

**TECHNICAL SPECIFICATIONS  
GROUNDWATER INTERIM REMEDIAL MEASUREMENTS  
GRUMMAN AEROSPACE CORPORATION  
BETHPAGE, NEW YORK**

**March 1996**

Prepared for  
Grumman Aerospace Corporation  
Bethpage, New York 11714

**NORTHROP GRUMMAN**

Prepared by  
Geraghty & Miller, Inc.  
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(201) 909-0700



**GERAGHTY  
& MILLER, INC.**  
*Environmental Services*

A Heidemij Company

**TECHNICAL SPECIFICATIONS  
SEWERAGE TREATMENT FACILITY MEASURE  
GRANMAN APARTMENT CORPORATION  
ROCKAWAY, NEW YORK**

**March 1966**

**Prepared for**

**Granman Apartment Corporation  
Rockaway, New York 11714**

**Prepared by**

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## **DISCLOSURE STATEMENT**

The laws of New York State require that corporations which render engineering services in New York be owned by individuals licensed to practice engineering in the State. Geraghty & Miller, Inc. cannot meet that requirement. Therefore, all engineering services rendered to Grumman Aerospace Corporation in New York are being performed by GM Consulting Engineers, P.C., a New York professional corporation qualified to render professional engineering services in New York. There is no surcharge or extra expense associated with the rendering of professional services by GM Consulting Engineers, P.C.

Geraghty & Miller, Inc. is performing all those services which do not constitute professional engineering and is providing administrative and personnel support to GM Consulting Engineers, P.C. All matters relating to the administration of the contract with Grumman Aerospace Corporation are being performed by Geraghty & Miller, Inc. pursuant to its Amended and Restated Services Agreement with GM Consulting Engineers, P.C. All communications should be referred to the designated project manager at Geraghty & Miller, Inc.



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**SECTION 01010  
SUMMARY OF WORK**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES:**

- A. Contract Description.
- B. Definitions.
- C. Scope of Work.
- D. Work Excluded.
- E. Principal Features.
- F. Responsibilities.
- G. Ownership.
- H. CONTRACTOR's Use of Site and Premises.
- I. Offsets.
- J. Quality Assurance.
- K. Operation and Maintenance Data.
- L. Warranties.
- M. References.
- N. Submittals.
- O. Project/Site Conditions.

**1.02 CONTRACT DESCRIPTION**

- A. Grumman Aerospace Corporation has retained Geraghty & Miller, Inc. and its engineering subcontractor, GM Consulting Engineers, P.C. to prepare these Technical Specifications for the design of a groundwater interim remedial measure (IRM) system for the Grumman Aerospace Site in Bethpage, New York.

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**1.03 DEFINITIONS**

- A. For the purpose of these Technical Specifications, Construction Drawings, and other contract documents, the following definitions apply:
1. OWNER: Grumman Aerospace Corporation.
  2. CONSULTANT: Geraghty and Miller, Inc.
  3. ENGINEER: GM Consulting Engineers, P.C.
  4. CONTRACTOR: The individual, firm, partnership, or corporation designated as the CONTRACTOR in these contract documents.
  5. SUPPLIER or MANUFACTURER: The individual, firm, partnership, or corporation selected to supply specific system equipment components.
  6. SITE: The area as indicated on Construction Drawing No. C1.

**1.04 SCOPE OF WORK**

- A. The Construction Drawings and these Technical Specifications shall constitute the design and construction requirements for this project. The CONTRACTOR shall provide the necessary supervision, labor, materials, equipment, tools, and appurtenances as required to affect a complete Work, acceptable to the permitting authorities, the OWNER, and the CONSULTANT/ENGINEER, and in compliance with the respective codes. Work under this Contract Document includes the following list of items which is meant as a guide and as a general description of the CONTRACTOR's scope of work.
1. Mobilize materials and equipment.
  2. Obtain access to all required utilities necessary for construction, including, but not limited to the following: electric power, natural gas, telephone, sewer, steam, and water.
  3. Drill, install, and develop three extraction wells.
  4. Install/construct the well head, concrete slab, wellhouse, controls, piping, fencing, and vertical shaft turbine pumps for the extraction wells.

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5. Excavate, position reinforcing steel, and pour concrete for the necessary support slabs, anchors, footings, and foundations as shown on the Construction Drawings.
6. Install all treatment system equipment within designated areas.
7. Install all associated process piping to direct groundwater and process vapor streams between the extraction wells, the extraction systems, the appropriate treatment systems, and the existing water distribution and storm sewer systems.
8. Supply all the necessary system components including: the air stripping system, skid mounted vapor phase granular activated carbon (VPGAC) regeneration system with blower and condenser/separator, pre-engineered buildings, pumps, process equipment, piping, concrete pads, foundations and clearwell, fencing, wiring, electrical devices, well pumps and control panels, instrumentation, backfill, supports, and miscellaneous materials, except as noted below:
  - a. Electrical Devices: Some electrical devices will be supplied (but not installed) by the OWNER, as noted in these specifications, and as shown on the Construction Drawings.
9. Install all the necessary system components including: the air stripping system, skid mounted vapor phase granular activated carbon (VPGAC) regeneration system with blower and condenser/separator, pre-engineered buildings, pumps, process equipment, piping, concrete pads, floors, foundations, and clearwell, fencing, wiring, electrical devices, well pumps and control panels, instrumentation, backfill, supports, and miscellaneous materials needed to provide a complete workable system in accordance with the Technical Specifications and Construction Drawings.
10. Provide and install all necessary instrumentation and controls to provide for integrated system operation.
11. Install and connect electrical devices to appropriate electrical service. Connect steam service to appropriate heating systems and to the vapor phase granular activated carbon regeneration system.
12. Perform system start-up.

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13. Maintain a complete set of marked-up contract drawings to reflect all approved field changes for the OWNER to develop record drawings.

**1.05 WORK EXCLUDED**

The following items will be provided by the OWNER or others:

**A. Electrical Devices**

CONTRACTOR shall install certain electrical devices (supplied by the OWNER) as specified in the Contract Documents, including one (1) 750 KVA Transformer, and the 15KV disconnect switches at the switching centers. CONTRACTOR shall install these devices in accordance with these Technical Specifications.

**1.06 PRINCIPAL FEATURES**

This section provides an overview and summary of the different processes associated with the project and the components associated with each portion of the project.

**A. Groundwater Recovery**

The following design parameters/criteria are incorporated in the design package:

1. Three (3) extraction wells shall be installed in the designated area. The wells shall be drilled to a depth and constructed as shown on the Construction Drawings and as specified by the on-site OWNER's representative. The wells shall be completed and developed as described in these Technical Specifications.
2. All three wells shall be fitted with an electrically controlled vertical shaft turbine pump for groundwater extraction as part of the Groundwater IRM Contract.
3. The groundwater extraction pipes from each well shall be manifolded together into two parallel header pipes. The header pipes shall be directed to the groundwater treatment system.

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**B. Groundwater Treatment System**

1. Groundwater from the header pipes shall be directed either to an air stripping tower located outside the treatment building or directly to the clear well. The treated water from the air stripper shall be discharged by gravity to the clear well located beneath the treatment building. From the clearwell, the treated water shall be directed through a sharp-crested rectangular wier and subsequently discharged to an on-site storm sewer. In addition, the clear well shall be equipped to direct water to the existing plant distribution system via three identical 1,500-gpm short-coupled vertical turbine distribution pumps.
2. The vapor stream resulