequate Working space for installing forms and for safety of personnel.
- G. Excavate to elevations indicated, or deeper, as directed by the ENGINEER, to remove unacceptable bottom material.
- H. Exercise care to preserve material below and beyond the lines of excavations.
- I. Place excavated material at the approved stockpile locations and in no case closer than 3 feet from edge of excavations to prevent cave-ins of bank slides.

- J. Boulders, rock fragments, and concrete encountered during excavation less than 1.0 cubic yards in volume shall be considered as a normal part of in-place soils and not included for payment as rock.

3.03 SEPARATION OF EXCAVATED MATERIALS FOR REUSE

- A. Remove only existing pavement that is necessary for prosecution of Work.
- B. Carefully remove loam and topsoil from excavated areas. Store separately for further use or furnish equivalent loam and topsoil as directed.
- C. Carefully remove acceptable material from excavated areas and store separately for further use as backfill material.

3.04 TRENCH EXCAVATION

- A. When pipe is to be laid in gravel bedding or concrete cradle, excavate trench by machinery to, or just below designated subgrade. If material remaining at bottom of trench is disturbed, recompaction shall be required.
- B. When pipe is to be laid directly on bottom of trench, do not excavate lower part of trenches by machinery to subgrade. Remove remainder of material to be excavated just before placing of pipe by use of hand tools. Form a flat or shaped bottom, true to grade, so pipe will have a uniform and continuous bearing. Support on firm and undisturbed material between joints, except for limited areas where use of pipe slings have disturbed bottom.

3.05 DEPTH OF TRENCH

- A. Excavate trenches to depths so as to permit pipe to be laid at elevations, slopes, or depths of cover indicated on Drawings, and at uniform slopes between indicated elevations.

3.06 WIDTH OF TRENCH

- A. Make pipe trenches as narrow as practicable and do not widen by scraping or loosening materials from the sides. Make every effort to maintain sides of trenches form and undisturbed until backfilling has been placed and compacted.
- B. Excavate trenches with approximately vertical sides between spring line of pipe and elevation 1 foot above top of pipe.

3.07 TRENCH EXCAVATION IN FILL

- A. Place and compact material to top of fill or to a minimum height of 1 foot above top of pipe, whichever is less, when pipe is to be laid in embankment or other recently filled material. Take particular care to ensure maximum consolidation of material under pipe location. Excavate pipe trench as though in undisturbed material.

3.08 EXCAVATION NEAR EXISTING STRUCTURES

- A. Discontinue digging by machinery when excavation approaches pipes, conduits, or other underground structures. Continue excavation by use of hand tools. Include such manual excavation in Work to be done when incidental to normal excavation and under items involving normal excavation.
- B. Excavate test pits when determination of exact location of pipe or other underground structure is necessary for doing Work properly.

3.09 REMOVAL OF SUBSURFACE OBSTRUCTIONS

- A. Remove indicated subsurface structures and related obstructions to extent shown.
- B. Promptly notify the ENGINEER when any unexpected subsurface facilities are encountered during excavation such as utility lines and appurtenances, walls and foundations.

3.10 UNAUTHORIZED EXCAVATION

- A. When the bottom of any excavation for structures is taken out beyond limits indicated or specified, backfill with crushed stone wrapped with non-woven geotextile fabric or with 1,500 psi concrete.

3.11 REUSE AND DISPOSAL OF SURPLUS EXCAVATED MATERIALS

- A. Reuse surplus acceptable excavated materials for backfill; deposit neatly and grade so as to make or widen fills, flatten side slopes, or fill depressions; or legally dispose of off-site; all as directed or permitted and without additional compensation.

3.12 SUBGRADE PREPARATION AND PROTECTION

- A. Remove loam and topsoil, loose vegetable matter, stumps, and large roots from areas upon which embankments will be built or material will be placed for grading. Shape subgrade as indicated on Drawings, and prepare by forking, furrowing, or plowing so that the first layer of new material placed therein will be bonded to it.
- B. As directed by the ENGINEER, over-excavate unacceptable materials below the foundation subgrade. Backfill the over-excavation with compacted gravel.
- C. Proof roll the foundation subgrade prior to backfilling and filling operation, or placing foundation concrete.
- D. Proof roll the pipe trench foundation subgrade prior to backfilling and filling operations, or placing soil-supported pipeline.
- E. Utilize excavating equipment equipped with a toothless or smooth edged, excavating bucket to expose the pipe trench foundation subgrade to avoid disturbance of the bearing surface. Tamp the exposed subgrade with the excavating bucket prior to backfilling and filling operation, or placing soil-supported pipeline.

3.13 CARE AND RESTORATION OF PROPERTY

- A. Enclose uncut tree trunks adjacent to Work in wooden boxes of such height as may be necessary for protection from injury from piled material, equipment, operations, or otherwise due to Work. Operate excavating machinery and cranes of suitable type with care to prevent injury to trees not to be cut and particularly to overhanging branches and limbs.
- B. Cut all branches, limbs, and roots smoothly and neatly without splitting or crushing. Neatly trim, cut the injured portions and cover with an application of grafting wax or tree healing paint as directed.
- C. Protect cultivated hedges, shrubs, and plants that might be injured by the CONTRACTOR'S operations by suitable means or dig up and temporarily re-plant and maintain. After construction operations have been substantially completed, re-plant in original position and care for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to effect their growth or diminish in their beauty or usefulness, replace with items of equal kind and quality existing at the start of Work.
- C. Restore surfaces damaged by the CONTRACTOR'S operations to a condition at least equal to that in which they were found immediately before Work commenced. Use suitable materials and methods for such restoration.

3.14 BACKFILLING – GENERAL

- A. Do not place frozen materials in backfill or place backfill upon frozen materials. Remove previously frozen material or treat before new backfills placed.
- B. Do not place, spread, roll or compact fill material during unfavorable weather conditions. If interrupted by heavy rain or other unfavorable conditions, do not resume until ascertaining that the moisture content and density of the previously placed soil are as specified.
- D. Do not use puddling, ponding, or flooding as a means of compaction.

3.15 MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS

- A. Compacted Gravel
 - 1. Dump and spread in layers not to exceed 8 inches uncompacted thickness.
 - 2. Compact, fill, and backfill under structure and bedding for pipes (from below pipe to spring line) to not less than 95 percent. Compact to not less than 90 percent in other areas unless otherwise indicated.
- B. Crushed Stone
 - 1. Dump and spread in layers not to exceed 12 inches uncompacted thickness.
 - 2. Compact using self-propelled vibratory steel drum or rubber tire rollers with a minimum of 4 passes in direction perpendicular to one another in open areas. In small areas, use manually operated vibratory plate compactors with a minimum of 4 passes.

- C. Acceptable Materials for Use as Non-Structural Fill:
 - 1. Dump and spread in layers not to exceed 12 inches uncompacted thickness.
 - 2. Compact to not less than 90 percent unless otherwise indicated.
- D. Backfilling and filling operation shall be suspended in areas where tests are being made until tests are completed and the testing laboratory has advised the ENGINEER that adequate densities are obtained.

3.16 STRUCTURAL FILL AND BACKFILL UNDER STRUCTURES

- A. Compact fill and backfill under structures and pavements with compacted gravel or crushed stone as specified and indicated.
- B. Conduct hydraulic testing as soon as practicable after structures are constructed and other necessary Work has been done. Start backfilling promptly after completion of tests.
- C. Deposit material evenly around structure to avoid unequal soil pressure.
- D. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage.

3.17 NON-STRUCTURAL BACKFILL

- A. Use acceptable materials for non-structural backfill and compacted as specified and indicated.

3.18 BACKFILLING PIPE TRENCHES

- A. General
 - 1. Begin backfilling and proceed until completed after: the pipes and conduits have been laid, joints have acquired maximum degree of hardness, pipelines and conduits have successfully passed tests and inspections as required in the Specifications and concrete or masonry structures within the trench have reached their design strength to support all loads.
 - 2. Backfill and compact indicated materials under, around, and above pipes, conduits, and other structures to the indicated or specified compaction density requirement. Utilize compaction devices that will not damage the pipe, conduit, or structure within the trench.
 - 3. Do not drop backfill material into trench from a height of more than 5 feet or in a manner that will damage the pipe, conduit, or other structure within the trench.
- B. Pipe Trenches
 - 1. Materials:

- a. From below pipe to 1 ft. above spring line: Use crushed stone or controlled low strength material (CLSM) as indicated.
- b. One foot above pipe to finished grade or to pavement subbase: Use compacted gravel unless otherwise indicated.
2. Compacting Around Pipes: Compact material around circumference of pipe and the area between the trench wall and the pipe by hand tamping in 6" layers.
3. Compacting Above Pipe: Compact material by hand tamping. If trench width is wide enough to accommodate power tools and the compacted material over the pipe will support the load of the power tools without damage to the pipe, use rollers or other powered compaction equipment above to more readily achieve compaction requirements.
4. Controlled Low Strength Material (CLSM) as backfill
 - a. CLSM shall only be placed when the ambient temperature is at least 30° F and rising. CLSM material shall be deposited within 2 hours of initial mixing.
 - b. CLSM may be placed by chutes, conveyors, buckets, or pumps depending upon the application and accessibility of the site. Should voids or cavities remain after the placement of the CLSM, the CONTRACTOR shall modify the placement method or flow characteristics of the CLSM. Voids or cavities which have not been filled properly shall be corrected as directed by the ENGINEER and at the CONTRACTOR'S expense.
 - c. The CONTRACTOR shall insure that pipe floatation or misalignment does not occur during placement of CLSM. Where required, pipe straps, soil anchors, or other approved means of restraining pipe movement shall be utilized. Material may be placed in stages with initially lesser flowability, to prevent movement or flotation of pipe.
 - d. Compaction of flowable backfill will not be required. The maximum layer thickness shall be 3 feet. Additional layers shall not be placed until the backfill has lost sufficient moisture to be walked on without indenting more than 2 inches. Any damage resulting from placing CLSM in layers that are too thick or from not allowing sufficient time between placement of layers shall be repaired in a method approved by the ENGINEER at the CONTRACTOR'S expense.

3.19 MATERIAL FOR FILLING AND EMBANKMENTS

- A. Use acceptable materials for filling and building embankments unless otherwise indicated.

3.20 PLACING AND COMPACTING EMBANKMENT MATERIAL

- A. Compact fill material as specified and indicated.
- B. Perform fill operation in an orderly and systematic manner using equipment in proper sequence to meet the specified compaction requirements.
- C. Place fill on surfaces that are free of unacceptable materials.

- D. Begin filling in lowest section of Work area. Grade surface of fill approximately horizontal but provide with sufficient longitudinal and transverse slope to allow for runoff of surface water from every point.
- E. Conduct filling so that no obstruction to drainage from other sections of fill area is created at any time.
- F. Install temporary dewatering sumps in low areas during filling operation where excessive amounts of rain runoff collect.
- G. Reduce moisture content of fill material, if necessary, in source area by working it over under warm and dry atmospheric conditions. A large disc harrow with two to three foot diameter disks may be required for working soil in a drying operation.
- H. Compact uniformly throughout. Keep surfaces of fill reasonably smooth and free from humps and hollows that would prevent proper and uniform compaction. Do not permit hauling equipment to follow a single track on the same layer but direct equipment to spread out to prevent over-compaction in localized areas. Take care in obtaining thorough compaction at edges of fill.
- I. Slightly slope surface of fill to ensure drainage during periods of wet weather. Do not place fill while rain is falling or after a rainstorm until the ENGINEER considered conditions satisfactory. During such periods and upon suspension of filling operations for any period in excess of 12 hours, roll smooth the surface of fill using a smooth wheel static roller to prevent excessive absorption of rainfall and surface moisture. Prior to resuming compaction operations, remove muddy material off surface to expose firm, compacted material, as determined by the ENGINEER.
- J. When fill is placed against an earlier fill or against in-situ material under and around structures, including around piping beneath structures or embankments, slope junction between two sections of fill, 1 vertical to 1.5 horizontal. Bench edge of existing fill 24 inches to form a serrated edge of compact stable material against which to place the new fill. Ensure that rolling extends over junction between fills.
- K. When fill is placed directly upon another older fill, clean surface thoroughly of debris and remove any loose material. Then proof-roll the entire old surface.
- L. After spreading each loose lift to the required thickness and adjusting its moisture content as necessary, roll with sufficient number of passes to obtain the required compaction. One pass is defined as the required number of successive trips that by means of sufficient overlap will ensure complete coverage and uniform compaction of an entire lift. Do not make additional passes until previous pass has been completed.
- M. In case material of any fill sinks and weaves under roller or under hauling units and other equipment, required degree of compaction is not being obtained. Reduce the moisture content. If such sinking and weaving produces surface cracks, suspend operations on the part of the embankment until it becomes sufficiently stabilized. Ideal condition in fill is that attained when the entire fill below the surface being rolled is so firm and hard as to show only the slightest weaving and deflection as roller passes. Spread out rolling operations over the maximum practicable area to minimize condition of sinking and weaving.

- N. If because of defective Workmanship, compaction obtained over any area is less than that required, remedy condition at no cost to OWNER. If additional rolling or other means fail to produce satisfactory results, remove material in that area down to a level of satisfactory density. Perform removal, replacement, and re-rolling without additional compensation.

3.21 COMPACTION CONTROL OF BACKFILL, FILL, AND EMBANKMENT

- A. Compact to density specified and indicated for various types of material. Control moisture content of material being placed as specified or if not specified, at a level slightly lower than optimum.
- B. The soil testing laboratory shall provide inspection during filling or backfilling operations to ensure compaction of compacted gravel or crushed stone and record compaction equipment in use.
- C. Moisture control may be required either at the stockpile area, its or on embankment or backfill. Increase moisture content when material is too dry by sprinkling or other means of wetting uniformly. Reduce moisture content when material is too wet by using ditches, pumps, drainage wells, or other devices and by exposing the greatest possible area to sub and air in conjunction with harrowing, plowing, spreading of material or any other effective methods.

3.22 ALLOWANCE FOR SHRINKAGE

- A. Build embankment or backfill to a height above finished grade that will in the opinion of the ENGINEER allow for the shrinkage or consolidation of material. Initially, provide at all points, an excess of at least one percent of total height of backfill measured from stripped surface to top of finished surface.
- B. Supply specified materials and build up low places as directed without additional cost if embankment or backfilling settles so as to be below the indicated level for proposed finished surface at any time before final acceptance of the Work.

END OF SECTION 02210

SECTION 02224**COMPACTED GRAVEL****PART 1 – GENERAL****1.01 DESCRIPTION**

- A. Provide and Compacted Gravel as indicated and specified.

1.02 RELATED WORK

- A. Division 1: General Requirements
- B. Section 02210: Earth Excavation, Backfill, Fill and Grading

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications
 - 1. D422: Test Method for Particle-Size Analysis of Soils
 - 2. D1140: Test Method for Amount of Material in Soils Finer than the No. 200 (75um) Sieve
 - 3. D1557: Test Method for Laboratory Compaction Characteristics of soil using Modified Effort (56,000 ft-lbf/ft³ (600 kN-m/m³))

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. Gradation and compaction test results from the soil testing laboratory, at least two (2) weeks prior to hauling material, for the ENGINEER'S acceptance.
 - 2. Submit a 20-lb. sample of the material when requested by the ENGINEER.

1.05 QUALITY ASSURANCE

- A. Qualifications of the independent soil testing laboratory as specified in Section 02210.
- B. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D422. Soil compaction test shall be performed in accordance with ASTM D155 Procedure C.
- C. Material testing frequency and requirements as specified in Section 02210.

PART 2 – PRODUCTS**2.01 MATERIAL**

- A. Compacted Gravel shall be material obtained from off-site barrow sources for use in pavement base/subbase, utility trench backfills beneath paved areas, and other areas where indicated on the Contract Documents. It shall consist of inert material that is hard, durable sand and gravel or crushed rock, free of organic material, loam, trash, debris, snow, ice or frozen soil, or other deleterious materials as determined by the ENGINEER. Suitable material shall be well-graded within the following gradation requirement:

Sieve Size	Percent Passing by Weight
1 1/2"	100
3/4"	45 – 80
1/4"	25 – 60
No. 10	15 – 45
No. 40	5 – 25
No. 100	0 – 10
No. 200	0 – 5

PART 3 – EXECUTION**3.01 PLACEMENT AND COMPACTION**

- A Specified in Section 02210 and where indicated on the drawing.

END OF SECTION 02224

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SECTION 02225**PROCESSED AGGREGATE BASE****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The processed aggregate base shall consist of a single course foundation constructed on the compacted gravel base/sub-base in accordance with these specifications and in conformity with the lines, grades, compacted thickness and typical cross section as shown on the plans.

1.02 RELATED WORK

- A. Division 1 "General Requirements"
- B. Section 02210: "Earth Excavation, Backfill, Fill and Grading"
- C. Section 02224 "Compacted Gravel"
- D. Section 02500 "Bituminous Concrete Pavement"

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications
 - 1. D422: Test Method for Particle-Size Analysis of Soils
 - 2. D1140: Test Method for Amount of Material in Soils Finer than the No. 200 (75um) Sieve
 - 3. D1557: Test Method for Laboratory Compaction Characteristics of soil using Modified Effort (56,000 ft-lbf/ft³ (600 kN-n/m³))

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. Gradation and compaction test results from the soil testing laboratory, at least two (2) weeks prior to hauling material, for the Engineer's acceptance.
 - 2. Submit a 20-lb. sample of the material when requested by the Engineer.

1.05 QUALITY ASSURANCE

- A. Qualifications of the independent soil testing laboratory as specified in Section 02210.
- B. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D422. Soil compaction test shall be performed in accordance with ASTM D155 Procedure C.
- C. Material testing frequency and requirements as specified in Section 02210.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. The processed aggregate base material shall conform to Article M.05.01 of Form 817.

PART 3 - EXECUTION

3.01 SUBBASE PREPARATION

- A. Should the sub-base material become mixed with the processed aggregate base material at any time, the Contractor shall, without additional compensation remove the mixture. The Contractor shall add new sub-base material if required and reshape and re-compact the sub-base in accordance with the requirements of these specifications. New processed aggregate base material shall be added, compacted and bound as specified herein to match the surrounding surface.
- B. Processed aggregate base should not be installed on the sub-base unless the sub-base has been compacted as specified in Section 02210 and is not saturated or weaving under compactive effort.

3.02 PLACEMENT AND COMPACTION

- A. Placement and compaction procedures and installation tolerance and testing for the processed aggregate base shall be the same as for the compacted gravel fill base as specified in Section 02210 "Earth Excavation, Backfill, Fill and Grading".

END OF SECTION 02225

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SECTION 02435**CRUSHED STONE****PART 1 – GENERAL****1.01 DESCRIPTION**

- A. Provide and compact crushed stone as indicated and specified.

1.02 RELATED WORK

- A. Division 1 “General Requirements”
- B. Section 02210 “Earth Excavation, Backfill, Fill and Grading”

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications

- 1. C33: Specification for Concrete Aggregates
- 2. D422: Test Method for Particle-Size Analysis of Soils

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. Gradation test result from the soil testing laboratory, at least two (2) weeks prior to hauling material, for the Engineer’s acceptance.
 - 2. Submit a 20 lb. sample of the material when requested by the ENGINEER.

1.05 QUALITY ASSURANCE

- A. Qualifications of the independent soil testing laboratory as specified in Section 02210.
- B. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D422.
- C. Material testing frequency and requirements as specified in Section 02210.

PART 2 – PRODUCTS

2.01 MATERIAL

- A. Crushed Stone: Gradation and physical property requirements of crushed stone shall conform to the grading requirements of Article M.01.01 and the physical properties of Article M.01.20 of Standard Specifications Form 817.
- B. Crushed stone shall be free from roots, leaves, and other organic materials, and free of ice, snow or frost and frozen soil particles.

PART 3 – EXECUTION

3.01 PLACEMENT AND COMPACTION

- A. Specified in Section 02210 and as indicated on the Drawings.

END OF SECTION 02435

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SECTION 02500**BITUMINOUS CONCRETE PAVEMENT****PART 1 – GENERAL****1.01 DESCRIPTION**

- A. This section includes all materials, labor, equipment, services, etc., necessary and incidental to the completion of all bituminous concrete pavement installation as shown on the Project Drawings and as specified herein.

1.02 RELATED WORK

- A. Section 02210 “Earth Excavation, Backfill, Fill And Grading”
- B. Section 02224 “Compacted Gravel”
- C. Section 02225 “Processed Aggregate Base”

1.03 REFERENCES

- A. The Standard Specifications: Requirements of the Standard Specifications for Roads, Bridges, and Incidental Construction, State of Connecticut, Department of Transportation, Form 817, together with all errata, addenda, additions, revisions, and supplemental specifications.
- B. When reference is made to a particular section of “Form 817”, it will be construed to include all related articles referred to in said section.

1.04 SUBMITTALS

- A. Mix designs with laboratory tests certifying conformance with specifications for the paving material.
- B. Certification by the paving material plant of conformance with referenced standards.
- C. Plant batch slips with each batch of material delivered to site giving information as required by the ENGINEER.

1.05 QUALITY ASSURANCE

- A. Permanent pavement shall not be installed when the ambient temperature is less than 40° F, the weather is foggy, or raining. The base must be dry and free of frost.
- B. Prior to excavation in paved areas, cut surface of existing pavement with a masonry saw. Pavement to be cut in straight line on both sides of proposed trench for entire length of job.

- C. Temporary pavement shall be placed over trenches on a daily basis in paved areas and where directed by ENGINEER. Temporary pavement shall be maintained until permanent pavement is placed.
- D. Where operations of CONTRACTOR result in removal of or damage to pavement, sidewalks or curbing, affected portions shall be removed as directed by ENGINEER and replaced with pavement or curbing as specified.
- E. Until the expiration of the guarantee period, maintain surfacing placed under this Contract and promptly correct any defect such as cracks, depressions, and holes with materials as specified.
- F. Manhole covers, catch basin grates, valve and meter boxes shall be adjusted to finished grade, adequately protected and left in clean condition.
- G. Feathering edges between new and existing pavement is not allowed when replacing pavement.
- H. Paving plant used for preparation of the bituminous concrete is acceptable to ENGINEER with right to inspect plant and material preparation.
- I. Equipment, tools, and machines used in the performance of the cold milling shall be maintained in a satisfactory Work condition. The cold milling machine shall be a self-propelled machine especially designed and built for milling bituminous pavement and capable of milling the pavement to the specified depth and smoothness. The pavement milling machine shall be capable of establishing grade control; shall have means of controlling transverse slope; and shall have effective means of controlling dust produced during the pavement milling operation. The machine shall have the ability to remove all millings or cuttings from the pavement and load them directly into a truck. The milling machine shall not cause damage to any part of the pavement structure that is not to be removed. Variable lacing patterns shall be provided to permit a rough grooved surface on bituminous surfaces left in place. The striations produced shall not be greater than $\frac{3}{8}$ inch nor less than $\frac{1}{4}$ inch deep unless otherwise directed.
- J. All cleaning equipment shall be suitable for removing and cleaning loose material from the pavement surface. Power brooms shall be used when directed.
- K. Milling shall not be performed when there is accumulation of snow or ice on the pavement surface.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Bituminous concrete for temporary pavement and binder course shall conform to the requirements of Article M.04.01 and M.04.02, Form 817, Class 1.
- B. Bituminous concrete base course shall conform to the requirements of Article M.04.01 and M.04.02, Form 817, Class 1 or Class 4 as indicated.
- C. Bituminous concrete wearing course shall conform to the requirements of Article M.04.01 and M.04.02, Form 817, Class 1 or Class 2 as indicated.

- D. Joint filler and sealant shall be bituminous cellular type conforming to AASHTO M213 and hot poured rubber type sealant conforming to AASHTO M173.

PART 3 – EXECUTION

3.01 INSPECTION OF BASE

- A. Prior to commencing with paving operations, the installer of this Work shall inspect the base and notify the ENGINEER, in writing, of any condition which will prevent him from the proper execution of the Work and/or will not drain all paved surfaces. Failure of notice shall be deemed as acceptance of the Work.

3.02 MEANS AND METHODS

- A. The means and methods employed by the CONTRACTOR in performing the Work and all equipment, tools, machinery and plant used in handling material and executing any part of the Work, shall be subject to the approval of the Engineer before the Work is started and, whenever found unsatisfactory, shall be changed and improved as required by the ENGINEER at no additional cost to the OWNER. All equipment, tools, machinery and plant used must be maintained in a satisfactory working condition.

3.03 TEMPORARY PAVEMENT

- A. Prior to placing temporary pavement, backfill shall be compacted as required under “Earth Excavation, Backfill, Fill and Grading”, to eliminate settling of backfill. No pavement is to be placed over poorly compacted backfill.
- B. Base course shall be installed to proper elevation and dressed so that temporary pavement construction is at required grade. Maintain surfaces of disturbed area until pavement is placed. If there is a time lapse such that the base course has been eroded or disturbed by traffic, restore to acceptable condition before placing paving.
- C. Remove and acceptably dispose of all surplus and unsuitable material.
- D. Place and maintain temporary pavement of 2 inches compacted bituminous concrete mixture, in safe and reasonably smooth condition until permanent pavement is placed.
- D. Temporary pavement shall be installed over all excavated trenches in existing paved area following proper preparation, at the end of each workday.

3.04 INSTALLATION OF BITUMINOUS CONCRETE PAVEMENT

- A. The installation of bituminous concrete pavement shall be in accordance with the requirement of Section 4.06.03 of Form 817 and these Specifications.

- B. The sequence of the bituminous concrete placing operations shall be as required to secure tight and well-compacted longitudinal joints.
- C. Before compaction, the finished surface struck by the machine shall be checked. Depressions shall be filled and drippings shall be removed.
- D. In areas where, on account of irregularities or unavoidable obstacles, the use of mechanical spreading and finishing equipment is impracticable, the mixture may be spread and screened by hand, subject to the approval of the ENGINEER.
- E. All vertical contact surfaces shall be painted with a uniform coat of hot asphalt cement, just before bituminous concrete is placed against them.
- F. The top of the binder course shall be thoroughly cleaned prior to installation of the wearing course. If binder course is over 5 days old the CONTRACTOR shall install a tack coat in accordance with the requirements of article 4.06.05 of the Standard Specifications Form 817.
- G. Bituminous concrete shall only be installed when the surface is dry, the atmospheric temperature in the shade is at least 40° F and the weather is not foggy or rainy. The ENGINEER may, however, permit Work of this character to continue when overtaken by sudden storms, up to the amount of which may be in transit from the plant at the time, provided the mixture is within temperature limits specified. Upon arrival, the mixture shall be dumped into the approved mechanical spreader and immediately spread and struck off the full width required and to such appropriate loose depth for each successive course that when the Work is completed the weight of the mixture required per square yard will be secured. The mechanical equipment shall strike off each course. For use in striking off the bottom course, the machine shall be equipped with easily adjustable strike-off plates.
- H. The refueling of equipment in such position that fuel might be spilled on a bituminous concrete mixture already placed or to be placed is prohibited.

3.05 COMPACTION

- A. After the courses have been screened as specified, each course shall be compacted to a density of at least 92% and no more than 97% of the theoretical void free density. When the course spread has set sufficiently or come to the proper condition, it shall be rolled at such a speed as not to cause undue displacement or shoving.
- B. Compaction testing shall be undertaken by the OWNER'S testing laboratory.
- C. Rollers used to compact the course shall be power driven rollers weighing not less than ten (10) tons. If only one roller is used, it shall be a tandem roller; a second roller may be of the three-wheel type. The roller wheels shall be wet with only sufficient water to moisten the wheel surface.
- D. Rolling shall begin at the sides and progress toward the center, uniformly lapping at least one-half width of the compacting wheel of the roller. Alternate trips of the roller shall be terminated in stops at least three (3) feet in distance from any preceding stop. The ENGINEER may direct other rolling procedures, as conditions may require. Rolling shall be discontinued if the surface shows signs of cracking and shall be continued later as directed by the ENGINEER.

- E. The speed of the roller shall not exceed three (3) miles per hour and shall at all times be slow enough to avoid displacement of the hot mixture. The rollers shall be in good condition. They shall be operated by experienced rollermen and must be kept in continuous operation as nearly as practicable in such manner that all parts of the pavement shall receive substantially equal compaction.
- F. In all places inaccessible to a roller, such as adjacent to curbs, headers, gutters, bridges, manholes, etc., the required compaction shall be obtained with tamps. Depressions that may develop before the completion of the rolling shall be remedied by adding new material to bring such depressions to a true surface. Should any depressions remain after the final compaction, new material shall be added to form a true and even surface. All high spots, high joints and other defects shall be adjusted as required.

3.06 JOINTS

- A. Placing of the courses shall be as nearly continuous as possible and the roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is discontinued or interrupted for an appreciable period and joints shall be formed at such joints. Where joints are to be formed, the end of the freshly laid mixture shall be cut "square" with the pavement, slightly set up with the back of a metal lute and rolled at slow speed so as to cause as little feathering as possible. Before new material is laid the joint shall be cut back and a thin coating of hot asphalt paint should be applied to the joint.

3.07 SURFACE TEST OF THE PAVEMENT

- A. For the purpose of testing the finished surface, a standard template cut to the true cross section of the road and a ten (10') foot straight edge shall at all times be available on the Work.
- B. The CONTRACTOR shall provide or designate an employee whose duty will be to confirm the compacted course thickness and checking all rolled surfaces during the execution of the Work.
- C. The finished pavement surface shall be such that it will not vary more than one-quarter (1/4") inch from the template cut to the cross-section of the road or more than one quarter (1/4") inch from a ten (10') foot straight edge applied parallel to the center line of the pavement. Any irregularity of the surface exceeding the above limits shall be corrected.
- D. Where the thickness of the bituminous concrete is less than that shown on the Drawings by more than one-quarter (1/4") inch, the CONTRACTOR, with the permission of the ENGINEER, shall place a correction course not less than one (1") inch in depth after compaction. The CONTRACTOR shall reconstruct by cutting back and into the pavement of an acceptable depth to the ENGINEER and place new material to achieve the proper depth, cross-section and profile.

3.08 PROTECTION OF WORK

- A. Sections of the newly finished work shall be protected from traffic at least six (6) hours, or until they have become properly hardened by cooling.

3.09 MAINTAINING BITUMINOUS CONCRETE SURFACES

- A. Until the expiration of the guarantee period, maintain surfacing placed under this Contact and promptly correct any defect such as cracks, depressions, high points and holes that may occur. Surfacing kept in a safe and satisfactory condition for traffic. If defects occur in surfacing constructed by CONTRACTOR, remove surface material and base course as is necessary to properly correct defects. Replace base course and surface material.

END OF SECTION 02500

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SECTION 02900**LAWNS AND GRASSES****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Provide all materials, labor, equipment, services, etc., necessary and incidental for the successful establishment of a grass cover.

1.02 RELATED WORK

- A. Drawings and general provisions of the Contract, including the Standard Specifications of the Greater New Haven Water Pollution Control Authority, apply to this Section.

1.03 REFERENCE STANDARDS AND DEFINITIONS

- A. Reference herein to any technical society, organization, group or body is made in accordance with the following abbreviations. Unless otherwise noted or specified, all work under this Section shall conform to the latest edition, as applicable.
1. ASTM American Society for Testing and Materials
 2. Gravel Base: Layer placed between the subbase and topsoil to improve drainage.
 3. Fill: Soil materials used to raise existing grades.
 4. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
 5. Topsoil: For the purposes of this section: Surface soil layer as stripped and stockpiled that contains organic matter desirable for plant growth.
 6. Prepared Topsoil: For the purposes of this section: Topsoil that has been screened, and amended for the purposes of establishing a seed bed for lawns and grasses.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass and low maintenance grass mix, identifying source, including name and telephone number of supplier.
- C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.
- D. Qualification Data: For Landscape Installer.
- E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns and meadows during a calendar year. Submit before expiration of required maintenance periods.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn and meadow establishment.
 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Preinstallation Inspection: Engineer shall be given ample opportunity to inspect finished topsoil grades and conditions prior to any planting activities. All planting or seeding done without prior approval is subject to rejection and removal at the Contractor's expense.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Seed: Deliver seed in original sealed, labeled and undamaged containers.

1.07 SCHEDULING

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
 1. Spring Planting: April 1 to June 15.
 2. Fall Planting: September 1 to October 15.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.08 LAWN MAINTENANCE – PERMANENTLY SEEDED AND SODDED AREAS

- A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 1. Seeded and Sodded Lawns & Grasses: 90 days from the time sod and seed is installed or 3 mowings, whichever is greater as designated for these lawns and grasses.

- a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance period during next planting season.
- B. Maintain and establish lawns & grasses by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.
 1. In areas where mulch has been disturbed by wind or maintenance operations restore topsoil grades and add new mulch. Anchor as required to prevent displacement.
- C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn areas uniformly moist to a depth of 4 inches (100 mm).
 1. Provide a minimum of $\frac{1}{4}$ " per acre of water per day. Amount of water per day may be adjusted by the Engineer. Watering schedule and amount shall be recorded and reported daily to the Engineer for the first three weeks after seeding and weekly thereafter.
 2. Schedule watering/control irrigation system to prevent rilling, puddling, erosion, and displacement of seed or mulch.
- D. Mowing:
 1. The area shall be mowed with a reel mower set to a mowing height of 1 1/2". The Reel blades and bed knife shall be kept sharp and evenly matched to provide a clean cut. The mower shall be operated within the manufacture's recommended speed range. The grass shall be mowed once every 5 days commencing 5 days after sod installation.
 2. Slope Lawn and Low Maintenance Lawn areas: Mow as required to facilitate overseeding during the maintenance period and once prior to final inspection.
 - a. Set mowing height of these Low Maintenance and Slope Lawn areas to 3"
 3. Other lawn areas: Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - a. Mow lawns 1-1/2 to 2 inches (38 to 50 mm) high.
- E. Fertilization:
 1. SEEDLINGS: Fertilize newly seeded areas with a 15-15-15 fertilizer grade two weeks after seeding. Fertilize at a rate of 293 lbs. per acre to supply 44 lbs N, P_2O_5 and K_2O per acre. Apply additional fertilizer applications after the 15-15-15 treatment using IBDU(31-0-0) at 4, 6 and 8 weeks after seeding at a rate of 142 lbs per acre.

F. Weed Control:

1. The Contractor is responsible for the control of weeds that establish into sodded and seeded areas during the maintenance period. The need for and method of weed control will be reviewed with and approved by the Engineer. Any approved Herbicide treatments shall be applied by a licensed State of Connecticut applicator.

G. Documentation

1. The Contractor is responsible for maintaining a log of maintenance activities performed as specified herein, including schedules and quantities of watering, repair, overseeding, fertilization, mowing, weed control activities and observations of seed and sod establishment. Copies of the Log shall be submitted to the Engineer weekly, except as noted for watering immediately after sod installation.

PART 2 - PRODUCTS

2.01 TOPSOIL

- A. Clean, fertile, friable, well-draining, natural sandy loam not containing materials harmful to plant life. All topsoil to be free of any subsoil, sod stones over 1" in any dimension, sticks, roots, weeds, litter, and other deleterious material. Topsoil shall be uniform in quality and texture and contain organic matter and mineral elements necessary for sustaining healthy plant growth as follows:
1. Organic content: 5% - 15%
 2. pH: 5.5 to 7
 3. Gradation: USDA Soils Textural Classification percentages of sand, silt, and clay for "Sandy Loam" or "Loam" classification.
 4. Nutrient Levels: As required by the additions of amendments to the topsoil to meet the optimum nutrient levels specified in the testing laboratory report.

2.02 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C602, agricultural limestone containing a minimum 80% calcium carbonate equivalent and as follows:
1. Class: Class O, with a minimum 95% passing through the no. 8 (2.36 mm) sieve and a minimum 55% passing through the no. 60 (0.25 mm) sieve.
 2. Provide lime in form of dolomitic limestone.
- B. Aluminum Sulfate: commercial grade, unadulterated.
- C. Perlite: Horticultural perlite, soil amendment grade.
- D. Agricultural Gypsum: Finely ground, containing a minimum of 90% calcium sulfate.

- E. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.03 ORGANIC SOIL AMENDMENTS

- A. Compost: well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35% to 55% by weight; 100% passing through the $\frac{3}{4}$ " (19 mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5% inert contaminants and free of substances toxic to plantings.
- B. Peat: Finely divided or granular texture, pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water absorbing capacity of 1100% to 2000%.
- C. Manure: well-rotted, unleached, stable or cattle manure containing not more than 25% by volume of straw, sawdust, or other bedding materials; free of toxic substances, stone, sticks, soil, weed seed, and material harmful to plant growth.

2.04 SEED

- A. All seed materials shall be fully clearly labeled according to the Laws and regulations of the state of Connecticut. The Contractor shall retain and produce seed bag labels if requested by the Owner or Architect. An invoice from the seed supplier shall be included certifying that the seed are the cultivars as listed on the labels.
- B. Hydroseeding of slope and lawn areas may be permitted upon written approval of the Architect.
- C. Permanent Lawns & Turfgrass: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 1 percent weed seed:
1. Standard Seed Mix: Proportioned by weight as follows:
 - a. 40 percent Kentucky bluegrass (*Poa pratensis*).
 - b. *40 percent chewings red fescue (*Festuca rubra* variety).
 - c. *20 percent perennial ryegrass (*Lolium perenne*).
* High endophyte
 - d. Ryegrass varieties shall be selected from varieties showing good wear tolerance and good disease resistance as listed in Rutgers University Cooperative Research & Extension Fact sheet FS546 „Perennial Ryegrass Varieties for New Jersey Sports Fields“ James A. Murphy, PhD.
 2. Slope Lawn Seed Mix: Proportioned by weight. Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 1 percent weed seed:

- a. 80% equal mix of the following:
 - Sheeps Fescue,
 - Dawson Slender Red Fescue,
 - SR5210 Creeping Red Fescue,
 - SR 5100 Chewings Fescue,
 - Jasper Creeping Red Fescue,
 - Scaldis Hard Fescue,
 - SR 3150 Hard Fescue
 - b. 20% annual ryegrass
3. Low Maintenance Seed Mix: Proportioned by weight. Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 1 percent weed seed: Mix shall be sown at a minimum rate of 5lbs per 1,000sf.
- a. 42% „Flyer“ Creeping Red Fescue
 - b. 34% fiesta II perennial Ryegrass
 - c. 8% Redtop
 - d. 8% Birdsfoot trefoil
 - e. 8% Alsike Clover
- D. Temporary Vegetative Cover: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 1 percent weed seed:
- 1. Temporary Vegetative Cover: Proportioned by weight as follows:
 - a. 60 percent annual Ryegrass
 - b. 40 percent perennial Ryegrass.
- 2.05 ACCESSORIES
- A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application as approved by the Engineer.
- 2.06 FERTILIZER
- A. Commercial Fertilizer: Commercial-grade composite fertilizer uniform in composition, dry and free flowing. It shall bear the manufacturer's guaranteed statement of analysis which shall be as indicated by soils testing for original fertilization and 10-6-4 for refertilization with 50% organic nitrogen. Fertilizer shall be derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
 - B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.06 MULCHES

- A. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- B. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive lawns and grasses for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by seed operations.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 TOPSOIL PREPARATION AND SCREENING

- A. All stockpiled topsoil shall be screened prior to placement to meet the specified requirements.
- B. Limit lawn subgrade preparation to areas to be planted.
- C. Spread topsoil to the minimum depths indicated on the Contract Drawings but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if topsoil or subgrade is frozen, muddy, or excessively wet.
- D. Beginning of installation means Contractor acceptance of prepared site conditions
- E. General Seeded Areas:

1. Harrow or rake the topsoil to a depth of 3 inches. Remove all sticks, foreign material and stones 1 1/2 inches or greater in any dimension.
 2. Thoroughly blend planting soil mix before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix using a subsoiler.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 3. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
 - a. Remove existing grass, vegetation and turf. Do not mix into surface soil.
 - b. Loosen surface soil to a depth of at least of 6 inches (200 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches (150 mm) of soil. Till soil to a homogeneous mixture of fine texture.
 - c. Remove stones larger than 3/4 inch in any dimension and sticks, roots, trash, and other extraneous matter.
 - d. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
 4. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation as measured with a 10" straight edge. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.
 5. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.04 SEEDING

- A. Permanent Seed: Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 1. Do not use wet seed or seed that is moldy or otherwise damaged.
 2. Sow seed at the following rates:

a. Standard Seed Mix:	5 lbs/1,000 sq. ft.
b. Slope Lawn Seed Mix:	5 lbs/1,000 sq.ft.
c. Low Maintenance Seed Mix:	5 lb/1,000 sq. ft.
 3. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray.

4. Protect seeded areas on slopes in accordance with Division 31 specification „Erosion Control system“.
5. Apply straw mulch composed of stems of grain after threshing and free of weeds at 2 tons per acre on athletic field areas of the site.

B. Temporary Seeding: Sow seed with spreader, seeding machine or hydroseed.

1. Sow seed evenly at the rate of 10 lb/1000 sq.ft.

3.05 HYDROSEEDING

A. Hydroseeding: Only as approved by the Engineer

B. Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic tackifier.
2. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at a minimum rate of 500-lb/acre (5.1-kg/93.9 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb/acre (10.2 kg/93.9 sq. m).
3. Protect seeded areas with slopes exceeding 1:1 with slope stabilization blankets installed and stapled according to manufacturer's written instructions.

3.06 REPAIRS

- A. The Contractor shall reseed and repair any areas missed by seeding after proper restoration of the seedbed.
- B. The Contractor is responsible for repairing and reestablishing any areas damaged by erosion or settling during the maintenance period.

3.07 SATISFACTORY LAWNS

- A. Final acceptance of Lawn areas shall be based upon a uniform grass cover on the seeded areas and no settling occurring that would result in an uneven surface.
1. Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m).
- B. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.08 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect barricades and warning signs as required protecting newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.
- C. Remove erosion-control measures after grass establishment period.

END OF SECTION 02900

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SECTION 03300**CAST-IN-PLACE CONCRETE****PART 1 – GENERAL****1.01 DESCRIPTION**

- A. This Section includes the furnishment of all labor, materials, and equipment necessary for the installation of cast-in place concrete, as indicated on the Project Drawings or as required to complete the Project work. This includes, but is not limited to, concrete pavement, concrete for bollards, concrete pads, and concrete for miscellaneous structures outside of the building.

1.02 RELATED WORK

- A. Related sections.
 - 1. Section 02105 “Selective Demolition”
 - 2. Section 02210 “Earth Excavation, Backfill, Fill and Grading”
 - 3. Section 02225 “Processed Aggregate Base”

1.03 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings
- B. ACI 318 - Building Code Requirements for Reinforced Concrete
- C. ACI 347 - Recommended Practice for Concrete Formwork
- D. ASTM C33 - Concrete Aggregates
- E. ASTM C94 - Ready-Mixed Concrete
- F. ASTM C150 - Portland Cement
- G. ASTM C260 - Air-Entraining Admixtures for Concrete
- H. ASTM C494 - Chemical Admixtures for Concrete
- I. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type)

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 “Specifications for Structural Concrete for Buildings” and ACI 318 “Building Code Requirements for Reinforced Concrete” unless specifically noted otherwise.

B. Material Testing

1. Testing and analysis of concrete will be performed by the OWNER'S testing laboratory.
2. OWNER'S testing laboratory shall take cylinders and perform compression, slump, temperature, and air entrainment tests in accordance with ACI 301.
3. Tests of cement and aggregates will be performed to ensure conformance with requirements stated herein.
4. One additional test cylinder will be taken during cold weather and cured on-site under same conditions as concrete it represents.
5. This cost of concrete testing and analysis services shall be borne by the owner unless a deficiency in material or workmanship is found, in which instance the contractor shall bear the cost of the testing agency's services.

1.05 SUBMITTALS

- A. Submit concrete mix designs for each class of concrete to ENGINEER for approval. Include graduation analysis of all aggregates and manufacturer's product information on all cement and admixtures used.
- B. Submit reinforcement shop drawings for all reinforcing steel. Comply with ACI SP-66 "Detailing Manual". Show bar schedules, bending diagrams, splices and laps, shapes, dimensions and details of reinforcements and all accessories. * Reproduction of concrete drawings is not acceptable for use as shop drawings.
- C. Submit certificates of compliance for reinforcement, cement, aggregates and admixtures.
- D. Batch certificates for each batch of concrete discharged and to be used in the Work shall be provided to the ENGINEER.

1.06 JOB CONDITIONS

- A. Make provisions for, coordinate with and provide access to all other CONTRACTORS for the installation of required base, sleeves, conduit, etc.
- B. Notify the ENGINEER at least 48 hours in advance of all pours. Obtain the ENGINEER'S approval prior to pouring.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Provide cold weather placement and protection in accordance with ACI 306.
- B. Provide hot weather placement and protection in accordance with ACI 305.

- C. Unless adequate protection is provided, concrete shall not be placed during rain, sleet or snow. Protect concrete from rainwater, maintain concrete water-cement ratio and protect concrete surface from damage by adverse weather conditions
- D. All concrete shall be adequately protected after pouring to prevent damage from freezing, by the use of suitable covers and adequate heating equipment. Frozen and damaged concrete must be removed and replaced at the CONTRACTOR'S expense. Do not place concrete on frozen earth.

PART 2 - PRODUCTS

2.01 FORMWORK MATERIALS

- A. Steel forms or form liners shall be standard commercially available prefabricated steel forms.
- B. Fiberglass forms shall be standard quality.
- C. Plywood forms shall be B-B plyform, Class I or Class II, $\frac{5}{8}$ " minimum thickness, edge sealed.
- D. Boards, sheathing and form lumber shall be No. 3, common or better, $\frac{3}{4}$ " minimum thickness.
- E. Framing lumber shall be standard or better.
- F. Form ties and all other accessories embedded in concrete shall be commercially manufactured type.
Non-fabricated wire ties are not permitted.
- G. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of concrete.

2.02 REINFORCEMENT

- A. Steel reinforcing bars shall conform to "Specifications for Deformed Billet - Steel Bars for Concrete Reinforcement", ASTM A 615 Grade 60, having a minimum yield strength of 60,000 psi.
- B. Tie Wire shall be black annealed wire, 16-gauge minimum.
- C. Provide supports for reinforcement as required. Bar supports shall conform to the "Bar Support Specifications" contained in "Manual of Standard Practice" as published by CRSI and WCRSI. Bar supports and accessories within $\frac{1}{2}$ " of surface of concrete exposed to weather shall be non-corrosive.

- D. Welded Wire Fabric shall be smooth wire fabric conforming to ASTM A185. Welded intersections shall not exceed 6" o.c. Sheet stock only, rolled stock not permitted.

2.03 CONCRETE MATERIALS

- A. Cement shall be gray Portland Cement, Type I, or II, conforming to ASTM C150 or ASTM C175 for air-entraining Portland Cement. Use the same cement and supplier for all exposed Work.
- B. Water shall be potable, clean and free from impurities affecting the strength of the concrete, in accordance with ACI and ASTM requirements.
- C. Concrete aggregates shall conform to ASTM C 33.
1. Fine and coarse aggregates shall be regarded as separate ingredients and each shall conform to the appropriate grading requirements of ASTM C33.
- D. Air-Entraining admixtures shall conform to ASTM C260.
- E. Water reducing admixture shall conform to ASTM C494, Type A (Low Range) or Type F (High Range).
- F. Accelerating admixture shall be non-chloride type and shall conform to ASTM C494, Type C.
- G. Retarding admixture shall conform to ASTM C494, Type D.
- H. Non-shrinking grout shall be non-metallic, non-staining type achieving a 28-day compressive strength of 3000 psi minimum.
- I. Expansion joints shall be 1/2" thick cane fiber expansion joints, conforming to ASTM D1751.
- J. Curing/Sealing compound shall conform to ASTM C309, minimum solids 18%.

2.04 CONCRETE MIX DESIGNS

- A. All site concrete shall be normal weight and consist of a proportioned mixture of Portland cement, fine and coarse aggregate, admixtures and water.
- B. All concrete mixes shall be proportioned on the basis of field experience and/or trial mixtures in accordance with ACI 318 to achieve the following properties:

Class	28 Day Compressive Strength (PSI)	Maximum Water/Cement Ratio	Minimum Cement Content (1 lb/cy)
A	4000 psi	0.49	611
B	3000 psi	0.53	517
C	1500 psi	0.69	423

- C. Class A and B shall be proportioned for a slump range of 2" minimum to 4" maximum. Class C shall not exceed 6" minimum.
- D. Class A and B concrete shall be air entrained with an air content of $6\% \pm 1\%$. Class C shall not be air entrained.
- E. Class A concrete shall be used for all concrete sidewalks, curbs, pavements and all exposed flatwork. Class B concrete shall be used for all footings and site structures. Class C concrete shall be used for all lean concrete fills.
- F. Class A concrete shall not contain any fly-ash. Blast furnace cement slag may be used.
- G. A low range admixture shall be utilized in all concrete.
- H. Admixtures to retard or accelerate setting, plasticize or prevent freezing shall not be used without prior approval from the ENGINEER. No admixtures containing calcium chloride will be permitted.
- I. All admixtures shall be mixed at the batch plant.
- J. Utilize the following maximum aggregate sizes that shall not exceed the tolerance on oversize specified in ASTM C33.

Class A	3/4"
Class B	1"
Class C	1 1/2"
- K. The use of fly ash in the mix design shall not be allowed for exposed floatwork, sidewalks, pavement, etc.

2.05 PRODUCTION

- A. Ready-mixed concrete shall conform to ASTM C94 and the National Ready Concrete Association. Use of non-agitating trucks is not permitted. Delete references for allowing additional water to the batch for insufficient slump. Addition of water to the batch is not permitted.
- B. Use of re-tempered concrete is not permitted.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine the subgrade and the conditions under which site concrete work is to be installed. Installation shall not proceed until all unsatisfactory conditions, if any, have been corrected.
- B. Concrete is not to be placed without the prior inspection and approval of the subgrade and forms by the ENGINEER.

3.02 BASE PREPARATION

- A. Remove any soft, yielding or loose materials. Replace with crushed stone, compacted gravel or processed aggregate as appropriate for the subject base course. Grade and prepare base to a smooth surface parallel to finish grade and to proper elevation. Proof compact the finished surface.
- B. Check elevations and position of all utility structures, manholes, catch basins, valve boxes, etc., that lie within the areas to receive concrete pavements. Make or have made any adjustments required to properly line up and set these elements with regard to the finish work.
- C. Moisten the base immediately prior to concrete placement.
- D. Notify the ENGINEER following completion of subgrade preparation to allow for inspection and approval prior to concrete placement.

3.03 FORM CONSTRUCTION

- A. All forms used for exposed concrete work shall be plywood forms. Reused plywood form, fiberglass forms and standard steel forms may be used for all concealed concrete work, provided that the reused form are cleaned and re-oiled prior to their reinstallation.
- B. All exterior corners and edges of exposed concrete shall be chamfered or bullnosed.
- C. All forms shall be temporarily braced from lateral loads as required by ACI 301, 318, 347 and other applicable specifications.
- D. Set forms to the required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- E. Check completed formwork for grade and alignment to the following tolerances:
 - 1. Top of form units: not more than 1/8" in 10 feet.
 - 2. Vertical face; not more than 1/4" in 10 feet on longitudinal axis.
- F. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

3.04 REINFORCEMENT

- A. Fabrication and placing tolerances of reinforcing bars and welded wire fabric shall conform to the CRSI "Manual of Standard Practice" and ACI 318 Building Code Requirements for reinforced Concrete for Buildings.

- B. Reinforcement shall be free from scale, oil, ice and structural defects, and kept in this condition on the job site. Reinforcement shall be stored out of contact with the ground.
- C. Appliances: adequate chairs and other devices shall be used to maintain proper elevation of bars and mesh reinforcing at all times. All chairs and other devices shall be galvanized. Continuous mesh reinforcing shall be lapped at least one wire space. All reinforcement and mesh shall be secured at the proper position prior to concrete placement.
- D. Reinforcement within the limits of 1 day's pour shall be in place and firmly wired before concrete pouring starts.
- E. Field bending of reinforcement by use of heat will not be permitted.

3.05 MIXING AND TRANSPORTING CONCRETE

- A. The mixing and transporting of concrete shall comply with ACI 304.
- B. Each batch of concrete shall:
 - 1. Be thoroughly mixed so that there is a uniform distribution of materials.
 - 2. Be entirely discharged from the mixers before recharging.
 - 3. Ready-mix concrete shall be mixed and delivered in accordance with the requirements set forth in ASTM C94. The CONTRACTOR shall see that a sufficient number of mixers are provided to rapidly and continuously carry out the work. The OWNER or its representatives shall at all times have free access to the batching plant and transit mix trucks for sampling materials and checking handling methods.
 - 4. Re-tempering of concrete is not permitted.

3.06 CONCRETE PLACEMENT

- A. Contractor shall complete pre-placement inspection prior to the arrival of the ENGINEER. Inspect formwork, reinforcing steel and items to be embedded or cast-in.
- B. Placement of concrete shall be in accordance with ACI 301 and ACI 304.
- C. Hot Weather Placement shall be in accordance with ACI 305.
- D. Cold Weather Placement shall be in accordance with ACI 306.
- E. Do not place concrete until subgrade and forms have been checked for line and grade. Moisten subgrade to provide a uniformed dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they have been brought to the required grade and alignment.
- F. Place concrete using methods which prevent segregation of the mix and with as little rehandling as possible. Consolidate concrete along the face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement or side forms. Use only square faced shovels for hand spreading and

consolidation. Consolidate with care to prevent dislocation of reinforcing dowels and joint devices.

- G. Deposit and spread concrete in a continuous operation between joints as far as possible. If interrupted for more than ½ hour, place a construction joint.

3.07 JOINTS

- A. Construct expansion, score (weakened plane/contraction) and construction joints as detailed on the drawing and in accordance with the accepted practice of the ACI. The ENGINEER specifically reserves the right to adjust joint locations without additional payment.
- B. All joints shall be constructed true to line with face perpendicular to surface of the concrete unless otherwise specified or detailed. Construct transverse joints at right angles to the centerline.
- C. Score (weakened plane/contraction) Joints: Provide score joints, sectioning concrete into areas as detailed and as shown on the Drawings. Construction joints ¼" wide by depth as detailed by grooving top portion of fresh concrete with a recommended cutting tool and finishing with a jointer.
- D. Construction Joints: Place construction joints at end of placements except where such placements terminate at expansion joints.
- E. Construction joints shall be keyed and doweled. See Contract Drawings for additional details.
- F. Expansion joints: Provide and install pre-molded joint filler for expansion joints abutting curbs, inlets, structures, walks, walls, other fixed objects and as shown on the Drawings.
- G. Locate expansion joints 24 ft. o.c. maximum, or as detailed.
- H. Extend joint fillers full width and depth of joint, and not less than ½" or more than 1" below finished surface. Install joint sealer at all expansion joints as detailed on the Contract Drawings.
- I. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
- J. Protect the top edge of joint filler during concrete placement with wood strip, metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

3.08 CONCRETE PAVEMENTS AND PADS

- A. Install base course in one course over previously prepared subgrade. Thoroughly compact base course and moisten.

- B. Construct and install forms as required and detailed.
- C. Placement of concrete for pavement and pads shall be in accordance with these specifications. Consolidate, screed and finish as detailed.
- D. Round all edges with an approved tool. Eliminate tool marks on concrete surfaces.

3.09 CONCRETE FINISHING

- A. After striking off and consolidating concrete, smooth surface by screening and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
- B. After floating, test surface for trueness with a 10 ft., straightedge. Distribute concrete as required to remove surface irregularities, and re-float repaired areas to provide a continuous smooth surface.
- C. Work edges of slabs, gutters, back top edge of curb and formed joints with an edging tool, and round to $\frac{1}{2}$ " radius, unless otherwise indicated. Eliminate tool marks on concrete surface.
- D. After completion of floating and troweling, when excess moisture or surface sheen has disappeared, complete surface finishing as detailed. Methods defined as follows:
 - 1. Light broom finish: Draw a fine-hair broom across concrete surface in direction as detailed. Repeat operation if required, to provide a fine line texture acceptable to the ENGINEER.
 - 2. Heavy broom finish: Draw a stiff-bristled broom across concrete surface in direction as detailed. Repeat operation if required, to provide a coarse, non-slip finish, acceptable to the ENGINEER.
 - 3. "Rubbed finish": Rub exposed concrete surfaces with a wood or rubber float to achieve a uniform, gritty texture.
 - 4. "Green Cleaned Finish": Conform to ACI 301, Section 10.3.2.
- E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects as directed by the ENGINEER.

3.10 CURING AND PROTECTION

- A. Cure and protect site concrete in strict accordance with ACI 301 procedures.
- B. Liquid membrane curing compounds shall be in accordance with the manufacturer's instructions.
- C. Prevent the loss of moisture for a period of seven days.

3.11 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms when acceptable to the Engineer.
- B. Cut out honeycomb, rock pockets and voids over ¼" in any dimension and holes left by tie rod and bolts, down to solid concrete, but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing mortar, coat the area to be patched with a bonding agent.
- C. For exposed to view surfaces, blend white Portland cement and standard Portland cement so that when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous locations to verify mixtures and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surfaces.
- D. Repair Formed Surfaces: Flush out form tie holes, fill with dry-pack mortar.
- E. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- F. Repaired of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plan to tolerances specified for each and finish. Correct low and high areas as herein specified. Text unformed surfaces sloped to drains for trueness of slope, in addition to smoothness, using a template have the required slope and shape.
- G. Repair finished unformed surfaces that contain defects that affect the durability of concrete. Surface defects, as shown, include crazing, cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets and other objectionable conditions.
- H. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
- I. Correct low areas in unformed surface during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.
- J. Repair defective areas, except random cracks and single holes not exceeding 1 inch 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 ¾" clearance all around. Dampen concrete surfaces in contact with patching concrete and brush with a neat cement grout or apply concrete of same type or class as original concrete. Place, compact and finish blending with adjacent finished concrete. Cure in the same manner as adjacent concrete.

- K. Repair isolated random cracks and single holes not over 1 inch diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and brush with neat cement grout or apply concrete bonding agent. Mix dry-pack, consisting of one part Portland cement to 2 ½ parts fine aggregate passing a no. 16 sieve, using only enough water as required for handling and placing. Install dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
- L. Use epoxy-based mortar, approved by the Engineer, for structural repairs. Structural repairs include, but are not limited to, areas of unsound concrete with a surface area greater than 9 square inches or with a depth greater than 1 ½ inches, areas where reinforcement is exposed or areas with cracks greater than 1/16 inch wide. All areas requiring a structural patch shall be approved by the Engineer.

3.12 PROTECTION

- A. Protect concrete from damage until acceptance of the Work. Exclude traffic from pavement for at least 28 days after placement. No construction traffic is permitted.
- B. Sweep concrete pavements and wash all concrete surfaces free of stains, discoloration, dirt and other foreign materials just prior to finish inspection.
- C. Protection of finished work is the responsibility of the installing CONTRACTOR until final acceptance of all work by the ENGINEER. The installing CONTRACTOR, at no additional cost to the OWNER, shall replace all unprotected damaged Work.
- D. Where required and/or directed, backfill sides of sidewalk with suitable materials compacted and finished flush with the top of the walk.

END OF SECTION 03300

SECTION 04200**UNIT MASONRY****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Provide all materials, labor, equipment, services, etc. that are necessary and incidental to the completion of the work described herein for masonry, as shown on the Project Drawings, or as otherwise required.

1.02 RELATED WORK

- A. Related Sections:

1. Section 03300 - "Cast-in-Place Concrete"
2. Section 07620 - "Sheet Metal Flashing and Trim"

1.03 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
 1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
 2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109 for compressive strength.
 3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:

1. Submittals shall be made in accordance with Section 106-07 of the Greater New Haven Water Pollution Authority Standard Specifications.
 2. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
- C. Samples: For each type and color of the following:
1. Pre-faced CMUs.
 2. Face brick.
 3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
 4. Weep holes and accessories.
 5. Accessories embedded in masonry.
- D. Qualification Data: For testing agency.
- E. Material Certificates: For each type and size of the following:
1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - d. For masonry units, include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.
- F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C91 for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- G. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

- H. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials and equipment to be used to comply with requirements.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely ties. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.08 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

2. Where one (1) wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least twelve (12) hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg. F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

- A. Regional Materials: Provide CMUs that have been manufactured within five hundred (500) miles of project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within five hundred (500) miles of Project site.
- B. Shapes: Provide shapes indicated and as follows with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide bull nose units for outside corners unless otherwise indicated.
- C. CMUs: ASTM C 90
1. Density classification: Lightweight.
 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
- D. Pre-faced CMUs: Lightweight hollow concrete units complying with ASTM C 90, with manufacturer's standard smooth resinous facing complying with ASTM C 744.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include but are not limited to, the following:
 - a. The Burns & Russell Company, Baltimore, MD, **Spectra-Glaze® II**
 - b. Trenwyth Industries, an Old Castle Company, Emigsville, PA; **Astra-Glaze-SW+**
 - c. Approved equal
 2. Size: Manufactured to dimensions specified in "CMUs" Paragraph but with pre-faced surfaces having 1/16-inch wide returns of facing to create 1/2-inch-wide mortar joints with modular coursing.
 3. Colors and Patterns: As selected by Owner from manufacturer's full range.

2.03 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.04 BRICK

- A. Regional Materials: Provide brick that has been manufactured within five hundred (500) miles of project site from materials that have been extracted, harvested, or recovered, as well as manufacturer, within five hundred (500) miles of Project site.
- B. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units with no cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 - 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- C. Face Brick: Facing brick complying with ASTM C 216.
 - 1. Manufacturer:
 - a. The Belden Brick Company, distributed by The Homer C. Godfrey Company
 - b. Watsonville Brick, Watsonville, PA (800.538.2040)
 - c. Mack Brick Company, Enfield, CT (860.627.6625)
 - d. Approved equal
 - 2. Grade: SW
 - 3. Type: FBX.
 - 4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 - 5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rate "not effloresced."
 - 6. Size (Actual Dimensions): 3-5/8 inches wide by 2 1/4 inches high by 7-5/8 inches long.
 - 7. Color and Texture:
 - a. Red Blended Veneer: As selected by Owner.

2.05 MORTAR AND GROUT MATERIAL

- A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within five hundred (500) miles of Project site.
- B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Product:
 - a. Davis Colors; **True Tone Mortar Colors.**
 - b. Lanxess Corporation; **Bayferrox Iron Oxide Pigments.**
 - c. Solomon Colors, Inc.; **SGS Mortar Colors.**
 - d. Approved equal.
- E. Colored Cement Product: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Products:
 - a. Colored Masonry Cement:
 - 1) Lafarge North America Inc.; **U.S. Cement Custom Color Masonry Cement.**
 - 2) Lehigh Cement Company; **Lehigh Custom Color Masonry Cement.**
 - 3) National Cement company, Inc.; **Coosa Masonry Cement.**
 - 4) Approved equal.
 2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 3. Pigments shall not exceed five percent (5%) of masonry cement by weight.
- F. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than ¼ inch thick, use aggregate graded with one hundred percent (100%) passing the No. 16 sieve.
 3. White-Mortar Aggregates: Natural white and or crushed white stone.
- G. Aggregate for Group: ASTM C 404.

- H. Water: Potable.

2.06 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
1. Interior Walls: Hot-dip galvanized, carbon steel.
 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 3. Wire Size for Side Rods: 0.187-inch diameter.
 4. Wire Size for Cross Rods: 0.125-inch diameter.
 5. Wire Size for Veneer ties: 0.187-inch diameter.
 6. Spacing of Cross Rod, Tabs and Cross ties: Not more than 16 inches o.c.
 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
1. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
 2. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1 1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.
- E. Masonry joint reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch-diameter, hot-dip galvanized, carbon-steel continuous wire.

2.07 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Stainless-Steel Wire: ASTM A 580, Type 304.
 2. Stainless-Steel Sheet: ASTM A 666, Type 304.
- B. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.031-inch-thick, stainless-steel sheet.

- C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
 2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1 1/4 inches.
 3. Wire: Fabricate from 3/16-inch-diameter, stainless-steel wire.
- E. Adjustable Anchors for Connecting to Structural Framing: Provide anchors that allow vertical or horizontal adjustment, but resist tension and compression forces perpendicular to plan or wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, stainless-steel wire.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch-diameter, stainless-steel wire.
- F. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 and amplitude of 0.06 to 0.10 inch made from 0.062-inch thick stainless steel sheet with dovetail tables for inserting into dovetail slots in concrete and sized to extend to within 1 inch of masonry face.
- G. Partition Top Anchors: 0.105-inch-thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from stainless steel.

2.08 MISCELLANEOUS ANCHORS

- A. Anchor bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.

2.09 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Section 07620 "Sheet Metal Flashing and Trim".
- B. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between two (2) layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) York Manufacturing, Inc.; **Multi-Flash 500.**
- 2) Advanced Building Products Inc.; **Copper Fabric Flashing.**
- 3) Sandell Manufacturing Co., Inc.: **Copper Fabric Flashing.**
- 4) Approved equal.

- C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counter flashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
4. Where flashing is fully concealed, use flexible flashing.

- D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07620 "Sheet Metal Flashing and Trim."

- E. Adhesives, Primers and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Preformed filler strips complying with ASTM D 1056, Grade 2A1; compressible up to thirty-five percent (35%); of width and thickness indicated; formulated from neoprene.

- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

- D. Weep/Vent Products: Use the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 less than depth of outer wythe, in color selected from manufacturer's full range.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the work include, but are not limited to, the following:

- 1) Advanced Building Products Inc.; **Mortar Maze weep vent.**
- 2) Heckmann Building Products Inc.; **No. 85 Cell Vent.**
- 3) Hohmann & Barnard, Inc.; **Quadro-Vent.**
- 4) Approved equal.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products:

- a. Advanced Building Products Inc.; **Mortar Break II.**
- b. Archovations, Inc.; **CavClear Masonry Mat.**
- c. Mortar Net USA, Ltd.; **Mortar Net.**
- d. Approved equal.

2. Provide one (1) of the following configurations:

- a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacture and manufacturer of masonry units being cleaned.

1. Manufacturers:

- a. Friedrich Technologies, Inc.
- b. E-Co Chem, Inc.
- c. ProSoCo, Inc.
- d. Approved equal.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use masonry cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For masonry below grade or in contact with earth, use Type S.
 2. For reinforced masonry, use Type S.
 3. For exterior, above-grade, load-bearing and non-load bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 4. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement products.
1. Pigments shall not exceed five percent (5%) of masonry cement by weight.
 2. Color to be as approved by Owner.
 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Pre-faced CMUs.
 - b. Face brick.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5.1 in AGI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1.
 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave opening for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of unit is specified. Install cut units with cut surfaces and where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they're placed.

3.03 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus $\frac{1}{2}$ inch or minus $\frac{1}{4}$ inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus $\frac{1}{2}$ inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus $\frac{1}{4}$ inch in a story height or $\frac{1}{2}$ inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than $\frac{1}{4}$ inch in 10 feet, or $\frac{1}{2}$ inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than $\frac{1}{8}$ inch in 10 feet, $\frac{1}{4}$ inch in 20 feet, or $\frac{1}{2}$ inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than $\frac{1}{4}$ inch in 10 feet, $\frac{3}{8}$ inch in 20 feet, or $\frac{1}{2}$ inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than $\frac{1}{8}$ inch in 10 feet, $\frac{1}{4}$ inch in 20 feet, or $\frac{1}{2}$ inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than $\frac{1}{4}$ inch in 10 feet, $\frac{3}{8}$ inch in 20 feet, or $\frac{1}{2}$ inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than $\frac{1}{4}$ inch in 10 feet, or $\frac{1}{2}$ inch maximum.

7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running and attacked bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

- H. Low Lift Grouting: Place first lift or grout to a height of 16 inches and rod for grout consolidation. Place subsequent lifts in 8 inch increments and rod for grout consolidation.
- I. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- J. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. At fire-rated partitions, treat joint between top of partition and underside of structure above.

3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints lightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.06 CAVITY WALLS

- A. Bond wythes of cavity walls together using one (1) of the following methods:
 - 1. Individual Metal Ties: Provide ties as indicated in Drawings. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.

2. Masonry Joint reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not over 8 inches clear horizontally and 16 inches clear vertically.
 4. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bond system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Apply air barrier to face of backup wythe to comply with Division 07 Section "Air and Vapor Barriers."
- 3.07 MASONRY JOINT REINFORCEMENT
- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at corners by using prefabricated L-shaped units.
- 3.08 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE
- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
1. Provide an open space not less than 12 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.09 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 1. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners or type indicated. Use two (2) fasteners unless anchor design only used one (1) fastener.
 2. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one (1) anchor for each 2 sq. ft., of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form Control joints in concrete masonry as follows:
 1. Install preformed control joint gaskets designed to fit standard sash block.
 2. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
- C. Form expansion joints in brick as follows:
 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 3. Build in compressible joint filler where indicated.
 4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and back rod specified in Section 07900 "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07900 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions, to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacture.
 2. At multi-wythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 2 inches, and through inner wythe to within $\frac{1}{2}$ inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
 3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
 4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than $\frac{1}{2}$ inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 6. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07900 "Joint Sealants" for application indicated.
 7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing as follows:
 - 1. Use specified weep/vent products to form weep holes.
 - 2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 - 3. Space weep holes 24 inches o.c. unless otherwise indicated.
 - 4. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
 - 5. Trim wicking material flush with outside face of wall after mortar has set.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas; as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 2 special inspections according to the "International Building Code."
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One (1) set of tests.
- D. Testing Frequency: One (1) set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.14 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
1. Crush masonry waste to less than 4 inches in each dimension.
 2. Mix masonry waste with at least two (2) parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earthwork."
 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04200

SECTION 05100**METAL FABRICATIONS****PART 1 – GENERAL****1.01 DESCRIPTION**

- A. This section includes, but is not limited to the general requirements for the furnishment and installation of the framing metal fabrications.

1. Miscellaneous structural steel

1.02 RELATED WORK

- A. Drawings and general provisions of the Contract, including the Greater New Haven Water Pollution Control Authority Standard Specifications apply to this Section.
- B. Section 02200 “Cast-in-Place Concrete” for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.

1.03 REFERENCES

- A. ASTM A36/A36M-05 Specification for Carbon Structural Steel
- B. ASTM A123/A123M-02 Specification for Zinc (Hot Dip galvanized) Coatings on Iron & Steel Products
- C. ASTM A153/A153M-05 Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
- D. ASTM A307-07b Specifications for Carbon Steel bolts and Studs, 60,000 PSI Tensile Strength
- E. ASTM A325-07a Specification for Structural bolts, Steel, heat Treated, 120/105 KSI Minimum Tensile Strength
- F. ASTM A500-07 Specification for Cold-Formed welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- G. ASTM A572/A575M-07 Specification for High Strength Low-Alloy Columbium Vanadium Structural Steel
- H. ASTM A780-01 (2006) Standard Practice for repair of damaged and uncoated areas of hot dip galvanized coatings
- I. ASTM A992/A992M-06a Specification for Steel for Structural Shapes for Use in Building Framing.
- J. ASTM F1554-07a Specification for Anchor Bolts, Steel 36, 55 and 105 KSI Yield Strength
- K. AWS D1.1-2006 American Welding Society, Structural Welding Code Steel
- L. Manual of Steel Construction - American Institute of Steel Construction (AISC- 13th edition)

1.04 SUBMITTALS

- A. Submit complete shop and erection drawings showing all fabrication, welding, connections, anchor bolt placement, finishes, materials and dimensions. Photo copies of Contract Drawings in whole or in part, will not be accepted as show drawings. Mark numbers painted on the shop assembled pieces of steel shall be the same mark numbers used on the detailed shop and erection drawings.
- B. Submit product data where required.
- C. Submit field welding equipment data including type, voltage and amperage.
- D. Submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one year old, the welding operator's qualification certificates shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.
- E. Qualifications:
 - 1. Steel Fabricator: A written description of ability including facilities, personnel, and a list of similar completed projects.
 - 2. Steel Erector: A written description of ability including equipment, personnel, and a list of similar completed projects.
- F. Submit certification from galvanizer that galvanizing is in accordance with Specifications.

1.05 QUALITY ASSURANCE

- A. Conform to AISI Specification for the Design, Fabrication and Erection of Structural Steel.
- B. Conform to AWS Structural welding Code for all welding operations.
- C. Galvanizing facility shall have an ongoing touchup and repair program.
- D. All welders shall be certified in accordance with the requirement of the AWS D Structural Welding Code with the following information:
 - 1. Type of welding for which the welder is qualified
 - 2. Welding position for which the welder is qualified
 - 3. Code and procedure for which the welder is qualified
 - 4. Date qualified
 - 5. Name of the firm and person certifying the qualification tests.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of products.
- B. Protect products from damage prior to and after installation.

- C. All products shall be stored off the ground and stored/handled in such a manner to prevent soiling, corrosion and/or damage.
- D. Remove damaged material from the site.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural steel shapes, and plates:
 - 1. Wide Flange beams ("W" shaped) ASTM A992 (Grade 50)
 - 2. Angles and other Shapes - ASTM A36 (Grade 36)
 - 3. Plates - ASTM 572 (Grade 50)
- B. Structural Steel Tubing: ASTM A500, Grade B
- C. Anchor Rods: ASTM F1554
- D. High Strength Bolts, ASTM A325
- E. Welding rods : AWS D111 (E70XX Electrodes)
- F. Finish:
 - 1. Structural Steel: Painted
 - 2. Bolts and Anchor Rods: Hot-Dipped galvanized: ASTM A153.

PART 3 - EXECUTION

3.01 FABRICATION

- A. Unless otherwise specified, structural steel shall be fabricated in accordance with the requirements of the 13th Edition of the AISC Specifications for the Design, Fabrication, and erection of structural steel for buildings. All members shall fit closely together and shall be straight and true, and the finished work shall be free from burrs, bends, twists, and open joints. Materials for welding shall be in accordance with the recommendations of the manufacturer of the material to be welded.
- B. All holes, angles, supports, and braces shall be provided as required.
- C. Except as otherwise indicated on the drawings, gusset plates shall have a minimum thickness of 3/8 inch.
- D. Holes shall be made in steel members for attachment of wood blocks, nailers, etc., holes shall be sized to suit the fasteners indicated on the architectural Drawings; where size and spacing are not indicated, holes shall be 9/16 inch diameter, at 3 feet o.c.
- E. Sheared and flame cut edges shall be true to line and free from rough corners and projections.

- F. Re-entrant cuts/corners shall be filleted to a radius of not less than $\frac{1}{2}$ inch.
- G. Holes shall be punched, sub-punched and reamed, or drilled in accordance with AISC "Specifications for structural steel". Holes shall not be made by flame cutting.
- H. Holes shall be $\frac{1}{16}$ larger than the normal bolt diameter, except holes for cast-in place anchor bolts which shall be $\frac{5}{16}$ inch large than the nominal bolt diameter and as otherwise shown on the Drawings.
- I. The use of oversize or slotted holes not shown on the Drawings shall be subject to prior review by the Engineer.
- J. Bend plate shall be in accordance with AISC "Minimum Radius for Bending:"
- K. Column ends bearing upon base and cap plates and beam ends with end plates shall be saw-cut or milled to true surfaces and correct bevels.
- L. Column base plate bearing surfaces on plates 2 inches or more in thickness shall be milled to true surfaces except at surfaces to be grouted against.
- M. Column caps and base plates and beam end plates shall have full contact when assembled.
- N. Welding shall be done in a sequence within minimizes distortion and shrinkage.
- O. Fabrication holes, notches, etc., not required by or shown on the Drawings shall be subject to prior review by the Engineer.

3.02 CONNECTIONS

- A. All welding shall conform to AWS D1.1 structural welding code and be performed by a certified welder in accordance with AWS Standards for type, size and position.
- B. Welded joints shall comply with the AWS code for procedures, appearance and quality of welds and methods of correcting welding work.
- C. All shop connections shall be bolted or welded. All field connections shall be bolted except where welding is specifically called for. Bolts shall be $\frac{3}{4}$ " diameter minimum with open holes $\frac{1}{6}$ " larger, except for column grout plates which are $\frac{3}{16}$ " larger and column base plates which are $\frac{5}{16}$ " larger. Connections not detailed shall be designed for the loads indicated on the Drawings, loads given in the AISC Uniform Load Tables or as indicated in the minimum connection details, whichever is greater.
- D. Provide high-strength threaded fasteners for bolted connections. Install high strength fasteners in accordance with AISC "Specifications for Structural Joints using A325 or A490 Bolts".
- E. All bolts connections that will be exposed to view shall have bolts for the full depth of the connection member, whether required to support the reaction or not.
- F. Continuous members, where indicated on the Drawings, shall require either 1) the member to be furnished as one piece, or 2) if individual pieces are to be provided, then they shall be connected by either welding or bolting to develop the full strength of the continuous member.

3.03 STEEL ERECTION AND INSTALLATION

- A. Erection of structural steel shall be in accordance with the AISC Manual of Steel Construction and all other applicable regulator agencies.
- B. Columns and base plates shall be set and accurately plumbed and leveled.
- C. Column base plates may bear on setting plates, as required by the erector. Setting plates shall conform to the following:
 - 1. Top surface of plates shall be flat to within 0.025 inches in 12 inches.
 - 2. Top surface of plates shall be level to within 0.025 inches in 12 inches
 - 3. Total of both out of level and cut of flatness shall not exceed 0.015 inches in 12 inches.
 - 4. Plates shall not be thinner than 1/4 inch, or smaller in any horizontal dimension that the base plate supported thereon.
- D. Installation of grout for the column setting plates and base plates shall be performed in accordance with Specification Section 03300. No load shall be applied to grout until 5 days after the plate has been grouted.
- E. All unmatched holes in shop assembly of field connections shall be reamed and the pieces match marked before disassembly. Drift pins shall be used only for bringing members into position and not to enlarge or distort holes. Any piece weakened by reaming to compensate for eccentricity to a point where the strength of the joint is impaired shall be rejected and a new and satisfactory piece shall be provided by the Contractor at his own expense. Slotted holes and washers shall be provided for tuning up steel requiring accurate alignment.
- F. The use of a gas cutting torch in the field for correcting fabrication errors will not be permitted upon any primary member of the structural framing.
- G. Steel work shall be adequately and safely supported and braced as required to prevent distortion or damage to the frame work due to wind or erection forces until the permanent supports and braces as shown on the Drawings are installed. Temporary lateral braces and support members which may be required during erection have not been designed by the Engineer or indicated on the Drawings. All temporary material and all traces thereof shall be completely removed before acceptance of the work. The Engineer has not designated the order of erection of steel work.

3.04 GALVANIZING

- A. Provide galvanizing to all structural steel and hardware as indicated on the Drawings and herein.
- B. Blast clean to near white metal in accordance with SSPC-SP10.
- C. Hot-Dip galvanize all fabricated items in accordance with ASTM A123 and Hardware items in accordance with ASTM A153.
- D. Galvanize items after assembly when possible
- E. Thickness of galvanizing shall be as specified in ASTM A123 and A153 except coating shall not be less than 2 oz., (3.3 mils) per square foot).

- F. Galvanizing shall provide a visually acceptable substrate for applied coatings and shall be free of lumps, globules, sharp edges or heavy deposits which will interfere with intended use or aesthetic appearance of materials.
- G. After erection touch-up all damaged galvanized surfaces and field welds as follows:
1. Surfaces to be reconditions with zinc-rich paint shall be clean, dry, and free of oil, grease and corrosion.
 2. Areas to be repaired shall be power disc sanded to bright metal. To ensure that a smooth reconditioned coating can be effected, surface preparation shall extend into the undamaged galvanized coating.
 3. At galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A80. Galvanizing repair paint shall have 65 percent zinc by weight.
 4. The paint shall be spray applied in multiple coats until a dry film thickness of 4-6 mils minimum has been achieved. A finish coat of aluminum paint shall be applied to provide a color blend with the surrounding galvanizing.
 5. Coating thickness shall be verified by measurements with a magnetic or electro magnetic gauge.
 6. Repair Paint:
 - a. ZIRP by Duncan Galvanizing
 - b. Tneme- Zinc by Tnemec
 - c. Or equal

3.05 SURFACE PREPARATION AND SHOP COATINGS

- A. Provide Surface Preparation and Shop Coatings in accordance with Specification Section 09900, except for areas which are to be field welded, shall be protected with a shop coat of linseed oil.
- B. Shop coats shall be compatible with and made by the same manufacturer as the field top coats as specified in Section 09900. Contractor shall coordinate.
- C. After erection touch-up all abrasions and field welds with the same material used on shop coating.

END OF SECTION 05100

SECTION 06100**ROUGH CARPENTRY****PART 1 - GENERAL****DESCRIPTION**

- A. This section includes the materials, labor, equipment, services, etc. necessary and incidental to rough carpentry including, but not limited to, temporary enclosures, all rough lumber, plywood sheathing, rough hardware, and lumber preservatives.

1.02 RELATED WORK

- A. Related Sections include the following:

1. Section 07620 "Sheet Metal, Flashing, and Trim"
2. Section 09900 "Painting"

1.03 REFERENCE

- A. Standard pressure treatment process shall conform to Federal Specification TT-W-573.
- B. Plywood shall conform to American Plywood Association APA Grade trademark and Product Standard PS-1.

1.04 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. RIS: Redwood Inspection Service.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.05 QUALITY ASSURANCE

- A. All lumber except as otherwise specified herein shall:
 - 1. Be new, dressed 4 sides (S4S), clean, and free from warping and other defects.
 - 2. Conform to U.S. Department of Commerce Simplified Practice Recommendations R-16 for sizes and use Classifications.
 - 3. Have a moisture content not exceeding 15 percent when delivered to the project.
 - 4. National Forest Products Association – “National Design Specification for Wood Construction – 1986 including Design Values for Wood Construction”.
- B. Plywood shall conform to American Plywood Association APA Grade trademark and Product Standard PS-1.
- C. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1.06 SUBMITTALS

- A. Products data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments specified to be High-temperature (HT) type, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - 1. Wood-preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Engineered wood products.
 - 4. Power-driven fasteners.

5. Power-actuated fasteners.
6. Expansion anchors.
7. Metal framing anchors.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Store all materials in an elevated dry location, protected by waterproof coverings. Do not store within the building until masonry, concrete, and other such wet work has been completed and allowed to dry.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end of back of each piece.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 4. Provide dressed lumber, S4S, unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWP C31 with inorganic boron (SBX).
 1. Preservation Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPA C20 lumber and AWPA C27 plywood.
 - 1. Use Exterior type for exterior locations and where indicated.
 - 2. Use Interior type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
 - 3. Use Interior type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Framing for raised platforms.
 - 2. Concealed blocking.
 - 3. Framing for non-load-bearing partitions.
 - 4. Framing for non-load-bearing exterior walls.
 - 5. Roof construction.
 - 6. Plywood backing panels.

2.04 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness.
- B. Framing Other Than Non-Load-Bearing Interior Partitions No. 2 grade and any of the following species:
1. Hem-fir (north); NLGA.
 2. Southern pine; SPIB.
 3. Douglas fir-larch; WCLIB or WWPA.
 4. Mixed southern pine; SPIB.
 5. Spruce-pine-fir; NLGA.
 6. Douglas fir-south; WWPA.
 7. Hem-fir; WCLIB or WWPA.
 8. Douglas fir-larch (north); NLGA.
 9. Spruce-pine-fir (south); NLMA, WCLIB, or WWPA.
- C. Exterior and Load-Bearing Walls, Framing Other Than Non-Load-Bearing Interior Partitions, Framing Other than Interior Partitions: Any species and grade with a modulus of elasticity of at least 1,600,000 psi and an extreme fiber stress in bending of at least 900 psi for 2-inch nominal thickness for single-member use.
- D. Joists, Rafters, and Other Framing Not Listed Above: Any species and grade with a modulus of elasticity of at least 1,600,000 psi and an extreme fiber stress in bending of at least 900 psi for 2-inch nominal thickness and 12-inch nominal width for single-member use.

2.05 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
 3. Rooftop equipment bases and support curbs.
 4. Cants.
 5. Furring.
 6. Grounds.
 7. Utility Shelving.
- B. For items of dimension lumber size, provide Standard, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:
1. Hem-fir (north); NLGA.
 2. Mixed southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB, or WWPA.

5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 6. Western woods; WCLIB or WWPA.
 7. Northern species; NLGA.
 8. Eastern softwoods; NeLMA.
- C. For exposed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
1. Hem-fir or hem-fir (north), Select Merchantable or No. 1 Common grade; NLGA, WCLIB, or WWPA.
 2. Spruce-pine-fir (south) or spruce-pine-fir, Select Merchantable or No. 1 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
1. Hem-fir or hem-fir (north), 2 Common grade; NLGA, WCLIB, or WWPA.
- E. For blocking not used for attachment of other construction, Utility, stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- 2.06 PLYWOOD BACKING PANELS
- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exterior, AC Exterior, C-C Plugged in thickness indicated or, if not indicated, not less than ½-inch nominal thickness.
- 2.07 FASTENERS
- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM/A 153M or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners; NES NER-272.

- D. Wood Screws: ASME B 18.6.1.
- E. Lag Bolts: ASME B 18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A: with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed as unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.08 METAL FRAMING ANCHORS

- A. Available Manufacturers: Subject to compliance with requirement, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:
 - 1. Alpine Engineered Products, Inc.
 - 2. Cleveland Steel Specialty Co.
 - 3. Hales Metal Products, Inc.
 - 4. KC Metals Products, Inc.
 - 5. Simpson Strong-Tie Co., Inc.
 - 6. Southeastern Metals Manufacturing Co., Inc.
 - 7. USP Structural Connectors.
- D. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published value shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- E. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 - 1. Use for interior locations and where stainless steel is not indicated.

- F. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - 1. Use for exterior locates and where indicated.
- G. Joist Hangers: U-shaped joist hangers with 2-inch long seat and 1-1/4 inch wide nailing flanges at least 85 percent of joint depth.
 - 1. Thickness: 0.050 inch.
- H. Post bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.
- I. Rafter Tie-Downs (Hurricane or Seismic ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss face of top plates, and side of stud below.

2.09 MISCELLANEOUS MATERIALS:

- A. Sill-Sealer gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM E 2498 that is approved for use indicated by adhesive manufacturer.
 - 1. Use adhesives that have a VOC content of 70 limit f/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 – EXECUTION

3.01 TEMPORARY BRACING

- A. Provide and maintain temporary bracing, until such time as permanently built into structure, all temporary bracing for walls, door frames, sills, and other work requiring bracing.

3.02 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- D. Do not splice structural members between supports, unless otherwise indicated.
- E. Pressure treated wood to be used wherever wood is to be used in contact with masonry, concrete, metal or any exterior application
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items and trim.
1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438m) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 m) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6m) o.c.
- H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other material to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- I. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water
- J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
 - 4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
 - 5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
 - 6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.
- K. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.
- L. For exposed work, arrange fasteners in straight rows parallel with edges of members with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Use finishing nails, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.03 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.04 RAFTER FRAMING INSTALLATION

- A. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 - 2. At hips, provide hip rafter of size indicated, or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- B. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions, if any.

3.05 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06100

SECTION 06600**FRP GRATING****PART 1 - GENERAL****1.01 DESCRIPTION OF WORK**

- A. The Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified and required to furnish, install and test fiberglass reinforced plastic (FRP) grating as shown on the Drawings and specified herein.
- B. FRP grating and all appurtenances shall be provided over each screen room floor opening at the James Street Siphon Station Facility where the existing bar screens are located. The Contractor shall also provide all related appurtenances, including but not limited to attachments, foundations, anchors, support brackets, hardware and all related accessories necessary to install the FRP grating as specified herein and as shown on the Contract Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. SECTION 11100, SCREENING SYSTEM

1.03 REFERENCES

- A. ASTM A-276: Standard Specification for Stainless Steel Bars and Shapes
- B. ASTM D-256: Determining the Notch Pendulum Impact Resistance of Plastics
- C. ASTM D-570: Standard Test Method for Water Absorption of Plastics
- D. ASTM D-638: Standard Test Method for Tensile Properties of Plastics
- E. ASTM D-648: Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- F. ASTM D-696: Standard Method for Coefficient of Linear Thermal Expansion of Plastics between -30 degrees C and 30 degrees C with a Vitreous Silica Dilatometer
- G. ASTM D-790: Standard Test methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- H. ASTM D-2853: Specification for Reinforced Olefin Polymers for injection Molding and Extrusion
- I. ASTM F-593: Stainless Steel Bolts, Hex cap Screws and Studs
- J. ASTM F-594: standard Specification for stainless Steel Nuts
- K. U.S. General Services Administration (GSA) CI(D A-A-272: Caulking Compounds

1.04 QUALITY ASSURANCE

- A. Materials and equipment shall be the standard products of a Manufacturer regularly engaged in the production of such products and shall essentially duplicate items that have been in satisfactory use in identical applications or in other wastewater pumping stations or treatment

facilities. The Manufacturer shall have a minimum of ten (10) years of documented experience in the design and production of fiberglass reinforced plastic grating.

1.05 SUBMITTALS

A. Information: Reference list of installation completed and operating using similar equipment under similar conditions of service including the Names of contact persons, phone numbers, and locations. Reference list shall contain a minimum of 10 installations of similar equipment operating for 5 years.

B. Product Data: Submit the following:

1. Complete materials list of all items to be provided including manufacturer's specifications and product data required to demonstrate compliance with requirements. Also include a detailed description of resin and glass fib content, and the layout for FRP construction.
2. Detailed drawings that show equipment fabrication dimensional layouts, bill of materials, bolt and anchor locations, method of attachment including number, locations and size of fasteners, and shall be based on field measurements by the Contractor to ensure proper installation.
3. Manufacturer's installation procedures.
4. Manufacturer's recommended testing, operation and maintenance procedures including a list of special tools and equipment required to maintain the unit.
5. Certified factory test reports of the physical and mechanical properties of the product, as listed in the Design Conditions table in Part 2.02 of this section. Hardness test shall be made with the resin rich surface of the product. Flexural tests shall be made with the resin rich surface in compression. Test samples shall be full thickness of the item produced and shall not be machined on the surface.

1.06 DELIVERY AND STORAGE

A. The Contractor shall inspect materials delivered to Site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings per manufacturers and suppliers specifications. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

PART 2 - PRODUCTS

2.01 GENERAL

- A. FRP grating specified in this section shall be manufactured by Strongwell or approved equal.
- B. All FRP products shall be manufactured using a pultruded process utilizing polyester resin with flame retardant and ultraviolet (UV) inhibitor additives. A synthetic surface veil fabric shall encase the glass reinforcement. FRP shape 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.

- C. If required, after fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating.
- D. All exposed surfaces shall be smooth and true to form, consistent with ASTM D4385.

2.02 PROCESS DESIGN CONDITIONS

A. General:

- 1. Grating shall be shipped from the manufacturer, palletized and banded with exposed edges protected to prevent damage in shipment.
- 2. Each piece shall be clearly marked showing manufacturer's applicable drawing number.

B. Design:

- 1. The panels shall be 1-1/2" deep and sustain a deflection of no more than 0.25" under a uniform distributed load of 100 PSF (4.79 kN/m) for the span lengths shown on the Drawings.
- 2. The bearing bars shall be joined into panels by passing continuous length fiberglass pultruded cross rods through the web of each bearing bar. A continuous fiberglass pultruded bar shaped section shall be wedged between the two cross rod spacers mechanically locking the notches in the cross rod spacers to the web of the bearing bars. Continuous adhesive bonding shall be achieved between the cross rod spacers and the bearing web and between the bar shaped edge and the two cross rod spacers locking the entire panel together to give a panel that resists twist and prevents internal movement of the bearing bars.
- 3. The top surface of all panels shall have a non-skid grit affixed to the surface by an epoxy resin followed by a top coat of epoxy resin.
- 4. Hold down camps shall be type 316L stainless steel clips. Use 2 at each support with a minimum of 4 per panel.
- 5. Grating color shall be yellow.

C. Products:

- 1. The pultruded FRP grating and stair treads shall be fabricated from bearing bars and cross rods manufactured by the pultrusion process. The glass fiber reinforcement for the bearing bars shall be a core of continuous glass strand rovings wrapped with continuous strand glass mat. A synthetic surface veil fabric shall encase the glass reinforcement.
- 2. Fiberglass grating shall be made from a chemical resistant, fire retardant polyester resin system with antimony trioxide added to meet the flame spread rating of 25 or less in accordance with ASTM E-84 testing, the flammability characteristics of UL 94 V0 and

satisfies the self-extinguishing requirements of ASTM D-635. UV inhibitors are added to the resin to reduce UV attack.

3. If required all cut and machined edges, holes and abrasions shall be sealed with a resin or compatible coating with the resin matrix used in the bearing bars and cross rods.
4. All panels shall be fabricated to the sizes shown on the approved Shop Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Contractor shall field verify existing dimensions and install grating in accordance with the Contract Drawings, approved shop drawings and manufacturer's recommendations. Field cutting of panels will be allowed to complete the installation as required and as directed by the Manufacturer. All field cut or drilled edges shall be sealed per the manufacturer's recommendations. All of the fasteners required for installation shall be supplied by the manufacturer.
- B. Perform cutting, drilling and fitting required for installation of FRP grating. Set FRP grating accurately in location, alignment and elevation, with edges and surfaces level, plumb, true and free of rack; measured from established lines and levels.
- C. Provide temporary bracing or anchors in form work for items that are to be built into concrete masonry or similar construction.
- D. If required, 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. Install items specified as indicated and in accordance with manufacturer's instructions.

3.02 INSPECTION AND TESTING

- A. The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.
- B. All labor, power, material, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the Owner.

3.03 WARRANTY

- A. The Manufacturer shall provide a full and comprehensive warranty for all equipment or materials specified in this section. The equipment shall be warrantied to be free from defect in workmanship, design, and materials for a period of one (1) year from the date of substantial completion. If any parts of the equipment supplied under this section should fail during the manufacturer's warranty period, replacement of parts or the units themselves shall be

provided. The units shall be restored to active working service at no expense to the Owner of the equipment. The Manufacturer shall incur all costs including but not limited to parts, labor, service, technicians, shipping, and handling required for restoration of equipment to active service as required for restoration of equipment to active service as required under the Manufacturer's warranty.

END OF SECTION 06600

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SECTION 07460**SIDING****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. This section includes the furnishment and installation of siding and all necessary appurtenances. The work includes, but is not limited to, the installation of fiber cement siding for soffit panels, accessories, and trim.

1.02 RELATED WORK

- A. Related Sections:

1. Section 06100 – “Rough Carpentry”
2. Section 07900 – “Joint Sealers”
3. Section 09900 – “Painting”

1.03 REFERENCES

- A. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants; 1998.
- B. ASTM C 1185 – Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Railing and Siding Shingles, and Clapboards; 1999.
- C. ASTM C 1186 – Standard Specification for Flat Non-Asbestos Fiber Cement Sheets; 1999.
- D. ASTM E 72 – Standard Test Methods of Conducting Strength Test of Panels for Building Construction; 1998.
- E. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 1999.
- F. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials; 1995.
- G. ASTM E 136 – Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 1999.
- H. ASTM E 228 – Standard Test Method for Linear Thermal Expansion of Solid Materials With a Vitreous Silica Dilatometer; 1995.
- I. ASTM G 26 – Standard Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials; 1996.

1.04 SUBMITTALS

- A. Submittals shall be made in accordance with Section 106-07 of the Greater New Haven Water Pollution Authority Standard Specifications.
- B. Product Data shall be submitted for each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Samples:
 - 1. 12-inch-long-by-actual-width Sample of siding.
 - 2. 12-inch-long-by-actual-width Samples of Trim and accessories.
- D. Product Certificates shall be submitted for each type of siding, from the manufacturer. These certificates shall certify that the products meet or exceed the specified requirements.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.
- F. Research/Evaluation Reports: For each type of siding required, from the ICC.
- G. Maintenance Data: For each type of siding and related accessories to include in maintenance manuals.
- H. Warranty: Sample of special warranty.

1.05 QUALITY ASSURANCE

- A. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- B. Source Limitations: Obtain siding, including related accessories, from single source from single manufacturer.
- C. Installer Qualifications: Provide installer with not less than three years of experience with products similar to those specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store materials off of the ground in a dry, well-ventilated, weathertight place.

1.07 COORDINATION

- A. Coordinate installation with flashing and other adjoining construction to ensure proper sequencing.

1.08 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace siding that fail(s) in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:

- a. Structural failures including cracking, deforming, and fading.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

- 2. Warranty Period: At least fifteen (15) years from date of Substantial Completion.

1.09 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish full lengths of siding including related accessories, in a quantity equal to two percent (2%) of amount installed.

PART 2 - PRODUCTS

2.01 FIBER-CEMENT SIDING

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of twenty-five (25) or less when tested according to ASTM E 84.

- 1. Manufacturers:

- a. CertainTeed Corp.
 - b. Approved equal.

- 2. Pattern:

- a. Manufacturer's full range of pattern samples shall be submitted to the Owner for selection.

- 3. Factory Finish: Color as selected by Owner from manufacturer's full range of colors.

2.02 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer.
 - 1. Provide accessories made from same material as adjacent siding unless otherwise indicated.
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
 - 1. Moldings and trim.
 - 2. Rake and frieze boards.
- C. Colors for Decorative Accessories: As selected by Owner from manufacturer's full range.
- D. Flashing: Provide aluminum flashing complying with Section 07620 "Sheet Flashing and Trim" at window and door heads and where indicated.
 - 1. Finish for Aluminum Flashing: High-performance organic finish, same color as siding.
- E. Fasteners:
 - 1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch into substrate.
 - 2. For fastening fiber-cement, use stainless-steel fasteners.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.03 INSTALLATION

- A. General: Comply with the manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.
- B. Install fiber-cement siding and related accessories.
 - 1. Install fasteners no more than 24 inches o.c.
- C. Install joint sealants as specified in Section 07900 "Joint Sealants" and to produce a weather tight installation.

3.04 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07460

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SECTION 07620**SHEET METAL FLASHING AND TRIM****PART 1 – GENERAL****1.01 DESCRIPTION**

- A. Provide all materials, labor, equipment, services, etc., necessary and incidental to the completion of the installation of sheet metal flashing and trim, including, but not limited to, drip edges, gutters, and downspouts.

1.02 RELATED WORK

- A. Related Sections
 - 1. Section 04200 "Unit Masonry"
 - 2. Section 06200 "Rough Carpentry"
 - 3. Section 07900 "Joint Sealers"

1.03 REFERENCES

- A. SMACNA - Architectural Sheet Metal Manual
- B. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.04 SUBMITTALS

- A. The Contractor shall submit product data and shop drawings as specified in Section 106-07 of the Greater New Haven Water Pollution Control Authority Standard Specifications.
- B. Large scale shop drawings shall be submitted. These drawings shall detail roofing, eave, gutters and downspouts, and accessories; include all splice plates and method of anchorage.
- C. Color chips for color selection by Engineer or Owner shall be submitted.
- D. Manufacturers catalog cuts, specification data sheets, and installation instruction shall be submitted to the Engineer.

1.05 QUALITY ASSURANCE

- A. Field measurements shall be taken by the Contractor prior to fabrications to assure symmetry and verify field conditions.

- B. All sheet metal flashing and trim shall be fabricated and installed in accordance with the recommendations in the SMACNA- Architectural Sheet Metal Manual.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be delivered with a protective vinyl masking.
- B. All materials shall be stored in properly protected and dry storage facilities until ready for use. Do not use materials which have been damaged in any manner.
- C. Work shall be protected from damage during the construction period so that it will be without any indication of abuse or damage at the time of acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Sheet Metal Flashing and trim
 - 1. Aluminum Drip Edge
 - a. Lamb and Richie
 - b. Or Approved Equal
 - 2. Aluminum Gutters and Downspouts
 - a. Atlas, Inc.
 - b. Englert
 - c. Or Approved Equal

2.02 MATERIALS

- A. Sheet Metal Flashing and Trim
 - 1. Drip Edge - 0.024 inch aluminum with a Kynar Finish, formed as detailed on the Project Drawings.
 - 2. Gutters, Downspouts and Accessories
 - a. Gutters shall be seamless 0.032 aluminum 5-inch K series as manufactured by Atlas, Englert, or equal.
 - b. Downspouts shall be 3 inch by 4 inch aluminum.
 - c. Heavy duty hidden hangers.
 - d. Straps, endcaps and accessories as required for a complete system.
 - e. Finish shall be Kynar 500 color as selected by the Engineer.

2.03 FINISH

- A. Finish shall be Fluoropon Kynar 500 resin finish, color selected by Engineer. Texture shall be smooth.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. All surfaces shall be inspected by the Contractor for any defects or other characteristics which may be detrimental to the installation and performance of the materials to be installed. All defective materials shall be immediately removed from the Project site by the Contractor at no additional cost to the Owner. All replacement materials shall be at no additional cost to the Owner.
- B. Commencement of work shall constitute acceptance of surface conditions by the Contractor.
- C. All dimensions of the prefabricated items shall be field verified by the Contractor prior to fabrication to ensure ease of installation with a proper tight fit.

3.02 INSTALLATION OF SHEET METAL FLASHING AND TRIM

- A. Installation of all materials in this Section shall be in strict accordance with the manufacturer's printed instructions.
- B. Ensure a watertight installation at all points where prefabricated items meet the roofing.

3.03 CLEANING

- A. At the completion of the work, clean, and remove from site, all rubbish and accumulated materials and leave the Work and Project Site in a satisfactory condition.

END OF SECTION 07620

SECTION 07900**JOINT SEALERS****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Provide all materials, labor, equipment, services, etc. necessary and incidental to the completion of the usage of joint sealers, including but not limited to, the preparation of the sealant substrate surfaces and the installation of the sealant and backing.

1.02 RELATED WORK

- A. Related Sections:

1. Section 02500 - "Bituminous Concrete Pavement"
2. Section 03300 - "Cast-in-Place Concrete"

1.03 REFERENCES

- A. ASTM C790 – Recommended Practices for Use of Latex Sealing Compounds.
- B. ASTM C920 – Specification for Elastomeric Joint Sealant.
- C. FS-TT-S-227 – Sealing Compound: Elastomeric Type, Multi-Component.
- D. FS-TT-S-230 – Sealing Compound: Elastomeric Type, Single-Component.
- E. FS-TT-S-001543 – Sealing Compound: Silicone Rubber Base.
- F. Sealing and Waterproofers Institute – Sealant and Caulking Guide Specification.

1.04 SUBMITTALS

- A. The Contractor shall submit product data as specified in Section 106-07 of the Greater New Haven Water Pollution Control Authority Standard Specifications.
- B. Color charts or samples shall be submitted.
- C. The Manufacturer's installation instructions shall be submitted.

1.05 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum ten years experience.
- B. Applicator Qualifications: Company specializing in applying the work of this Section with minimum five years experience.
- C. Compatibility: Verify sealants used are compatible with joint substrates.
- D. Joint Tolerance: Compliance with the manufacturer's limitation is required.
- E. Conform to Sealant and Waterproofers Institute requirements for installation.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
- B. VOC Standards – All sealants shall be in accordance with all applicable State and Federal VOC standards.

1.07 SEQUENCING AND SCHEDULING

- A. Coordinate work in this Section with related sections.

1.08 WARRANTY

- A. Installer to provide five year warranty to include coverage of installed sealants, caulking and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. S-1, Epoxidized Polyurethane Sealant: Multi-component, chemical curing, non-staining, non-bleeding, non-sagging type; color as selected by Engineer; Dymeric 240 as manufactured by Tremco, Sika Corporation or equal.

Durability (Bond and Cohesion)	-25 percent + 40 percent
Shore "A" Hardness Range	25

- B. S-2, Polyurethane Sealant: Multi-component, chemical curing, non-staining, non-bleeding, non-sagging type; color as selected by Engineer; Sikaflex 2C as manufactured by Sika Corporation, Tremco or equal.

Durability (Bond and Cohesion)	+/- 50 percent
Service Temperature Range	-40 to 170 degrees F
Shore "A" Hardness Range	25 (40 for self leveling)

- C. S-4, Flexible Epoxy Jointing Compound: Multi-component, solvent-free, moisture insensitive epoxy resin, self leveling type; Sikadur 15 as manufactured by Sika Corporation, Tremco or equal.

Tensile Strength	650 psi
Shore "A" Hardness Range	75-80

- D. S-6, Polyurethane Sealant: One component, moisture curing, non-staining, non-bleeding, non-sagging type; color as selected by Engineer; Sikaflex 1A as manufactured by Sika Corporation, Tremco or equal.

Durability (Bond and Cohesion)	+/- 25 percent
Service Temperature	-40 to 170 degrees F
Shore "A" Hardness Range	40

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer.
- B. Joint Cleaner: Non-corrosive, and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D 4056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width; as recommended by sealant manufacturer.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by manufacturer.
- B. Beginning of installation means installer accepts existing conditions.

3.02 PREPARATION

- A. Clean and prime joints in accordance with manufacturer's instructions.
- B. Remove loose materials and foreign matter which might impair adhesion of sealant.
- C. Verify that joint backing and release tapes are compatible with sealant.
- D. Perform preparation in accordance ASTM C790 for latex base sealants.
- E. Protect elements surrounding the work of this Section from damage or disfiguration.

3.03 INSTALLATION

- A. Install sealant in strict accordance with manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve required width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
- D. Install bond breaker where joint backing is not used.
- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Tool joints concave.

3.04 CLEANING AND REPAIRING

- A. Clean work under provisions of Section 104-06 of the Greater New Haven Water Pollution Control Authority Standard Specifications.
- B. Clean adjacent soiled surfaces.
- C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.05 PROTECTION OF FINISHED WORK

- A. Protect sealants until cured.

END OF SECTION 07900

SECTION 08110**HOLLOW METAL DOORS AND FRAMES****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Provide all materials, labor, equipment, services, etc., necessary and incidental to the completion of the installation of hollow metal doors and frames as shown on the drawings, and as specified herein.
- B. Contractor to perform field measurement to obtain dimensions prior to ordering.
- C. Contractor shall be required to repair brick as required for installation of door, in accordance to the standards specified elsewhere in these Specifications.

1.02 RELATED WORK

- A. Related Sections:
 - 1. Section 04200 "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 - 2. Section 09900 "Painting" for field painting hollow metal doors and frames.

1.03 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door design
 - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensional profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.

5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices and connections.
7. Details of accessories.
8. Details of moldings, removable stops and glazing.

- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed, and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.
- D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.06 PERFORMANCE REQUIREMENTS

- A. Doors must meet the 2006 International Energy Conservation Code.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery
1. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit. Additional protection shall be undertaken to prevent damage to finish of factory-finished units.
- B. Storage of Doors
1. Store door vertically in a dry area, under proper cover. Place the units on at least 4" high wood sills on floors in a manner that will prevent rust and damage. Avoid storage in non-vented plastic or canvas shelters, which create a humidity chamber and promote rusting. If the door becomes wet, or moisture appears, removed protective wrapping immediately. Provide a 4" space between the doors to permit air circulation. Proper storage is required to meet the requirements of ANSI/SDI A250.11 and HMMA 840.

C. Storage of Frames

1. Store frames in an upright position with heads uppermost under cover on 4" wood sills on floors in a manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters, which create a humidity chamber and promote rusting. Store assembled frames in a vertical position, five units maximum in a stack. Provide a 2" space between frames to permit air circulation.
2. Provide proper storage for doors and frames, to maintain the quality and integrity of the factory applied paint, and maintain the requirement of ANSI/SDI A250.10 and HMMA 840.
3. Sand, touch up and clean prime painted surfaces prior to finish painting in accordance with the manufacturer's instructions.

1.08 PROJECT CONDITIONS

- A. Field measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.09 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable manufacturers for doors and frames are listed below. Doors and frames shall be provided from a single manufacturer:
1. Steelcraft; an Ingersoll-Rand company
 2. Approved equal
- B. Description: Steelcraft Brand Model L16 Series Flush Steel Self-Closing Door; 16 ga., 1-3/4" exterior insulated pre-primed galvanized steel with 16 ga. pre-fabricated frames. Accessories to include head and jam weather stripping, door sweeps, and hydraulic closers.

2.02 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated, fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
1. Design: Flush panel.
 2. Core Construction: Manufacturer's polystyrene core.
 3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
 - a. Beveled Edge: 1/8 inch in 2 inches
 4. Top and Bottom Edges: Close with flush or inverted 0.042 inch-thick, end closures or channels of same material as face sheets.
 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Zinc-Iron-Alloy-Coated Galvannealed Steel, ASTM A 653, Class A60, 16 gage. Provide doors complying with requirements indicated by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A150.4 for physical performance level: Level 3 and Physical Performance Level A (Extra Heavy Duty, Model 2 (seamless with welded edges)).
1. Include galvannealed components and internal reinforcements with galvannealed doors.
 2. Close tops of exterior swing-out doors to eliminate moisture penetration. Galvannealed steel top caps are permitted.
 3. Exterior doors are to be factory primed.
- C. Hardware Reinforcements:
1. Hinge reinforcements for full mortise hinges: minimum 7 gage [0.180" (4.7 mm)].
 2. Lock reinforcements: minimum 16 gage [0.053" (1.3 mm)].
 3. Closure reinforcements: minimum 14 gage [0.067" (1.7 mm)], 20" long.
 4. Galvannealed doors: include galvannealed hardware reinforcements.
 5. Projection welded hinge and lock reinforcements to the edge of the door.
 6. Provided adequate reinforcements for the hardware as required.

2.03 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Zinc-Iron Alloy-Coated Galvannealed steel, ASTM A 653, Class A60, 16 gage.
1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames as full profile welded unless otherwise indicated.
 3. Frames for Level 3 Steel Doors: 0.053-inch-thick steel sheet.

2.04 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup to T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames: not less than 0.042 inch thick.
3. Compression type for Drywall Slip-on Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two (2) holes to receive fasteners.
2. Separate topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.05 STOPS AND MOLDINGS

A. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

2.06 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration in accordance with the manufacturer's recommendations

D. Hollow metal frames:

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Provide countersunk, flat-or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two (2) anchors per jamb up to 60 inches high.
 - 2) Three (3) anchors per jamb from 60 to 90 inches high.
 - 3) Four (4) anchors per jamb from 90 to 120 inches high.
 - 4) Four (4) anchors per jamb plus one (1) additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three (3) anchors per jamb up to 60 inches high.
 - 2) Four (4) anchors per jamb from 60 to 90 inches high.
 - 3) Five (5) anchors per jamb from 90 to 96 inches high.
 - 4) Five (5) anchors per jamb plus one (1) additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two (2) anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - c. Compression type: Not less than two (2) anchors in each jamb.
5. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three (3) door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two (2) door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from galvanized steel.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and forms to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

2.07 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Two coats of exterior grade paint applied in the field. Color and Gloss: as selected by Owner from manufacturer's full range.

2.08 HARDWARE

- A. Heavy duty, exterior commercial grade locksets shall be provided. Locksets shall be keyed in accordance with GNHWPCA requirements. Contractor shall coordinate with GNHWPCA. Locksets shall be Sargent 9 Line locks with panic bar type exit devices or approved equal

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

3. Twist: plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and top doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. Remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Install frames with removable glazing stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that are filled with grout containing anti-freezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 6. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

- c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lies, and perpendicular to plan of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary. Comply with manufacturer's recommendations, and ANSI/SDI 250.11.
 - 1. Non-Fire-Rated- Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Door (no Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments; Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying rust-inhibitive primer.
- D. Metallic-Coated Surfaces: clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08110

SECTION 09900**PAINTING****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. This section includes the application of specified finish coats of paint to pre-primed surfaces and complete finishing systems to unprimed items.

1.02 RELATED WORK

A. Related Sections

1. Section 09905 "Surface Preparation and Shop Coats"
2. Section 11000 "Equipment - General"
3. Section 16000 "Electrical - General"

1.02 REFERENCES

- A. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100 Percent Relative Humidity.
- B. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- C. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- D. Federal Test Method No. 141 - Method 6141, Stain Removal.
- E. ANSI A13.1 - Scheme for the Identification of Piping Systems.
- F. SSPC- Steel Structures Painting Council.
- G. SSPC-PA1, "Standard for Shop, Field, and Maintenance Painting".
- H. SSPC-PA2, "Measurement of Dry Paint Thickness with Magnetic Gauges".
- I. SSPC-SP1, "Solvent Cleaning".
- J. SSPC-SP2, "Hand Tool Cleaning".
- K. SSPC-SP3, "Power Tool Cleaning".

- L. SSPC-SP6, “Commercial Blast Cleaning”.
- M. SSPC-SP10 - “Near-White Blast Cleaning”.
- N. SSPC-SP13, “Surface Preparation for Concrete”.
- O. SSPC-PA Guide 3, Standard “A Guide to Safety in Paint Application”, latest revision.
- P. VOC Standards - All coatings shall be in accordance with all applicable State and Federal VOC Standards.
 - 1. OSHA 29 CFR 1925.55 Gases, Vapors, Fumes, Dusts and Mists

1.03 SUBMITTALS

- A. Product data shall be submitted as specified in Section 106-07.
- B. A minimum of three (3) color charts shall be submitted for color selection by the Engineer.
- C. A schedule including a list of items to be coated, the type and manufacturer of shop coating and type of field coating, including primers, details on surface preparation methods, application procedures and dry mil thickness shall be submitted to the Engineer.
- D. The color scheme shall be in accordance with schedules provided by the Engineer, and all tinting and matching shall be to the satisfaction of the Engineer.
- E. The Contractor shall submit the coating manufacturer’s certification that proposed field coatings are compatible with shop coatings.
- F. The Contractor shall submit the coating manufacturer’s certification that the proposed coatings meet all State and Federal VOC regulations.

1.04 DEFINITIONS

- A. Definitions are as specified in Section 09905 “Surface Preparation and Shop Coatings”.

1.05 QUALITY ASSURANCE

- A. All material used on Work shall be exactly as specified in brand and quality, unless priorly approved by the Engineer.
- B. Before purchasing materials for the Work, the Contractor shall submit to the Engineer a list of the products he proposes to use for his review and approval.
- C. Materials selected for coating systems for each type of surface shall be the products of a single manufacturer.

D. Include on label of all containers:

1. Manufacturer's name
2. Type of paint
3. Manufacturer's stock number
4. Color
5. Instructions for reducing, where applicable.
6. Label analysis
7. Shelf Life dates

E. Field Quality Control:

1. Contractor shall request review by the Engineer, of first finished room, space or item of each color, texture and method of applications, prior to proceeding with additional painting.
2. Use first acceptable room, space or item as the project standard for each color scheme.
3. For spray application, when applicable, paint a surface not smaller than 100 square feet as the project standard.
4. Repainting of materials failing to meet the requirements of the Specifications or drawings, shall be performed by the Contractor, at no additional cost to the Owner.
5. The number of coats and total mil thickness specified in the paint schedule are minimums. If the specified minimum film thickness is not achieved, additional coats shall be applied to achieve the total film thickness specified.

F. Items that consist of copper, bronze, brass, chromium plated, stainless steel, or aluminum metals do not require paint or finish coating unless otherwise specified.

G. All process, mechanical, structural, architectural and electrical work exposed to view, including but not limited to, equipment, piping, electrical panels, electrical conduit, electrical boxes, stanchions, and supports shall be painted, unless specified in the respective Section to be pre-finished.

H. Motors which are pre-finished, shall receive one top coat to provide a color matching the system color indicated in the pipe identifications schedule.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems shall be applied.
- B. Do not apply coatings in areas where dust is being generated.
- C. Do not apply coatings when the air or material surface temperature is below 50 degrees Fahrenheit and unless the temperature is at least 5 degrees Fahrenheit above the dew point.
- D. Do not apply exterior coatings in frosty, damp or rainy weather or while surfaces are exposed to hot sunlight.

1.07 EXTRA MATERIALS

- A. For all material with a shelf life of greater than 12 months, one gallon of each type and each color of touch-up paint shall be provided to the Owner by the Contractor in unopened containers.

PART 2 - PRODUCTS

2.01 MANUFACTURER'S

- A. Sherwin Williams
- B. Approved equal

2.02 MATERIALS

- A. Refer to the paint schedule for specific products and application.

2.03 COMPONENTS

- A. All finish coats shall be compatible with shop prime coats.

2.04 MIXING AND TINTING

- A. Deliver paints and enamels ready-mixed to project site.
- B. Accomplish job mixing and job tinting only when required and no exceptions taken by the Engineer.
- C. Mix only in mixing pails placed in suitably sized nonferrous or oxide resistant metal pans.
- D. Use only tinting color recommended by the manufacturer for the specific type of finish.
- E. Fungicidal agents, when applicable, shall be incorporated into the paints and stains by the manufacturer.
- F. Mix and prepare paints in strict accordance with the Manufacturers recommendations.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Deliver coating materials in sealed containers with labels legible and intact.
- B. Store only acceptable project materials on the project site.
- C. All painting materials shall be stored and mixed in a single location coordinated with the Engineer. The Contractor shall not use any plumbing fixture or pipe for mixing or for disposal of any refuse. The Contractor shall carry all necessary water to the mixing room, and shall dispose of all waste outside of the building in a suitable receptacle.
- D. Restrict storage location to paint materials and related equipment and supplies.
- E. Keep storage location neat and clean.
- F. Remove all soiled and used rags, waste and trash from the storage location and building at the end of each workday.
- G. Repair all damage to the storage location caused by painting materials and equipment at no additional cost to the Owner.
- H. Comply with all applicable health and fire codes and regulations including safety precautions recommended by the manufacturer. Storage space shall be provided with a suitable fire extinguisher fully charged at all times.
- I. Heat shall be provided in the storage area if paints are to be stored during winter months. The temperature shall be maintained above 40 degrees F at all times.

3.02 INSPECTION

- A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work as included in Part 3.03 Surface Preparation.
- B. Immediately notify the Engineer in writing when a surface to be finished cannot be put into an acceptable condition.
- C. Do not proceed with surface preparation or coating application until conditions are suitable.
- D. The Contractor shall be responsible for and shall rectify, at no additional cost to the Owner any unsatisfactory finish resulting from the application of coatings on surfaces not in acceptable condition.

3.03 SURFACE PREPARATION

A. Concrete

1. Clean all dust, dirt, oil and efflorescence from surfaces.
2. Fill cracks and irregularities with Portland Cement grout to provide uniform surface texture.
3. Etch dense and smooth concrete, or concrete that has had a hardener applied, with a five percent solution (by weight) of muriatic acid.
4. Allow surfaces to thoroughly dry prior to application of first coat.

B. Ferrous Metal Surfaces (Items not shop primed)

1. All submerged ferrous metals shall be sandblast cleaned in accordance to SSPC-SP10 immediately prior to priming.
2. All other ferrous metals shall be sandblast cleaned in accordance to SSPC-SP6 immediately prior to painting.
3. Remove dirt, oil and grease by washing surfaces with mineral spirits.
4. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming.
5. Feather edges of sound existing paint by grinding, if necessary.
6. Clean and touch up weathered, worn or damaged shop coats of paint with the specified primer.
7. Restore shop coats of paint with identical materials if removed for welding and fabrication.

C. Galvanized Metal

1. Thoroughly clean surface with mineral spirits to remove oil residue.
2. Dry with clean cloth.
3. Treat surface with copper sulphate or with a compound made for this purpose (Lithoform, Self-Metallic Coating, etc.) in accordance with the manufacturer's directions, before applying the primer.

D. Previously Coated Surfaces

1. The areas of the coated surface that are blistered, eroded, brittle or otherwise failed shall be completely removed before beginning the specified surface preparation.
2. The areas where the existing coating is intact shall be sanded to dull the finish.
3. Before applying the new coating over an existing coating, a test section must be done to ensure compatibility of the new and old coatings.
4. Ferrous metals arriving at the job site with shop primers other than the polyamide epoxy or rust inhibitive primers specified shall be provided with an intermediate coat as necessary for compatibility with specified topcoats.
5. Special attention shall be paid to the potential for epoxy shop and intermediate coats to chalk upon exposure to sunlight. The Contractor shall follow the manufacturer's required surface protection/covering and surface preparation recommendations before any intermediate or top coats can be applied over chalked surface.

3.04 APPLICATION

A. Workmanship

1. Employ skilled workmen to insure workmanship of the highest quality.
2. Materials shall be applied only by craftsmen experienced in the use of the specific products involved.

B. General Requirements

1. Apply all coatings under adequate illumination.
2. Perform no work in the rain, dew, or fog, when the temperature is below 50 degrees Fahrenheit, when the temperature is not more than 5 degrees Fahrenheit above the dew point, or before the other coats have thoroughly dried.
3. Do not apply coatings until the material surfaces are thoroughly dry.
4. Apply paints and varnishes with suitable brushes, rollers or spraying equipment.
 - a. The rate of application shall not exceed that recommended by the paint manufacturer for the surface involved.
 - b. Keep brushes, rollers and spraying equipment clean, dry and free from contaminates and suitable for the finish required.
 - c. Apply stain by brush. Cover surfaces with a uniform coat and wipe off if required.
 - d. Make each coat a different tint from that of the preceding coat, with final coat tinted to the exact shade selected by the Engineer. Lightly sand surfaces between each coat of gloss and semi-gloss finishes, and wipe clean.
5. Comply with the recommendation of the product manufacturer for drying time between succeeding coats. Contractor shall follow the manufacturer's specific curing requirements for red inhibitive primer shop coats prior to allowing top coating.
6. Sand and dust between each coat to remove defects visible from a distance of five feet.
7. Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints and skipped or missed areas.
8. Inspection:
 - a. Do not apply additional coats until the completed coat has been inspected by the Engineer.
 - b. Only inspected and reviewed coats will be considered in determining the number of coats applied.
9. Leave all parts of moldings and ornaments clean and true to details with no undue amount of paint in corners and depressions.
10. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.
11. Refinish entire wall where portion of finish has been damaged or is not acceptable.

3.05 PROTECTION

- A. Furnish and lay drop cloths in all rooms and areas where painting and finishing is being done, to adequately protect flooring and other work from damage during the execution of the painting work.
- B. Remove all canopies of lighting fixtures, all electric switch plates, and similar equipment, set them carefully away with adequate cover. All unremoved fixtures shall be protected during the painting work. After the completion of the work, all removed canopies, plates, etc. shall be placed to their original location. Any fixtures, canopies, plates, etc. that are damaged shall be replaced in kind by the Contractor at no additional cost to the Owner.

3.06 CLEANING

- A. At the completion of the work of this Section, remove all paint spots and oil or grease stains, caused by this work from floors, walls, fixtures hardware and equipment, leaving their finishes in a satisfactory condition. Remove all materials and debris and leave the site of the work in a clean condition so far as this work is concerned.

3.07 FINAL INSPECTION

- A. Protect all painted and finished surfaces against damage until the date of final acceptance of the work. The Engineer will conduct a final inspection of all painters' work. As part of the final inspection the Contractor shall demonstrate compliance with the specified film thickness with appropriate paint gauges. The Contractor shall be required to repaint, refinish, or retouch any areas found which do not comply with the requirements of this Section.

3.08 PAINT SCHEDULE

- A. The product model and coatings system numbers listed below are based on products provided by the Sherwin Williams Company and the H&C Concrete Company, and are listed to establish the standard of quality. Equivalent products which meet or exceed the performance of the listed products may be accepted if priorly approved by the Engineer.

SURFACE/ITEM	SURFACE PREPARATION	PRIMER	INTERMEDIATE	FINISH
METALS				
Submerged Ferrous Metals, Piping & Equipment Specified to be Shop Primed in their Respective Sections (see note 3)	SHOP	SHOP PRIME	N/A	SW COR-COTE SC SEWER COTE at 15.0-20.0 mils
Enclosed Ferrous Metals, Piping and equipment Specified to be Shop	SHOP	SHOP PRIME	N/A	SW COR-COTE SC SEWER COTE

Primed in Their Respective Sections				at 15.0- 20.0mils
All other Enclosed Ferrous Metals	SSPC-SP6	SHOP PRIME OR SW Recoatable Epoxy Primer at 4.0 – 6.0 mils	N/A	SW COR-COTE SC SEWER COTE at 15.0- 20.0mils
Exposed electrical conduit, conduit fittings and outlet boxes mounted on painted or finished surfaces			Same color and finish as background surface and/or equipment	Same color and finish as background surface and/or equipment
Non-Ferrous Metals and Galvanized Steel in Contact with or Embedded in Concrete	SSPC-SP1 Solvent Cleaning Followed by SSPC-SP7	SW Recoatable Epoxy Primer at 5.0 – 7.0 mils	Top Coats as noted herein for the surfaces exposed to view	Top Coats as noted herein for the surface exposed to view

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SURFACE/ITEM	SURFACE PREPARATION	PRIMER	INTERMEDIATE	FINISH
METALS				
Exhaust Piping and Hot Ferrous Metals	SSPC-SP10 Near White Metal Blast Cleaning	SW Inorganic Zinc-Rich Primer at 3.0 mils	SW Silver-Brite Hi-Heat at 1.0 mil	SW Silver-Brite Hi-Heat at 1.0 mil
Weather Exposed Ferrous Metals, Piping, & Equipment Specified to be Shop Primed in Their Respective Sections	SHOP	SHOP	SW Macropoxy 3.0 – 6.0 mils	SW-Corothane II polyurethane at 3.0 mils
All Other Weather Exposed Ferrous Metals	SSPC-SP6	SW Recoatable Epoxy Primer at 4.0 – 6.0 mils	SW Corothane II Acrylic Urethane at 3.0 - 5.0 mils	SW Corothane II Acrylic Urethane at 3.0 – 5.0 mils
PIPING (other than ferrous metal)				
Insulated Pipe to be Color Coded	Clean & Dry	SW Pro-Mar 200 at 2.0 – 3.0 mils	SW Pro-Mar 200 at 3.0 – 4.0 mils	SW Pro-Mar 200 at 3.0 – 4.0 mils
PVC Color Coded Pipe	Cleaned & Dry – Scuffed Up with Medium Grit Sandpaper	SW Sher-Tile at 5.0 – 7.0 mils	N/A	SW Sher-Tile at 5.0 – 7.0 mils
CONCRETE AND MASONRY				
Exterior Concrete and Masonry	SSPC-SP13	N/A	N/A	H&C Concrete and Masonry Water Proofing Sealer
Interior Concrete	SSPC-SP13	N/A	SW H&C Concrete Stain Solid Color Water Based	W H&C Concrete Stain Solid Color Water Based

NOTES:

1. Surface preparation shall be as specified within this section and as noted in the table above.
2. All dry film thicknesses indicated are the minimum required.
3. All epoxy coatings subjected to UV Exposure shall receive an additional Polyurethane topcoat with a minimum dry film thickness of 3 mils. No epoxy coating shall be left exposed to UV light. This shall include all equipment drives, motors gear reducers etc.
4. All ferrous metals, piping and equipment delivered to the site with shop primers other than the specified primer shall receive an intermediate coat as necessary for compatibility with the indicated topcoats.
5. All ferrous, nonferrous and galvanized metals in contact with concrete or masonry shall receive a POLYAMIDE epoxy primer with a minimum dry film thickness of 4 mils applied to the contact area.
6. Galvanized surfaces shall be treated as required by the manufacturer to be compatible with the primer and topcoats specified.

7. If the polyurethane topcoats are not compatible with the manufacturer's alkyd primer apply a polyamide epoxy as the intermediate coat.
8. The hollow metal doors and frames shall receive the primer indicated above, applied over the manufacturer's shop coatings.
9. Painting of the piping system shall include all ferrous valves, levers, valve handles, fittings stands, supports, hangers, sumps and appurtenances.
10. Paint motors for color coordination.
11. Epoxy primers and intermediate coats that have been in place for more than 45 days shall be prepared as indicated under the "Surface Preparation" section of this Specification.
12. Steel-seam FT 910 shall be used as required for filling pits and transitioning sharp edges, weld seams, etc., on steel.

3.09 PIPING, EQUIPMENT AND VALVE IDENTIFICATION SCHEDULE

- A. All pipes, whether concealed or exposed to view shall be painted as specified in the pipe identification schedule. For insulated pipes only the insulation shall be painted.

PIPE IDENTIFICATION SCHEDULE

SYSTEM NAME	LEGEND	PIPE COLOR ⁽²⁾ DESIGNATIONS	MATERIAL
Drains	D	Black	PVC
Sewer	S	Gray	CLD I
Forcemain	FM	Gray	CLD I
City water	W	Blue	Copper
Vent		Exterior	To match shingles
		Interior	To be selected by Owner
Gas	G	Yellow	
Walls & Ceiling		White	Concrete
Floors		Gray	Concrete
Railings, Ladder, Mezzanine Framing & Exterior Bollards		Safety Yellow	Galvanized Steel

- (1) YB = Yellow Background with Black Letters
 GW = Green Background with White Letters
 RW = Red Background with White Letters
 BW = Blue Background with White Letters

- (2) Stainless steel piping shall not be color coded, but shall receive the markings indicated.

- B. Markers shall be corrosion resistant laminated plastic bound to the pipes with nylon fasteners. Pipes with diameters less than 1-1/4 inch shall have marker hung from pipe with nylon fasteners.

- C. Lettering size shall be in accordance with the following:

SIZE OF LEGEND LETTERS		
Outside Diameter of Pipe or Covering	Minimum Length of Marker	Size of Letters
In.	In.	In.
Up to 1-1/4	8	1/2
1-1/2 to 2	8	3/4
2-1/2 to 6	12	1-1/4
8 to 10	24	2-1/2
over 10	32	3-1/2

- D. Adjacent to each marker there shall be an arrow indicating flow direction.
- E. Marker location shall be in accordance with the American National Standard Institute Scheme for Identification of Piping Systems (ANSI A13.1). Markers shall be placed adjacent to all valves and/or flanges; adjacent to all changes in direction on all pipe branches; and where all pipes pass through walls or floors on each side of wall/floor. On straight runs of piping, markers shall be placed at not less than 10-foot intervals. Where pipes are located above or below the normal line of vision, the lettering shall be placed below or above (as appropriate) the horizontal centerline of the pipe.
- F. All valves, pumps and other equipment shall be assigned an identification number and shall be marked with the identification number with 3-inch (76.2 mm) diameter tags.
1. The tags shall be rugged plastic with metal eyelets.
 2. The tags shall be tied with nylon fasteners.
- G. Valve status indicator alignment arrows shall be provided on the indicator and scale sides of all interior handwheel, chain and lever operated valves. Arrow heads shall appear aligned when the valve is in the full-open position. Arrow heads shall be painted on with stencils, of a color contrasting with the color of the valve. Arrow Heads shall be a minimum of 3/4" in smallest dimensions. Valve position indicators shall be aligned to be visible from normal working levels.
- H. Manufacturer – To establish a standard of quality, design and function, markers, bands and tags have been based on Seton Name Plate Corporation, New Haven Connecticut or an equal.
- I. Pipe supports consisting of pipe rings, clamps, clevises, U bolts, pipe rollers, saddles, etc., shall be painted with the same color as that of the pipe.
- J. Wall supported pipe hangers consisting of brackets, standoffs, etc. shall be painted with the same color as that of the wall.
- K. Ceiling/roof supported pipe hangers consisting of thread rods, beam clamps etc., shall be painted with the same color as that of the ceiling.

- L. Floor supported pipes consisting of stanchions shall be painted with the same color as that of the pipe.
- M. Miscellaneous items to be painted:
 - 1. Exposed electrical and instrumentation conduit.
 - 2. Pipe Bollards.
 - 3. Generator exhaust piping.
 - 4. Vent piping.
 - 5. Structural Steel.
- N. Contractor to coordinate color selection with the Owner for all miscellaneous items to be painted.

END OF SECTION 09900

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SECTION 09905**SURFACE PREPARATION AND SHOP COATINGS****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The work described in this Section is the surface preparation and application of shop coatings on material, equipment, and piping indicated in the various specification sections relating thereto, and as specified herein, including primers and top coats for materials, equipment and piping that are finished at the point of manufacturer or fabrication.

1.02 RELATED WORK**A. Related Sections**

1. Section 09900 "Painting"
2. Section 11000 "Equipment - General"

1.03 REFERENCES

- A. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100 Percent Relative Humidity.
- B. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- C. ASTM E84 - Test method for Surface Burning Characteristics of Building Materials.
- D. Federal Test Method No. 141 - Method 6141, Stain Removal.
- E. SSPC- Steel Structures Painting Council.
- F. SSPC-PA1, "Standard for Shop, Field, and Maintenance Painting".
- G. SSPC-PA2, "Measurement of Dry Paint Thickness with Magnetic Gauges".
- H. SSPC-SP1, "Solvent Cleaning".
- I. SSPC-SP6, "Commercial Blast Cleaning".
- J. SSPC-SP10 - "Near-White Blast Cleaning".
- K. SSPC-PA Guide 3, Standard "A Guide to Safety in Paint Application", latest revision.

1.04 SUBMITTALS

- A. Product data shall be submitted as specified in Section 106-07.
- B. At a minimum, the following shall be included in the submittal package for all items, products, material or equipment, as specified.
 - 1. Data on the proposed shop coatings, details on surface preparation methods, application procedures and dry mil thickness.
 - 2. A minimum of three (3) color charts for all factory top coats for color selection by Engineer.
 - 3. Coating manufacturer's certification that proposed shop coatings are compatible with field coatings.

1.05 DEFINITIONS

- A. Submerged surfaces are defined as follows:
 - 1. Those surfaces which are below the maximum water surface level as indicated on the drawings, and /or extend 3'-0" above the maximum water surface for uncovered tanks.
 - 2. All surfaces contained within covered tanks.
 - 3. The full height of all partially submerged items such as sluice gates, slide gates, weir gates, piping, etc.
 - 4. All surfaces contained within underground structures, vaults and manholes such as valve pits, drywells, etc.
- B. Enclosed surfaces are those non-submerged surfaces enclosed and/or protected within a building in such a manner that it cannot be exposed to UV light or weather conditions.
- C. Weather exposed surfaces are all other conditions, including buried items, which do not fall into the definition of submerged or enclosed surfaces, as noted above.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All Shop Coatings shall meet the requirements of the materials section, and shall be guaranteed by the manufacturer to be compatible with the field coatings, as specified in Section 09900 "Painting". The Contractor shall coordinate this requirement during the Shop Drawing Phase.
- B. All Shop Coatings shall meet all Federal and State regulations pertaining to Volatile Organic Compounds (VOC) compliance.

- C. Copper, bronze, brass, chromium plate, nickel, stainless steel, aluminum or monel metals, except surfaces in contact with or embedded within concrete or masonry, do not require paint or finish, unless otherwise specified elsewhere.

2.02 MATERIALS

- A. Refer to Part 3 - Execution for specific products and applications.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Ferrous Metal

1. Remove dirt, oil and grease by washing surfaces with solvent cleaning per SSPC-SP1.
2. All submerged ferrous metals shall be sandblast cleaned in accordance to SSPC-SP10, near white, immediately prior to priming. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile. (2-3 mils). Remove all weld spatter and round all sharp edges. Any bare metal must be primed the same day as it is cleaned or before flash rusting occurs.
3. Enclosed and weather exposed ferrous metal surfaces shall be sandblast cleaned in accordance to SSPC-SP6 commercial grade or SSPC-SP10, immediately prior to priming.
4. Surfaces shall be dry and free of dust, oil, grease, and other foreign material before priming.

B. Non-Ferrous Metals

1. Remove dirt, oil and grease by washing surfaces with mineral spirits.
2. Surfaces in contact with or embedded within concrete or masonry that are to be primed, shall be cleaned in accordance to SSPC-SP-1, Solvent Clean, immediately prior to priming.
3. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming.

C. Galvanized Metals

1. Thoroughly clean surface with mineral spirits to remove oily residue.
2. Dry with clean cloth.
3. Treat surface with copper sulphate, or with a compound made for this purpose (Lithoform, Solfo Metallic Coatings, etc.) in accordance with the manufacturer's direction, before applying the primer.

3.02 APPLICATION

A. Equipment

1. Motors, speed reducers and similar parts shall have a surface preparation in accordance with the manufacturer standard coating requirements and suitable for weather exposed use.
2. Items customarily finished at the point of manufacture (shop primed and painted) shall receive manufacturer's standard corrosion resistant coating of baked enamel or powder epoxy, suitable for the intended service.
3. All equipment casing openings requiring protection shall have a water repellent tape and vapor phase inhibitor treated paper.
4. All other ferrous surfaces shall be factory primed in accordance with Section 3.02C, except ferrous surfaces obviously not to be painted (such as gears, exposed machined or bearing surfaces, enclosed machined or bearing surfaces, lubricated contact surfaces moving under load, thread connections to be field connected and other similar items) which shall be given a heavy shop coat of grease or other suitable rust resistant coating per manufacturer's recommendations.
5. All coating shall be maintained as necessary by the Contractor to prevent corrosion during all periods of storage and erection, until final acceptance by the Owner.

B. Pipe, Fittings and Valves

1. The following surfaces shall be prepared in accordance with the manufacturer's recommendations and shall receive a shop coat of asphaltum varnish meeting Federal Specifications TT-C-494A or fusion bonded epoxy coating:
 - a. Interior surfaces of all hydrants, ductile iron pipe, fittings and valves except for air piping lines and air valves which shall be completely unlined.
 - b. The exterior surfaces of buried valves and miscellaneous piping appurtenances.
2. The exterior surfaces of all ductile iron pipe and fittings buried shall receive the standard factory applied asphaltum coating (in accordance with AWWA C151), unless otherwise recommended by the manufacturer.
3. The exterior surfaces of ductile iron pipe, fittings and valves submerged, enclosed or weather exposed shall receive a factory applied shop primer in accordance with Section 3.02C unless otherwise recommended by the manufacturer.
4. Machined surfaces shall be cleaned and coated immediately after being machined, with a suitable rust resistant coating per manufacturer's recommendations.
5. All of the ferrous surfaces shall be factory primed in accordance with Section 3.02C, unless otherwise recommended by the manufacturer, except ferrous surfaces obviously not to be painted which shall receive a heavy shop coat of grease or other suitable rust resistant coating per manufacturer's recommendations.
6. These coatings shall be maintained as necessary to prevent corrosion during all periods of storage and erection until final acceptance by the owner.

C. Schedule

The product model and coatings system number listed below are based on products by the Sherwin Williams Company. The prior review and approval by the Engineer of products by other manufacturers shall be required.

SURFACE/ITEM	SURFACE PREPARATION	Sherwin Williams SHOP PRIME
METALS		
Submerged Ferrous Metals, Piping, Fittings, Valves and Equipment specified to be shop primed in their respective sections.	SSPC-SP10 Near White Metal Blast Cleaning	Copoxy Shop Primer 4 to 6 mils
Weather Exposed Ferrous metals, Piping, Fittings, Valves and Equipment specified to be shop Primed in their respective sections.	SSPC-SP6 Commercial Blast Cleaning	Recoatable Epoxy Primer 4 to 6 mils
Non-Ferrous and Galvanized Metals in contact with or embedded in concrete.	SSPC-SP1 Solvent Wiping	Recoatable Epoxy Primer 4 to 6 mils
Ferrous Metals in contact.	SSPC-SP6 Commercial Blast Cleaning	Recoatable Epoxy Primer 4 to 6 mils
All Other Weather Exposed and Enclosed Ferrous Metals.	SSPC-SP6 Commercial Blast Cleaning	Recoatable Epoxy Primer 4 to 6 mils

Notes:

1. Surface preparation specified within this section and as noted in the table above are minimums. Surface preparation shall be in accordance with the manufacturer's written recommendations.
2. All dry film thickness indicated are the minimum required.
3. All epoxy coatings subjected to UV Exposure shall receive an additional Polyurethane top coat with a minimum dry film thickness of 3 mils. No epoxy coating shall be left exposed to UV light. This shall include all equipment drives, motors, gear reducers, etc.
4. All ferrous metals and equipment delivered to the site with shop primers other than polyamide epoxy or alkyd primer indicated above, shall receive an intermediate coat as necessary for compatibility with epoxy top coats.
5. All ferrous, nonferrous and galvanized metals in contact with concrete or masonry shall receive a polyamide epoxy primer with a minimum dry film thickness of 4 mils applied to the contact area.
6. Galvanized surfaces shall be treated as required by manufacturer to be compatible with the primer and top coats specified.
7. Steel-seam FT 910 shall be used as required for filling pits and transitioning sharp edges, weld seams, etc., on steel.

END OF SECTION 09905

SECTION 102-16**SPECIAL SPECIFICATIONS AND NOTES****1. LIQUIDATED DAMAGES**

For each calendar day that any work remains uncompleted after the date specified for the completion of the work provided in the Contract, the amount of FIVE HUNDRED DOLLARS AND NO CENTS (\$500.00) per calendar day will be deducted from any money due the Contractor, not as a penalty but as liquidated damages; provided, however that due account shall be taken of any adjustment of the contract time of completion of the work as provided for elsewhere in the Specifications.

2. SCOPE OF WORK

The James Street Siphon Station Upgrades Project consists of, but is not limited to, the following items of work:

- A. The obtainment of building permits through the City of New Haven Building Department.
- B. Maintain continuous operation of the siphon station.
- C. Improvements to the Siphon Station's, including but not limited to:
 - Replace existing mechanical bar screens with new screens. A screenings washer/compactor will also be installed. Detailed information related to the proposed screens and washer/compactor is included in Appendix A.
 - Replace the slide gates that are upstream and downstream of each screen. Each gate will be constructed from stainless steel and will be 3'-0" x 4'-6" which is one foot taller than the existing gates.
 - Replace all grating throughout the facility with new fiberglass grating.
 - Demolish the fixtures and other items inside the existing Men's bathroom. Refinish room and install new bathroom fixtures.
 - Demolish the fixtures and other items inside the Women's bathroom and convert it to a new electrical room.
 - Replace a portion of the roof. (Flashing may contain asbestos. Testing and abatement will be required. See Allowance)
 - Replace the existing exterior T1-11 siding with Hardiboard or similar siding.
 - Replace the exterior doors.
 - Convert the existing women's bathroom into a new electrical room and provide all new electrical distribution equipment needed to power the new mechanical screens, heating

and ventilation equipment, lights, instrumentation and building systems. Confirm that the walls are designed to provide a 3-hour fire rating as required by code.

- Demolish existing electrical distribution equipment in the boiler room after the new electrical room is constructed. Work will include the replacement of existing 400A 120/208V underground service with new 200A 120/208V underground service to accommodate the voltage requirements of the new mechanical screens and washer/compactor. This task will require close coordination with the local electric utility to provide the new service.
- Install a permanent standby-diesel-engine-driven generator with integral belly fuel tank inside the station. The generator fuel tank will be sized to provide 48-hours of run time. A new automatic transfer switch (ATS) will be installed in the new electrical room for connection of the generator to the distribution system.
- Replace all existing conduit, wiring, lighting and receptacles in the facility.
- Three new submersible pressure transducers will be installed in sched. 80 PVC stilling wells. Two of these transducers will measure the levels upstream of each new screen, and one sensor will be installed down stream of the new screens. Backup floats will also be provided by the screen manufacturer.
- New Hazardous gas detectors to measure low oxygen level, hydrogen sulfide, and carbon monoxide will be installed inside the screenings room.

3. COORDINATION WITH OWNER'S OPERATIONS

A. Coordinate all activities and/or scheduling outages with the Authority's Operations Department. Calls must be made to all of the following:

- 1) Operations front desk: (203) 466-5280
- 2) Charlie Biggs, Maintenance Administrator: (203) 410-3488
- 3) Joseph Megale, Deputy Director of Operations (or as assigned): (203) 466-5280

4. INFORMATION AVAILABLE TO BIDDERS

The following items are available for review by the prospective bidder, and are included as part of the bid package:

- A. The plan set entitled "James Street Siphon Station Upgrades Project, New Haven, Connecticut", Dated: 12/16/19 and prepared by Criscuolo Engineering, LLC
- B. It is the responsibility of the bidder, before submitting a bid, to thoroughly review the Contract Documents, Specifications, and other information provided by the Authority, as indicated above, as well as to visit the site to determine any extraneous conditions which may affect the cost, progression, and/or performance of the Work.

5. LABOR AND EMPLOYMENT REGULATIONS

Wage rates for the James Street Siphon Station Upgrades Project as determined by the State of Connecticut Department of Labor to be the "Prevailing Wages Rates", as published in Appendix C of these specifications.

6. PROJECT INSURANCE REQUIREMENTS

The GNHWPCA & Criscuolo Engineering LLC shall be included under “Additional Insured” on all insurance policies required, and as specified in the specifications, for all policies except Workers Compensation.

7. MODIFICATION OF GENERAL PROVISIONS

A. Section §107-06 Insurance

1) The insurance limits set forth in Section 107-06 are hereby modified as follows:

- a. Workers’ Compensation and Employer’s Liability insurance:
 - Workers’ compensation - statutory limits
 - Employer’s Liability each accident \$ 250,000
 - Employer’s Liability disease - each employee \$ 250,000
 - Employer’s Liability disease - policy limit \$1,000,000
- b. Commercial General Liability:
 - Each occurrence \$ 1,000,000
 - Aggregate \$ 2,000,000
- c. Business Automobile Liability:
 - Each accident - combined single limit \$ 1,000,000
- d. Owner’s and Contractor’s Protective Liability insurance in the name of the Greater New Haven Water Pollution Control Authority: N/A
- e. Contractor’s Protective Liability and Public Liability and Property Damage Liability Insurance:
 - Each occurrence \$ 2,500,000
 - General Aggregate \$ 2,000,000
- f. Railroad Protective Public Liability and Property Damage Liability Insurance: N/A
- g. Umbrella Excess Liability:
 - Each occurrence \$ 2,000,000
- h. Equipment Installation Floater: N/A

2) Section §107-06.10, Termination or Change of Insurance, is replaced with the following:

Each insurance policy shall be endorsed to provide that the insurance company shall notify the Authority by certified mail at least thirty (30) days in advance of any cancellation or material change. Such notice provision shall be absolute and unequivocal. The words “endeavor to” and “but failure to mail such notice shall impose no obligation or any liability of any kind upon the company, its agents or representatives” shall be deleted from the certificate form’s cancellation provision.

3) The following sections shall be added:

- §107-06.18 The period of completed operations coverage for purposes of Commercial General Liability and Excess Umbrella Liability coverage shall be two (2) years after completion and acceptance of the entirety of the work.
- §107-06.19 No deductible for any policy shall exceed the sum of \$ 25,000 without the prior approval of the Authority.
- §107-06.20 Certificates of Insurance that are to be provided by the Contractor shall fully evidence compliance with the insurance requirements specified in the Standard Specifications, and as noted hereon.

B. Section §109-01 Estimates and Payment

- 1) The second paragraph shall be modified to read as follows: "In computing amounts in estimates or Work done, the unit prices published in the Schedule of Values that has been accepted by the Engineer shall be used."

8. MODIFICATION OF TECHNICAL SPECIFICATIONS

SPECIAL SPECIFICATIONS

The following special specifications are hereby incorporated and made a part of the Greater New Haven Water Pollution Control Authority Standard Specifications:

Special Specifications for the James Street Siphon Station Upgrades Project

<u>Section Number</u>	<u>Description</u>
01295	Schedule of Values
01300	Submittals
01752	Startup and Commissioning
01760	Operation and Maintenance Manuals
01770	Project Closeout
02105	Selective Demolition
02210	Earth Excavation, Backfill, Fill and Grading
02224	Compacted Gravel
02225	Processed Aggregate Base
02435	Crushed Stone
02500	Bituminous Concrete Pavement
02900	Lawns and Grasses
03300	Cast-In-Place Concrete
04200	Unit Masonry
05100	Metal Fabrications
06100	Rough Carpentry
06600	FRP Grating
07460	Siding
07620	Sheet Metal Flashing and Trim
07900	Joint Sealers
08110	Hollow Metal Door and Frames

09900	Painting
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SECTION 11000
EQUIPMENT - GENERAL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section provides the general requirements for the furnishment, installation and testing of equipment included elsewhere in the Specifications, and as specified in the Project Drawings.

1.02 RELATED WORK

A. Related Sections

1. Section 01760 - "Operation and Maintenance Manuals"
2. Section 01770 - "Project Closeout"
3. Section 16000 - "Electrical - General"

1.03 SUBMITTALS

A. Shop Drawings

1. Shop drawings shall be submitted to the Engineer for review and approval for all equipment specified in the Project Drawings, or elsewhere in these specifications.
2. The manufacturer shall integrate all required shop drawings for each equipment system proposed.
3. The manufacturer's literature and illustrations for all equipment shall be submitted. This literature shall include dimensions, construction details, shop painting details, and materials by generic name.
4. The manufacturers operation and maintenance manuals including installation and storage requirements shall be submitted for each item of equipment.
5. All requirements for the equipment's interface with controls and/ or other equipment shall be submitted, including wiring diagrams that accurately depict all of the interface requirements, to ensure the proper operation of each system or item of equipment

B. Certifications and Warranties

1. The Contractor shall submit a certification from the individual manufacturer of each item of equipment that states that the equipment manufacturer or supplier has reviewed the project drawings and specifications relating to the item of equipment or equipment system, the intended installation, and intended functional and operational conditions and has determined that all conditions are acceptable and found no conditions which would cause the warranty to be void, the equipment to function improperly, or the equipment to not meet the performance requirements.

2. Certification shall be provided from the manufacturer of each item or system of equipment that states that the equipment, accessories, and shop painting that they would provide would meet or exceed the Specification requirements. Should the proposed equipment not comply with all of the specification requirements, all deviations from the specification requirements shall be listed.
3. The Contractor shall submit the manufacturers warranty and service agreement for each item of equipment or equipment system for review. Equipment that is to function as a complete and integrated system shall be warranted accordingly.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. Attention is directed to the fact that the Project Drawings and Specifications may be based upon items of equipment or equipment systems from a particular manufacturer. If the Contractor proposes equipment that differs from that which is specified, the prior review and approval of the Engineer shall be required. Any costs incurred from any changes deemed necessary by the Engineer to the Project Drawings, Specifications, or design of the proposed work resulting from the usage of alternate equipment or equipment systems shall be the responsibility of the Contractor and at no additional cost to the Owner.
2. All parts and components of mechanical equipment shall be designed for satisfactory service under continuous duty without undue wear under the specified operating conditions.
3. All equipment and machinery furnished under this Contract shall be the latest improved design suitable for the service specified. All equipment and machinery shall be designed and constructed to operate efficiently, continuously and quietly under the specified requirements with a minimum of maintenance, renewals and repairs. The design and construction of all equipment and machinery shall be such as to permit operation with minimum wear, vibration and noise when properly installed.
4. Ample room for erecting, repairing, inspecting and adjusting of all equipment and machinery shall be provided. The design, construction and installation of all equipment and machinery shall conform to and comply with the latest safety codes and regulations.
5. All equipment of identical size, type and service shall be the product of the same manufacturer.
6. All equipment selected shall suit the general arrangement of the space in which it is to be installed.
7. Suitable provisions shall be made for easy access for service and replacement parts.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. All equipment shall be delivered in the manufacturer's original, unopened, and undamaged packages. Unless otherwise specified, all storage and demurrage charges from suppliers and transportation companies shall be the responsibility of the Contractor.
- B. It shall be the responsibility of the Contractor to ensure that all equipment is stored, and maintained in strict accordance with the manufacturers' written short and long term storage requirements.
- C. The Contractor shall be responsible for the protection, loss of, or damage to materials and equipment furnished until the final completion and acceptance of the Work by the Owner and Engineer.
- D. Defective material and equipment shall be removed immediately from the site of the Work, at no additional cost to the Owner.

3.02 INSTALLATION

- A. All equipment shall be installed in strict accordance with the manufacturer's requirements.
- B. Equipment shall not be installed until all defects or inadequacies have been corrected to meet the Specifications, and to the satisfaction of the engineer.
- C. Equipment shall be erected and lubricated in strict accordance with the manufacturer's instructions.
- D. Installation shall include all oil and grease required for proper operation.

3.03 ERECTION OF EQUIPMENT

- A. Bolts, Anchor Bolts and Nuts
 - 1. All necessary bolts, anchor bolts, nuts washers, lock washers or locking nuts, plates and bolt sleeves shall be furnished in accordance herewith and in accordance with the manufacturer's recommendations. Anchor bolts shall have suitable washers, lock washers and, where so required, their nuts shall be hexagonal.
 - 2. All bolts, anchor bolts, nuts, washers, lock washers, plates and bolt sleeves shall be galvanized unless otherwise indicated below or as specified elsewhere.
 - a. Stainless steel hardware (minimum of Type 304, unless otherwise indicated) is required in all corrosive atmospheres and exterior areas.

3. Unless otherwise specified, bolts, anchor bolts, nuts, washers, and lock washers specified to be galvanized, shall be zinc coated, after being threaded, by the hot-dip process in conformity with the ASTM Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip Designation A123, latest revision or the ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Designation A153, latest revision as is appropriate.
4. Unless otherwise specified, expansion bolts shall have malleable iron and lead composition elements of the required number of units and size.
5. Unless otherwise specified, stud, tap, and machine bolts shall be of the best-quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to ANSI Standard B 1.1-1974 for Unified Inch Screw Threads (UN and UNR Thread Form).
6. Anchor bolts and expansion bolts shall be set accurately. If anchor bolts are set before the concrete has been placed, they shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required, anchor bolts shall be provided with square plates at least 4 in. by 4 in. by 3/8 in., or shall have square heads and washers and be set in the concrete forms with suitable pipe sleeves, or both. If anchor or expansion bolts are set after the concrete has been placed. All necessary drilling and grouting or caulking shall be done by the Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.
7. All bolts shall be suitable size for the intended purposed, and in accordance with the manufacturer's recommendation.
8. Assembly hardware shall be provided in accordance with the complete parts list of the manufacturer.

B. Foundations and Grouting

1. The Contractor shall furnish the necessary materials and construct suitable concrete foundations for all equipment installed by him, even though such foundations may not be indicated on the Drawings. Foundation sizes and elevations may be determined in the field by the Engineer. The tops of foundations shall be at such elevations as will permit grouting as specified above.
2. All such equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.
3. In setting pumps, motors, and other items of equipment customarily grouted, the Contractor shall make an allowance of at least 1 in. for grout under the equipment bases. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise specified, all grout shall be an approved non-metallic non-shrink grout.

4. Grout shall be mixed and placed in accordance with the recommendations of the manufacturer. Where practicable, the grout shall be placed through the grout holes in the base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.
5. Where such procedure is impracticable, the method of placing grout shall be as permitted by the Engineer. After the grout has hardened sufficiently, all forms, hoppers, and excess grout shall be removed, and all exposed grout surfaces shall be patched in an approved manner, if necessary. All foundation and grout exposed surfaces shall be given a burlap-rubbed finish, and painted with at least two coats of epoxy based paint specified for concrete.
6. If threaded rod with lower support nuts are used to secure the equipment in place temporarily during concrete equipment pad placement, the support nuts shall be removed prior to grouting so that the threaded rod and lower bolts are not supporting the equipment and the top nuts can be tightened to secure the equipment directly to the large bedding surface provided by the non-shrink grout and concrete equipment pad. Equipment foundations shall be designed to absorb equipment vibration and transmit forces to building structure or ground.

3.04 START- UP AND APPLICATION

- A. The Contractor shall arrange and provide for a qualified service representative from each company manufacturing or supplying equipment to perform the Work herein described:
 1. After installation of the equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, the representative shall inspect, operate, test and adjust the equipment. The inspection shall include, but shall not be limited to, the following points as applicable:
 - a. Soundness (without cracked or otherwise damaged parts).
 - b. Completeness in all details, as specified.
 - c. Correctness of setting, alignment, and relative arrangement of various parts.
 - d. Adequacy and correctness of packing, sealing and lubricants, etc.
 2. The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.
 3. Upon completion of his work, the manufacturer's or supplier's representative shall submit in triplicate to the Engineer a complete, signed report of the results of his inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report shall certify that the equipment (1) has been satisfactorily installed and conforms to the contract requirements; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping, supports or anchor bolts; (4) has been operated under full load and operates satisfactorily; and (5) that nothing in the installation will render the manufacturer's warranty null and void.

4. After the Engineer has reviewed the reports from the manufacturer's representatives, make arrangements to have the manufacturer's representatives present when the field acceptance tests are made.
- B. Final documentation shall be provided in both bound paper copies (3 sets submitted to Engineer) and electronic compact disk (CD) (3 copies submitted to Engineer).
1. Provide three paper sets of manuals a minimum of 120 days prior to the Contract Completion Date. Each copy shall be in a separate, bound manual. Manuals shall include:
 - a. Clear and concise instructions for the operation, adjustment, lubrication, and maintenance of the equipment.
 - b. Listing of all parts for the equipment with the manufacturer and manufacturer's identification number for each part and other data necessary for ordering replacement parts.
 - c. Information applicable only to the model of the equipment specifically furnished. References to other size and types or similar models shall be deleted. Information on where to obtain parts and services shall be provided.
 - d. Any revisions completed during start-up, testing, and training shall be documented in three final paper sets and three CD copies of manuals. Final copies shall be furnished prior to the Contract Completion Date.
- C. Operator Training
1. Upon satisfactory completion of the start-up and calibration, a representative of the manufacturer shall be provided by the Contractor to instruct the Owner's personnel in the proper operation and maintenance of the equipment. This separate period of on-site training shall be provided independent of start-up and testing services.
 2. The manufacturer's representative who will be providing the instruction shall have prior operation, maintenance and instructing experience that is acceptable to the Engineer.
 3. The Contractor shall submit the individual's name and qualifications to the Engineer for approval at least one week prior to the scheduled operating and maintenance instruction sessions.
- D. Each piece of equipment shall be provided with a substantial nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation.
- E. All equipment driven by open shafts, belts, chains, or gears shall be provided with approved all-metal guards enclosing the drive mechanism. Guards shall be constructed of galvanized sheet steel or galvanized 1-inch screen (woven wire or expanded metal) set in a frame of galvanized steel numbers. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. Equipment guards shall conform to all applicable OSHA requirements.

- F. Electrolysis - Where dissimilar metals are used in conjunction with each other, suitable installation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coating, non-metallic separators or washers, or other approved materials.
- G. Fabrication, manufacture, painting or testing work may be inspected by the engineer before shipment. Notice shall be given to the Engineer of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Engineer in ample time so that the necessary arrangements for the inspection can be made.

END OF SECTION 11000

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SECTION 11100

SCREENING SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

- A. This section includes the furnishing of two (2) front-cleaning, front-return link driven mechanically cleaned bar screen assemblies to be installed indoors in James Street Siphon Station, New Haven, CT. Appendix A provides channel dimensions, influent flows, and equipment details.
- B. All equipment supplied under this section shall be furnished by or through a single Screening System Supplier who shall coordinate with the Contractor, the design, fabrication, delivery, installation and testing of the screening components. The Screening System Supplier shall have the sole responsibility for the coordination and performance of all components of the screenings system with the performance and design criteria specified herein.
- C. The Contractor shall be responsible to coordinate all details of the screening equipment with other related part of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. The Contractor shall be responsible for all structural and other alterations in the Work required to accommodate the equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

1.02 RELATED SECTIONS

- A. The following list of related sections is provided for the convenience of the Contractor and is for reference only to support commonly referenced sections that are in-general applicable to all equipment supplied. For complete list of sections see specification index.
 - 1. All sections of Division 1, including but not limited to Submittal Procedures, Shop Drawings, Product Data and Samples, Operating and maintenance information, Protection of Materials and Equipment, Installation, Testing, and Commissioning, Instruction of Operations and Maintenance Personnel, and Spare Parts Maintenance Manuals.
 - 2. Section 09900 Painting
 - 3. Section 11000 Equipment – General
 - 4. Section 13420 Instrumentation

1.03 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. American Welding Society (AWS)
- D. American Institute of Steel Construction (AISC)
- E. American Bearing Manufacturers Association (ABMA)
- F. American Gear Manufacturers Association (AGMA)

- G. National Electrical Manufacturers Association (NEMA)
- H. Underwriters Laboratory (UL)

1.04 SUBMITTALS

- A. The equipment manufacturer shall submit the following items:
 - 1. General Arrangement drawings that illustrate the layout of the equipment, equipment weight, principal dimensions with related verifications required for installation including anchorage locations. Other related data including descriptive literature, Electrical Control Drawings, Catalog Cut Sheets for individual components and Drive Motor Data. See Appendix for quantity required.
 - 2. A list of recommended Spare Parts including any Special Tools required for routine maintenance of the equipment shall be provided. See Appendix for any custom spare parts required.
 - 3. O & M Manuals including As-Built Drawings of the Mechanically Cleaned Bar Screen Arrangement, Controls and Accessories shall be provided after equipment ship for inclusion in the Close-Out Submittal process. See Appendix for quantity required.

1.05 QUALITY ASSURANCE

- A. The Mechanically Cleaned Bar Screens shall be fully assembled and shop tested at the manufacturing facility prior to shipment.
- B. 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 installation, for at least five (5) years.
- C. The equipment furnished shall be fabricated, assembled, installed and placed in proper operation condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.

1.06 WARRANTY

- A. Manufacturer shall provide a written one year standard warranty from the date of use of the mechanically cleaned bar screen equipment to guarantee that there shall be no defects in material or workmanship in any item supplied.
- B. Manufacturer shall warrant for the period of five (5) years all rotating parts of the Mechanically Cleaned Bar Screen including the gear motor, bearing, drive head, and the link system including the links, castings, pins and retaining rings. Manufacturer warrants that these components shall be replaced if damaged or defective in the normal use of the equipment.

PART 2 – PRODUCTS

2.01 MANUFACTURER

- A. FlexRake® Model Full Penetration Screens shall be as manufactured by Duperon Corporation, 1200 Leon Scott, Saginaw, Michigan, 48601.

2.02 SCREEN BASIS OF DESIGN

- A. 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.
- B. The mechanically cleaned bar screen shall run continuously without an operator.
- C. The equipment shall have multiple scrapers 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 shall not be allowed. Cleaning mechanisms that utilize shock absorbers, springs or other dampening or hydraulic actuations are unacceptable.
- D. The link system shall have jam evasion capability by flexing around and collecting large objects such as a 2 x 4 board, bowling 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.
- E. 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.
- F. Equipment utilizing a greater than ½ HP motor or two or more motors to complete a screen cleaning cycle is not acceptable.
- G. 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.*

2.03 SCREEN COMPONENTS

- A. Bar screen assembly: Bar screen assembly shall be of stainless steel and designed to withstand 1 foot head differential unless noted otherwise in the Appendix. See Appendix for materials of construction and design requirements such as: slot opening, angle of installation, channel dimensions, etc. The Bar screen assembly shall be shipped in one piece.
 - 1. Screen Bars: Bars shall be stainless steel and be rectangular shaped with minimum dimensions of 0.25 inch x 1.00 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 0.25 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 11ga. (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 containment.
 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/scrapers on the mechanically cleaned bar screen unit as recommended by the manufacturer.
- D. Screen Enclosure: A 14 gauge SSTL Enclosure shall be installed to cover the screen above the operating deck level. Front Enclosure has options for removable covers for maintenance. Removable panels shall be 1/4" thick Polycarbonate to allow for visual observation during screen operation. Rear Enclosure has hinged removable door provided with 1/4 turn latches with an integral viewing door to provide a look inside. See Appendix for materials of construction.
- E. Link System: The link system shall be stainless steel. See Appendix for materials of construction.
- F. Scrapers: Scrapers shall be 1.00 inch thick UV Stable UHMW-PE with thru bar technology that fully clean (3) sides of the rectangular bar. Scrapers shall be spaced 21 inches apart. The scrapers move at no greater than 28 inches per minute at standard operating speed of 1/2 rpm allowing for approximately 1 debris discharge per minute.
- 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 shall be coated ASTM A48, CL40 cast iron with ASTM A536 80- 55-06 ductile cast iron end castings.
 - b. Drive Shaft shall be AISI 1018 steel
 - c. Gearbox shall be shaft-mounted, right angle type and incorporate cycloidal and spiral bevel gearing with a total ratio of 809:1. The gear reducer output shaft speed shall be controlled by a volts/hertz type inverter or per rake manufacturer's recommendation. It shall have at least a 1.52 or greater 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, 3 phase 240/480 volt and mounted to the gear reducer. Motor shall be ½ hp, designed for 1800 RPMs base speed and rated for Class I, Groups C & D, Class II Groups F & G environments and for use with an inverter. Motor shall have a 4/1 speed range, EPNV enclosure, NEMA design B with a 56C frame size. Service factor shall be 1.0 with 1600V, Class F insulation rated for temperatures up to 40 degrees C. The motor will have 1600 volt insulation, optimized for IGBT type inverters and shall be UL listed.
 - 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.
2. Bearing: Bearing shall be greased ball bearing type, non self-aligning, sealed and lubricated.
 3. Speed Reducer: Speed reducer shall be 0.50 to 2.2 (in high flow conditions) output rpm, 11,417 in-lb output torque 809:1.
- H. Standard Coating: All steel bar screen components shall be coated with a urethane moisture-cure two coat paint system in accordance with the paint manufacturer's specification. Products will be MC Zinc and MC Ferro and MC Euster, as manufactured by Wasser, or equivalent. Standard color is Safety Blue. Material shall meet all state and federal VOC and other regulatory requirements.

2.04 MATERIALS

- A. Fabrications: All welded fabrications are to be made from 304 stainless steel. All welded connections and welding procedures shall comply with AWS "Structural Welding Code – Sheet Steel" D1.3/D1.6.
- B. Select Parts: Select power transmission parts to be made from cast iron; however, shall conform to coating as follows.
- C. Standard Coating:
 1. 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. The three-part coating system shall be manufactured by Tnemec as follows: Prime Coat Series 90-97 Tnemec Zinc at 2.5-3.5 mils DFT, Intermediate Coat Series 27 F.C. Typoxy at 3.0-5.0 mils DFT, and Top Coat Series 1075U Endura-Shield II at 2.0-3.0 mils DFT. Standard color is 11SF Safety Blue. Material shall meet all state and federal VOC and other regulatory requirements.
 2. Alternatives: Any alternate products must provide certified test reports when submitting products other than those specified herein the specification. Test reports shall indicate the test method, system and requirements for those products being submitted, and shall meet or exceed the test criteria and performance values of the specified coatings herein.

Non-metal: Parts not covered above shall be made from UHMW polyethylene.

2.05 ELECTRICAL, CONTROLS, INSTRUMENTATION

Controls for the two bar screens shall be in a single NEMA 4X enclosure provided by the Screen manufacturer. Controls shall be designed to accept 3PH 240 volt incoming power supply per plans/specs. Control panel power shall be 1PH/120VAC and shall include a step-down transformer to achieve 120V.

Controls shall be built by a UL-approved panel builder and bear the UL-approved logo. Controls shall be tested by panel builder and by the manufacturer prior to shipment to owner. Manufacturer shall verify all overload settings in the Screen and Washer Compactor controllers to insure proper overload and speed settings required for the application are properly programmed.

SCREEN CONTROLS:

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- A. General: Normal screen operation is at low speed on a timer. Screen speed and on-off cycle times must be easily set by the operator with a touch screen on the main control panel enclosure. During high flows, the timer is overridden when the wastewater in the channel reaches a height that is preset by the operator. The screen operates continuously until the water level recedes, at which point timed operation resumes. During very high storm flows, at a preset "high-high" channel level, the screen begins to operate continuously on a higher speed, also preset by the operator. When the water level recedes, the screen reverts to low speed continuous operation, then timed operation when flow returns to normal.
 - B. Controls for each rake 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 unless specified otherwise.
 - 1. Main control panel shall be installed indoors in temperature-controlled, non-hazardous location. Local emergency push-button controls shall be located adjacent to the screens for operator safety.
 - 2. Controls shall be designed to accept incoming power supply per plans/specs and shall include a step-down transformer as needed to achieve 120V.
 - 3. Control Panel(s) 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.
 - 4. Controls shall be tested by the panel builder and by the rake manufacturer 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.
 - 5. Control panel(s) 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.

6. All panel(s) and panel mounted devices shall be labeled with engraved I.D. markers that reference back to the system schematics. Tags shall be white with black core, engraved as required.
7. All field wiring and power cables between the bar screen Main Control Panel and the Local Push Button Station shall be provided by others under the Electrical Section.

C. Components:

1. Main Control Panel

- a. Enclosure(s) shall be NEMA 4X stainless steel.
- b. Enclosure shall have a continuous hinge, exterior lockable door and shall be located outside of any explosive environment.
- c. Main Control Panel shall be designed with a SCCR rating of 25KA minimum and labeled as such.
- d. All terminals utilized in the main panel shall be 600V rated terminals and spare terminal space shall be provided for any potential future revisions.
- e. The Main Control Panel shall include at a minimum the following
 - Main control power breaker with lockable operator
 - Hand On/Auto (HOA) Selector Switch and Push/pull E-Stop
 - Elapsed run-time meter
 - Push-To-Test type indicator lights for "Power On", "Forward" and necessary fault indication
- f. PLC Based Controls shall included the following:
 - Unitronics Programmable Logic Controller (PLC)
 - AC Tech Variable Frequency Drive (VFD)
 - HMI programmable functions as required
 - SCADA Interlocking via Hard Contact

2. Local Control Push Button Stations (One for each screen: two (2) local stations total.

- a. Enclosures shall be NEMA 7/9 rated for installation local to the equipment to maintain requirements of local safety codes as determined by the Engineer.
- b. Panel shall be mounted as close to the equipment as safely possible and be field wired by the electrical subcontractor to the corresponding terminal inputs in the main control panel.
- c. The remote pushbutton stations shall include Forward, Jog Reverse and E-

Stop buttons.

3. Instrumentation: Each rake shall have a separate level system that shall be installed and field wired by others per the manufacturer's instructions.

- a. Single Level Control

- One (1) KPSI Series 700 Submersible Transducer shall be located upstream of the each screen (installed in stilling wells).
- One (1) Float Switch shall located upstream of each screen as a high water level backup.

2.06 SPECIALTY TOOLS, SPARE PARTS AND LUBRICATION

- A. Manufacturer shall provide any specialty tools and recommend spare parts required for maintaining the equipment as follows:

1. Drive Clevis Pin (1)
2. Snap/Retaining Rings (10)
3. Link Clevis Pins (4)
4. Scraper Bolts (4)
5. Scraper Nuts (4)
6. Snap Ring Tool (1)
7. Never Seez, 3/8" tube (1)

- B. Manufacturer shall provide a 1-year supply of lubrication required for maintaining all bar screen components.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Equipment shall be installed in strict conformance with the manufacturer's installation instructions as submitted with Shop Drawings, Operation and Maintenance Manuals and/or any pre-installation checklists. Installation shall utilize standard torque values and be installed secure in position and neat in appearance. Installation shall include any 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 customer and/or specified by the manufacturer.
- B. The overall bar screen unit will be fabricated so that it can be split into two (2) disassembled segments at the project site to enable rigging into the pump station.
- C. The bar screen will be shipped from the factory fully assembled with the exception of the operating deck enclosure(s).

- D. The installation contractor will need to disassemble the bar screen at the site and in locations directed by Duperon and approved for during the submittal process. The contractor will then reassemble the bar screen in the facility. The contractor is required to provide all material, equipment and labor for this process.
- E. Anchor Bolts: Anchor bolts and nuts shall be stainless steel and furnished for each item of equipment by the CONTRACTOR.
 - a. Anchor bolt template drawings shall be included in the submittal to permit verification of the location structural elements, new or existing in the concrete.
 - b. Anchor bolt sizes, quantity and requirements are indicated in Appendix A and will be confirmed on the submittal drawings.

3.02 TESTING

- A. After completion of installation, CONTRACTOR shall provide for testing and shall be performed in strict 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 containment.
- B. Field certification shall include inspection of the following:
 - 1. Verify equipment is properly aligned and anchored per the installation instruction and drawings. Assure the bar screen unit is square, flat and unobstructed with required clearances maintained.
 - 2. Assure controls and instrumentation work in all modes.
 - 3. Check equipment for proper operation of debris blade, scrapers, etc as well as completion of the Start-Up requirements in the Installation guide.

3.03 ONSITE TECHNICAL ASSISTANCE

- A. Provide three (3) days in two (2) trips manufacturer's services to include installation Certification, Start-Up and Training. Manufacturer shall be given minimum 10 days notification prior to the need for such services.

Appendix A: Screening Equipment

James Street Pump Station, New Haven, CT:

Quantity of mechanically cleaned bar screens:	Two (2)
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James Street Design Parameters:

Channel Width:	4' 0"
Channel Height:	14.79'
Bar Clear Opening Size:	1.5 inch
Angle of Installation:	150 degrees from vertical
Average Flow:	To Be Determined
Average Water Level:	To Be Determined
Maximum Flow:	20 MGD per channel
Maximum Water Level:	To Be Determined
Maximum Head Differential:	To Be Determined
Screenings Discharge Height:	5' into Debris bin by others
Material of Construction:	SSTL304
Link Material of Construction:	SSTL304
Estimated Weight	5000 lbs. each screen
Standard Anchors	SSTL304
1/2" dia. x 4 1/2" Lg. embed Hilti H48 RODS w/ RE-500 SD Adhesive system	Sixteen (16)
3/8" dia. x 3 3/8" Lg. embed Hilti H48 RODS w/ RE-500 SD Adhesive system	Fifty (50)
Indoor Installation:	
Screen Height	10' 1 7/8"
Site Access Constraints	Screens assumed to be supplied with two-piece frame for rigging into building
Incoming Power: (Voltage/Phase)	Main disconnect for 240/3/60 incoming power

END OF SECTION 11100

SECTION 11200**STAINLESS STEEL SLUICE GATES & SLIDE GATES****PART 1 - GENERAL**

The sluice gates and slide gates shall be provided as specified and as shown in the Contract Documents.

The gates shall be in compliance with the latest version of AWWA C561 as modified herein.

1.01 DEFINITIONS

- A. A stainless steel sluice gate is defined herein as a heavy-duty gate with a four-sided seal system that is used to close off an orifice that experiences a maximum water level that can exceed the top of the orifice.
- B. A stainless steel slide gate is defined herein as a gate that has a three-sided seal system. The seals are positioned along the sides and across the invert of the opening.
- C. A stainless steel weir gate is a downward-opening slide gate.

1.02 PERFORMANCE REQUIREMENTS

- A. Leakage for sluice gates and slide gates shall be restricted to 0.025 gpm/ft or less of the seal perimeter at the design seating head and the design unseating head.

1.03 SUBMITTALS

- A. Submittals shall include, at a minimum, detailed custom drawings of the gate assembly with dimensional and mounting information and a listing of the materials of construction. General arrangement drawings and cut sheets are not considered acceptable drawings.
- B. Calculations shall be provided to confirm compliance with the safety factors listed in AWWA C561 for all parts of the frame, anchorage and slide including the portion of the slide that engage the frame.
- C. A copy of the test results from the minimum 30,000 cycle test confirming the durability of the seal system.
- D. A copy of the ISO 9001:2008 certification.

1.04 QUALITY ASSURANCE

- A. The basis for the design of the sluice gates and slide gates is the Model RW1000-S as manufactured by RW Gate Company, Troy, NY.
- B. All gates shall be shop inspected for proper operation prior to shipment.
- C. Welds shall be performed by welders with ASME Section IX certification.
- D. The gate manufacturer shall be ISO 9001:2008 certified.

PART 2 - PRODUCTS

2.01 MATERIALS OF CONSTRUCTION

- A. All stainless steel referenced in this specification shall be Type 316, ASTM A240 or ASTM A276 unless otherwise indicated herein.
 - 1. All welded stainless steel components shall be constructed of Type 316L stainless steel.
 - 2. All structural stainless steel used in the construction of slides and frames shall have a minimum material thickness of 1/4-inch.
 - 3. All non-welded stainless steel components, excluding anchor bolts and assembly bolts, shall be Type 316 or Type 316 stainless steel.
 - 4. Anchor bolts and assembly bolts shall be Type 316 stainless steel.

2.02 SLIDE

- A. The slide shall consist of a stainless steel plate that is reinforced with stiffeners to withstand the specified head conditions. The slide shall engage the frame a minimum of 1-inch on each side.
 - 1. The slide shall be reinforced with plates or channel shaped members to restrict deflection to 1/16-inch or less at the design head.
 - 2. The stiffeners shall be welded to the slide plate in the horizontal and vertical positions.
 - 3. The portion of the slide that engages the frame shall have a minimum thickness of 1/2-inch.
 - 4. On rising stem gates, a stem connector shall be welded to the slide as a means of connecting the operating stem. The bottom portion of the stem shall be affixed to the stem connector with a minimum of two attachment bolts.
 - 5. On non-rising stem gates, the slide shall be arranged to allow travel of the stem along the length of the slide, and an internally threaded bronze thrust nut shall be provided on the slide.

2.03 FRAME

- A. The frame shall be constructed of stainless steel plate, with the guide section formed into a C channel shape or similar to house the seal, and shall be reinforced to withstand the specified operating conditions.
 - 1. The guides shall be of a one-piece design with gussets that extend along the outside and top to accommodate unseating head. The guide members shall incorporate a tubular cross section along the guides for additional rigidity. Two-piece, sandwich type guides that are bolted together are not acceptable.
 - 2. The mounting configuration of the frame shall be as shown on the Contract Drawings.
 - 3. Wall mounted frames shall be of the flanged frame type. Flat frames shall only be provided on gates with frames that will be embedded in the concrete wall or mounted inside existing channels.

4. The guide portion of flanged frame gates shall have a minimum weight of 13 lbs/ft. The portion of the flanged frame, where the anchors penetrate, shall have a minimum thickness of 1/2-inch.
5. The guide extension portion of the frame shall have a minimum weight of 6 lbs/ft. Angles are not considered acceptable guide extensions.
6. Lifting lugs shall be provided on all frame styles.
7. On self-contained gates, the side frame shall extend above the operating floor and the operating mechanism shall be mounted to the yoke. When shown, the frame may extend to or below the operating floor and a floorstand may be mounted on the yoke.
8. Yoke members shall be C channel shaped structural members. Angles are not considered acceptable yoke members.

2.04 SEALS

- A. The seal system shall consist of self-adjusting UHMWPE seals with a nitrile or EPDM compression cord.
 1. The UHMWPE seals shall be arranged to ensure that there is no metal-to-metal contact between the slide and frame.
 2. The compression cord shall be contained by the UHMWPE seal so that it shall not be in contact with the slide.
 3. Seal system shall be self-adjusting for the life of the gate. Adjustable wedging devices such as wedges, wedge bars and pressure pads are not acceptable.
 4. On upward-opening gates, rubber side seals and/or top seals such as J-bulb seals or similar rubber seals are not acceptable in lieu of UHMWPE seals.
 5. On downward opening gates, rubber side seals and/or invert seals such as J-bulb seals or similar rubber seals are not acceptable in lieu of UHMWPE seals.
 6. The invert seal on upward opening gates shall use a compressible EPDM seal located in the invert of the frame.
 - a. The invert seal shall be of a flush bottom arrangement.
 - b. The invert seal shall be mechanically fastened with stainless steel bolts.
 - c. Invert seals attached solely by the use of adhesives are not acceptable.
 7. All seats and seals shall be secured with assembly bolts. All seals shall be field removable and field replaceable without the need to remove the gate frame from the wall. Gates that require disassembly of any portion of the frame, to replace seals, are unacceptable.
 8. The seal system shall have been shop tested with a minimum 30,000 cycle operating test in an abrasive environment to confirm the ability of the seals to withstand the abrasive condition with negligible deterioration and to confirm that the leakage restriction requirement is still possible.

- a. The shop test shall have been performed on a stainless steel sluice gate and the test results shall have been certified by the manufacturer in writing.
- b. A copy of the test shall be provided to the Engineer.

2.05 OPERATING STEM

- A. The operating stem shall be of stainless steel and shall be designed to transmit in compression at least 2 times the rated output of the manual operating mechanism with an 80 lbs effort.
- B. The stem shall have a slenderness ratio (L/r) less than 200.
- C. The threaded portion of the stem shall have a minimum diameter of 1-1/2 inches.
 - a. The threads shall have machine rolled, full depth ACME threads.
 - b. Stub threads are not acceptable.
- D. Stems provided in multiple pieces shall be provided with couplings.
 - a. Couplings shall be bronze or stainless steel and shall be internally threaded and keyed or bored and bolted.
- E. Stem guides shall be constructed of stainless steel with UHMWPE bushings.
- F. Gates with rising stems shall be provided with a clear plastic stem cover.
 - a. The stem cover shall be butyrate and shall have a cap and condensation vents.
 - b. Clear mylar indicating tape shall be provided for field application after the gate has been installed and positioned.
- G. Stop collars shall be provided to limit the downward travel on gates with manual gearboxes.
 - a. Stop collars shall be bronze and shall be internally threaded and provided with a stainless steel set screw.

2.06 OPERATING MECHANISM

- A. Operating mechanisms shall be provided by the gate manufacturer.
- B. Manual operators shall be yoke mounted on self-contained gates or floorstand mounted when shown in the Contract Documents.
 - a. Manual operators shall be of the bevel gear type suitable for operation with a portable operator.
 - b. Gear ratios shall be selected by the gate manufacturer to ensure that the maximum operating effort is 40 lbs at the design head.
 - c. Minimum gear ratio shall be 2:1.
 - d. Gearboxes shall have ductile iron housings, a bronze lift nut, steel gears and a stainless steel input shaft.

- e. Ball or roller bearings shall support the lift nut and input shaft.
- f. The housing shall be grease lubricated and permanently sealed.
- g. Handwheels shall be provided for gearboxes and a T-handle wrench shall be provided for 2" square operating nuts.
- h. Adaptor plates shall be utilized to attach the operating mechanism to the yoke. Adaptor plates shall be stainless steel and shall have a minimum thickness of 3/4-inch.

2.07 FLOORSTANDS AND WALL BRACKETS

- A. Floorstands shall be mounted to the concrete, mounted to a wall bracket or mounted on the yoke of a self-contained gate as shown on the Contract Drawings.
- B. All floorstands and wall brackets shall be fabricated from stainless steel.
 - a. The base plate, adaptor plate and gussets shall be minimum 1/2-inch thick.
 - b. The pedestal tube shall have a minimum diameter of 4 inches.

2.08 ANCHORAGE

- A. Anchor bolts shall be 316 stainless steel, fully threaded and shall have a minimum diameter of 1/2-inch.
 - a. Anchor bolts shall be of the epoxy type.

2.09 FINISH

- A. All heat tint and slag from the welding process shall be acid passivated or mechanically passivated through bead blasting in accordance with ASTM A380. Grinding or buffing is not acceptable in lieu of passivation. If bead blasting is used, the entire slide and entire frame shall be bead blasted.
- B. All ferrous components shall be suitably prepared and then shop coated with primer. Finish coating shall be applied by the Contractor. The ductile iron operator housing shall be finish coated by the Contractor with a suitable paint that complies with the Painting section.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be performed in accordance with the gate manufacturer's installation instructions and the approved installation drawings.
- B. Installation instructions and installation drawings shall be found in the O&M manual.
- C. Non-shrink grout shall be applied, by the Contractor, between the gate frame and the wall to ensure that there is no leakage around the gate.

3.02 FIELD SERVICE

- A. A factory certified service technician shall be provided to instruct the Contractor prior to the installation of the first gate. The service technician shall be available for one (1) 8-hour work day at the project site to supervise installation, prior to grouting the gates.

END OF SECTION 11200

NOT FOR BIDDING PURPOSES
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SECTION 13420

INSTRUMENTATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Submersible Pressure Transducer
- B. Installation and startup of instrumentation furnished under this section.

1.02 RELATED SECTIONS

- A. Refer to Division 11 for equipment furnished by other sections but requiring wiring diagrams developed under this section to reflect complete integration of the systems, instrumentation, interlocking, interfacing and installation under this section.
- B. Refer to Division 16, Electrical for wiring standards and practices.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications - Firms regularly engaged in the manufacture of instrumentation systems (the "System Supplier"), whose products have functioned satisfactorily in similar service, and has demonstrated proficiency and extensive experience with current technology.
- B. Installer's Qualifications - Firms regularly engaged in the installation, calibration and adjustment of instrumentation systems, with a minimum of five years of experience, whose systems have functioned satisfactorily in similar service and have demonstrated proficiency and extensive experience with current technology.

1.04 SUBMITTALS

- A. Provide complete equipment specifications, details of connections, wiring, range and dimensions. Submittals consisting of only general sales literature will not be acceptable. Shop drawings shall be bound in separate three ring binders with an index and section, sub-section, etc., dividers. The dividers shall be arranged so its individual tabs can locate each item being referenced.
- B. Submit detailed information for each instrument or control device, including manufacturer's descriptive literature and a specific data sheet for each device which shall include as a minimum:
 - 1. Product (item) name used herein.
 - 2. Manufacturers complete model number.

3. Location of the device
 4. Input - output characteristics
 5. Range, size and graduations.
 6. Physical size with dimensions, enclosure NEMA classification and mounting details.
 7. Materials of construction of all components.
- C. Exceptions to the Specifications or Drawings shall be clearly defined by the system supplier. Data shall contain sufficient details so the Engineer may make a proper evaluation.

1.05 PRODUCT HANDLING

A. Identification

1. Each component shall be tagged per the users standard numbering system or as defined herein and in the contract drawings. To identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.
2. A permanent stainless steel tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this section. In the case where any supplied instrument is too small or of such a material as to make a stainless steel tag impossible to attach, a method of indelible marking, demonstrating the intent of this paragraph shall be submitted to the Engineer for approval.

B. Storage

1. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, the System Supplier at his own cost and expense shall repair such damage. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the System Supplier, or the System Supplier at his own expense shall replace the apparatus.

1.06 INSTRUMENTATION GENERAL

A. Type

1. Instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals that are established standards for the water and wastewater industries.
2. Electronic instrumentation shall be of the solid-state type. Analog control signals shall be linear and be industry standard currents of 4 to 20 mA DC (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 1-5 VDC (Volts direct current), or the like. No zero based signals shall be allowed.
3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission.

4. Instruments shall be provided with stainless steel mounting hardware and/or galvanized steel floor stands, wall brackets, or instruments racks as appropriate for each location.
5. Equipment installed in a hazardous area shall meet Class, Group, and Division as shown on the Contract Electrical Drawings, to comply with the National Electrical Code.
6. Indicators and recorder readouts shall be linear in the process units.
7. Transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to \pm percent.
8. Electronic equipment shall be of the manufacturer's latest design. Circuit boards and associated components shall have suitable conformal coating to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose to assure optimum long-term performance and dependability over normally anticipated atmospheric conditions of temperature, pressure and humidity. The field-mounted equipment and system components shall be designed for installation industry, humid, and slightly corrosive service conditions.
9. Equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

1.07 ELECTRICAL

- A. Equipment shall be designed to operate on a 60 Hertz alternating current power source at a nominal 110 volts, plus or minus 10 percent except where specifically noted. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.
- B. Analog transmitter and controller outputs shall be 4-20 milliamps into a minimum load range of 0-750 ohms, unless specifically noted otherwise.
- C. Switches shall have double-pole, double throw contacts rated at a minimum of 600 VA unless specifically noted otherwise.
- D. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.
- E. Equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation upon manual resetting when power is restored.

PART 2 - PRODUCTS

2.01 SUBMERSIBLE PRESSURE LEVEL TRANSDUCER

- A. The level transducer shall be of the submersible pressure type that will be used to measure the level of fluid in the wet well.
- B. Wetted materials: 316 stainless steel
- C. Accuracy: +/- 0.25%
- D. Temperature range: 0 to 176 degrees F
- E. Power requirement: 10 to 28 VDC
- F. Output signal: 4 to 20 mA DC, two wire
- G. Shielded & vented cable, 40' length
- H. Response time: 50 msec
- I. Loop resistance: 900 ohms
- J. Agency approvals: CE and UL listed
- K. Manufacturers:
 - 1. Mercoid: - PBLTX
 - 2. or approval equal
- L. Provide a spare submersible pressure transducer
- M. Transducer shall be installed in existing wells accessible from the floor above. Each transducer shall be fitted with a stainless steel lifting chain.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The location of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of process control work and in case of any interference with other work, proceed as requested by the Engineer. Furnish all labor and materials necessary to complete the work in an approved manner.
- B. The System Supplier shall make all necessary mechanical changes to install new instrumentation equipment provided under this Contract. This work includes all fittings, fabrications, supports, guides, restraints, bolting, gaskets, and accessories. All work shall be done in a workmanlike manner.
- C. The instrumentation drawings indicate the intent of the interconnections between the individual instruments. Any exceptions should be noted.

- D. Work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances, and regulations, the System supplier shall bear full responsibility for such violations and assume all costs arising there from.
- E. Equipment used in areas designated as hazardous shall be designed for the Class, Group and Division as required on the Electrical Drawings for the locations. All installations shall be in strict accordance with codes.
- F. Instrument cabinets located outdoors or in unheated locations shall be provided with heating and/or cooling devices as necessary to maintain all instruments and/or electronics installed in those cabinets within their design temperature limits.
- G. Brackets and hangers required for equipment mounting shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.
- H. The system Supplier shall investigate, and make any field modifications to the allocated space for each cabinet, enclosure, and panel to ensure proper space and access (front, rear, side).
- I. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded as directed by the manufacturer of the instrumentation equipment, but in no case shall more than one ground point be employed for each shield.
- J. Lifting rings from cabinets/assemblies shall be removed. Hole plugs shall be provided for the holes of the same color as the cabinet.
- K. The System Supplier shall coordinate the installation, the placing and location of the system components, their connections to the process equipment panels, cabinets and devices. He shall be responsible to ensure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to ensure a satisfactory functioning installation.

3.02 SYSTEM TESTS AND ACCEPTANCE

- A. After the equipment has been delivered and installed at the site, a field acceptance test shall be performed to verify the integrity of the system. The Engineer shall witness the test. Satisfactory completion of the test, as approved in writing by the Engineer, shall constitute conditional approval of the system. The system must operate without failure for a period of 100 hours before this test will be considered successful, and the system fully accepted.
- B. Before this test is started, the System supplier shall satisfy himself that the system is operating correctly with live plant data.
- C. Any malfunctions during the test shall be analyzed and corrections made by the System Supplier. The Owner's Project representative will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

3.03 FIELD TESTS

- A. The system supplier shall furnish the services of the Manufacturer's servicemen, all special tools, calibration equipment and labor to perform the tests. Certified copies of the tests shall be furnished in duplicate to the Engineer.
- B. Following connection, checkout, and final adjustment of all panels, instruments, meters, monitoring and control devices, a performance check shall be made on each. Analog inputs shall be tested to 0 percent, 25 percent, 50 percent, 75 percent and 100 percent of scale, as required. All status and alarm switches as well as all monitoring and control functions shall also be checked. Each device on the electrical schematic\Logic diagrams must be signed-off by the Engineer as being acceptable.
- C. If, during running of the tests, one or more points appear to be out by more than the specified amount, the Manufacturer's servicemen shall make such adjustments or alterations as are necessary to bring equipment up to specification performance. Following such adjustments, the tests shall be repeated for all specified points to ensure compliance.

3.04 INSTRUCTION - STAFF TRAINING

- A. All plant personnel will need training on the instrument systems. The system supplier shall be responsible for providing detailed Operation and Maintenance (O&M) Manuals. The O&M Manuals shall include specific details of equipment supplied and details of operations specified to this project. The training will be conducted at the facilities.
- B. The O&M Manuals shall include descriptions of all equipment, the nature and intended modes of operation, testing procedures for all units in the System, and safety measures to be taken in operation. All necessary procedures and methods for effective operation of the System shall be included.
- C. O&M Manuals shall include record drawings and instructions necessary for the planned maintenance of all equipment in the system. The O&M Manuals will incorporate maintenance procedures and schedules, and they will coordinate and be cross-referenced to detailed operating procedures provided by the manufacturers. There shall be 6 printed copies and 1 electronic copy of the O&M Manuals submitted.
- D. The system training shall be structured such that the operating personnel will understand the system's operation, and the functions available in the system. The amount of training will be a minimum of 1 day, scheduled as convenient for the Owner. Preventive and corrective maintenance of hardware shall be presented.

3.05 MAINTENANCE CONTRACT

- A. Maintenance Controls: After the final acceptance of the instrument system, the vendor shall furnish to the Owner a one-year contract for complete maintenance service of the instrument system. The services under the maintenance contract will take place at the plant site. The

contract will include preventive maintenance and calibration, emergency service repairs, replacements of defective or worn parts or device and accessories and expendable items, and verification of correct software operation. The service shall be performed by the manufacturer and shall provide for a minimum of one inspection during the contract year. The service technicians shall be equipped with all tools and test equipment necessary for calibration.

- B. Preventive or corrective maintenance shall include a systematic and periodic examination of each device supplied under this section. This equipment shall be calibrated, cleaned, lubricated, adjusted or aligned to insure property operation. This preventive maintenance shall be rendered generally such that each component will be tested at least four times annually. The calibration shall include the simulation of the process variable system where applicable.
- C. Emergency Service: Emergency service shall be provided during normal working hours (8:00 a.m. to 5:00 p.m. Monday through Friday) to correct any hardware defect or failure and to apply the appropriate corrective action to restore the defective device to the manufacturer's original specifications or tolerances. A qualified instrument technician directly employed by the manufacturer within 24 hours after notification shall provide this service.
- D. Parts: As part of this maintenance service, all parts shall be provided by the manufacturer at no additional costs. Transfer of ownership shall take place when a part is installed in the Owner's instrumentation or other equipment covered by the Contract.

PART 4 - SYSTEM DETAILS

3.01 SYSTEM DETAILS

- A. Unless specifically stated otherwise, the system supplier shall be responsible for providing all instrumentation, control equipment and auxiliary devices necessary to perform the functions specified herein and as shown and described on the contract drawings.
- B. Any auxiliary devices such as lighting/surge protectors, relays, timers, signal isolators, signal boosters, etc., which are necessary for complete operation of the system, or to perform the function specified, shall be included, whether or not they are specifically shown or tabulated on the diagram.

END OF SECTION 13420

SECTION 16005**SUMMARY OF THE ELECTRICAL WORK****PART 1 - GENERAL****1.01 GENERAL INFORMATION & DESCRIPTION OF PROJECT**

- A. The electrical work for this project includes demolition and improvements of the existing power, control, instrumentation for new traveling screen and siphon systems serving the existing equipment at James Street Siphon Chamber Facility. Refer to Section 16010 for detailed demolition instruction.
- B. Additionally, electrical work includes providing all electrical materials and equipment necessary for the installation of new electric service, underground service lateral, main circuit breaker, distribution panels, emergency generator and automatic transfer switch.
- C. Additionally, electrical work includes providing all electrical materials for interconnection of electrically operated bar screen systems and associated automated controls with pressure level transducers and float switches, complete lighting and receptacle outlet improvements, and new owner supplied SCADA radio system components, connection to new owner installed radio antenna, and miscellaneous control devices associated with the station equipment.

1.02 REFERENCE

- A. The following Sections shall be considered an integral part of this Section:

Division 1	-	General Requirements
Division 16	-	All Sections Inclusive

1.03 WORK INCLUDED

- A. This Section describes the labor and materials required to accomplish the major elements of Work at the James Street Facility, including the electrical demolition, installation of control equipment and electrical systems described herein and as indicated on the Contract Drawings.
- B. Prior to the start of Work, the Contractor shall verify acceptability of the construction schedule with the Owner, intention being to avoid any unnecessary disruptions of pumping operations.
- C. The work shall include, but not be limited to. Provide the following:
- Maintaining continuous operations to the facility throughout the project, including temporary services throughout course of work.

- Demolition of electrical service equipment, motor controls, non-functioning controls, and certain electrical equipment noted on electrical plan.
- Furnish new electric underground service lateral up to and including Utility Co. service drop, distribution equipment, Utility co. metering. New service distribution equipment improvements including incoming main circuit breaker and metering provisions.
- Complete improvements to Screen Room Hazardous location wiring, conduits, wiring, lighting, receptacles, switching, heating equipment, MU air systems, gas and fire detection systems.
- Complete replacement of wiring, conduits, wiring, lighting, receptacles, switching, heating equipment, exhaust systems, gas and fire detection systems, for the storage, boys - girls lavatory rooms.
- Replacement and complete improvements to exterior lighting systems. Furnish new conduits, wiring, switching, lighting fixtures and lamps.
- Remove existing LED Lighting Fixtures, raceways and wiring in Traveling Screen Room. Clean and inspect units and prepare for reuse in new utility and lavatory rooms. Deliver remainder of fixtures to owner for future use.
- Furnish and install new Gas Detection systems in Traveling Screen Room and New Utility Room. Interconnect each zone into plant SCADA system. Refer to plans and notes for detailed construction instruction.
- Diesel Engine generator set, 20kW standby rated, pad mounted installation, diesel fuel skid mounted tank, digital status panel, remote automatic transfer switch, and other auxiliaries to facilitate a complete coordinated assembly. All necessary transportation, rigging and manpower for assembly and erection of the generator set to the designated location.
- Unit protection, instrumentation, interlock control and alarm wiring inter-connecting generator, automatic transfer switch and local status panel. Generator auxiliary power and control services, engine block heater, generator space heater, engine battery charger, maintenance and receptacle outlets.
- Interlock control and instrument wiring for traveling screen systems, instrumentation, interlock effluent level and alarm wiring interconnecting new screen control cabinets.
- Installation of new SCADA/radio system components supplied by owner. Provide control and instrument wiring for these systems. Reconnection of radio antenna cable to new antenna installed by owner.
- Ground grid installation for new electric service, related metallic structures and auxiliaries. Raceways, equipment and circuit bonding, with the connection of new ground grid into facility components.
- All Conduit, wiring, fittings, boxes and pull boxes, mounting hardware, fittings, including accessories to support these installations.

- Transport and dispose of all electrical demolition equipment. Deliver existing duplex pump control panels to location designated by owner.. Cleanup and disposal of unused materials and construction debris.

1.04 EQUIPMENT AND SERVICES BY OTHERS

A. GENERAL

- a) The electrical contractor shall provide new terminal enclosures for owners specialty systems. WPCA-SCADA system PLC's, communication hardware, instruments, control functions by owner.
- b) "SCADA" PLC and final terminations
- c) Facility Communication System for monitoring process operations and SCADA,
- d) Intrusion alarm Hardware and final terminations
- e) Above system raceways, conduit, wiring and cabling will be installed by the contractor. The Contractor shall assist the OWNER'S Instrumentation & Control Integrator with internal connections, adjustments, programming, and final terminal interconnects.

1.05 CODES

- A. All work shall conform to the current edition of the State Basic Building Code, National Electric Code and NFPA standards. The provisions of the National Electric Code constitute a minimum standard. Utility, Design and Standards often require larger wire sizes, additional branch circuits and higher grades of equipment than the minimum that may be specified in the code. Where such provisions are called for in these specifications, they shall take precedence over code requirements.

1.06 SCHEDULING WORK

- A. All work shall be performed following a schedule previously approved by the Engineer and the Owner. Reference Section 108 of the GNHWPCA's Standard Specifications.
- B. All schedules shall be prepared using MS Project, or acceptable scheduling software.
- C. Attention is directed to the fact that the James Street Siphon Station (function) will remain in operation during the entire period of construction. The integrity and reliability of the distribution system, alarm and life safety utilities must be maintained at all times during construction. The Contractor will perform all work in a manner, schedule, and sequence such that normal building activities will be maintained in operation without interruption to the safety, use, and function of the facilities.
- D. The Contractor shall request service outages and switching with the OWNER a minimum of 48 hours prior to the required outage. The OWNER will coordinate all requests.
- E. **Note well** that the 48-hour notification may not necessarily assure a power outage. All requests for outages will be subject to the approval of the Owner administration and coordinated with activities surrounding the use and function of facilities at the time of request.
- F. The successful bidder shall provide continuous supervision and adequate manpower to assure successful completion of work within the prescribed time limits. Normal working

hours for this project will be at the Contractors discretion however, limited by the operations, availability to facilities and City of New Haven permit requirements.

- G. At the discretion of the Owner's management, the Contractor will be permitted to work holidays, Saturdays, and Sundays or beyond normal hours meeting the City of New Haven permit requirements. If, in the opinion of the OWNER, the progress of work has not maintained a timely schedule, the Contractor will expand his workforce, and work overtime hours in order to satisfy the requirements of the Project Schedule.
- H. The Contractor shall furnish necessary manpower to startup and assist in testing the new service source. Any corrective work resulting from errors discovered during startup will be performed at no additional cost to this contract.
- I. Location of equipment shown on plans shall be considered diagrammatic and approximate. All pertinent drawings shall be studied prior to installation of equipment. The Contractor shall consult with Engineer and verify all mounting heights, spacing, and exact locations for equipment. It shall be understood that prior to installation, any device or unit equipment, may be relocated a distance of TEN FEET from the location shown on the drawings. If relocation is required or directed by the Engineer, the change shall be performed at no additional cost to the contract.
- J. The Contractor shall remove and/or relocate existing obstructions, electrical services, etc., interfering with the project modifications. Where interfering services are presently serving vital equipment operations, the Contractor shall reroute, rewire, or re-connect such services and related components into their systems as directed by the OWNER.
- K. During the progress of his work the Contractor shall notify the Engineer of any latent or unknown conditions encountered that differ materially from information shown on the Plans or implied in these specifications.

The Engineer will promptly investigate such conditions, consult with OWNER and instruct the Contractor as to any field changes that may be required. Any increase or decrease in costs will be adjusted in the manner set forth in the GENERAL CONDITIONS of this document.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials shall be free from defects, which would adversely affect the performance or maintainability of individual components or the overall assembly.
- B. Material not specified herein shall be of the same quality used for the intended purpose in specification grade installations.
- C. Unless otherwise specified herein, all equipment, material, and articles incorporated in the Work covered by this Section shall be factory new and without blemish or defect. Salvage or rebuilt equipment or materials will not be acceptable.
- D. All electrical devices including safety switches, panelboards and control devices shall be identified by nameplates. Nameplates shall be white laminate (micarta or similar) with

black engraved capital letters. A nameplate schedule shall be submitted for approval of all items. Tape nameplates are not acceptable.

2.02 SUBMITTALS

- A. Specific Instructions in each Section of Division 16 of this specification.
- B. Manufacturer's Descriptive Literature.
 - 1. Prior to procuring equipment or materials, and before executing any work, the Contractor shall submit to the Engineer four (4) copies of all manufacturer information to thoroughly describe the equipment and materials he proposes to furnish for accomplishment of the Work.
 - 2. Submittals for each manufacturer item shall include, but not be limited to Manufacturer's descriptive literature, equipment shop drawings, wiring diagrams and installation instruction.
- C. Upon completion of the Work, the Contractor shall provide four (4) sets of equipment shop drawings, performance data, and maintenance and operation instructions for the James Street Siphon Station.

2.03 WARRANTY AND GUARANTEES

- A. The Contractor, at the convenience of the Owner, shall remove, replace and/or repair, at his own cost and expense, any defects in workmanship, materials, ratings, capacities or characteristics occurring in or to the Work covered by the Contract within one (1) year, excepting equipment requirements in other sections. The period of such guarantee to commence with the Engineer's final acceptance of all Work covered under the Contract. The Manufacturer/Contractor, upon demand, shall pay for all damage to all other work resulting from such defects and all expenses necessary to remove, replace and/or repair such other work which may be damaged in removing, replacing or repairing the said defects.
- B. Unless such removal, replacement and/or repair shall be performed by the Contractor within ten (10) working days after it receives written notice from the Owner specifying such defect, or if such defect is of such a nature that it cannot be completely removed, repaired and/or replaced within said ten (10) day period and the Contractor shall not have diligently commenced removing, repairing and/or replacing such defect within said ten (10) day period and shall not, thereafter, with reasonable diligence and in good faith, proceed to do such work, the Owner may employ such other person, firm or corporation as it may choose to perform such removal, replacement and/or repair and the Contractor agrees, upon demand, to pay to the Owner all amounts which it expends for such work.

2.04 PROJECT RECORD DOCUMENTS

- A. The Contractor shall maintain an up-to-date set of Contract documents and note any and all revisions and deviations that are made during the course of the project for the James Street Station.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall provide all supervision, labor, tools, and materials, to install all systems as indicated on the Contract Drawings and as specified herein.
1. Contractor shall field verify site conditions and lay out tasks prior to start of work.
 2. Contractor shall initiate appropriate efforts to establish a „lock-out, tag-out“ zone surrounding the equipment affected by demolition and new construction.
 3. If pumping operations are deemed essential, a pre-construction temporary service with panelboard and over-current protection shall be provided. Work shall not start until all components are operational and on site.
 4. Install appropriate tags on the cable ends to maintain tractability and identity when dismantling existing equipment. This procedure will be maintained by the removal of system components. Restoration to the original condition of work area must be done prior to start of installation phase.
 5. Tagged cable systems will be removed to the most advantageous point such that removal operation is not hampered by „dangling“ cables or cables presenting a tripping hazard.
 6. Demolition and disposal of all materials not requested to be salvaged by the Owner.
 7. Rigging into place and setting of new equipment.
 8. System startup and testing, including phasing and motor rotation, with necessary adjustments at completion of installation.
 9. Clean, paint, and name tag all conduits and equipment, where specified.

3.02 QUALITY ASSURANCE

- A. The Work shall be performed only by experienced workmen related to the trade and task being accomplished, utilizing only the best quality materials and proper tools and procedures.

3.03 FIELD QUALITY CONTROL

A. GENERAL

1. Engage the services of the OEM generator service representative for initial start-up, testing, and calibration, and perform all adjustments to assure for smooth operations.

2. The Contractor shall provide sufficient manpower to assist the manufacturer representation in start-up, and testing of equipment. Contractor shall not be relieved of this task until operations are approved to the satisfaction of the Engineer.
3. The Contractor shall give a minimum of 48 hours notice to the Engineer and the OWNER prior to the start of any tests or inspections.
4. The Contractor shall furnish all personnel to assist during testing. The OWNER will not assume responsibility until the Work has been fully accepted by the Engineer.

END OF SECTION 16005

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SECTION 16110**ELECTRICAL DEMOLITION and REMOVALS****PART 1 - GENERAL****1.01 WORK INCLUDED**

- A. This Section covers the requirements for the demolition and removal of equipment, devices and materials to facilitate the installation of improvements at the James St. Siphon Station.
- B. The Contractor shall be advised that the Demolition Drawings and Specifications serve only to identify the Project Scope and area of Work. The drawings are not sufficiently detailed to reference every element to secure a material take off accounting for the total Scope of Work. Pre-Bid Field inspections are necessary to accomplish a full understanding of project scope.
- C. Coordinate and assist Utility Co. with existing and service lateral dismantling and removals.
- D. Equipment to be demolished and removed is, in general, indicated on the Contract Drawings. The demolition shall be performed in a sequential and phased manner in accordance with a schedule to insure continuous operations of the facility. Work included, but not be limited to, providing the following:
1. Coordinate all demolition and specific equipment removals and with WPCA management prior to the execution of work.
 2. Removal and dismantling of the existing boiler room 400A service, service lateral, incoming cabinet equipment, metering, distribution panels, raceways and wiring. Existing 12"X12" wireway and conduits below panelboards shall remain.
 3. Existing Steam Boiler, condensate pumps, Boiler & Heating controls, and room ventilating equipment to remain intact. New power services will be served from Panel Boiler Room Panel "BRP", see new work.
 4. Remove Screen Room process equipment, raceways, conduit and wiring within this area. Refer to replacement systems as detailed in new work electrical plan. Note well that the screen room is a Hazardous Location, Division I, Class I. Electrical installation shall reflect procedures and guidelines detailed in NEC Article 500.
 5. Removal, relocation and reserving power circuits associated with traveling screen equipment, heating ventilating equipment, siphon system instrumentation, and fire alarm systems. Boiler Room gas detection system to remains.
 6. Remove existing LED Lighting Fixtures, raceways and wiring in Traveling Screen Room. Clean and inspect units and correct hardware or wiring deficiencies. Prepare

units for reuse in new utility and lavatory rooms. Deliver remainder of fixture to owner for future use.

7. Existing storage room, boys-girls lavatory rooms, and the area designated as NEW utility and toilet rooms shall be electrically stripped of services. Remove all wiring, raceways, circuitry, within area as noted. Prepare this area for improvements.
8. Remove all exterior lighting and provide new lighting fixtures and related equipment. Remove and prepare for revised circuitry as detailed in new work electrical plan.
9. Provide all supervision to prepare for new system equipment improvements and work detailed on the drawings.
10. Contractor is responsible for removal and disposal of all demolition equipment and materials not noted as salvage from the site.
11. Existing equipment removed during demolition phase shall be delivered to Owner.
12. The Owner will be responsible for testing and disposal of hazardous materials.

1.02 RELATED SECTIONS

- A. Division 1 of this Specification.
- B. Division 16 of this Specification.

1.03 SPECIAL CONDITIONS

- A. There may be elements of the system where ACM is suspected to exist. These areas may be in the form of electrical cable insulation. Asbestos Abatement shall be the responsibility of the Owner. **The Contractor shall notify the Agency Representative, Facility Representative, and the Construction Coordinator ten (10) days in advance of the time it and when asbestos removal is required.**

1.04 REFERENCES

- A. Where applicable all work performed under this section shall be in accordance with the latest edition and latest addenda thereto of the applicable codes, standards and regulations of authority having jurisdiction.
- B. Where reference is made to codes or standards, or to technical or trade specifications (such as ASTM or ANSI) or to the Engineer's standards, the latest edition and latest addenda shall be used.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. System materials and equipment for removals are as specified here in or other Sections of this Specification.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Demolition work for this facility is based on casual field observation without the aid of extensive testing equipment and manpower. Report discrepancies to Engineer before disturbing and/or removing utilities.

The successful Contractor shall verify facility components, structural elements and construction details indicated on drawings. Notify the Engineer of any latent or unknown conditions encountered during the progress of his work that differ materially from the information shown on the Plans or as implied in the Specification. The Engineer will promptly investigate and instruct the Contractor as to any field changes that may be required.

3.02 PREPARATION

- A. Coordinate relocation of new service with Utility Co. in a manner that will minimize any unscheduled interruption of power.
- B. Remove existing 400A service, manual transfer switch, generator power receptacle, traveling screen and control equipment, in a sequence that will allow continued operation of the station siphon process.
- C. Remove existing SCADA control and instrumentation, antenna and radio transmitter, and deliver to owner for their disposal.
- D. Contractor shall remove and/or relocate all existing obstructions, electrical services, etc., interfering with new construction. Where services are servicing system components vital to the pumping operations, the contractor shall reroute, rewire, and connect services and components into their respective systems as directed by the Engineer.
- E. Provide temporary power and control - instrumentation services where applicable.
- F. Install tags on wire-cable ends to maintain identity and tractability when dismantling equipment. This procedure shall be maintained throughout removal of systems. Restoration to original work condition must be done prior to start of installation phase.
- G. Tagged cable systems will be removed to the most advantageous point such that removal operation is not hampered by „dangling“ cables or cables presenting a tripping hazard.

- H. Deliver existing power wiring & cables, equipment panels, and distribution equipment to owner for their use or disposal.

3.03 PROJECT RECORD DOCUMENTS

- A. Contractor shall maintain an up-to-date set of Contract documents and note any and all revisions and deviations that are made during the course of the project.

END OF SECTION 16110

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SECTION 16111**ELECTRICAL RACEWAYS****PART 1 - GENERAL****1.01 WORK INCLUDED**

A. Metallic conduit.

B. Related Sections:

1. Section 16005 Summary of the Electrical Work
2. Section 16123 Building Wire and Cable
3. Section 16124 Instrument & Control Wire and Cable
4. Section 16130 Junction, Splice and Pull Boxes
5. Section 16160 Cabinets and Enclosures
6. Section 16170 Grounding and Bonding

1.02 DESIGN REQUIREMENTS

- A. State of Connecticut Basic Building Code and the National Electric Code NFPA 70.
- B. The provisions of the National Electric Code constitute a minimum standard. Design often requires larger sizes of wire, more branch circuits and better grades of equipment than the minimum that is specified in governing codes. Where provisions are called for in specifications, they shall take precedence over such code requirements.
- C. National Electric Code NFPA 70 Article 500 Hazardous Locations, Class 1 Division 1 & 2.
- D. NFPA 820 Standards for Wastewater Treatment and Collection Facilities

1.03 REGULATORY REQUIREMENTS

- A. Product shall conform to ANSI/NFPA requirements.
- B. Furnish products listed and labeled by Underwriters Laboratory, Inc.
- C. National Electric Code Article 500 Hazardous Locations, Class 1 Division 1 & 2.
- D. NFPA 820 Standards for Wastewater Treatment and Collection Facilities

PART 2 - PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. All wiring shall be installed in raceways as outlined in NFPA 70.
 - 1. Screen Room Raceways shall be Galvanized Rigid Steel type $\frac{3}{4}$ " minimum.
 - 2. Interior Toilet and Utility Rooms shall be Galvanized Rigid Steel type $\frac{3}{4}$ " minimum.
 - 3. Exposed exterior & underground raceway shall be galvanized rigid steel type.
- B. Raceways shall be $\frac{3}{4}$ inch MINIMUM UL approved and labeled for specific use.
- C. Intermediate Metallic Conduit and EMT conduit may not be used within interior facility.
- D. Raceways used for instrument and control systems, installed within enclosure, shall be NEC approved for use and application.

2.02 FLEXIBLE STEEL CONDUIT

- A. Rotating motor assemblies shall be terminated with liquid tight flexible steel conduit.
- B. Liquid tight flexible $1\frac{1}{4}$ " to $\frac{1}{2}$ " minimum shall be "Sealtite" Type UA.
- C. Liquid tight flexible raceway shall not be used for extension between terminal and junction boxes, control device, instruments and electrical devices.
- D. Liquid tight flexible conduit larger than $1\frac{1}{4}$ " shall be Type EF flexible conduit installed with compatible fittings of the same Manufacturer.
- E. Flexible conduit shall be equipped with Thomas & Betts, Appleton Electric, Crouse-Hines/Cooper or Engineer Approved Equal fittings.

2.03 CONDUIT SEALS

- A. Conduit seals shall be provided as noted on the Contract Drawings.
- B. Conduit sleeves shall be schedule 40 wall PVC.
- C. Fittings for sealing assemblies shall have a hot-dipped galvanized finish.

- D. Seals shall be as manufactured by O.Z. Electric Manufacturing Company, General Signal Company, Link-Seal or approved equal.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall deliver, store, protect and handle product at Site under provisions of this Specification. Damaged product will not be allowed for use on this project.

3.02 CONDUIT INSTALLATION

- A. Conduits shall be grounded in accordance with the National Electrical Code.
- B. Exposed raceways shall be installed parallel and perpendicular to structure(s).
- C. Exposed conduits shall be supported by approved hangers, straps or racks not more than 5'-0" apart.
- D. Conduits shall be grouped together, installed and fastened on galvanized utility channel or structural steel securely anchored to structure or walls.
- E. Threaded joints shall be made watertight by applying sealant to the threads.
- F. Conduits shall be reamed and burrs removed and cleaned before installing wire within.
- G. Authorized Officials shall inspect underground conduits prior to backfill covering.

3.03 CONDUIT FITTINGS

- A. Contractor shall provide grounding type insulated metallic bushings at all entries.
- B. Intermediate fittings shall be cast type bodies with threaded hubs, gasketed screw type covers. Conduit unions where applicable shall be Erickson type couplings.
- C. Conduit entries into equipment cabinets and sheet metal enclosures, and junction boxes shall be threaded type, malleable iron body, rain-tight hub fittings with insulated throat.

3.04 PROJECT RECORD DOCUMENTS

- A. Contractor shall maintain an up-to-date set of Contract documents. Note any and all revisions and deviations that are made during the course of the project.

END OF SECTION 16111

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SECTION 16123**BUILDING WIRE and CABLE****PART 1 - GENERAL****1.01 WORK INCLUDED**

A. Building wire & cable, wiring connectors & connections

B. Related Sections:

1. Section 16005 Summary of the Electrical Work
2. Section 16111 Electrical Raceways
3. Section 16124 Instrument & Control Wire and Cable
4. Section 16130 Junction, Splice and Pull Boxes
5. Section 16160 Cabinets and Enclosures
6. Section 16170 Grounding and Bonding

1.02 DESIGN REQUIREMENTS

A. ANSI/NFPA 70 National Electric Code (NEC)

1. The provisions of the National Electric Code constitute a minimum standard. Design and Standards often require larger sizes of wire, more branch circuits and better grades of equipment than the minimum which is specified in the code. Where such provisions are called for in these Specifications, they shall take precedence over such code requirements.

1.03 REGULATORY REQUIREMENTS

A. Where applicable, all electrical products and devices shall bear the Underwriters Laboratory, Inc. (UL), label.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

A. Acceptable Manufacturers for Building Wire and Cable are General Wire & Cable, Okonite, Rockbestos, Triangle Wire & Cable, or an Engineer Approved Equal.

2.02 MATERIALS SPECIFICATION

- A. Wire sizes in these Specifications or on the Drawings are American Wire Gauge.
- B. Wiring for branch and feeder circuits shall be stranded, tinned copper conductors, 600 VAC insulation rating.
- C. Minimum Size Conductors:
 - #10AWG for power in Screen Room - refer to NEC Art 500 for conduit fill requirements
 - #12AWG minimum for all other Rooms or as noted on Drawings
- D. Insulation NFPA70, table 310-90deg.C apply to all feeders and branch circuits,
- E. Internal Motor Control and Control Panel wiring shall be switchboard type SIS, 600 VAC, #14 AWG tinned copper, 90 deg. C. ratings.
- F. Where applicable conductors entering cable trays shall be multi-conductor cable type assembly and code NEC TYPE TC, 90 deg. C rated.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall deliver, store, protect and handle wire on site under provisions of this specification. Accept wire on site and inspect for damage.

3.02 PREPARATION

- A. Refer to branch circuit arrangement shown on One Line Diagram & Contract Drawings.

3.03 INSTALLATION

- A. See additional requirements on Section 16721 for specifics relating to Fire Alarm System.
- B. Contractor shall install products in accordance with manufacturer's instructions.
- C. The installation of all wire and cables shall result in a continuous conductor without splices between final terminations. Spliced conductors will not be allowed or acceptable.
- D. Wiring shall be neatly trained and laced inside equipment, terminal and panelboards.

- D. Cable, taps and terminations shall be full ampacity of conductor and not less than branch circuit rating.
- E. Power cable and wiring extending vertically along structures will require strain relief fittings, install strain relief grips at top and end of services.

3.04 CABLE CONNECTORS

- A. Wire and cable connectors for No. 8 AWG and smaller shall be of the pressure indent type with an insulating cover by Buchanan Electric Products, Burndy, ILSCO or Engineer Approved Equal.
- B. Wire and cable connectors for No. 6 AWG and larger shall be of the bolted pressure type as manufactured by OZ Electrical Manufacturing Company, Burndy, T & B Company, or Engineer Approved Equal.

3.05 TESTING OF CABLES

- A. Cables and each wiring system shall be tested for continuity and resistance to ground with megger testing device. Contractor will furnish testing instruments.
- B. All cables shall be initially tested prior to their installation into raceways and cable trays. Cables shall be retested after installation. All cables and conductors that do not conform to the above standards will be considered damaged during installation.
- C. Test results shall yield a minimum resistance between conductors and ground not less than 100 megohms per 1000 ft. at 500VDC (max.) shall test free of grounds and short circuits.
- D. Wiring not conforming to test standards must be considered damaged during installation and replaced. Contractor will reinstall damaged cables at no additional cost to this contract.

3.06 QUALITY CONTROL

- A. Contractor shall inspect, assess, and measure tightness of bolted connections and compare torque measurements with manufacturer's recommendations.
- B. Contractor shall verify continuity of each branch circuit conductor and establish correctness with Panelboard schedule with One Line Diagram for panel details.

3.07 PROJECT RECORD DOCUMENTS

- A. Contractor shall maintain an up-to-date set of Contract documents and note all revisions and deviations that are made during the course of the project.

END OF SECTION 16123

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SECTION 16124**INSTRUMENT & CONTROL WIRE and CABLE****PART 1 - GENERAL****1.01 SECTION INCLUDES**

A. Instrument & Control Wire & Cable

B. Related Sections

1. Section 16005 Summary of the Electrical Work
2. Section 16111 Electrical Raceways
3. Section 16123 Building Wire and Cable
4. Section 16130 Junction, Splice and Pull Boxes
5. Section 16160 Cabinets and Enclosures
6. Section 16170 Grounding and Bonding

1.02 REFERENCES

A. All Work performed where applicable under this Section, shall be in accordance with the most recent edition and most recent addenda thereto of the applicable codes, standards, specifications, regulations, procedures, and tests of the following organizations to the extent referred to herein:

1. Insulation ICEA Standard S-66-524.
2. Jacket Standard S-19-81 (CSPE).
3. ANSI/IEEE 383 & 323.
4. ICEA Standard T-29-520 Flame Test.
5. UL Listed Type TC - UL 1277.

1.03 DESIGN REQUIREMENTS

A. ANSI/NFPA 70 National Electric Code (NEC).

1. The provisions of the National Electric Code constitute a minimum standard. Design and Standards often require larger sizes of wire, more branch circuits and better grades of equipment than the minimum which is specified in the code. Where such provisions are called for in these specifications, they shall take precedence over such code requirements.

1.04 DEFINITIONS

- A. Control Functions are opened or closed contact closures reflecting static equipment state.
- B. Instrument sources are dynamic signal generating either current or voltage signal.

1.05 REGULATORY REQUIREMENTS

- A. All Work performed, where applicable under this Section, shall be in accordance with the most recent edition and most recent addenda hereto of the applicable codes, standards, specifications, regulations, procedures, and tests of the following organizations to the extent referred to herein:

1. Underwriters Laboratory, Inc. (UL) UL Standard 1277
2. National Electric Code (NEC)

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers for Instrument & Control Wire and Cable are: General Wire & Cable, Roskhestos, Triangle Wire & Cable, Okonite or an Engineer Approved Equal.

2.02 MATERIALS SPECIFICATION

- A. Wire sizes in these Specifications or on the Contract Drawings are American Wire Gauge, Single or Stranded - copper conductors, with ratings:
 1. Control Services 300 VAC minimum rating.
 2. Instrument Services 300 VAC minimum rating.
- D. Control cables shall be twisted, multi assembly, stranded #14 AWG tinned copper annealed conductors, color coded silicon rubber insulation with an aluminum-backed fire barrier tape and cross linked polyolefin XLPE black outer jacket.

- E. Instrument cables shall be shielded twisted, two insulated conductors with flexible strand tin coated annealed copper drain wire, helical aluminum laminated tape shield, isolation tape and copper drain wire. Conductors shall be No. 16 AWG stranded tinned copper conductors, color coded silicon rubber insulation. Cable assembly shall either be single or multi pair, according to application. Protective outer jacket shall be cross linked polyolefin XLPE black outer jacket.
- F. Instrument cables, unless otherwise indicated in the Contract Documents, shall be two (2) pair assemblies.
- G. Control and Instrument cables shall have NEC TYPE TC ratings.
- H. Internal Screen Panel wiring shall be switchboard type SIS, 600 VAC, #14/6AWG tinned copper, 90 deg. C. ratings.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall deliver, store, protect and handle wire on site under provisions of this Specification. Accept wire on Site, and inspect for damage. Any wire which is damaged shall be rejected and replaced.

3.02 PREPARATION

- A. Contractor shall refer to branch circuit arrangement shown on Contract Drawings.
- B. Conduits must be swabbed and made thoroughly dry before pulling wire & cables.

3.03 INSTALLATION

- A. Traveling Screen equipment instrument cable will be furnished with equipment and installed by this contractor. Control wiring serving, start- stop local control, level and position indication will be provided by this contractor.
- B. Cables serving plant control functions shall be twisted multi conductor assembly,
- C. Cables serving instrument functions shall be twisted, single or multi pair shielded,
- D. The installation of all wire and cables shall be accordance with Manufacturer's instructions resulting in continuous conductors without splices between terminations. Spliced wire and cables will not be allowed or acceptable.
- E. Control Panel and equipment wiring shall be continuous without splices and shall be identified at each end with sleeve type marker. Internal panel wiring and cabling shall be terminated with not more than TWO (2) wires on a device or terminal end.

- F. Panel wiring shall be assembled in a neat and orderly fashion, with wiring neatly trained and lace wiring inside boxes, fastened perpendicular or at right angles to interiors, for all Control Equipment, Panelboards and equipment terminal compartments.
- G. Internal equipment wiring shall be terminated on terminal blocks to insure proper interface with new cabling and wiring. The terminal blocks shall be General Electric type CR-151B2, with permanent marking terminal strips.
- H. Control wiring terminations and closing connections at control devices shall be terminated using compression type insulated ring lugs, crimp style connectors. Wiring lugs shall be attached with an approved crimping tool.

3.04 TESTING OF CABLES

- A. Cables and each wiring system shall be tested for continuity and resistance to ground with megger testing device. Contractor will furnish testing instruments.
- B. Cables shall be initially tested prior to installation into raceways and cable trays.
- C. Cables shall be retested after installation.
- D. Cables and conductors that do not conform to the above standards will be considered damaged during installation and will be the responsibility of the Contractor.
- E. Test shall yield a min. resistance between conductors and ground not less than 100 megohms per 1000ft, at 500VDC (max.) test free of ground and short circuits.

3.05 QUALITY CONTROL

- A. Contractor shall inspect and measure tightness of bolted connections and compare torque measurements with manufacturer's recommendations.
- B. Contractor shall verify continuity of each branch circuit conductor and establish correctness with panelboard, switchboard and/or with One Line Diagram.
- C. Wire tests that do not conform to the above standards will be considered damaged during installation and rejected. Contractor will perform reinstallation of damaged cables at his own expense without additional cost to this contract.

3.06 PROJECT RECORD DOCUMENTS

- A. Contractor shall maintain an up-to-date set of Contract Documents and note all revisions and deviations that are made during the course of the project.

END OF SECTION 16124

SECTION 16130**JUNCTION, SPLICE AND PULL BOXES****PART 1 - GENERAL****1.01 WORK INCLUDED**

- A. Boxes general, Junction Boxes, Pull & Splice Boxes.

1.02 REFERENCES

- A. All Work performed, where applicable under this Section shall be in accordance with the most recent edition and most recent addenda thereto of the applicable codes, standards, specifications, regulations, procedures, and tests of the following organizations to the extent referred to herein:

1. ANSI/NFPA 70 National Electric Code
2. NEMA 250 Enclosures for Electrical Equipment

1.03 RELATED SECTIONS

- A. Section 16005 Summary of the Electrical Work
- B. Section 16111 Electrical Raceways
- C. Section 16123 Building Wire and Cable
- D. Section 16124 Instrument & Control Wire and Cable
- E. Section 16160 Cabinets and Enclosures
- F. Section 16170 Grounding and Bonding

1.04 SUBMITTALS

- A. Submit manufacturer's standard data for, transfer switch, specialty boxes and enclosures.
- B. Submit product data and shop drawings including dimensions of physical size, entry and closure operating details.

1.05 REQUIREMENTS

- A. Conform to ANSI/NFPA 70 - National Electric Code.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer's for Junction, Splice and Pull Boxes are: Hoffman, Hammond Manufacturing Enclosures, other substitutions fall under the provisions of Section 16000 of this Specification. Suggested Manufacturer: Hoffman TYPE ULTRX

2.02 BOXES - GENERAL

- A. Note well that the Screen Room is classified as a Hazardous Locations, Class I, Division I&II. When used in that location, lighting, receptacle outlets, switching and light fixture boxes shall be labeled and approved for Hazardous Location use.
- B. Screen Room Enclosures for flush mounted installation and complete with receptacle outlet and switch be approved for Hazardous locations.
- C. All Junction, Terminal, Splice and Pull boxes for indoor service shall be fiberglass construction, with full hinged solid door, interior mounting plate, and where required terminal blocks to interface other connections with owner's equipment. Provide units for "SCADA" PLC & Communication System, Intrusion & Door Entry Alarm, and Building Temperature Monitor Alarm Systems.
- D. Surface mounted receptacle outlet, switching and device boxes used in conjunction with branch circuits in the remaining areas shall be cast alloy, with threaded hubs and device covers suitable for industrial plant service.
- E. Boxes shall be of the material, finish, type and size specified and required for the location, kind of service, number of wires, and the function. Unless otherwise specified, they shall conform to the requirements of the "Standard for Cabinets and Boxes" (Designation:UL-50) and to the "Standard for Boxes and Fittings" (Designation:UL-514), Underwriters Laboratories, Inc., as may be applicable.
- F. Product shall be suitable for industrial service, use in Damp and Wet locations, shall be Corrosion and rust-resistant parts, watertight and airtight, gasketed and removable cover.
- G. Boxes not over 100 cubic inches in size shall be standard boxes not less than No. 14 U.S.S. gauge. Boxes over 100 cubic inches in size shall conform to the requirements for cabinets. Covers shall be of the same thickness as boxes and secured in position by means of brass screws. Covers shall be so arranged as to be readily and conveniently removed.
- H. Approved sealing fittings and outlets shall be installed in Hazardous classified areas.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install product in accordance with NEC 70 and NFPA 820.
- B. Coordinate interface terminations for Owner's "SCADA" PLC & Communication System, Intrusion & Door Entry Alarm, and Building Temperature Monitor Alarm Systems.
- C. Boxes shall be installed where shown on the Contract Drawings or where necessary to accommodate equipment device terminations, branches or services that have more than three (3) 90° bends.
- D. All code required pull, splice, and junction boxes may not be shown on the Contract Drawings, but additional boxes of the proper code size shall be installed as may be necessary for a neat and satisfactory installation.
- E. Boxes shall be set plumb and true, face parallel with plane of associated finish surface, at least one edge parallel to wall or ceiling.
- F. Where applicable, faces of recessed box shall be flush with finished surface and, if required, extended with suitable extension devices.
- G. All junction and pull boxes shall be rigidly fastened to the building structure and shall not depend on the conduits for support.

END OF SECTION 16130

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SECTION 16141

WIRING DEVICES

PART 1 GENERAL

WORK INCLUDES

- A. Work in this section is supply and installation of receptacles and toggle switches.
- B. Work shall also include supply and installation of device boxes for receptacles and toggle switches.

1.02 RELATED SECTIONS

Section 16000 –All Sections of this Specification

Section 16005 - General Electrical Summary

Section 16111 - Conduit and Raceway

Section 16123 - Building Wire and Cable

1.03 REFERENCE TO STANDARDS

- A. NFPA 70 - NEC
- B. UL Standard 943 Class A
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA WD-1 & WD-6

1.04 DELIVERY, STORAGE AND HANDLING

- A. Supplied items shall not be shipped loose but shall be in boxes, labeled with material and equipment enclosed. Boxes shall be stored away from contact with earth and shall be protected from weather.

1.05 SUBMITTAL REQUIREMENTS

- A. Submit under provisions of Section 16
- B. Hazardous Locations – Screen Room
- C. Receptacles.
- D. Toggle switches.
- E. Where applicable, color of wiring devices to be identified during submittal review.

1.06 QUALIFICATIONS

- A. Wiring devices shall be manufactured and supplied by companies regularly engaged in business of furnishing wiring devices. If required by Owner representative, manufacturers shall submit certification to a minimum experience of five years in manufacture of respective wiring devices.

1.07 MAINTENANCE SERVICE

- A. WARRANTY

All equipment shall be warranted to be free from defects in material and workmanship for a period of one year from date of substantial completion

- A. established by the Owner's Representative.

PART 2 PRODUCTS

2.01 EQUIPMENT SPECIFICATION

- B. **All Outlet and receptacle boxes in the** facility shall be "FS" cast -hub type;
- C. Receptacles shall be specification grade and installed under this section as shown on drawings.
- D. Explosion Proof Receptacle Outlet and Switches shall be labeled for that use.
- E. All Equipment, Receptacle and Switch outlets located in **Screen Room** shall be rated for **Hazardous Locations, Division I, Class I & II.**
1. Receptacle Outlets shall be KILLARK KRJC type completely assembled with 120VAC-20 amp receptacle, cast metal enclosure, $\frac{3}{4}$ " hubs, gasketed cover and accessories for surface mounting.
 2. Switches, lighting & toggle type, shall be KILLARK XS-41C & 43C completely assembled rated 120VAC-20 amp, cast metal enclosure, $\frac{3}{4}$ " hubs, gasketed cover and accessories for surface mounting.
- F. General Purpose Receptacles for wall type convenience outlets in nonhazardous areas shall be of 20 amp, 120 volt, 3 wire grounding type, NEMA 5-20R, back and side wire compatible, heavy duty industrial specification grade.
- G. Approved Manufacturer:
- a. Hubbell HBL5362 (typical)
 - b. General Electric
 - c. Equivalent
- H. Ground Fault Circuit Interrupting (GFCI) shall be provided and installed where noted on drawings.
1. All units shall be rendered permanently inoperative at its "end of useful life" (EOL) as defined in UL 943.
 2. All receptacles shall be rated 20 amp with NEMA 5-20R receptacle configuration.
 3. To simplify locating the proper "reset" button after tripping, unless specifically noted project drawings, DO NOT utilize "feed-thru" feature to protect downstream GFCI outlets.
 4. Provide self-protected GFCI receptacles at each required location. Receptacles shall be back and side wire compatible, feed-thru type
 - a. Hubbell GF-5362A
 - b. Equivalent, meeting requirements noted.

- B. Toggles Switches shall be installed under this item.

1. Lighting and General Purpose Toggle Switches

- a. Units for use in non-hazardous, toggle-type applications shall be 20A, 120VAC rated, back and side wired type, industrial specification grade.
- b. Switches shall be duty rated for 1 HP at 120 VAC.
- c. Hubbell HBL1221, 1222, 12223
- d. And /or Equivalent

C. Unless noted otherwise on the drawings, wall plates shall be of nylon construction for resistance to impact, abrasion and mechanical stress fracture. Wall plate color shall match receptacle or switch at each location.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All receptacles and toggle switches shall be grounded with a ground conductor connected to their respective grounding terminal or screw.
- B. Grounded conductors (neutrals) shall be continuous between outlets, boxes, and devices, as per NEC Article 300.13.
- C. Wiring device neutral connections shall not be utilized as splice points. Neutral path shall not be broken with wiring devices removed from boxes.
- D. Test all receptacles, toggle switches and control stations for proper operation, including GFCI operation where applicable.
- E. Ground device enclosure with a ground conductor connected to respective grounding lug.
- F. Unless otherwise specified, install wall switches with "OFF" position down, install duplex outlets with ground blade on the bottom if mounted vertically or to the right if mounted horizontally.
- G. Install GFCI receptacles in such that "Test" and "Reset" wording are oriented correctly.

END OF SECTION 16141

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SECTION 16160**CABINETS AND ENCLOSURES****PART 1 - GENERAL****1.01 WORK INCLUDED**

A. Cabinets and Enclosures.

B. Related Sections

1. Section 16005 Summary of the Electrical Work
2. Section 16111 Electrical Raceways
3. Section 16123 Building Wire and Cable
4. Section 16124 Instrument & Control Wire and Cable
5. Section 16130 Junction, Splice and Pull Boxes
6. Section 16170 Grounding and Bonding

1.02 REFERENCES

A. All Work performed, where applicable under this Section, shall be in accordance with the most recent edition and most recent addenda thereto of the applicable codes, standards, specifications, regulations, procedures, and tests of the following organizations to the extent referred to herein.

1. ANSI/NFPA 70 National Electric Code
2. NEMA 250 Enclosures for Electrical Equipment

1.03 SUBMITTALS

- A. Contractor shall submit manufacturer's standard data for enclosures and cabinets.
- B. Contractor shall submit product data and shop drawings including dimensions of physical size, entry and closure operating details.
- C. With manufacturer's installation instructions, Contractor shall indicate application conditions and limitations of use stipulated by product testing.

1.04 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 70 - National Electric Code.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer's for Cabinets and Enclosures shall be: Hoffman, Hammond Manufacturing Enclosures, other substitutions fall under the provisions of Section 16000 of this Specification.
- B. Suggested Manufacturer: Hoffman TYPE ULTRX
- C. Assemblies will be required for Owner's "SCADA" PLC & Communication System, Intrusion & Door Entry Alarm, and Building Temperature Monitor Alarm Systems.

2.02 ENCLOSURES – GENERAL APPLICATION

- A. Note well that the Screen Room is classified as a Hazardous Locations, Class I, Division I&II. Installation and use in this location will require label and approval for Hazardous Locations.
- B. Exterior Outdoors and exposed to weather – NEMA 4X Stainless Steel,
- C. Interior Indoor and Protected application shall be surface cabinet type,
- D. Interior Indoor and Protected NEMA 12 Fiberglass, with interior mounting plates
- E. Solid door with continuous hinge, with Hasp or Flush Latch.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. See Control Wiring Diagrams for Owner's Specialty Systems.
- B. Coordinate interface terminations for Owner's "SCADA" PLC & Communication System, Intrusion & Door Entry Alarm, and Building Temperature Monitor Alarm Systems.
- C. Contractor shall install product in accordance with NFPA 70 as applicable.

- D. Install product in conformance with Manufacturer's installation instructions.

END OF SECTION 16160

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SECTION 16170**GROUNDING AND BONDING****PART 1 - GENERAL****1.01 WORK INCLUDED**

- A. System Grounding electrode and conductors.
- B. Equipment grounding conductors.
- C. Related Sections
 - 1. Section 16005 Summary of the Electrical Work
 - 2. Section 16111 Electrical Raceways
 - 3. Section 16123 Building Wire and Cable
 - 4. Section 16124 Instrument & Control Wire and Cable
 - 5. Section 16130 Junction, Splice and Pull Boxes
 - 6. Section 16160 Cabinets and Enclosures

1.02 REFERENCES

- A. All Work performed, where applicable under this Section, shall be in accordance with the most recent edition and most recent addenda thereto of the applicable codes, standards, specifications, regulations, procedures, and tests of the following organizations to the extent referred to herein:

- 1. ANSI/NFPA 70 - National Electric Code

1.03 EXISTING GROUND GRID SYSTEM

- A. Existing siphon chamber ground grid shall be bonded and connected into new distribution equipment with new wiring.
- B. Main service equipment metering, protection panels and wireways, motors, and control cabinets inclusive, shall be grounded in accordance with NEC – Article 250.

1.04 PERFORMANCE REQUIREMENTS

- A. Ground system resistance shall not exceed 25 OHMS.

1.05 REGULATORY REQUIREMENTS

- A. All Work performed, where applicable under this Section, shall be in accordance with the most recent edition and most recent addenda thereto of the applicable codes, standards, specifications, regulations, procedures, and tests of the following organizations to the extent referred to herein:

1. ANSI/NFPA 70 - National Electric Code
2. State Basic Building Code

- B. Where specified furnish products listed and labeled by Underwriters Laboratory.

PART 2 - PRODUCTS

2.01 WIRING

- A. Stranded bare copper conductors and sized in accordance with NEC - Article 250.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Field Verify condition of existing ground source. Remove existing water service ground clamp and clean water main, ground clamp, and reassemble. Test for continuity among other system components. Bond and connect existing network to new distribution equipment.
- B. Detailed grounding will be noted on One Line Diagram and take precedence over the general requirements listed below. Ground connections shall be installed with copper conductors and not less than scheduled in NEC Table 250- 6.
- C. Non-current carrying metallic parts of new equipment, conduits, control cabinets and loads shall be securely connected to the ground bus and ground grid.
- D. Contact surfaces shall be thoroughly cleaned and bright before connection is made so as to ensure a good metal-to-metal contact.
- E. Ground conductors and taps from equipment shall be made with as few connections as possible and welded with exothermic type connections.
- F. Interior connections shall not be concealed, Ground conductors shall be exposed and connections shall be readily accessible for inspection.
- G. Connections shall be made at Auto Transfer Switch, Service Entrance, Neutral bus, and Control Equipment. Traveling Screen Control Cabinet be grounded in accordance with manufacturers' detailed instructions.

END OF SECTION 16170

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SECTION 16195**ELECTRICAL IDENTIFICATION****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Service Entrance Equipment
- B. Duplex Screen Control Panel
- C. Nameplates and Labels
- D. Wire and Cable Markers

1.02 REFERENCES AND REGULATORY REQUIREMENTS

- A. Work performed, where applicable under this Section, shall be in accordance with the most recent edition and most recent addenda thereto of the applicable codes, standards, specifications, regulations, procedures, and tests of the following organizations to the extent referred to herein:
 - 1. ANSI/NFPA 70 - National Electric Code

1.03 SUBMITTALS

- A. Submit summary and inventory of applicable equipment.
- B. Product catalogs data for nameplates, labels, and markers.

PART 2 PRODUCTS**2.01 NAMEPLATES**

- A. Engraved multi layered laminated, black face with white lettering.
- B. The nameplates shall be at least one (1) inch high by three (3) inches wide of 3-ply plastic or lamicaid to produce WHITE letters on Black background, or as approved by the Engineer.
- C. The letters shall be 1/4inch high and arranged in maximum of two (2) rows. Where equipment nomenclature requires additional space, resize nameplates to fit hardware.

Where space is a constraint, nameplates shall be of appropriate size to properly identify equipment or instrumentation.

2.02 WIRE MARKERS

- A. Printed 1-1/2" diameter tags with numerals for detailed power cables, branch circuit wiring and control and instrument cables.
- B. Individual Control Circuit conductors shall have shrink tube barreled type sleeves with unique nomenclature identifying the conductor with the origin, use, and function of the wire in a particular control scheme.

PART 3 EXECUTION

3.01 LOCATIONS

- A. Nameplates shall be provided to identify service panelboard and control panels, circuit breakers, disconnects, and instrumentation devices.
- B. Identification Tags for control cables and sleeved type markers at each conductor entering and exiting siphon chamber, junction enclosures, end devices and Control System Cabinets.
- C. Load Description Directories and Schedules at control panel.
- D. Nameplates shall properly identify the equipment or instrumentation and shall be inscribed as noted in Construction Documents or as approved by the Engineer.
- E. Each and Every Motor driven device serviced from utility and generator shall have appropriate signage indicating:

"MOTOR STARTS AUTOMATICALLY BY REMOTE CONTROL
DO NOT ATTEMPT TO SERVICE EQUIPMENT WITHOUT
AN APPROVED TAG-OUT SERVICE PROCEDURE".

- F. Arc Flash notification on all 480V/3 phase or 230V/3 phase equipment.

END OF SECTION 16195

SECTION 16425**SERVICE ENTRANCE EQUIPMENT****PART 1 - GENERAL****1.01 WORK INCLUDED**

- A. The requirements of the Contract, Division 1, and Division 16 apply to work in this Section. The Section Includes Low Voltage, Front-Accessible Service Entrance Equipment with circuit breakers as specified below and shown on the contract drawings.

1.02 RELATED SECTIONS**1.03 REFERENCES**

- A. The low voltage Service Entrance C.B. s and protection devices in this specification are designed and manufactured according to latest revision of the following standards.
1. ANSI 61
 2. ANSI/NEMA PB 2, Deadfront Distribution Service Entrance C.B. s
 3. ANSI/NEMA PB 2-1, General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Service Entrance C.B. s Rated 600 Volts or Less
 4. ANSI/NFPA 70, National Electrical Code
 5. NEMA AB-1, Molded Case Circuit Breakers and Molded Case Switches
 6. UL 489, Molded Case Circuit Breakers and Circuit Breaker Enclosures
 7. UL 891, Dead Front Service Entrance C.B. s

1.04 DEFINITIONS

- A. Front-Accessible only shall be as defined by UL 891 standard which requires that all line and load connections for phase, neutral, and ground conductors can be made and maintained from the front of the Service Entrance C.B. without access to the rear.

1.05 SYSTEM DESCRIPTION

- A. The power system feeding low voltage service entrance Circuit Breaker will be served from Utility Co. Pole Mount Transformer,
- B. System characteristics are 60 hertz, 120/2080volts, 3 phase, 4wire wye grounded.

- C. Service Entrance equipment shall be surface mounted with front access only.

1.06 SUBMITTALS

- A. Manufacturer shall provide (4) copies of the following documents to owner for review and evaluation in accordance with general requirements of Division 1 and Division 16:
 - 1. Product Data on specified product;
 - 2. Shop Drawings on specified product;
 - 3. Trip curves for each specified product.

1.07 INSTALLATION, OPERATION AND MAINTENANCE DATA

- A. Manufacturer shall provide (4) copies of installation, operation and maintenance procedures to owner in accordance with general requirements of Division 1 and Division 16.

1.08 QUALIFICATIONS and QUALITY ASSURANCE

- A. Manufacturer shall have specialized in the manufacture and assembly of low voltage Service Entrance Circuit Breakers for a minimum of 20 years.
- B. Low voltage Service Entrance C.B.s shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in this specification.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.
- B. Ship each Service Entrance C.B. wrapped for protection.
- C. Contractor shall inspect and report concealed damage to carrier within 24 hours.

1.10 PROJECT SITE ENVIRONMENTAL CONDITIONS

- A. Follow service conditions before, during and after Service Entrance C.B. installation.
- B. Ambient temperature of area will be between minus [30] and plus [25] degrees C, the maximum ambient temperature per UL 891.
- C. Low voltage Service Entrance C.B. s shall be mounted in protected enclosure, free from excess humidity, dust and dirt and away from hazardous materials.
- D. Outdoor installation shall be protected to prevent water and moisture from entering enclosure.

1.11 WARRANTY

- A. Contractor and Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of installation.

1.12 FIELD MEASUREMENTS

- A. Contractor shall make all necessary field measurements and verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in N.E.C.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. General Electric Company products have been used as the basis for design. Other manufacturers' products of equivalent quality, dimensions and operating features may be acceptable, at the Engineer's discretion, if they comply with all requirements specified in these Contract documents.

2.02 COMPONENTS

- A. Refer to Contract Drawings for Utility Room Plan layout and location of equipment and components; One Line Diagram for device current ratings, metering, and components; voltage ratings of devices, assemblies; interrupting and withstand ratings of devices, and other required details.
- B. Standard Features
 - 1. Service Entrance C.B. shall be surface and fully self-supporting within equipment NEMA 42 enclosure to form the desired arrangement. C.B. equipment shall be bolted directly to the rear of dead front enclosure.
 - 2. The equipment shall be front-access only. Components shall be front and rear aligned installed plumb with horizontal and vertical cover.

2.03 CONSTRUCTION

- A. Service Entrance equipment shall be furnished as listed on drawings and specified herein, including circuit protection and interconnections.
- B. Protective devices shall be rated for the voltage and frequency listed.
- C. Service Equipment current ratings, including all devices, shall be based on a maximum ambient temperature per UL Standard 891. Temperature rise of Service Entrance C.B. and devices shall not exceed 65 degrees C in a 25 degree C ambient environment.

- D. Service Entrance Device shall comply with UL Service Entrance requirements including a UL Service entrance label, with incoming line and load lugs, removable neutral bond, and ground bus for solid systems grounding.
- E. Bus arrangement A-B-C left to right shall be used throughout to assure convenient and safe testing maintenance.
- F. Incoming bus bars shall be rated for the main protection device and incoming conductors.
- G. Bus Bars:
 - 1. Shall be continuously silver-plated copper rated for current 60 amperes.
 - 2. Assembly shall be braced to withstand mechanical forces exerted during short circuit conditions not less than 22KA RMS SYM.
 - 3. Phase and neutral bus ampacity shall be as shown on plans.

2.04 UTILITY REVENUE METERING

- A. Provide utility revenue metering assembly, rated for 320amperes, 120/208V, 3 phase operations complying with UI Co. standards.
- B. Procure U.I. Co. approvals prior to ordering this equipment.

2.05 MAIN INCOMING CIRCUIT BREAKER

- A. Main device shall be individually mounted molded case circuit breaker.
- B. 225amp 3 pole frame, 150 A Trip 240VAC class for 120/208V wye operations.
- C. Main breaker shall have thermal magnetic trip units.
- D. Main breaker shall be rated to carry 100 percent of their frame ampacity continuously.
- E. Main Circuit Breaker shall be GE type TEB.
- F. Lugs shall be tin-plated and UL listed for copper cable. Lugs shall be rated for 90 degree C.
- G. Provide mechanical lugs for #4/0 conductor phase.
- H. Service Entrance C.B. lugs compartment shall be arranged for BOTTOM ENTRY of underground incoming cable,

2.06 LIGHTING and POWER DISTRIBUTION PANELS

- A. Refer to section 16471 of this specification.

2.07 FINISH

- A. All steel surfaces shall be chemically cleaned prior to painting.
- B. Exterior paint color shall be ANSI 61 Light Gray over phosphate - type rust inhibitor.

PART 3 - EXECUTION

3.01. EXAMINATION

- A. The following procedures shall be performed by the Contractor.
- B. Examine installation area to assure there is enough clearance to install Service Entrance Assembly within enclosure.
 - 1. Check structure for uniformity and level surface.
 - 2. Verify field measurements.
 - 3. Verify that Service Equipment is ready to install.
 - 4. Verify that required utilities are available in proper location and ready for use.
 - 5. Beginning the installation means contractor installer accepts the noted conditions.

3.02. INSTALLATION

- A. Installation shall be performed by the Contractor.
- B. THIS WORK WILL REQUIRE SHUTDOWN OF ENERGIZED UTILITY CIRCUIT. DO NOT ATTEMPT TO EXECUTE THIS WORK WITHOUT PERFORMING NECESSARY ISOLATION AND COORDINATION WITH UTILITY Co.
- C. The work shall be performed under the direction of the U.I.Co. service specialists.
- D. Install and terminate cable per equipment manufacturer's install instructions.
- E. Install required Identification and safety labels.

3.03. FIELD QUALITY CONTROL

- A. Adjust circuit breaker trip and time delay settings to values determined by the Project Engineer.
- B. Verify and establish correct phase rotation before energizing loads.

3.04. CLEANING

- A. Clean interiors of enclosure and remove debris, dirt, construction materials.

- B. Repaint scratched or marred exterior surfaces to match original finish.

END OF SECTION 16425

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SECTION 16441**ENCLOSED SAFETY SWITCHES****PART 1 GENERAL****1.01 WORK INCLUDED**

- A. The requirements of the Contract Documents and Division 1 and Division 16 of these Specifications apply to work in this Section.
- B. General, heavy and mill duty safety switches.
- C. Related Sections:
 - 1. Section 16005 Summary of the Electrical Work
 - 2. Section 16111 Electrical Raceway
 - 3. Section 16123 Building Wire and Cable
 - 4. Section 16124 Instrument & Control Wire and Cable
 - 5. Section 16130 Junction, Splice and Pull Boxes
 - 6. Section 16160 Cabinets and Enclosures
 - 7. Section 16170 Grounding and Bonding
 - 8. Section 16195 Electrical Identification

1.02 REFERENCES

- A. Safety switches and protection devices in this specification shall be designed and manufactured according to latest revision of the following standards.
 - 1. ANSI/NEMA KS 1 - 1990, Enclosed and Misc. Distribution Equipment Switches (600 V)
 - 2. ANSI/NFPA 70 - 1993, National Electrical Code
 - 3. Federal Specification W-S-865 - Heavy Duty Switches
 - 4. UL 98 - 1994, Enclosed and Dead Front Switches

1.03 SYSTEM DESCRIPTION

- A. Manual Transfer and Safety switches shall be quick-make, quick-break construction. Switches shall be suitable for use as service entrance equipment.
- B. All Devices shall be Heavy duty switches and shall be horsepower and I²t rated.

1.04 SUBMITTALS

- A. Manufacturer shall provide copies of following documents to owner for review and evaluation in accordance with the requirements of Division 1 and Division 16.
- B. Shop Drawings and Product Data on specified product.

1.05 OPERATION AND MAINTENANCE DATA

- A. Provide copies of installation, operation and maintenance procedures to owner in accordance with the requirements of Division 1 and Division 16.
- B. Operation and maintenance data shall be submitted based on factory and field testing, operation and maintenance of specified product.

1.06 QUALITY ASSURANCE

- A. Manufacturer shall have specialized in the manufacture and assembly of heavymill duty safety switches for 20 years.
- B. Heavy duty safety switches shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in Article 1.03 of this specification, shall be CSA listed. And shall meet JCO performance specifications.
- C. Manufacturer's Certificate of ISO 9002 Compliance.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall deliver, store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals. Handle in accordance with manufacturer's written instructions in order to avoid equipment damage, components, devices and finish.

1.08 EXTRA MATERIALS

- A. Contractor shall provide sizes and ratings of spare fuses as indicated in drawings.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. General Electric Company products have been used as the basis for design. Other manufacturers' products of equivalent quality, dimensions and operating features may be acceptable, at the Engineer's discretion, if they comply with all requirements specified or indicated in these Contract documents.

2.02 MANUFACTURED UNITS

- A. Contractor shall furnish industrial grade heavy duty disconnect switches.
- B. Manual transfer switch at service entrance serving utility and portable generator.

2.03 COMPONENTS

- A. Equipment and component layout, location and ratings, shall be in accordance with those specified on the Contract Drawings.

2.04 CONSTRUCTION

- A. Operation handle shall be a highly visible, box-mounted type that directly drives switch mechanism. It shall be able to be padlocked in OFF position with up to three padlocks with 5/16 inch diameter shanks.
- B. Switches shall have defeatable, front access, coin-proof interlocks. Interlocks shall prevent opening the switch door when switch is ON and prevent turning switch ON when door open.
- C. A high visibility, securely fastened nameplate shall show ON-OFF position indication.
- D. Interior shall be easily removable. Provide wiring gutter, clear of obstructions and moving parts. Interior shall contain line and load terminations suitable for use with copper conductors.
- E. Heavy Duty Enclosure, Type TH NEMA Class 12 enclosures.
- F. Minimum ratings 50K symmetrical RMS ampere interrupting at 120/240VAC.
- G. Transfer switch shall be 60 Amp, 240 V, 3-Ph with neutral block, 3 position and manually operated. Switch shall be G.E.Cat. # TC 35323.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Use NEMA 12 Enclosures within new Electrical Power Cabinet.
- B. Install equipment as detailed in Manufacturer's instructions.
- C. Install identifying nameplates and safety labels in clear view of operations.

3.02 FIELD QUALITY CONTROL

- A. Inspect installed safety switches for anchoring, alignment, and grounding.
- B. Tightness of all accessible mechanical and electrical connections shall be checked with calibrated torque wrench. Minimum acceptable values are specified in Manufacturer's instructions.
- C. Switch mechanism, access doors and operating handles shall be adjusted for free mechanical and electrical operation as described in Manufacturer's instructions.
- D. Enclosure interiors shall be cleaned of construction debris, dirt and shipping materials.
- E. Scratched or marred exterior surfaces shall be repainted to match original finish.

END OF SECTION 16441

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SECTION 16471
LIGHTING AND POWER DISTRIBUTION PANELBOARDS

PART 1.0 - GENERAL

- 1.01 The requirements of the Contract, Division 1, and Division 16 apply to work in this Section.
- 1.02 SECTION INCLUDES
- A. Low voltage power panelboards
- 1.03 RELATED SECTIONS
- 1.04 REFERENCES
- A. The low voltage power panelboards and protection devices in this specification are designed and manufactured according to latest revision of the following standards.
- B. ANSI/NEMA PB 1, Panelboards
- C. ANSI/NFPA 70, National Electrical Code
- D. Federal Specification W-C-375, Rev. B, Amend. 1 Circuit Breakers, Molded Case;
- E. Federal Specification W-P 115, Rev. C, Panel Power Distribution
- F. UL 489, Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
- G. UL 50 - Enclosures, UL 67 - Panelboards, UL 98 - Enclosed and Dead Front Switches
- 1.05 DEFINITIONS
- A. Overcurrent Protective Device: Single or multi pole circuit breaker.
- 1.06 SYSTEM DESCRIPTION
- A. Equipment shall be indoor deadfront power panelboards for molded-case circuit breakers.
- B. Panelboards shall meet service entrance requirements.
- C. Panelboards shall have integrated fully rated panel short circuit rating.
- 1.07 SUBMITTALS
- A. Manufacturer shall provide copies of following documents to owner for review and evaluation in accordance with general requirements of Division 1 and Division 16:
1. Product Data on specified product;
 2. Shop Drawings on specified product;
 3. Trip curves for each specified product;
- 1.08 INSTALLATION, OPERATION AND MAINTENANCE DATA
- A. Manufacturer shall provide copies of installation, operation and maintenance procedures to owner in accordance with general requirements of Division 1 and Division 16.

1.09 QUALIFICATIONS and QUALITY ASSURANCE

- A. Manufacturer shall have specialized in the manufacture and assembly of low voltage power panelboards for 20 years.
- B. Low voltage power panelboards shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in Article 1.03 of this specification.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall deliver, store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.
- B. Ship each power panelboard section in individual shipping splits for ease of handling. Each section shall be mounted on shipping skids and wrapped for protection.
- C. Contractor shall inspect and report concealed damage to carrier within 24 hours.
- D. Prior to installation, the contractor shall store in a clean, dry space and maintain factory protection, cover with film or plastic to keep out dirt, water, construction debris, and traffic.
- E. Contractor shall handle in accordance with manufacturer's written instructions to avoid damaging equipment, installed devices, and finish.

1.11 SITE ENVIRONMENTAL CONDITIONS

- A. Follow standard service conditions before, during and after panelboard installation.
- B. Service equipment room will be heated. Set ambient temperature of area between 20 and 25 degrees C. Or to prevent moisture from entering enclosure.

1.12 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for one Year from date of installation.

1.13 FIELD MEASUREMENTS

- A. Contractor shall confirm all field measurements to verify that equipment shall fit in allocated space in full compliance with minimum clearances specified in National Electrical Code.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. General Electric Company products have been used as the basis for design. Other manufacturers' products of equivalent quality, dimensions and operating features may

be acceptable, at the Engineer's discretion, if they comply with all requirements specified or indicated in these Contract documents.

2.02 MANUFACTURED ASSEMBLIES

A. Furnish GE Low Voltage Power Panelboards, or equal, as indicated in drawings.

2.03 COMPONENTS

A. Refer to the One Line Diagram, device current ratings, bus bar ratings, voltage ratings, electrical assembly of components, and other required details.

B. New panelboard shall be installed for facility and equipment loads being served.

C. Lighting Panel & Boiler Room Panel Main Circuit Breaker, rated for 120/208 volt, 3 phase-4 wire operations. Main buss shall be fully rated 125Amp @120/208V 3 phase-4 wire service.

D. Power Panel Main Circuit Breaker, for 208 volt, 3 phase-4 wire. Main buss shall be fully rated 225Amp @ 208V 3 phase-4 wire system.

E. Thermal-magnetic trip, bolt on circuit breakers, and as note on drawings, fully rated assembly for 22K amps @120/208V - 3 phase 4w wye.

2.04 ENCLOSURES

A. Panel box shall be galvanized code gauge sheet steel with removable end walls.

B. Enclosures shall be NEMA 12 and surface mounted.

C. Lockable Access door hinged door with concealed hinges to cover circuit breakers access.

D. Door locks shall be GL Valox style, or Yale #511 or National.

2.05 INTERIORS

A. Panelboard interior shall be designed and assembled such that circuit protective devices shall be solidly connected to the distribution panel vertical bus. The bus bars shall be attached to the feeder device by bolts and to the vertical bus by bolts and anti-turn methods.

B. Design Circuit breaker connector and removal so that device may be removed without disturbing adjacent devices.

C. Panelboards shall be rated as indicated in drawings,

D. Panelboards shall have vertically aligned bus bars with minimum rating of 125 amperes.

E. Bus bars shall be copper.

F. Bus bars shall be phase-sequenced and rigidly supported by high impact resistant, insulated bus supporting assemblies to prevent vibration or short circuit mechanical damage.

G. Neutral bus shall be fully rated.

B) All terminations shall be suitable for copper UL listed wire or cable. Terminations shall be rated for use with conductor ampacity as assigned in the NEC 75 degree C table.

2.06 BRANCH DEVICES

A. Main and branch circuit breakers shall be quick-make, quick break, and trip indicating, GE Type low voltage molded-case, (or equal).

B. Circuit breaker case shall have ON/OFF and International I/O position indicators.

C. Breaker faceplate shall list current rating, UL and IEC certification standards, and AIC ratings.

D. Circuit breakers shall be factory sealed and shall be date coded on breaker case.

E. Breakers shall be UL listed for reverse connection without restrictive line or load markings. Circuit breakers shall be able to mount in any operating position.

F. Three pole breaker ratings greater than 125 amperes shall have interchangeable rating plugs.

G. Interrupting rating of breakers shall not be less than maximum short circuit current available at incoming line terminals. Branch Circuit protective devices shall have a minimum symmetrical current interrupting rating 25kA.

H. Main lugs shall be convertible by installer for top or bottom incoming feed.

2.07 ACCESSORIES

A. Grounding Bus and Neutral bus shall have grounding lug for Service Entrance applications.

B. Exterior mounted equipment label.

C. Furnish nameplates for each device as indicated in drawings.

2.08 TESTING

See General Conditions.

2.09 FINISH

A. Standard panelboard boxes shall be galvanized (zinc finished) or galvanized.

B. Fronts shall be coated with phosphatized rust inhibitor and finish coated with ANSI 61 light gray baked on powder coat.

C. Screw fasteners shall be zinc coated to retard corrosion.

PART 3 - EXECUTION

3.01. EXAMINATION

A. The Contractor shall perform the following procedures:

- 1) Examine installation area to assure there is enough clearance to install Service entrance Equipment. Check concrete floor for uniformity and level surface.
 - 2) Verify that Service Entrance Equipment is ready to install.
 - 3) Verify field measurements are as shown on Drawings.
 - 4) Verify that required utilities are available, in proper location and ready for use.
- B. Beginning the installation means contractor installer accepts the noted conditions.

3.02. INSTALLATION

- A. Installation shall be performed by the Electrical Contractor.
- B. The work shall be performed under the direction of qualified supervision or service specialists.
- C. Install and terminate cable per equipment manufacturer's instructions.
- D. Install required Identification and safety labels.

3.03. FIELD QUALITY CONTROL

- A. Inspect and test installation, and compare with one line diagram to assure correct branch circuit distribution of loads.
- B. Measure and test phase load current for improper balance among phases. Report to engineer if load differential exceeds ten (10) percent among phases.
- C. Adjust circuit breaker trip and time delay settings to values required by equipment loads characteristics.
- D. Confirm phase rotation prior to energizing loads.
- E. Contractor shall verify phase rotation for new service and confirm that rotation is correct for loads served.

3.04. CLEANING

- A. Clean interiors of enclosure and remove construction debris, dirt, and construction materials.
- B. Repaint scratched or marred exterior surfaces to match original finish.

END OF SECTION

SECTION 16496**AUTOMATIC TRANSFER SWITCH****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. The requirements of Division 1 and Division 16 of these Specifications apply to work in this Section.
- B. Related Sections:
- | | |
|------------------|--------------------------------------|
| 1. Section 16005 | Summary of The Electrical Work |
| 2. Section 16123 | Building Wire and Cables |
| 3. Section 16124 | Instrument & Control Wire and Cables |
| 4. Section 16160 | Cabinets and Enclosures |
| 5. Section 16170 | Grounding and Bonding |
| 6. Section 16622 | Generator Set |

1.02 SYSTEM DESCRIPTION

- A. The Engine Generator, Automatic Transfer switch, auxiliary equipment along with distribution equipment will serve select standby loads for the James St. Siphon Station Facilities.
1. Provide automatic transfer switch (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the One Line Diagram. The automatic transfer switch shall consist of an inherently double throw ATS unit and a microprocessor controller, interconnected to provide complete and fully automatic operation.
 2. The transfer switch and control panel shall be the product of the same manufacturer.
 3. The transfer switch shall be installed above Siphon Station grade level.

1.03 CODES AND STANDARDS

- A. The Automatic Transfer Switch and accessories shall conform to the following requirements of:
1. UL 1008 - Standard for Automatic Transfer Switches
 2. NFPA 70 - National Electrical Code
 3. NFPA 110 - Emergency and Standby Power Systems
 4. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 5. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
 6. NEC Articles 700, 701, 702
 7. International Standards Organization ISO 9001

1.04 SUBMITTALS

- A. Automatic transfer switches shall be ASCO, Kohler, Onan or equal. Consideration for alternates shall be formally submitted to the engineer as described under Substitutions.
- B. Submit an integrated package of shop drawings for ATS reflecting all coordinated issues with diesel generator equipment.

1.05 FIELD MEASUREMENTS

- A. Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum clearances specified in National Electrical Code.

1.06 SUBSTITUTION

- A. Proposed deviations from the specifications will be addressed as follows:
Substitution Procedure - The base bid shall include specified equipment ONLY. Any add or deduct for alternate proposals shall accompany the base bid. Requests for substitutions and alternate proposals may be requested by the successful low bidder. All substitutions and requests for alternate proposals shall include:

1. A narrative explanation for substitution.
2. Cost incentives with either ADD or DEDUCT from base bid,
3. Any scheduling advantage,
4. A performance comparison,
5. Full Manufacturers catalog data shall accompany each request

Substitution Responsibility

The power system has been designed to the specified manufacturer's electrical and physical characteristics. The equipment sizing, spacing, amounts, electrical wiring, ventilation equipment, fuel and exhaust components have all been sized and designed around ASCO or Kohler supplied equipment. Should any substitutions be offered, the CONTRACTOR shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs, which may result from such substitutions.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Acceptable manufacturer(s) of the transfer switch are the following:
 1. ASCO
 2. KOHLER
 3. ONAN
 4. Approved Equal.

2.02 MECHANICALLY HELD TRANSFER SWITCH

- A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized single-solenoid mechanism, over current disconnect device operators will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.
- B. Designs utilizing components of molded-case circuit breakers, contactors, or parts which are not intended for continuous duty, repetitive switching or transfer between two active power sources will not be acceptable.
- C. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value such that contact temperature rise will be minimized for maximum reliability and operating life.
- D. All main contacts shall be silver composition. Switches rated 400 amperes and above shall have segmented, blow-on construction for high withstand current capability and shall be protected by separate arcing contacts.
- E. Inspection of contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual-operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
- F. The circuit neutral must be switched by fully rated ATS neutral transfer contacts.
- G. Neutral conductors shall be solidly connected. The neutral terminations shall fully rated AL-CU mechanical pressure connectors.

2.03 MICROPROCESSOR CONTROLLER WITH MEMBRANE INTERFACE PANEL

- A. The controller shall direct the operation of the transfer switch. The controller sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.
- B. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.
- C. The controller shall meet or exceed the requirements for electromagnetic compatibility (EMC) as follows:
 - 1. ANSI C37.90A/IEEE 472 Voltage Surge Test
 - 2. NEMA ICS – 109.21 Impulse Withstand Test
 - 3. IEC801-2 Electrostatic discharge (ESD) immunity

4. ENV50140 and IEC 801 – 3 Radiated electromagnetic field immunity
5. IEC 801 – 4 Electrical fast transient (EFT) immunity
6. ENV50142 Surge transient immunity
7. ENV50141: Conducted radio-frequency field immunity
8. EN55011: Group 1, Class A conducted and radiated emissions
9. EN61000 –4 – 11 Voltage dips and interruptions immunity

2.04 ENCLOSURE

- A. The ATS shall be furnished in a NEMA 12 enclosure.
- B. Provide enclosure strip heater with thermostat.
- C. Controller shall be flush-mounted display with led indicators for switch position and source availability. It shall also include test and time delay bypass switches.

2.05 ATS OPERATION - VOLTAGE AND FREQUENCY SENSING

- A. An adjustable time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.
- B. An adjustable time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.
- C. An adjustable time delay shall be provided on retransfer to normal, adjustable to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
- D. A 15-minute cool down time delay shall be provided on shutdown of engine generator.
- E. All adjustable time delays shall be field adjustable without the use of tools.

2.06 STANDARD CONTROL FEATURES

- A. Programmable Engine Exerciser - A seven-day electronic time switch for automatic weekly testing of the engine - generator set. The exerciser shall be fully programmable and backed up by a permanent battery.
- B. The ATS shall have the following standard features:
 1. A push-button type test switch shall be provided to simulate a normal source failure.
 2. A push-button type switch to bypass the time delay on transfer to emergency, the engine exerciser period on the retransfer to normal time delay whichever delay is active at the time the push-button is activated.
 3. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). Also provide indicating lights for both normal and standby availability.

4. Gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
5. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of:
 - Form “c” contact closed when the ATS is connected to Normal source report into “SCADA”
 - Form “c” contact closed when the ATS is connected to Standby source report into “SCADA”
6. Output Control Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts that open to inhibit transfer to emergency and/or retransfer to normal.
7. Output Control Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.
8. Engine Exerciser – A fully programmable engine generator-exercising timer shall be provided, including a selector switch to select exercise with or without load transfer.
9. In phase Monitor - An In phase monitor shall be inherently built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in phase monitor shall be specifically designed for and be the product of the ATS manufacturer.
10. Selective Load Disconnect – A double throw contact shall be provided to operate after a time delay, adjustable to 20 seconds prior to transfer and reset 0 to 20 seconds after transfer. This contact can be used to selectively disconnect specific load(s) when the transfer switch is transferred. Output contacts rated at 10 amps at 28 VDC or 120 VAC.

2.07 WITHSTAND AND CLOSING RATINGS

- A. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at ATS terminals with over current protection shown on the plans. WCR ATS ratings shall be 65KA @ 120/240V when used with specific circuit breakers.

2.08 TESTS AND CERTIFICATION

- A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
- B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
- C. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and service in accordance with ISO 9001.

2.09 SERVICE REPRESENTATION

- A. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hrs 365 days a year.
- B. Manufacturer shall maintain switch records, by serial number, for a minimum of 20 years.
- C. ATS switch nameplate shall include drawing numbers, part numbers for main coil and control for maintenance and parts replacement.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall examine installation area to assure clearance to install control and power connections.

3.02 INSTALLATION

- A. Contractor shall perform installation in conformance with manufacturer's instructions.
- B. Contractor shall install required safety labels.

3.03 OPERATION AND MAINTENANCE MANUALS

Provide SIX (6) printed and one electronic copy of operation and maintenance manuals covering the ATS and auxiliary components. Include parts manuals, final as-built wiring diagrams and preventative maintenance schedules.

3.04 FIELD QUALITY CONTROL

- A. Refer to Manufacturer's instructions for proper testing procedures.
- B. Tightness of all mechanical and electrical connections shall be checked with calibrated torque wrench. ATS manufacturer will specify minimum acceptable values.
- C. Contractor shall inspect, verify and test installation to ensure proper phase rotation to equipment. Verify phase rotation prior to load test.

3.05 ADJUSTMENTS

- A. Access door and operating handles shall be adjusted for free mechanical and electrical operation, as described in manufacturer's instructions.
- B. Normal and standby transfer intervals shall be adjusted to values specified by the Engineer.

3.06 TRAINING

- A. Provide one day of on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment.

- B. Review operation and maintenance manuals, parts manuals, and emergency service procedures.
- C. Provide (3) copies Video Taped recording and (1) electronic copy of training class and operating procedures to owner.

3.07 CLEANING

- A. Equipment Interior shall be cleaned to remove dirt and construction debris.
- B. Scratched or marred exterior surfaces shall be repainted to match original finish.

END OF SECTION 16496

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

SECTION 16622**GENERATOR SET – DIESEL FUEL ENGINE****PART 1 - GENERAL****1.01 REFERENCES AND STANDARDS**

- A. The generator covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards of ANSI, NEC, ISO, U.L., IEEE and NEMA.

B. RELATED SECTIONS

- | | |
|------------------|--------------------------------------|
| 1. Section 16005 | Summary of the Electrical Work |
| 2. Section 16010 | Electrical Demolition |
| 3. Section 16123 | Building Wire and Cables |
| 4. Section 16124 | Instrument & Control Wire and Cables |
| 5. Section 16170 | Grounding and Bonding |
| 6. Section 16195 | Electrical Identification |
| 7. Section 16496 | Automatic Transfer Switch |

1.02 WORK INCLUDED

A. Installation

1. The work includes furnishing, supplying and installing a complete integrated generator system. The system will consist of a 20 kW generator set with related component accessories and automatic transfer switch specified under a separate Section 16496.
2. The generator rating and design is based on a specific sequence of operations for serving station loads and the startup of station equipment. It is essential that existing controls and new equipment be coordinated to reflect specific interlock for running load and pump startup.
3. Diesel fuel base tank. Provide the following SCADA alarm functions:
 - a. low fuel alarm
 - b. fuel tank leak alarm

B. Fuel System

1. The Generator Set Engine shall be fueled by Diesel. Contractor shall provide all connections required to connect the assembly in accordance with manufacturer's installation instructions. Tank fill connection shall be fully accessible through outside wall for deliveries.

C. Requirements, Codes and Regulations

1. The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a qualified MANUFACTURER having a minimum of 25 years experience manufacturing generation equipment.

1.03 SUBSTITUTION

A. Proposed deviations from the specifications will be addressed as follows:

1. Substitution Procedure

- a. The base bid shall include specified equipment ONLY. Any add or deduct for alternate proposals shall accompany the base bid. Requests for substitutions and alternate proposals may be requested by the successful low bidder. All substitutions and requests for alternate proposals shall include:

- 1) A narrative explanation for substitution
- 2) Cost incentives with either ADD or DEDUCT from base bid
- 3) Any scheduling advantage
- 4) A performance comparison
- 5) Full Manufacturers catalog data shall accompany each request.

2. Substitution Responsibility

- a. The power system has been designed to the specified manufacturer's electrical and physical characteristics. The equipment sizing, spacing, amounts, electrical wiring, ventilation equipment, fuel and exhaust components have all been sized and designed around Kohler supplied equipment. Should any substitutions be offered, the Contractor shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs, which result from substitutions.

1.04 SUBMITTALS

A. Engine-generator submittals shall include the following Manufactures information:

1. Published specification sheet indicating standard and optional accessories, ratings, etc.
2. Cut sheets of all auxiliary components such as isolators, battery charger, silencer, exhaust flex main circuit breaker, etc.
3. Dimensional layout drawings of the generator set, enclosure and transfer switch
4. Weights of all equipment
5. Concrete pad layout and stub-up locations of electrical and fuel systems
6. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, remote alarm indications.
7. Engine mechanical data at varying loads up to full load, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc.
8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
9. Generator resistances, reactance and time constants
10. Generator current decrement curve
11. Generator motor starting capability
12. Generator thermal damage curve
13. Jacket water heater connection diagram
14. Control panel schematics
15. Automatic load transfer switch
16. Oil sampling analysis, laboratory location and information
17. Manufacturer's and dealer's written warranty
18. Emissions data.
19. Sound housing dBA __ ft housing
20. 80 gallon (min.) or 72 hrs@ 1/2 load, double wall U. L. Listed double wall tank

1.05 FACTORY TESTING

- A. The system manufacturer must certify that engine, generator, controls, and switchgear have been tested as complete system.
- B. Testing shall include:
 1. Fuel consumption at 1/4, 1/2, 3/4, and full load
 2. Cooling system performance
 3. Exhaust emissions
 4. Mechanical and exhaust noise
 5. Governor speed regulation at 1/4, 1/2, 3/4, and full load; and during transients
 6. Motor starting kVA
 7. Generator temperature rise in accordance with NEMA MG1-22.40
 8. Harmonic analysis, voltage waveform deviation and telephone influence factor
 9. Generator short circuit capability
 10. The manufacturer shall supply equipment that is a current factory production model.
 11. Load bank test at factory or at the installation site.

1.06 GENERATOR SET DISTRIBUTOR

- A. The engine generator set shall be supplied by the Manufacturer's authorized distributor.
- B. All equipment shall be new and of current production. There shall be one source responsibility for warranty, parts and service, through a local representative with factory trained service personnel.
- C. The generator distributor shall provide at his facility, prior to shipping, a full load test for a duration of two (2) hours, in the presence of the Owner and/or the Owner's representative. A report on frequency, voltage and current at full load, shall be furnished to the Owner.

1.07 WARRANTY

- A. The manufacturer's warranty shall be no less than two (2) years from date of final acceptance of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables such as lubricating oil, filters, antifreeze, and other service items made unusable by the defect, used during the course of repair. Running hours shall not be a limiting factor for the system warranty by either the manufacturer or servicing distributor. Submittals received without written warranties as specified will be rejected in their entirety.
- B. See General Conditions for related and applicable issues concerning warranty.

1.08 PARTS AND SERVICE QUALIFICATIONS

- A. The engine-generator supplier shall have service facilities within 50 miles of the project site and maintain 24-hour parts and service capability. The distributor shall stock parts as needed to support the generator set package for this specific project.
- B. The dealer shall maintain qualified factory trained service personnel that can respond to an emergency call within 4 hours of notification.

PART 2 - PRODUCT SPECIFICATIONS

2.01 GENERAL REQUIREMENTS

- A. Kohler Generator products have been used as the basis for design. Other manufacturers' products of equivalent quality, dimensions and operating features may be acceptable, at the Engineer's discretion, if they comply with all requirements specified or indicated in these Contract documents.
- B. Manufactured Assemblies - Furnish Kohler Generator set #20REOZK, with Alternator #4D8.3 as indicated on drawings and described in these specifications.
- C. Generator Set Requirements
 - 1. The generator set Ratings:

- a. Rating - Standby at
- b. Speed - 1800 RPM,
- c. Power Factor - 0.8 power factor,
- d. Voltage - 120/208 VAC, 3 phase, 4 wire Wye,
- e. Voltage characteristics shall be compatible with normal Utility Co. source,
- f. Frequency - 60 hertz,
- g. Rating non-inclusive of all parasitic loads.
- h. Minimum fuel storage: 72 hrs @ ½ load

D. Material and Parts –The unit assembly of materials and parts shall be new and unused.

2.02 ENGINE

- A. Engine Requirements - The engine shall be as manufactured by an OEM Manufacturer. The engine shall be water-cooled, four-cycle, and meet specifications when operating on diesel fuel. Two cycle engines will not be considered. The engine shall be equipped with block heater, fuel filter, lube oil filter and cooler, and intake air filter and service meter.
- B. Governor- Isochronous - The governor shall be electronic. It shall maintain +/- 0.25% regulation from no load to full rated load. The governor shall be equipped with a speed adjust potentiometer on the main Generator set control panel.
- C. Engine Block Design -The complete engine block shall be machined from one casting. Designs incorporating multiple blocks bolted together are not acceptable.
- D. Engine Lubrication System - The engine shall utilize a gear-type, positive displacement, full pressure lubricating oil pump and water-cooled lube oil cooler. Provide oil filters, oil pressure gauge, dipstick and oil drain.
- E. Fuel System - Fuel filter and serviceable fuel system components shall be located on the engine body.
- F. Exhaust System: Shall have stainless flex connector, silencer, insulated (see Para. 2.08) and weather cap at exterior.

2.03 GENERATOR

- A. Generator Specifications - The synchronous generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling.
- B. Insulation - The insulation material shall meet NEMA standards for Class H insulation and be impregnated in a polyester varnish or vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall not exceed NEMA class F (130 °C rise by resistance over 40 °C ambient). The excitation system shall be of brushless construction.

- C. Self-Excited Type Exciter - The self-excited, brushless exciter shall consist of a three-phase armature and a three-phase full wave bridge rectifier mounted on the rotor shaft. Surge suppressors shall be included to protect the diodes from voltage spikes.
- D. Automatic Voltage Regulator - The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 1.0% for any constant load between no load and full load. The regulator shall be a totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, overexcitation protection, loss of sensing protection, temperature compensation, shall limit voltage overshoot on startup, and shall be environmentally sealed.
- E. Motor Starting - Provide motor starting capability of voltage dip per NEMA MG 1.
- F. Generator strip heater and thermostat.

2.04 OUTPUT CIRCUIT BREAKER

- A. Provide a generator mounted circuit breaker, molded case or insulated case construction, 100 amp frame with 70A trip, 3 pole, NEMA /IP22. Breaker shall be GE, ABB or equal and utilize a thermal magnetic trip unit. The breaker shall be UL listed with shunt trip device connected to engine/generator safety shutdowns. Breaker shall be housed in a steel NEMA 12 enclosure mounted on a separate support stand vibration isolated from the engine / generator. Bus bars, sized for the cable type shown on drawing, shall be supplied on the load side of breaker.

2.05 GENERATOR MOUNTED CONTROL PANEL

- A. Provide a generator set mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation, cycle cranking, digital AC metering with phase selector switch, shutdown sensors and alarms with horn and reset, adjustable cool down timer and emergency stop push-button.
- B. Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Components shall be housed in a NEMA 12/IP22 enclosure with hinged door. The panel shall be mounted on a separate support stand isolated from the engine / generator arrangement. Panel / breaker arrangements mounted on the generator set in such a way that access to the AC Generator terminal box is restricted in any way whatsoever are not acceptable.
- C. Readouts - Provide the following status indication readouts:
 - 1. Engine oil pressure
 - 2. Coolant temperature
 - 3. Engine RPM
 - 4. System DC Volts
 - 5. Engine running hours

6. Generator AC volts
7. Generator frequency
8. Generator AC amps

D. Alarm NFPA 110 - Provide the following indications for protection and diagnostics according to NFPA 110 level 1:

1. Low oil pressure
2. High water temperature
3. Low coolant level
4. Overspeed & Overcrank
5. Emergency stop depressed
6. Approaching high coolant temperature
7. Approaching low oil pressure
8. Low coolant temperature
9. Low voltage in battery
10. Control switch not in auto position
11. Low fuel main tank
12. Battery charger AC failure
13. High battery voltage
14. Four (4) Spare

E. Control Functions and Interfaces

1. Provide the following control functions
 - a. Three DPDT NC OUTPUT contacts for interlocking SCADA system components, for generator run; for generator fail; for power fail.
 - b. Terminals located inside the control panel for REMOTE EMERGENCY STOP
 - c. ON / OFF / AUTO control switch
 - d. Remote start delay

2.06 COOLING SYSTEM ENGINE RADIATOR

- A. The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions and 85 F ambient air entering the enclosure without derating the unit and 50/50 anti-freeze mixture. The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.
- B. Jacket Water Heater - A unit mounted thermal circulation type water heater. The heater Watt rating shall be sized by the manufacturer to maintain jacket water temperature at 90 degrees F, and shall be a (120/208/240/480) volt, single phase, 60 hertz.

2.07 FUEL SYSTEM

- A. Fuel Piping - Fuel piping shall be stainless steel flexible fuel line rated for this service. Flexible fuel lines shall be rated 300 degrees F and 100 PSI.

- B. Fuel Filters - Standard fuel filter provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine.

2.08 EXHAUST SYSTEM

- A. Silencer - A critical type silencer, companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation. Mounting shall be provided by the Contractor as shown on the drawings. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe shall be sized to ensure exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer.
- B. Exhaust System – The contractor shall install muffler and indoor exhaust piping such that the surface temperature of exhaust components will not exceed 150F. The insulation shall be installed so that it does not interfere with the functioning of the flexible exhaust fitting.

2.09 STARTING SYSTEM

- A. Starting Motor
 - 1. A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.
- B. Batteries
 - 1. A gel electrolyte storage battery shall be provided for starting operations. Battery voltage shall be compatible with the starting system and rated not less than recommended by the manufacturer. Provide all necessary cables and clamps to assure a coordinated assembly.
- C. Battery Trays
 - 1. A battery tray shall be provided for the batteries and shall conform to NEC 480-7(b). It shall be treated to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil-over battery electrolyte shall be contained within the tray to prevent a direct path to ground.
- D. Battery Charger
 - 1. A current limiting battery charger shall be furnished to automatically recharge batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. Charger shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC voltmeter, and fused AC input. AC input voltage shall be 120 volts, single phase.

2.10 AUTOMATIC TRANSFER SWITCH - SEE SECTION 16496

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install equipment in accordance with manufacturer's recommendations and installation instruction, project drawings and specifications.

3.02 START-UP AND TESTING

- A. Coordinate all start-up and testing activities with the Engineer and Owner.
- B. At completion of installation, power available, the Equipment Dealer shall verify that the equipment is installed properly and perform the following:
 - 1. Check all fluid levels, Check all auxiliary devices for proper operation, including battery charger, jacket water heaters, generator heater, remote annunciator, etc.
 - 2. Test all alarms and safety shutdown devices for proper operation and annunciation.
 - 3. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.
 - 4. Verify proper voltage and phase rotation at the transfer switch before connecting load.
 - 5. Connect generator load and verify generator starting and reliable operations.
 - 6. Load bank test shall be performed on site if not performed at the factory.

3.03 OPERATION AND MAINTENANCE MANUALS

- A. Provide SIX (6) sets of printed copies and one (1) electronic copy of operation and maintenance manuals covering the generator and auxiliary components. Include parts manuals, final as-built wiring diagrams and preventative maintenance schedules.

3.04 TRAINING

- A. Provide one day of on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. The session shall be video taped.
- B. Review operation and maintenance manuals, parts manuals, and emergency service procedures.
- C. Provide (3) Video Taped (DVD or CD) copies and one (1) electronic copy of the recording of training class and operating procedures to the Owner.

END OF SECTION 16622

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SECTION 16721 FIRE ALARM SYSTEM

PART 1.0 - GENERAL

1.1. DESCRIPTION:

- A. This section includes the furnishing and installation of the fire alarm equipment required to form a complete coordinated control system. It shall include, but not limited to, Fire Alarm initiating devices, notification appliances, control panel, auxiliary control devices, power supplies, Ethernet and/or digital alarm communications to Owner's SCADA system as detailed on drawings and specified herein.
- B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as supplemented in this specification. The system field wiring shall be electrically supervised.
- C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
- D. The Fire Alarm Control Panel (FACP) and peripheral devices shall be manufactured by a single U.S. manufacturer.
- E. The system and components shall be Underwriters Laboratories, Inc. listed under the UL testing standard for fire alarm applications and shall be installed in compliance with the UL listing.

1.2. SCOPE:

- A. A new conventional control system shall be installed in accordance with drawings and this specifications.
- B. Basic Performance:
 - 1. The FACP shall meet requirements of UL ANSI 864 Ninth Initiation Device Circuits (IDC) shall be wired Style B(Class B)Per NFPA 72.
 - 2. Notification Appliance Circuits(NAC)shall be wired Style Y (Class B) Per NFPA 72.
 - 3. All circuits shall be power-limited, per UL864 requirements.
 - 4. A single ground or open on any IDC or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
- C. Basic System Functional Operation:

When a fire alarm condition is detected and reported by one of the initiating devices, the following functions shall immediately occur:

 - 1. The system Alarm LED on the FACP shall flash.
 - 2. A local control panel sounder shall sound.
 - 3. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

4. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm. Additionally, the system shall send events to Owner's SCADA equipment.

1.3. Submittals:

A. General:

1. Four copies of all submittals shall be submitted to the Engineer for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.
3. For equipment other than specified, refer to Section 16005

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Identify manufacturer, model, ratings, power requirements, equipment layout, arrangement, complete wiring point-to-point diagram's layout.
3. Show annunciator layout, configurations and terminations.

C. Manuals:

1. Submit with the shop drawings, technical data, operating and maintenance manuals.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications:

1. Provide the services of a qualified technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

1.4. GUARANTY:

- A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (5) years from the date of acceptance.

1.5. POST CONTRACT MAINTENANCE:

- A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative

of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

1.6. APPLICABLE PUBLICATIONS:

The publications listed below form a part of this specification.

A. National Fire Protection Association (NFPA) - USA:

No. 70 National Electrical Code
No. 72 National Fire Alarm Code
No. 101 Life Safety Code

B. Underwriters Laboratories Inc. (UL) - USA:

No. 38 Manually Actuated Signaling Boxes
No. 217 Smoke Detectors, Single and Multiple Station
No. 228 Door Closers-Holders for Fire Protective Signaling Systems
No. 268 Smoke Detectors for Fire Protective Signaling Systems
No. 268 A Smoke Detectors for Duct Applications
No. 346 Waterflow Indicators for Fire Protective Signaling Systems
No. 464 Audible Signaling Appliances
No. 521 Heat Detectors for Fire Protective Signaling Systems
No. 864 Control Units for Fire Protective Signaling Systems
No. 1481 Power Supplies for Fire Protective Signaling Systems
No. 1638 Visual Signaling Appliances
No. 1971 Visual Signaling Appliances
No. 2017 General-Purpose Signaling Devices and Systems
CAN/ULC S524-01 Standard for Installation of Fire Alarm Systems

The FACP shall be ANSI 864, 9th Edition Listed. Systems listed to ANSI 864, 8th edition (or previous revisions) shall not be accepted.

C. Local and State Building Codes and all requirements of the Authority having Jurisdiction (AHJ).

1.7. APPROVALS:

Each system must have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories Inc

FM Factory Mutual

PART 2.0 - PRODUCTS

2.1. EQUIPMENT AND MATERIAL, GENERAL:

- A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency and meeting the National Fire Alarm Code.

B. All equipment must be available through the Security Equipment Distributor (SED) market and may be installed by independent dealerships.

2.2. CONDUIT AND WIRE:

A. Conduit:

1. Raceways shall be galvanized rigid steel type, shall be 3/4inch minimum in accordance with The National Electrical Code NEC and Section 16.
2. All wiring shall be installed in raceways and conduit fill shall not exceed 40 percent where (3) or more cables are contained within a raceway.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
4. With the exception of communication circuits, wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

B. Wire:

1. Fire alarm system wiring and raceways shall be new and in accordance with national codes (e.g., NEC Article 760) and as recommended by the system manufacturer. Number and size of conductors shall be as detailed by the alarm system manufacturer, not less than 14 AWG for Initiating Device Circuits and Notification Appliance Circuits.
2. All wire and cable shall be UL listed and/or approved by a recognized testing agency for a protective signaling system.
3. Field wiring shall be electrically supervised for open circuit and ground fault.

C. Terminal Boxes, Junction Boxes and Cabinets:

1. Enclosures in **SCREEN ROOM** shall be rated for **HAZARDOUS LOCATION, CLASS I, DIVISION I**, applications.
2. Other area enclosures shall be RSC hub type boxes and UL listed for use and purpose.
3. The fire alarm system control panel will be served by a dedicated branch circuit as noted on the One Line Diagram.
4. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.
5. The control panel cabinet shall be grounded securely to city water main.

2.3. CONTROL PANEL:

- A. The FACP shall be a Fire-Lite Model MS-10UD-7 and shall communicate with and control the following types of equipment used to make up the system: smoke and thermal heat detectors, manual stations, alarm notification appliances, and Ethernet Communicators and other system controlled devices.

Ethernet communications shall be via a Fire-Lite Model IPDACT. Central station supervisory equipment listed to UL-864 standards.

1. The control panel shall be a UL listed and FM approved microprocessor controlled Conventional Control Panel.
2. Function: The control panel shall perform the following functions:
 - a. Supervise and monitor all initiating device circuits and alarm notification circuits for trouble and alarm conditions.
 - b. Detect the operation of any initiating device circuit and the location of the alarm condition. Operate all notification appliances devices as designed.
 - c. Visually and audibly annunciate any trouble, supervisory or alarm condition on panel display.

B. System Capacity

The Control Panel shall include ten programmable initiating device circuits, four programmable output circuits, three programmable Form-C relays, digital communicator, power supply and 80 character LCD.

1. The IDCs (Initiating Device Circuits) shall be individually programmable as conventional two-wire smoke detector circuits as well as any dry contact input devices include four-wire smoke detectors, manual pull stations, heat detectors, pressure switches, and waterflow switches.
2. The four programmable outputs shall be individually programmable as conventional supervised NACs (Notification Appliance Circuits). Each NAC may be individually programmed as any of the following:
Silence Inhibit, Auto-Silence, Strobe Synchronization, Selective Silence (horn-strobe mute), Temporal or Steady Signal, Silenceable or Non-silenceable.
3. The FACP shall be capable of coding Notification Appliance Circuits in March Time Code (120 PPM), Temporal (NFPA 72), Code. Main panel notification circuits (NACs 1, 2, 3 & 4) shall also automatically synchronize other manufacturer's notification appliances.
4. The three programmable relays shall be individually programmable as Alarm, Trouble and Supervisory. When programmed as a Trouble relay, the relay shall be fail-safe.
5. The on board MS-10UD-7 power supply shall be capable of 7.0 Amps of filtered regulated power.

C. System Display

The system shall have five LED indicators as well as an 80 character LCD (Liquid Crystal Display). The LCD shall be capable of displaying a custom description for each input and output circuit. The system LEDs shall indicate the status of the following system parameters:

AC POWER	Green LED
FIRE ALARM	Red LED
SUPERVISORY	Yellow LED
TROUBLE	Yellow LED
ALARM SILENCED	Yellow LED

1. The main system display shall be an integral, eighty characters LCD with a keypad. The keypad shall have full programming capability without requiring the use of a laptop computer.
2. The FACP shall include a history log with 256 event storage. The history shall be accessible from the main system display.
3. The system shall include a real-time clock/calendar with daylight savings time control.

D. System Control Switch Operation

1. ACK/Step Silence Switch:
 - a. Activation of the control panel tone silence switch in response to alarms troubles and supervisory conditions shall silence the local panel piezo electric signal and change the LED from flashing mode to steady-ON mode. Occurrence of any new conditions in the system shall cause the control panel to resound the Local Piezo sounder and repeat the alarm, trouble, or supervisory sequences.
 - b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
2. Alarm Silence Switch: Activation of the alarm signal silence switch shall cause all alarm notification appliances to return to the normal condition after an alarm condition.
3. System Reset Switch: Activation of the System Reset Switch shall cause all electronically-latched initiating devices, as well as all associated output devices and circuits, to return to their normal condition. Holding system reset switch down shall perform a LAMP EST function and will activate the piezo sounder.
4. Alarm Activate (Drill): Switch The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
5. Lamp Test: The System RESET switch shall also function as a Lamp Test switch and shall activate all system LEDs and light each segment of the liquid crystal display.

E. System Operation

1. Zone Status LEDs: The alarm, supervisory, or trouble LED(s) shall flash until event(s) have been acknowledged LED(s) shall then illuminate steady. Any subsequent alarm, supervisory or trouble will flash the new event only.

2. Supervisory: A short circuit on this zone shall cause the supervisory LED and zone yellow LED to flash, and shall activate the supervisory notification circuit. An open circuit shall report as a zone trouble.
3. Zone Disable: Disable/Enable shall be accomplished in programming mode. If a zone has been disabled, the control panel LCD will display the zone which has been disabled and FACP will turn on the Trouble LED.

F. Programming and System Commissioning

1. The FACP shall have a configuration option which allows the user to program the FACP.

G. The control panel shall support the following modules:

1. 80 character Remote LCD Annunciator which mimics the FACP main display.
2. I/O LED Driver which provides LED outputs for connection to a custom graphics annunciator.
3. Printer Module which provides a serial/parallel output for connection to a UL listed event printer.
4. Relay Module which provides 10 form C relays
5. LED Annunciator Module which mounts on the FACP door and provides three LEDs for each zone: Alarm, Trouble and Supervisory.
6. Built in Digital Communicator (complies with NFPA 72).
7. Optional transmitter module which complies with NFPA-72 Auxiliary and Remote Station Protective Signaling systems.
8. Optional Class A Converter Module

H. The control panel shall also include the following functions:

1. Battery/Earth fault supervision,
2. 7 AH to 26 AH battery options shall be available, providing up to 90 hours standby,
3. Remote Synchronization Output,
4. Programmable Make/Break ratio,
5. Watchdog timer to supervise microprocessor.

I. Remote Field Charging Power Supply

1. The remote field charging power supply shall be a FCPS-24FS6 or FCPS-24FS8. The FCPS-24FS6/8 shall be used to provide power to audio visual devices or any other device on the system whenever the power requirements exceed those provided by the FACP.
2. The FCPS-24FS6 shall offer up to 6.0 amps continuous current of regulated, filtered, 24 volt power. It shall include an integral charger designed to charge 7.0 to 18.0 amp hour batteries and to support 60 hour standby.
3. The FCPS-24FS8 shall offer up to 8.0 amps continuous current of regulated, filtered, 24 volt power. It shall include an integral charger designed to charge 7.0 to 18.0 amp hour batteries and to support 60 hour standby.
4. The Field Charging Power Supply shall provide regulated and filtered 24 VDC power to four notification appliance circuits configured as either four Class B (Style Y) or Class Z (Style Z, with ZNAC-4 option module). Alternately, the four outputs may be configured as all non-resettable, all resettable, or two non-resettable and two resettable.
5. The Field Charging Power Supply shall include an attractive surface mount backbox.
6. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
7. The Field Charging Power Supply shall include power limited circuitry per UL standards.
8. The Field Charging Power Supply shall provide UL-Listed NAC synchronization using System Sensor, Wheelock, or Gentex "Commander²" appliances.

J. Digital Alarm Communicator Transmitter (DACT) and Internet Protocol Digital Alarm Communicator Transmitter (IPDACT). The DACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station. When the optional IPDACT Ethernet module is connected to the on board DACT, the system shall be capable of transmitting contact ID formatted alarms to a central station equipped with a compatible IP receiver via Ethernet over a private or public WAN/LAN, Intranet or Ethernet

1. The IPDACT shall be an integral module component of the fire alarm control panel enclosure.
2. The IPDACT shall include connections to the alarm panel's phone outputs and shall convert the contact ID protocol in DTMF form into UDP Ethernet Packets. It

shall include the ability for simultaneous reporting of panel events up to three different IP addresses.

3. The IPDACT shall be completely field-programmable locally from a PC via a serial port or via Ethernet and Telnet.
4. The IPDACT shall be capable of transmitting events in contact ID Format.
5. Communication shall include vital system status such as:
 - Independent Zone (Alarm, supervisory, trouble, non-alarm)
 - AC (Mains) Power Loss
 - Low Battery and Earth Fault
 - System Off Normal
 - 12 and 24 Hour Test Signal
 - Abnormal Test Signal (per UL requirements)
 - IP Line Failure
6. The IPDACT shall support independent zone/point reporting via the Contact ID format. This format shall enable the central station to have exact details concerning the location of the fire for emergency response. The IPDACT shall be capable of providing simulated phone lines to the NACP and panel communication over IP shall be transparent to the panels normal operation over phone lines.
7. The IPDACT shall utilize a supervisory heart beat signal of no less than once every 90 seconds insuring multiplexed level line supervision. Loss of Internet or Intranet connectivity shall be reported in no more than 200 seconds. Alarm events shall be transmitted to a central station within 90 seconds from time of initiation to time of notification.
8. The supervising station shall consist of a Teldat Corporation Visoralarm-Plus receiver. Said receiver shall contain a smart card for backup of all account data. Backup smart card shall initiate a new receiver with all account information in less than 60 seconds from powerup.

K. Stand Alone Voice Evacuation Control Panel NOT REQUIRED at this Time.

L. Power Supply

1. The power supply for the MS-10UD-7 panel shall be integral to the control panel itself, and shall provide all control panel and peripheral device power needs.
2. Input power shall be 120 VAC, 60 HZ. The power supply shall

provide an integral battery charger for use with batteries up to 26 AH for the MS-10UD-7 FACP.

4. The MS-10UD-7 shall provide 7.0 amperes of regulated 24 VDC power for notification devices, Four-Wire smoke detector power 24 VDC up to 500 mA, non resettable power 24 VDC up to 500 mA.
5. The power supply shall be designed to meet UL and NFPA requirements for power-limited operation on all notification and initiating circuits.

M. Cabinet - Mechanical Design

The control panel shall be housed in a cabinet designed for direct wall or vertical surface mounting. The back box and door shall be stainless steel with provisions for electrical conduit entry into the top, sides, & bottom. Door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. The cabinet shall be 6" deep, 18" wide 20" high. Space shall be provided in the cabinet for batteries. Where 26 AH batteries are used, a separate battery enclosure shall be available.

2.4. BATTERIES

- A. Shall be 12 volt, (2) Gel-Cell type required.
- B. Capacity to power the alarm system for not less than 24 hours plus 5 minutes of alarm upon AC power failure.
- C. Batteries are to be completely maintenance free.

2.5. SYSTEM COMPONENTS

- A. Horns, Strobes, and Horn Strobes

1. General

All Fire Alarm Components located in Screen Room shall be approved for Hazardous Locations, Class I, Division I.

All horns, strobes and horn/strobes shall be System Sensor SpectraAlert Advance series. Horns, strobes and horn/strobes shall mount to a cast hub type back box. A mounting plate shall be used for mounting ceiling and wall products.

2. Strobes

The strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system.

3. Horn/Strobe Combination

The horn/strobe shall be a System Sensor SpectrAlert Advance Model P2R listed to UL 1971 and UL 464 and shall be approved for fire protective service. The horn/strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The horn shall have three audibility options and an option to switch between a temporal three-pattern and a non-temporal (continuous) pattern. These options are set by a multiple position switch. On four-wire products, the strobe shall be powered independently of the sounder. The horn on horn/strobe models shall operate on a coded or non-coded power supply.

4. Outdoor Horns, Strobes, and Horn/Strobes

SpectrAlert Advance outdoor horns, strobes and horn/strobes shall be listed for outdoor use by UL and shall operate between minus 40 degrees and 151 degrees Fahrenheit. The products shall be listed for use with a System Sensor outdoor/weatherproof back box with half inch and three-fourths inch conduit entries.

5. Synchronization Requirements

All Horns, Strobes, and Horn/Strobes shall be synchronized without the need for additional synchronization hardware or modules. Synchronization shall be provided by the MS-10UD-7 power supply power supply. All Horns, Strobes, and Horn/Strobes shall be Synchronized at 1Hz and horns at temporal three. Also, while operating the strobes, the FACP shall silence the horns on horn/strobe models over a single pair of wires.

B. Manual Fire Alarm Stations

Manual Fire Alarm Pull Station assemblies located in Screen Room shall be approved for Hazardous Locations.

1. Manual Fire Alarm Stations IN Screen Room shall be File-liteKillark XAL-53.

Enclosure made of copper-free aluminum alloy, 3/4" Conduit openings NPT feed-through, Red, textured powder epoxy paint finish on box and cover, Bilingual nameplates and (1) normally open and (1) normally closed contact, and internal ground screw.

2. All other areas, Manual Fire Alarm Stations shall be File-lite BG-12 Series and be non-code, with a key- or hex-operated reset lock in order that they may be tested, and so designed that after actual Emergency Operation, they cannot be restored to normal except by use of a key or hex. An operated station shall automatically condition itself so as to be visually detected as activated.

3. Manual stations shall be constructed of red colored LEXAN (or polycarbonate equivalent) with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in white letters, 1.00 inch or larger.

4. Stations shall be suitable for surface mounting on matching backbox SB-10 or SB-I/O; or semi-flush mounting on a standard single-gang, double-gang, or 4" square cast electrical box, and shall be installed within the limits defined by the Americans with Disabilities Act (ADA) or per national/local requirements. Manual Stations shall be Underwriters Laboratories listed.

C. Conventional Photoelectric Area Smoke Detectors

Smoke Detector assemblies located in Screen Room shall be approved for Hazardous Locations

1. Smoke Detectors in Screen Room shall be Photoelectric type FireLite 30-3003 Explosion Proof Assembly for installation in Hazardous Area Class I, Division I.

2. Other Areas, detector shall be System Sensor i3 Series conventional photoelectric smoke detector, listed to Underwriters Laboratories UL 268 for Fire Protection Signaling Systems. The detector shall be a photoelectric type (Model 2W-B, 4W-B) or a combination photoelectric/thermal (Model 2WT-B, 4WT-B) with thermal sensor rated at 135°F (57.2°C).

3. The detector shall include a mounting base for mounting to 3½-inch and 4-inch octagonal, single gang, and 4-inch square back boxes with a plaster ring. Wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type.

4. The detector shall have a nominal sensitivity of 2.5 percent-per-foot nominal as measured in the UL smoke box. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall provide dual color LED indication which blinks to indicate power up, normal standby, out of sensitivity, alarm, and freeze trouble. (Model 2WT-B, 4WT-B) conditions.

5. Two-wire models shall include a maintenance signal to indicate the need for maintenance at the alarm control panel, and shall provide a loop testing capability to verify the circuit without testing each detector individually.

G. Automatic Conventional Heat Detectors in Screen Room shall be

Automatic Heat Detector assemblies located in Screen Room shall be approved for Hazardous Locations

1. Heat Detector in Screen room shall be FireLite Alarm Model 302-EPM-194, 194DEG, with Killark Series "JL" fixture base with threaded hubs.

2. Remaining facility mechanical heat detector devices, shall be a System Sensor 5600 series model, listed to Underwriters Laboratories UL 521 for Heat Detectors for Fire Protective Signaling Systems.

3. The detector shall be either a single-circuit or a dual-circuit type, normally open. The detector shall be rated for activation at 194°F and shall activate by a combination fixed temperature/rate-of-rise thermal sensor. The rate-of-rise element shall be activated by a rapid rise in temperature, approximately 15°F (8.3°C) per min.

3. The detector shall include a reversible mounting bracket for mounting to FS single or Two Gang 4-inch back boxes with a square to round plaster ring. Wiring connections shall be made by means of SEMS screws that shall accommodate 14AWG wire.
4. The detector shall contain alphanumeric markings on the exterior of the housing to identify temperature rating and activation method.
5. The rate-of-rise element of combination fixed temperature/rate- of-rise models shall be restorable, to allow for field-testing. The detectors shall include an external collector that shall drop upon activation to identify the unit in alarm.

PART 3.0 - EXECUTION

3.1. INSTALLATION:

1. Consult equipment manufacturer installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning installation.
2. Smoke detectors shall not be installed prior to system programming and testing. If construction is ongoing during this period, measures taken to protect detectors from contamination and damage.

3.2. TEST:

1. A factory trained representative shall perform the Final inspection and system tests.
2. Before energizing the system cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
3. Open initiating device circuits and verify that the trouble signal actuates.
4. Open and short notification appliance circuits and verify that trouble signal actuates.
5. Ground device circuits and verify response of trouble signals.
6. Confirm audibility of tone at alarm notification devices.
7. Verify heat detector installation and verify function as specified.
8. Conduct tests to confirm trouble indications for AC power failure and for other failures common to operating scenarios.

3.3. FINAL INSPECTION:

Provide the service of a qualified, factory-trained specialist to technically supervise testing and participate in system adjustments.

At the final inspection the specialist shall demonstrate the system functions properly in every respect.

3.4. INSTRUCTION:

Provide facility management with overview of system operating procedures. Demonstrate
"Hands-on" operation of system during the session.

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ITEMIZED PROPOSAL

For Constructing

PROJECT: JAMES STREET SIPHON STATION UPGRADES PROJECT

GNHWPCA PROJECT NO. SSF 2017-02

The work proposed herein must be completed within 270 days of the Notice to Proceed.

Greater New Haven
Water Pollution Control Authority
260 East Street
New Haven, Connecticut 06511

To Whom It May Concern,

In submitting this bid the duly authorized undersigned declares that the entity on behalf of which this bid is made is, or they are, the only person or persons interested in the said bid; that the bid is made without any connection with any person making another bid for the same contract; that the bid is in all respects fair and without collusion, fraud or mental reservation; and that no official of the Greater New Haven Water Pollution Control Authority, or any person in the employ of the Authority is directly or indirectly interested in said bid or in the supplies or work to which it relates, or in any portion of the profits thereof.

The undersigned also hereby declares that they have, either for themselves or on behalf of the entity they represent, carefully examined the Plans, specifications, and form of Contract for this Project, have personally inspected the actual location of the Work and have considered potential local sources of supply, and are satisfied as to all the quantities and conditions and understands that in signing this Proposal they or the entity that they represent waives all rights to plead any misunderstanding regarding the same.

The undersigned further understands and agrees that they are to furnish and provide for the respective item price bid all the necessary material, machinery, implements, tools, labor, services, and other items of whatever nature, and to do and perform all the Work necessary under the aforesaid conditions, to complete the improvements of the Project, which Plans and specifications it is agreed are a part of this Proposal, and to accept in full compensation therefore the amount of the summation of the products of the approximate quantities multiplied by the unit prices bid. This summation will hereinafter be referred to as the gross sum bid.

The undersigned further agrees to accept the aforesaid unit bid prices in compensation for any additions or deductions caused by any variation in quantities due to more accurate measurement, or by any changes or alterations in the Plans or specifications

of the Work and for use in the computation of the value of the Work performed for monthly estimates.

Every Proposal must be accompanied by a certified check or bank cashier's check or bid bond payable to the Greater New Haven Water Pollution Control Authority in the amount of fifteen percent (15%) of the bid.

Accompanying this Proposal is a certified check or bank cashier's check or bid bond payable to the Greater New Haven Water Pollution Control Authority in the amount of \$_____. In case this Proposal shall be accepted by the Authority, and the undersigned shall fail to execute the Contract, the monies represented by such certified check or bank cashier's check or bid bond shall be regarded as liquidated damages and shall be forfeited and become the property of the Authority. The undersigned understands and accepts:

- A. When Work is required in which no specific payment item is listed on the Proposal Form, the cost of such Work shall be included in the unit prices bid.
- B. All unit prices, lump sums, etc. listed in the bid Proposal are firm and not subject to change for ninety (90) days from the day bids are opened.
- C. Within ten (10) days from the date of a notice of acceptance of this Proposal, the undersigned agrees to execute the Contract and to furnish to the Authority a satisfactory "Faithful Performance Bond" and "Labor and Material Payment Bond" in the amount of one hundred percent (100%) of the Contract price.
- D. Time is of the Essence. All Work to be performed under the Contract shall be completed within the time stated in the Agreement for the Project or within such extended time for completion as may be granted by the Authority.
- E. As a condition of the Contract Award, the successful Bidder shall provide proof, from the Connecticut Secretary of State's office, of its current authorization to do business in Connecticut. All Connecticut corporations must provide a Certificate of Good Standing from the Secretary of State's Office. All foreign (out of State) corporations shall provide a valid license to do business in Connecticut, in the form of a current Certificate of Authority from the Secretary of State's office and evidence of compliance with the bond requirements of the Connecticut Department of Revenue Services. These documents must be presented within thirty (30) days from the date of the bid opening.

Bidder acknowledges receipt of the Addenda listed below and further acknowledges that the provisions of each Addendum have been included in the preparation of this bid.

Addendum No.	Date Received	Addendum No.	Date Received
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

COMPANY NAME (BIDDER): _____

Address of Bidder: _____

Phone Number: Area Code (_____) _____

I hereby sign this document acting within my authority as a duly authorized representative of the named Bidder. By signing below, I certify, acknowledge and affirm that the information set forth in this document is true, accurate and complete to the best of my knowledge and belief.

Signature of Bidder: _____ **Dated:** _____

Name and Addresses of Members of the Firm:

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
Project: James Street Siphon Station Upgrades Project
East Haven, Connecticut
Project Number: SSF 2017-02



Schedule Of Bid Items

The quantities of work proposed in this form are intended for bidding purposes only. The Authority reserves the right to reject any proposal in which any of the bid prices are unbalanced to the potential detriment to the Authority.

ITEM NUMBER	ESTIMATED QUANTITY	UNIT	ITEM WITH UNIT PRICE WRITTEN IN WORDS	UNIT BID PRICE		AMOUNT BID	
				DOLLARS	CTS	DOLLARS	CTS
1000	1	LS	LUMP SUM For the Installation of New Power & Control Enclosures, mechanical upgrades and structural modifications as shown and detailed in the Project Plans and Specifications, including all work incidental thereto.				
1001	1	LS	ALLOWANCE For the initial testing for the presence of asbestos and the abatement measures, if required, to be included in base bid	\$10,000		\$10,000	
BASE BID							
TOTAL OR GROSS SUM IN WORDS:						\$	
						IN FIGURES	
Signature of Bidder: _____				Dated: _____			
Printed Name: _____							
Name of Firm: _____							

STATEMENT OF QUALIFICATIONS

Bidder

Address

DATE: _____

Similar Projects Completed by Bidder:

1. NAME OF PROJECT: _____
OWNER: _____ ADDRESS: _____
CONTACT PERSON: _____ TELEPHONE: () _____
DATE STARTED: _____ DATE COMPLETED: _____
VALUE OF CONTRACT: _____
DESCRIPTION & APPROX. QUANTITIES OF MAJOR ITEMS: _____

2. NAME OF PROJECT: _____
OWNER: _____ ADDRESS: _____
CONTACT PERSON: _____ TELEPHONE: () _____
DATE STARTED: _____ DATE COMPLETED: _____
VALUE OF CONTRACT: _____
DESCRIPTION & APPROX. QUANTITIES OF MAJOR ITEMS: _____

3. NAME OF PROJECT: _____
OWNER: _____ ADDRESS: _____
CONTACT PERSON: _____ TELEPHONE: () _____
DATE STARTED: _____ DATE COMPLETED: _____
VALUE OF CONTRACT: _____
DESCRIPTION & APPROX. QUANTITIES OF MAJOR ITEMS: _____

BIDDER: _____

4. NAME OF PROJECT: _____
- OWNER: _____ ADDRESS: _____
- CONTACT PERSON: _____ TELEPHONE: () _____
- DATE STARTED: _____ DATE COMPLETED: _____
- VALUE OF CONTRACT: _____
- DESCRIPTION & APPROX. QUANTITIES OF MAJOR ITEMS: _____
- _____
- _____

5. NAME OF PROJECT: _____
- OWNER: _____ ADDRESS: _____
- CONTACT PERSON: _____ TELEPHONE: () _____
- DATE STARTED: _____ DATE COMPLETED: _____
- VALUE OF CONTRACT: _____
- DESCRIPTION & APPROX. QUANTITIES OF MAJOR ITEMS: _____
- _____
- _____

6. NAME OF PROJECT: _____
- OWNER: _____ ADDRESS: _____
- CONTACT PERSON: _____ TELEPHONE: () _____
- DATE STARTED: _____ DATE COMPLETED: _____
- VALUE OF CONTRACT: _____
- DESCRIPTION & APPROX. QUANTITIES OF MAJOR ITEMS: _____
- _____
- _____

7. OTHER PROJECT REFERENCES: _____
- _____
- _____
- _____
- _____

ADDITIONAL SHEETS MAY BE ADDED AS REQUIRED

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

APPENDIX A
PERFORMANCE BOND
AND
LABOR AND MATERIALS PAYMENT BOND

PROJECT: JAMES STREET SIPHON STATION UPGRADES PROJECT

GNHWPCA PROJECT NO. 567-2017-02

BOND NO. _____

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That _____ as Principal, and _____, as Surety, located at _____ (Business Address), a surety insurer chartered and existing under the laws of the State of _____ and authorized to do business in the State of Connecticut, are held and firmly bound unto the Greater New Haven Water Pollution Control Authority, as Obligee, in the sum of _____ (\$_____) for the payment whereof we bind ourselves, our heirs, executors, personal representatives, successors and assigns, jointly and severally.

WHEREAS, Principal has entered into a contract dated as of the ____ day of _____, 200__ with Obligee for

in accordance with drawings and specifications, which contract is incorporated by reference and made a part hereof, and is referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS BOND is that of Principal:

1. Performs the Contract at the times and in the manner prescribed in the Contract; and
2. Pays Obligee any and all losses, damages, expenses, costs, direct or indirect, and attorney's fees, including costs of any mediation, arbitration, litigation or appellate proceedings, that Obligee sustains because of any default by Principal under the Contract, including, but not limited to, all delay damages, whether liquidated or actual, incurred by Obligee;

then this Bond is void; otherwise it remains in full force and effect and Surety shall be fully liable for performance of the Principal's obligations provided thereunder.

In the event of a declaration of default of Principal by Obligee under the Contract, the Surety shall, within twenty (20) days of receipt of notice of such default, either: (1) tender the Obligee the full amount of the penal sum of this Bond; or (2) undertake to perform or complete the remaining Contract obligations itself through its agents or through independent contractors.

If Surety denies liability, in whole or in part, it shall notify the Obligee, in writing, citing the detailed reasons therefor, within fifteen (15) days of receipt of the aforesaid declaration of default of Principal.

The Surety, for value received, hereby stipulates and agrees that no changes, extensions of time, or additions to the terms of the Contract, or other work to be performed hereunder, or the specifications referred to therein shall in anyway affect its obligations under this Bond, and it does hereby waive notice of any such changes, extensions of time, alterations, or additions to the terms of the Contract, to the work thereunder or to the specifications.

In no event will the Surety be liable in the aggregate to Obligee for more than the penal sum of this Performance Bond, regardless of the number of suits that may be filed by Obligee.

Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the State of Connecticut and shall be instituted within the applicable statute of limitations for contract actions after Principal defaults.

IN WITNESS WHEREOF, the above parties have executed this instrument this ____ day of _____, 200__, the name of each party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Signed, sealed and delivered
in the presence of:

PRINCIPAL

Witnesses as to Principal:

By: _____

Name: _____

Its: _____

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, 200____ by _____, as _____ of _____, a _____ [corporation/limited liability company/partnership], on behalf of the [corporation/limited liability company/partnership]. [He/She[is personally known to me or what has produced _____ as identification and who [did] [did not] take an oath.

My Commission Expires:

Notary Public (Signature)

(AFFIX NOTARY SEAL)

(Printed Name)

(Title or Rank)

(Serial Number, if any)

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

ATTEST:

SURETY:

Witnesses as to Surety:

(Printed Name)

(Business Address)

(Authorized Signature)

(Printed Name)

OR

Witnesses as to Attorney-in-Fact:

As Attorney-in-Fact
(Attach Power of Attorney)

(Business Address)

(Printed Name)

(Telephone Number)

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, 200____ by _____, as _____ of _____, a _____ [corporation/limited liability company/partnership], on behalf of the [corporation/limited liability company/partnership]. [He/She/ is personally known to me or what has produced _____ as identification and who [did] [did not] take an oath.

My Commission Expires:

Notary Public (Signature)

(AFFIX NOTARY SEAL)

(Printed Name)

(Title or Rank)

(Serial Number, if any)

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

BOND NO. _____

PAYMENT BOND (incorporating C.G.S. § 49-41)

KNOW ALL MEN BY THESE PRESENTS: That by this Bond, we, _____ (hereinafter called the "Principal") and _____ (hereinafter called the "Surety"), located at _____, a surety insurer chartered and existing under the laws of the State of _____ and authorized to do business in the State of Connecticut, are held and firmly bound unto the Greater New Haven Water Pollution Control Authority (hereinafter called "Owner") in the sum of _____ (\$_____) for the payment whereof we bind ourselves, our heirs, personal representatives, executors, successors and assigns, jointly and severally.

WHEREAS, Principal and the Owner have reached a mutual agreement (hereinafter referred to as the "Contract") for the purpose of _____, said Contract being made a part of this Bond by this reference.

NOW, THEREFORE, THE CONDITION OF THIS BOND is that if the Principal:

1. Promptly makes payments to all claimants supplying the Principal with labor, materials or supplies, as used directly or indirectly by the Principal in the prosecution of the work provided for in the Contract; and
2. Pays the Owner for all losses, damages, expenses, costs, and attorneys' fees, including the costs of any mediation, arbitration, litigation or appellate proceedings, that the Owner sustains because of a default by the Principal under paragraph 1 of this Bond, then this Bond is void; otherwise this Bond remains in full force and effect.

BE IT FURTHER KNOWN:

Any changes in or under the Contract and compliance or noncompliance with formalities connected with the Contract or alterations which may be made in the terms of the said Contract, or in the work to be done under it, or the giving by the Owner of any extension of time for the performance of the said Contract, or any other forbearance on the part of the Owner or Principal to the other, shall not affect the obligation of the Principal and the Surety, or either of them, their heirs, personal representatives, successors or assigns under this Bond, notice to the Surety of any such changes, alterations, extensions or forbearance being hereby waived.

This Bond is issued in accordance with and expressly incorporates herein the requirements of Conn. Gen. Stat. § 49-41.

IN WITNESS WHEREOF, the above parties have executed this instrument this ____ day of _____, 200__, the name of each party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Signed, sealed and delivered in the presence of:

Witnesses as to Principal:

PRINCIPAL:

By: _____

Name: _____

Its: _____

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this ____ day of _____, 200__ by _____ as _____ of _____, a _____ [corporation/limited liability company /partnership], on behalf of the _____ [corporation/limited liability company/partnership]. [He/She/It is personally known to me or who has produced _____ as identification and who [did] [did not] take an oath.

My Commission Expires: _____

Notary Public (Signature)

(AFFIX NOTARY SEAL)

(Printed Name)

(Title or Rank)

(Serial Number, if any)

ATTEST:

SURETY:

Witnesses as to Surety:

(Printed Name)

(Business Address)

(Authorized Signature)

(Printed Name)

OR

Witnesses as to Attorney-in-Fact:

As Attorney-in-Fact
(Attach Power of Attorney)

(Business Address)

(Printed Name)

(Telephone Number)

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this ____ day of _____, 200__ by _____, as _____ of _____, a Surety, on behalf of the Surety. [He/She] is personally known to me or who has produced _____ as identification and who [did] [did not] take an oath.

My Commission Expires:

(AFFIX NOTARY SEAL)

Notary Public (Signature)

(Printed Name)

(Title or Rank)

(Serial Number, if any)

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

APPENDIX B

SAMPLE CERTIFICATE OF INSURANCE

PROJECT: JAMES STREET STATION STATION UPGRADES PROJECT

GNHWPCA PROJECT NO. SEP 2017

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

SAMPLE

Certificate of Insurance						Issue Date (MM/DD/YY)																																	
PRODUCER				INSURERS AFFORDING COVERAGE				NAIC #																															
INSURED <i>Contractor's Name</i>				INSURER	A																																		
				INSURER	B																																		
				INSURER	C																																		
				INSURER	D																																		
				INSURER	E																																		
COVERAGES																																							
THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.																																							
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>CO LTR</th> <th>TYPE OF INSURANCE</th> <th>POLICY NUMBER</th> <th>POLICY EFFECTIVE DATE (MM/DD/YY)</th> <th>POLICY EXPIRATION DATE (MM/DD/YY)</th> <th>Limits</th> </tr> </thead> <tbody> <tr> <td></td> <td> GENERAL LIABILITY <input type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS MADE <input checked="" type="checkbox"/> OCCUR. <input checked="" type="checkbox"/> ISO FORM CG 00 01 12 04 <input checked="" type="checkbox"/> XCU HAZARDS COVERAGE GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POL-ICY <input checked="" type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC </td> <td> POLICY NUMBER PER PROJECT AGGREGATE ENDORSEMENT </td> <td></td> <td></td> <td> EACH OCCURRENCE \$ 1,000,000 PRODUCTS-COMP/OP AGG. \$ 2,000,000 PERSONAL & ADV INJURY \$ GENERAL AGGREGATE \$ 2,000,000 FIRE DAMAGE (Any one fire) \$ MED. EXPENSE (Any one person) \$ </td> </tr> <tr> <td></td> <td> AUTOMOBILE LIABILITY <input checked="" type="checkbox"/> ANY AUTO <input type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> SCHEDULED AUTOS <input checked="" type="checkbox"/> OCCUR <input type="checkbox"/> HIRED AUTOS <input type="checkbox"/> NON-OWNED AUTOS <input type="checkbox"/> GARAGE </td> <td> POLICY NUMBER PER PROJECT ENDORSEMENT </td> <td></td> <td></td> <td> COMBINED SINGLE LIMIT PER ACCIDENT \$ 1,000,000 \$ \$ \$ </td> </tr> <tr> <td></td> <td> EXCESS LIABILITY <input checked="" type="checkbox"/> INCLUDED UMBRELLA FORM <input checked="" type="checkbox"/> OCCUR </td> <td> POLICY NUMBER PER PROJECT ENDORSEMENT </td> <td></td> <td></td> <td> EACH OCCURRENCE 2,000,000 AGGREGATE \$ 2,000,000 </td> </tr> <tr> <td></td> <td> WORKERS' COMPENSATION AND EMPLOYER'S LIABILITY <input type="checkbox"/> IN CL. THE PROPRIETOR, PARTNERS, EXECUTIVE OFFICERS ARE: </td> <td> POLICY NUMBER COVERAGE APPLIES IN STATE OF JOBSITE OPERATION UNDER THIS SPECIAL CONTRACT IF NO COVERAGE IS INCLUDED HERE NEEDED </td> <td></td> <td></td> <td> <input checked="" type="checkbox"/> STATUTORY LIMITS EACH ACCIDENT FOR BODILY INJURY \$ 250,000 DISEASE-POLICY LIMIT \$ 1,000,000 EACH EMPLOYEE FOR BODILY INJURY BY DISEASE \$ 250,000 </td> </tr> </tbody> </table>										CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	Limits		GENERAL LIABILITY <input type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS MADE <input checked="" type="checkbox"/> OCCUR. <input checked="" type="checkbox"/> ISO FORM CG 00 01 12 04 <input checked="" type="checkbox"/> XCU HAZARDS COVERAGE GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POL-ICY <input checked="" type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC	POLICY NUMBER PER PROJECT AGGREGATE ENDORSEMENT			EACH OCCURRENCE \$ 1,000,000 PRODUCTS-COMP/OP AGG. \$ 2,000,000 PERSONAL & ADV INJURY \$ GENERAL AGGREGATE \$ 2,000,000 FIRE DAMAGE (Any one fire) \$ MED. EXPENSE (Any one person) \$		AUTOMOBILE LIABILITY <input checked="" type="checkbox"/> ANY AUTO <input type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> SCHEDULED AUTOS <input checked="" type="checkbox"/> OCCUR <input type="checkbox"/> HIRED AUTOS <input type="checkbox"/> NON-OWNED AUTOS <input type="checkbox"/> GARAGE	POLICY NUMBER PER PROJECT ENDORSEMENT			COMBINED SINGLE LIMIT PER ACCIDENT \$ 1,000,000 \$ \$ \$		EXCESS LIABILITY <input checked="" type="checkbox"/> INCLUDED UMBRELLA FORM <input checked="" type="checkbox"/> OCCUR	POLICY NUMBER PER PROJECT ENDORSEMENT			EACH OCCURRENCE 2,000,000 AGGREGATE \$ 2,000,000		WORKERS' COMPENSATION AND EMPLOYER'S LIABILITY <input type="checkbox"/> IN CL. THE PROPRIETOR, PARTNERS, EXECUTIVE OFFICERS ARE:	POLICY NUMBER COVERAGE APPLIES IN STATE OF JOBSITE OPERATION UNDER THIS SPECIAL CONTRACT IF NO COVERAGE IS INCLUDED HERE NEEDED			<input checked="" type="checkbox"/> STATUTORY LIMITS EACH ACCIDENT FOR BODILY INJURY \$ 250,000 DISEASE-POLICY LIMIT \$ 1,000,000 EACH EMPLOYEE FOR BODILY INJURY BY DISEASE \$ 250,000
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	AUTOMOBILE LIABILITY <input checked="" type="checkbox"/> ANY AUTO <input type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> SCHEDULED AUTOS <input checked="" type="checkbox"/> OCCUR <input type="checkbox"/> HIRED AUTOS <input type="checkbox"/> NON-OWNED AUTOS <input type="checkbox"/> GARAGE	POLICY NUMBER PER PROJECT ENDORSEMENT			COMBINED SINGLE LIMIT PER ACCIDENT \$ 1,000,000 \$ \$ \$																																		
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DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS 1. All operations performed under [Project Name] project, Street Address, City, State Zip. _____ Project Number _____. The following are included as Additional Insured (Endorsement ISO Form CG 20 10 11 85 or equivalent) for all coverages except Workers' Compensation: The Greater New Haven Water Pollution Control Authority, its directors, officers, employees, subsidiaries & affiliates; [list any others as identified by the contract documents ("Additional Insureds")]. 2. All policies except workers' compensation are primary and non-contributing with any insurance maintained by Additional Insureds. 3. All policies contain an express waiver of subrogation rights against Additional Insureds. 4. For commercial general liability and excess liability coverages Additional Insureds are covered for liability arising out of named insured's ongoing and completed operations. 5. Listing of all endorsements to all policies identified on this certificate is attached hereto and incorporated herein. 6. All policies are occurrence based and project specific.																																							
CERTIFICATE HOLDER																																							
The Greater New Haven Water Pollution Control Authority 260 East Street New Haven, CT 06511 Attn: Gabriel Varca				SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED ** BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT.																																			
				AUTHORIZED REPRESENTATIVE																																			

**NON-RENEWED OR MATERIALLY CHANGED

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

APPENDIX C

PREVAILING WAGE RATES

PROJECT: JAMES STREET SITION STATION UPGRADES PROJECT

GNHWPCA PROJECT NO. SFE 2017

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY



Opportunity ★ Guidance ★ Support



THIS IS A PUBLIC WORKS PROJECT

Covered by the

PREVAILING WAGE LAW

CT General Statutes Section 31-53

**If you have QUESTIONS regarding your wages
CALL (860) 263-6790**

Section 31-55 of the CT State Statutes requires every contractor or subcontractor performing work for the state to post in a prominent place the prevailing wages as determined by the Labor Commissioner.

Sec. 31-53b. Construction safety and health course. New miner training program. Proof of completion required for mechanics, laborers and workers on public works projects. Enforcement. Regulations. Exceptions.

(a) Each contract for a public works project entered into on or after July 1, 2009, by the state or any of its agents, or by any political subdivision of the state or any of its agents, described in subsection (g) of section 31-53, shall contain a provision requiring that each contractor furnish proof with the weekly certified payroll form for the first week each employee begins work on such project that any person performing the work of a mechanic, laborer or worker pursuant to the classifications of labor under section 31-53 on such public works project, pursuant to such contract, has completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, has completed a new miner training program approved by the Federal Mine Safety and Health Administration in accordance with 30 CFR 48 or, in the case of telecommunications employees, has completed at least ten hours of training in accordance with 29 CFR 1910.268.

(b) Any person required to complete a course or program under subsection (a) of this section who has not completed the course or program shall be subject to removal from the worksite if the person does not provide documentation of having completed such course or program by the fifteenth day after the date the person is found to be in noncompliance. The Labor Commissioner or said commissioner's designee shall enforce this section.

(c) Not later than January 1, 2009, the Labor Commissioner shall adopt regulations, in accordance with the provisions of Chapter 54, to implement the provisions of subsections (a) and (b) of this section. Such regulations shall require that the ten-hour construction safety and health courses required under subsection (a) of this section be conducted in accordance with federal Occupational Safety and Health Administration Training Institute standards, or in accordance with Federal Mine Safety and Health Administration Standards or in accordance with 29 CFR 1910.268, as appropriate. The Labor Commissioner shall accept as sufficient proof of compliance with the provisions of subsection (a) or (b) of this section a student course completion card issued by the federal Occupational Safety and Health Administration Training Institute, or such other proof of compliance said commissioner deems appropriate, dated no earlier than five years before the commencement date of such public works project.

(d) This section shall not apply to employees of public service companies, as defined in section 16-1, or drivers of commercial motor vehicles driving the vehicle on the public works project and delivering or picking up cargo from public works projects provided they perform no labor relating to the project other than the loading and unloading of their cargo.

(P.A. 06-175, S. 1; P.A. 08-83, S. 1.)

History: P.A. 08-83 amended Subsec. (a) by making provisions applicable to public works project contracts entered into on or after July 1, 2009, replacing provision re total cost of work with reference to Sec. 31-53(g), requiring proof in certified payroll form that new mechanic, laborer or worker has completed a 10-hour or more construction safety course and adding provision re new miner training program, amended Subsec. (b) by substituting "person" for "employee" and adding "or program", amended Subsec. (c) by adding "or in accordance with Federal Mine Safety and Health Administration Standards" and setting new deadline of January 1, 2009, deleted former Subsec. (d) re "public building", added new Subsec. (d) re exemptions for public service company employees and delivery drivers who perform no labor other than delivery and made conforming and technical changes, effective January 1, 2009.

NOT FOR BIDDING PURPOSES
REFERENCE COPY ONLY

Informational Bulletin

THE 10-HOUR OSHA CONSTRUCTION SAFETY AND HEALTH COURSE

(applicable to public building contracts entered into *on or after July 1, 2007*, where the total cost of all work to be performed is at least \$100,000)

- (1) This requirement was created by Public Act No. 06-175, which is codified in Section 31-53b of the Connecticut General Statutes (pertaining to the prevailing wage statutes);
- (2) The course is required for public building construction contracts (projects funded in whole or in part by the state or any political subdivision of the state) entered into on or after July 1, 2007;
- (3) It is required of private employees (not state or municipal employees) and apprentices who perform manual labor for a general contractor or subcontractor on a public building project where the total cost of all work to be performed is at least \$100,000;
- (4) The ten-hour construction course pertains to the ten-hour Outreach Course conducted in accordance with federal OSHA Training Institute standards, and, for telecommunications workers, a ten-hour training course conducted in accordance with federal OSHA standard, 29 CFR 1910.268;
- (5) The internet website for the federal OSHA Training Institute is http://www.osha.gov/iso/ot/training/edcenters/fact_sheet.html;
- (6) The statutory language leaves it to the contractor and its employees to determine who pays for the cost of the ten-hour Outreach Course;
- (7) Within 30 days of receiving a contract award, a general contractor must furnish proof to the Labor Commissioner that all employees and apprentices performing manual labor on the project will have completed such a course;
- (8) Proof of completion may be demonstrated through either: (a) the presentation of a *bona fide* student course completion card issued by the federal OSHA Training Institute; *or* (2) the presentation of documentation provided to an employee by a trainer certified by the Institute pending the actual issuance of the completion card;
- (9) Any card with an issuance date more than 5 years prior to the commencement date of the construction project shall not constitute proof of compliance;

- (10) Each employer shall affix a copy of the construction safety course completion card to the certified payroll submitted to the contracting agency in accordance with Conn. Gen. Stat. § 31-53(f) on which such employee's name first appears;
- (11) Any employee found to be in non-compliance shall be subject to removal from the worksite if such employee does not provide satisfactory proof of course completion to the Labor Commissioner by the fifteenth day after the date the employee is determined to be in noncompliance;
- (12) Any such employee who is determined to be in noncompliance may continue to work on a public building construction project for a maximum of fourteen consecutive calendar days while bringing his or her status into compliance;
- (13) The Labor Commissioner may make complaint to the prosecuting authorities regarding any employer or agent of the employer, or officer or agent of the corporation who files a false certified payroll with respect to the status of an employee who is performing manual labor on a public building construction project;
- (14) The statute provides the minimum standards required for the completion of a safety course by manual laborers on public construction contracts; any contractor can exceed these minimum requirements; and
- (15) Regulations clarifying the statute are currently in the regulatory process, and shall be posted on the CTDOL website as soon as they are adopted in final form.
- (16) Any questions regarding this statute may be directed to the Wage and Workplace Standards Division of the Connecticut Labor Department via the internet website of <http://www.ctdol.state.ct.us/wgwkstnd/wgmenu.htm>; or by telephone at (860)263-6790.

THE ABOVE INFORMATION IS PROVIDED EXCLUSIVELY AS AN EDUCATIONAL RESOURCE, AND IS NOT INTENDED AS A SUBSTITUTE FOR LEGAL INTERPRETATIONS WHICH MAY ULTIMATELY ARISE CONCERNING THE CONSTRUCTION OF THE STATUTE OR THE REGULATIONS.

November 29, 2006

Notice

To All Mason Contractors and Interested Parties Regarding Construction Pursuant to Section 31-53 of the Connecticut General Statutes (Prevailing Wage)

The Connecticut Labor Department Wage and Workplace Standards Division is empowered to enforce the prevailing wage rates on projects covered by the above referenced statute.

Over the past few years the Division has withheld enforcement of the rate in effect for workers who operate a forklift on a prevailing wage rate project due to a potential jurisdictional dispute.

The rate listed in the schedules and in our Occupational Bulletin (see enclosed) has been as follows:

Forklift Operator:

- **Laborers (Group 4) Mason Tenders** - operates forklift solely to assist a mason to a maximum height of nine feet only.
- **Power Equipment Operator (Group 9)** - operates forklift to assist any trade and to assist a mason to a height over nine feet.

The U.S. Labor Department conducted a survey of rates in Connecticut but it has not been published and the rate in effect remains as outlined in the above Occupational Bulletin.

Since this is a classification matter and not one of jurisdiction, effective January 1, 2007 the Connecticut Labor Department will enforce the rate on each schedule in accordance with our statutory authority.

Your cooperation in filing appropriate and accurate certified payrolls is appreciated.

STATUTE 31-55a

- SPECIAL NOTICE -

To: All State and Political Subdivisions, Their Agents, and Contractors

Connecticut General Statute 31-55a - Annual adjustments to wage rates by contractors doing state work.

Each contractor that is awarded a contract on or after October 1, 2002, for (1) the construction of a state highway or bridge that falls under the provisions of section 31-54 of the general statutes, or (2) the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project that falls under the provisions of section 31-53 of the general statutes shall contact the Labor Commissioner on or before July first of each year, for the duration of such contract, to ascertain the prevailing rate of wages on an hourly basis and the amount of payment or contributions paid or payable on behalf of each mechanic, laborer or worker employed upon the work contracted to be done, and shall make any necessary adjustments to such prevailing rate of wages and such payment or contributions paid or payable on behalf of each such employee effective each July first.

- The prevailing wage rates applicable to any contract or subcontract awarded on or after October 1, 2002 are subject to annual adjustments each July 1st for the duration of any project which was originally advertised for bids on or after October 1, 2002.
- Each contractor affected by the above requirement shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.
- It is the **contractor's** responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's Web Site. The annual adjustments will be posted on the Department of Labor Web page: www.ctdol.state.ct.us. For those without internet access, please contact the division listed below.
- The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project. All subsequent annual adjustments will be posted on our Web Site for contractor access.

Any questions should be directed to the Contract Compliance Unit, Wage and Workplace Standards Division, Connecticut Department of Labor, 200 Folly Brook Blvd., Wethersfield, CT 06109 at (860)263-6790.

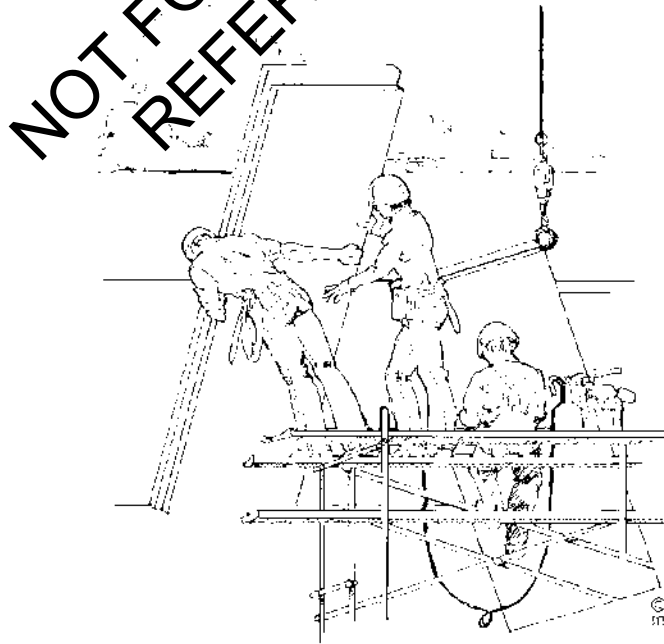
~NOTICE~

TO ALL CONTRACTING AGENCIES

Please be advised that Connecticut General Statutes Section 54-53, requires the contracting agency to certify to the Department of Labor, the total dollar amount of work to be done in connection with such public works project, regardless of whether such project consists of one or more contracts.

Please find the attached "Contracting Agency Certification Form" to be completed and returned to the Department of Labor, Wage and Workplace Standards Division, Public Contract Compliance Unit.

 Inquiries can be directed to (860)261-6543



CONNECTICUT DEPARTMENT OF LABOR
WAGE AND WORKPLACE STANDARDS DIVISION
CONTRACT COMPLIANCE UNIT

CONTRACTING AGENCY CERTIFICATION FORM

I, _____, acting in my official capacity as _____,
authorized representative title

for _____, located at _____,
contracting agency address

do hereby certify that the total dollar amount of work to be done in connection with

_____, located at _____,
project name and number address

shall be \$_____, which includes all work, regardless of whether such project
consists of one or more contracts.

CONTRACTOR INFORMATION

Name: _____

Address: _____

Authorized Representative: _____

Approximate Starting Date: _____

Approximate Completion Date: _____

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Signature

Date

Return To: Connecticut Department of Labor
Wage & Workplace Standards Division
Contract Compliance Unit
200 Folly Brook Blvd.
Wethersfield, CT 06109

Date Issued: _____

CONNECTICUT DEPARTMENT OF LABOR
WAGE AND WORKPLACE STANDARDS DIVISION

CONTRACTORS WAGE CERTIFICATION FORM
Construction Manager at Risk/General Contractor/Prime Contractor

I, _____ of _____
Officer, Owner, Authorized Rep. Company Name

do hereby certify that the _____
Company Name

Street

City

and all of its subcontractors will pay all workers on the

Project Name and Number

Street and City

the wages as listed in the schedule of prevailing rates required for such project (a copy of which is attached hereto).

Signed

Subscribed and sworn to before me this _____ day of _____, _____.

Notary Public

Return to:

Connecticut Department of Labor
Wage & Workplace Standards Division
200 Folly Brook Blvd.
Wethersfield, CT 06109

Rate Schedule Issued (Date): _____

[New] In accordance with Section 31-53b(a) of the C.G.S. each contractor shall provide a copy of the OSHA 10 Hour Construction Safety and Health Card for each employee, to be attached to the first certified payroll on the project.

In accordance with Connecticut General Statutes, 31-53 Certified Payrolls with a statement of compliance shall be submitted monthly to the contracting agency.												PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS												Connecticut Department of Labor Wage and Workplace Standards Division 200 Folly Brook Blvd. Wethersfield, CT 06109																			
CONTRACTOR NAME AND ADDRESS:												SUBCONTRACTOR NAME & ADDRESS								WORKER'S COMPENSATION INSURANCE CARRIER POLICY # EFFECTIVE DATE: EXPIRATION DATE:																							
PAYROLL NUMBER		Week-Ending Date		PROJECT NAME & ADDRESS																																							
PERSON/WORKER, ADDRESS and SECTION		APPR RATE %	MALE/ FEMALE AND RACE*	WORK CLASSIFICATION		DAY AND DATE						Total ST Hours	BASE HOURLY RATE	TYPE OF FRINGE BENEFITS	GROSS PAY FOR ALL WORK PERFORMED THIS WEEK	TOTAL DEDUCTIONS				GROSS PAY FOR THIS PREVAILING RATE JOB	CHECK # AND NET PAY																						
						S	M	T	W	TH	F	S				TOTAL FRINGE BENEFIT PLAN	FICA	FEDERAL	STATE			LIST OTHER																					
				Trade License Type & Number - OSHA 10 Certification Number		HOURS WORKED EACH DAY						Total O/T Hou	CASH	1 through 6 (see back)																													
													1. \$																														
													2. \$																														
												Base Rate	3. \$																														
													4. \$																														
												\$	5. \$																														
												Cash Fringe	6. \$																														
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												Base Rate	3. \$																														
													4. \$																														
												\$	5. \$																														
												Cash Fringe	6. \$																														
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												\$	5. \$																														
												Cash Fringe	6. \$																														
12/9/2013												*IF REQUIRED												*SEE REVERSE SIDE												PAGE NUMBER ____OF							
WWS-CP1																																											

***FRINGE BENEFITS EXPLANATION (P):**

Bona fide benefits paid to approved plans, funds or programs, except those required by Federal or State Law (unemployment tax, worker’s compensation, income taxes, etc.).

Please specify the type of benefits provided:

- 1) Medical or hospital care _____
- 4) Disability_____
- 2) Pension or retirement _____
- 5) Vacation, holiday_____
- 3) Life Insurance _____
- 6) Other (please specify) _____

CERTIFIED STATEMENT OF COMPLIANCE

For the week ending date of _____,

I, _____ of _____, (hereafter known as
Employer) in my capacity as _____ (title) do hereby certify and state:

Section A:

1. All persons employed on said project have been paid the full weekly wages earned by them during the week in accordance with Connecticut General Statutes, section 31-53, as amended. Further, I hereby certify and state the following:

- a) The records submitted are true and accurate;
- b) The rate of wages paid to each mechanic, laborer or workman and the amount of payment or contributions paid or payable on behalf of each such person to any employee welfare fund, as defined in Connecticut General Statutes, section 31-53 (h), are not less than the prevailing rate of wages and the amount of payment or contributions paid or payable on behalf of each such person to any employee welfare fund, as determined by the Labor Commissioner pursuant to subsection Connecticut General Statutes, section 31-53 (d), and said wages and benefits are not less than those which may also be required by contract;
- c) The Employer has complied with all of the provisions in Connecticut General Statutes, section 31-53 (and Section 31-54 if applicable for state highway construction);
- d) Each such person is covered by a worker’s compensation insurance policy for the duration of his employment which proof of coverage has been provided to the contracting agency;
- e) The Employer does not receive kickbacks, which means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided directly or indirectly, to any prime contractor, prime contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a prime contractor in connection with a subcontractor relating to a prime contractor; and
- f) The Employer is aware that filing a certified payroll which he knows to be false is a class D felony for which the employer may be fined up to five thousand dollars, imprisoned for up to five years or both.
2. OSHA~The employer shall affix a copy of the construction safety course, program or training completion document to the certified payroll required to be submitted to the contracting agency for this project on which such persons name first appears.

(Signature)

(Title)

Submitted on (Date)

Weekly Payroll Certification For
Public Works Projects (Continued)

PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS

Week-Ending Date:
Contractor or Subcontractor Business Name:

WEEKLY PAYROLL

PERSON/WORKER, ADDRESS and SECTION	APPR RATE %	MALE/ FEMALE AND RACE*	WORK CLASSIFICATION Trade License Type & Number - OSHA 10 Certification Number	DAY AND DATE							Total ST Hours Total O/T Hours	BASE HOURLY RATE TOTAL FRINGE BENEFIT PLAN CASH	TYPE OF FRINGE BENEFITS Per Hour 1 through 6 (see back)	GROSS PAY FOR ALL WORK PERFORMED THIS WEEK	TOTAL DEDUCTIONS				GROSS PAY FOR THIS PREVAILING RATE JOB	CHECK # AND NET PAY	
				S	M	T	W	TH	F	S					FICA	FEDERAL	STATE	OTHER			
				HOURS WORKED EACH DAY																	
												\$ Base Rate	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$								
												\$ Cash Fringe	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$								
												\$ Base Rate	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$								
												\$ Cash Fringe	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$								
												\$ Base Rate	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$								
												\$ Cash Fringe	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$								
												\$ Base Rate	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$								
												\$ Cash Fringe	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$								
												\$ Base Rate	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$								
												\$ Cash Fringe	1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$								

*IF REQUIRED

12/9/2013
WWS-CP2

NOTICE: THIS PAGE MUST BE ACCOMPANIED BY A COVER PAGE (FORM # WWS-CP1)

PAGE NUMBER ____ OF

[New] In accordance with Section 31-53b(a) of the C.G.S. each contractor shall provide a copy of the OSHA 10 Hour Construction Safety and Health Card for each employee, to be attached to the first certified payroll on the project.

In accordance with Connecticut General Statutes, 31-53 Certified Payrolls with a statement of compliance shall be submitted monthly to the contracting agency.										PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS WEEKLY PAYROLL										Connecticut Department of Labor Wage and Workplace Standards Division 200 Folly Brook Blvd. Wethersfield, CT 06109			
CONTRACTOR NAME AND ADDRESS: Landon Corporation, 15 Connecticut Avenue, Northford, CT 06472										SUBCONTRACTOR NAME & ADDRESS: XYZ Corporation 2 Main Street Yantic, CT 06389										WORKER'S COMPENSATION INSURANCE CARRIER: Travelers Insurance Company POLICY # #BAC8888928 EFFECTIVE DATE: 1/1/09 EXPIRATION DATE: 12/31/09			
PAYROLL NUMBER 1	Week-Ending Date 9/26/09	PROJECT NAME & ADDRESS DOT 105-296, Route 82																					
PERSON/WORKER, ADDRESS and SECTION	APPR RATE %	MALE/ FEMALE AND RACE*	WORK CLASSIFICATION Trade License Type & Number - OSHA 10 Certification Number	DAY AND DATE							Total ST Hours	BASE HOURLY RATE \$	TYPE OF FRINGE BENEFIT PLAN 1 through 6 (see back)	GROSS PAY FOR ALL WORK PERFORMED THIS WEEK	TOTAL DEDUCTIONS			GROSS PAY FOR THIS PREVAILING RATE JOB	CHECK # AND NET PAY				
				S	M	T	W	TH	F	S					FICA	FEDERAL WITH- HOLDING	STATE WITH- HOLDING			LIST OTHER			
Robert Craft 81 Maple Street Willimantic, CT 06226		M/C	Electrical Lineman E-1 1234567 Owner OSHA 123456		8	8	8	8	8	8			1. \$ 5.80 2. \$ 3. \$ 2.01 4. \$ 5. \$ 6. \$	\$1,582.80				P-xxxx	\$1,582.80	#123 \$ xxx.xx			
Ronald Jones 212 Elm Street Norwich, CT 06360	65%	M/B	Electrical Apprentice OSHA 234567		8	8	8	8	8				1. \$ 2. \$ 19.99 3. \$ 4. \$ 5. \$ 16.63 6. \$	\$1,464.80	xx.xx	xxx.xx	xx.xx	G-xxx	\$1,464.80	#124 \$xxx.xx			
Franklin T. Smith 234 Washington Rd. New London, CT 06320 SECTION B		M/H	Project Manager			8							1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$	\$1,500.00	xx.xx	xx.xx	xx.xx	M-xx.x	#125 xxx.xx				
													1. \$ 2. \$ 3. \$ 4. \$ 5. \$ 6. \$										

7/13/2009 WWS-CP1 *IF REQUIRED

*SEE REVERSE SIDE

PAGE NUMBER 1 OF 2

OSHA 10 ~ATTACH CARD TO 1ST CERTIFIED PAYROLL

***FRINGE BENEFITS EXPLANATION (P):**

Bona fide benefits paid to approved plans, funds or programs, except those required by Federal or State Law (unemployment tax, worker's compensation, income taxes, etc.).

Please specify the type of benefits provided:

- 1) Medical or hospital care Blue Cross 4) Disability _____
2) Pension or retirement _____ 5) Vacation, holiday _____
3) Life Insurance Utopia 6) Other (please specify) _____

CERTIFIED STATEMENT OF COMPLIANCE

For the week ending date of 9/26/09,

I, Robert Craft of XYZ Corporation, (hereafter known as

Employer) in my capacity as Owner (title) do hereby certify and state:

Section A:

1. All persons employed on said project have been paid the full weekly wages earned by them during the week in accordance with Connecticut General Statutes, section 31-53, as amended. Further, I hereby certify and state the following:

a) The records submitted are true and accurate;

b) The rate of wages paid to each mechanic, laborer or workman and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as defined in Connecticut General Statutes, section 31-53 (h), are not less than the prevailing rate of wages and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as determined by the Labor Commissioner pursuant to subsection Connecticut General Statutes, section 31-53 (d), and said wages and benefits are not less than those which may also be required by contract;

c) The Employer has complied with all of the provisions in Connecticut General Statutes, section 31-53 (and Section 31-54 if applicable for state highway construction);

d) Each such employee of the Employer is covered by a worker's compensation insurance policy for the duration of his employment which proof of coverage has been provided to the contracting agency;

e) The Employer does not receive kickbacks which means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided directly or indirectly, to any prime contractor, prime contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a prime contractor in connection with a subcontractor relating to a prime contract; and

f) The Employer is aware that filing a certified payroll which he knows to be false is a class D felony for which the employer may be fined up to five thousand dollars, imprisoned for up to five years or both.

2. OSHA-The employer shall affix a copy of the construction safety course, program or training completion document to the certified payroll required to be submitted to the contracting agency for this project on which such employee's name first appears.

Robert Craft owner 10/2/09
(Signature) (Title) Submitted on (Date)

Section B: Applies to CONNDOT Projects ONLY

That pursuant to CONNDOT contract requirements for reporting purposes only, all employees listed under Section B who performed work on this project are not covered under the prevailing wage requirements defined in Connecticut General Statutes Section 31-53.

Robert Craft owner 10/2/09
(Signature) (Title) Submitted on (Date)

Note: CTDOL will assume all hours worked were performed under Section A unless clearly delineated as Section B WWS-CP1 as such. Should an employee perform work under both Section A and Section B, the hours worked and wages paid must be segregated for reporting purposes.

THIS IS A PUBLIC DOCUMENT
DO NOT INCLUDE SOCIAL SECURITY NUMBERS

Information Bulletin

Occupational Classifications

The Connecticut Department of Labor has the responsibility to properly determine "job classification" on prevailing wage projects covered under C.G.S. Section 31-53(d).

Note: This information is intended to provide a sample of some occupational classifications for guidance purposes only. It is not an all-inclusive list of each occupation's duties. This list is being provided only to highlight some areas where a contractor may be unclear regarding the proper classification. If unsure, the employer should seek guidelines for CTDOL.

Below are additional clarifications of specific job duties performed for certain classifications:

- **ASBESTOS WORKERS**

Applies all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems.

- **ASBESTOS INSULATOR**

Handle, install apply, fabricate, distribute, prepare, alter, repair, dismantle, heat and frost insulation, including penetration and fire stopping work on all penetration fire stop systems.

- **BOILERMAKERS**

Erects hydro plants, incomplete vessels, steel stacks, storage tanks for water, fuel, etc. Builds incomplete boilers, repairs heat exchanges and steam generators.

- **BRICKLAYERS, CEMENT MASONS, CEMENT FINISHERS, MARBLE MASONS, PLASTERERS, STONE MASONS, PLASTERERS. STONE MASONS, TERRAZZO WORKERS, TILE SETTERS**

Lays building materials such as brick, structural tile and concrete cinder, glass, gypsum, terra cotta block. Cuts, tools and sets marble, sets stone, finishes concrete, applies decorative steel, aluminum and plastic tile, applies cements, sand, pigment and marble chips to floors, stairways, etc.

- **CARPENTERS, MILLWRIGHTS. PILEDRIVERMEN. LATHERS. RESILEINT FLOOR LAYERS, DOCK BUILDERS, DIKERS, DIVER TENDERS**

Constructs, erects, installs and repairs structures and fixtures of wood, plywood and wallboard. Installs, assembles, dismantles, moves industrial machinery. Drives piling into ground to provide foundations for structures such as buildings and bridges, retaining walls for earth embankments, such as cofferdams. Fastens wooden, metal or rockboard lath to walls, ceilings and partitions of buildings, acoustical tile layer, concrete form builder. Applies firestopping materials on fire resistive joint systems only. Installation of curtain/window walls only where attached to wood or metal studs. Installation of insulated material of all types whether blown, nailed or attached in other ways to walls, ceilings and floors of buildings. Assembly and installation of modular furniture/furniture systems. Free-standing furniture is not covered. This includes free standing: student chairs, study top desks, book box desks, computer furniture, dictionary stand, atlas stand, wood shelving, two-position information access station, file cabinets, storage cabinets, tables, etc.

- **LABORER, CLEANING**

- The clean up of any construction debris and the general (heavy/light) cleaning, including sweeping, wash down, mopping, wiping of the construction facility and its furniture, washing, polishing, and dusting.

- **DELIVERY PERSONNEL**

- If delivery of supplies/building materials is to one common point and stockpiled there, prevailing wages are not required. If the delivery personnel are involved in the distribution of the material to multiple locations within the construction site then they would have to be paid prevailing wages for the type of work performed: laborer, equipment operator, electrician, ironworker, plumber, etc.

- An example of this would be where delivery of drywall is made to a building and the delivery personnel distribute the drywall from one "stockpile" location to further sub-locations on each floor. Distribution of material around a construction site is the job of a laborer or tradesman, and not a delivery personnel.

- **ELECTRICIANS**

Install, erect, maintenance, alteration or repair of any wire, cable, conduit, etc., which generates, transforms, transmits or uses electrical energy for light, heat, power or other purposes, including the Installation or maintenance of telecommunication, LAN wiring or computer equipment, and low voltage wiring. ****License required per Connecticut General Statutes: E-1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9.***

- **ELEVATOR CONSTRUCTORS**

Install, erect, maintenance and repair of all types of elevators, escalators, dumb waiters and moving walks. **License required by Connecticut General Statutes: R-1,2,5,6.*

- **FORK LIFT OPERATOR**

Laborers Group 4) Mason Tenders - operates forklift solely to assist a mason to a maximum height of nine (9) feet only.

Power Equipment Operator Group 9 - operates forklift to assist any trade, and to assist a mason to a height over nine (9) feet.

- **GLAZIERS**

Glazing wood and metal sash, doors, partitions, and 2 story aluminum storefronts. Installs glass windows, skylights, store fronts and display cases or surfaces such as building fronts, interior walls, ceilings and table tops and metal store fronts. Installation of aluminum window walls and curtain walls is the "joint" work of glaziers and ironworkers, which require equal composite workforce.

- **IRONWORKERS**

Erection, installation and placement of structural steel, precast concrete, miscellaneous iron, ornamental iron, metal curtain wall, rigging and reinforcing steel. Handling, sorting, and installation of reinforcing steel (rebar). Metal bridge rail (traffic), metal bridge handrail, and decorative security fence installation. Installation of aluminum window walls and curtain walls is the "joint" work of glaziers and ironworkers which require equal composite workforce.

- **INSULATOR**

• Installing fire stopping systems/materials for "Penetration Firestop Systems": transit to cables, electrical conduits, insulated pipes, sprinkler pipe penetrations, ductwork behind radiation, electrical cable trays, fire rated pipe penetrations, natural polypropylene, HVAC ducts, plumbing bare metal, telephone and communication wires, and boiler room ceilings.

- **LABORERS**

Acetylene burners, asphalt rakers, chain saw operators, concrete and power buggy operator, concrete saw operator, fence and guard rail erector (except metal bridge rail (traffic), decorative security fence (non-metal)).

installation.), hand operated concrete vibrator operator, mason tenders, pipelayers (installation of storm drainage or sewage lines on the street only), pneumatic drill operator, pneumatic gas and electric drill operator, powermen and wagon drill operator, air track operator, block paver, curb setters, blasters, concrete spreaders.

- **PAINTERS**

Maintenance, preparation, cleaning, blasting (water and sand, etc.), painting or application of any protective coatings of every description on all bridges and appurtenances of highways, roadways, and railroads. Painting, decorating, hardwood finishing, paper hanging, sign writing, scenic art work and drywall hhg for any and all types of building and residential work.

- **LEAD PAINT REMOVAL**

- Painter's Rate

1. Removal of lead paint from bridges.
2. Removal of lead paint as preparation of any surface to be repainted.
3. Where removal is on a Demolition project prior to reconstruction.

- Laborer's Rate

1. Removal of lead paint from any surface NOT to be repainted.
2. Where removal is on a *TOTAL* Demolition project only.

- **PLUMBERS AND PIPEFITTERS**

Installation, repair, replacement, alteration or maintenance of all plumbing, heating, cooling and piping. **License required per Connecticut General Statutes: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2 S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4.*

- **POWER EQUIPMENT OPERATORS**

Operates several types of power construction equipment such as compressors, pumps, hoists, derricks, cranes, shovels, tractors, scrapers or motor graders, etc. Repairs and maintains equipment. **License required, crane operators only, per Connecticut General Statutes.*

- **ROOFERS**

Covers roofs with composition shingles or sheets, wood shingles, slate or asphalt and gravel to waterproof roofs, including preparation of surface. (demolition or removal of any type of roofing and or clean-up of any and all areas where a roof is to be relaid.)

- **SHEETMETAL WORKERS**

Fabricate, assemble, install and repair sheetmetal products and equipment in such areas as ventilation, air-conditioning, warm air heating, restaurant equipment, architectural sheet metal work, sheetmetal roofing, and aluminum gutters. Fabrication, handling, assembling, erecting, altering, repairing, etc. of coated metal material panels and composite metal material panels when used on building exteriors and interiors as soffits, fascia, louvers, partitions, canopies, cornice, column covers, awnings, beam covers, cladding, sun shades, lighting troughs, spires, ornamental roofing, metal ceilings, mansards, copings, ornamental and ventilation hoods, vertical and horizontal siding panels, trim, etc. The sheet metal classification also applies to the vast variety of coated metal material panels and composite metal material panels that have evolved over the years as an alternative to conventional ferrous and non-ferrous metals like steel, iron, tin, copper, brass, bronze, aluminum, etc. Fabrication, handling, assembling, erecting, altering, repairing, etc. of architectural metal roof, standing seam roof, composite metal roof, metal and composite bathroom/toilet partitions, aluminum gutters, metal and composite lockers and shelving, kitchen equipment, and walk-in coolers. To include testing and air –balancing ancillary to installation and construction.

- **SPRINKLER FITTERS**

Installation, alteration, maintenance and repair of fire protection sprinkler systems.

****License required per Connecticut General Statutes: F-1,2,3,4.***

- **TILE MARBLE AND TERRAZZO FINISHERS**

Assists and tends the tile setter, marble mason and terrazzo worker in the performance of their duties.

- **TRUCK DRIVERS**

~How to pay truck drivers delivering asphalt is under REVISION~

Truck Drivers are required to be paid prevailing wage for time spent "working" directly on the site. These drivers remain covered by the prevailing wage for any time spent transporting between the actual construction location and facilities (such as fabrication, plants, mobile factories, batch plant, borrow pits, job headquarters, tool yards, etc.) dedicated exclusively, or nearly so, to performance of the contract or project, which are so located in proximity to the actual construction location that it is reasonable to include them. ****License required, drivers only, per Connecticut General Statutes.***

For example:

- Material men and deliverymen are not covered under prevailing wage as long as they are not directly involved in the construction process. If, they unload the material, they would then be covered by prevailing wage for the classification they are performing work in: laborer, equipment operator, etc.
- Hauling material off site is not covered provided they are not dumping it at a location outlined above.
- Driving a truck on site and moving equipment or materials on site would be considered covered work, as this is part of the construction process.

➤ *Any questions regarding the proper classification should be directed to:*

*Public Contract Compliance Unit
Wage and Workplace Standards Division
Connecticut Department of Labor
200 Folly Brook Blvd, Wethersfield, CT 06109
(860) 263-6543.*

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**Connecticut Department of Labor
Wage and Workplace Standards Division
FOOTNOTES**

- ⇒ Please Note: If the “Benefits” listed on the schedule for the following occupations includes a letter(s) (+ a or + a+b for instance), refer to the information below.

Benefits to be paid at the appropriate prevailing wage rate for the listed occupation.

If the “Benefits” section for the occupation lists only a dollar amount, disregard the information below.

Bricklayers, Cement Masons, Cement Finishers, Concrete Finishers, Stone Masons
(Building Construction) and
(Residential- Hartford, Middlesex, New Haven, New London and Tolland Counties)

- a. Paid Holiday: Employees shall receive 4 hours for Christmas Eve holiday provided the employee works the regularly scheduled day before and after the holiday. Employers may schedule work on Christmas Eve and employees shall receive pay for actual hours worked in addition to holiday pay.

Elevator Constructors, Mechanics

- a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day, plus the Friday after Thanksgiving.
- b. Vacation: Employer contributes 8% of basic hourly rate for 5 years or more of service or 6% of basic hourly rate for 6 months to 5 years of service as vacation pay credit.

Glaziers

- a. Paid Holidays: Labor Day and Christmas Day.

Power Equipment Operators

(Heavy and Highway Construction & Building Construction)

- a. Paid Holidays: New Year's Day, Good Friday, Memorial day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day, provided the employee works 3 days during the week in which the holiday falls, if scheduled, and if scheduled, the working day before and the working day after the holiday. Holidays falling on Saturday may be observed on Saturday, or if the employer so elects, on the preceding Friday.

Ironworkers

- a. Paid Holiday: Labor Day provided employee has been on the payroll for the 5 consecutive work days prior to Labor Day.

Laborers (Tunnel Construction)

- a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. No employee shall be eligible for holiday pay when he fails, without cause, to work the regular work day preceding the holiday or the regular work day following the holiday.

Roofers

- a. Paid Holidays: July 4th, Labor Day, and Christmas Day provided the employee is employed 15 days prior to the holiday.

Sprinkler Fitters

- a. Paid Holidays: Memorial Day, July 4th, Labor Day, Thanksgiving Day and Christmas Day, provided the employee has been in the employment of a contractor 20 working days prior to any such paid holiday.

Truck Drivers

(Heavy and Highway Construction & Building Construction)

- a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas day, and Good Friday, provided the employee has at least 31 calendar days of service and works the last scheduled day before and the first scheduled day after the holiday, unless excused.

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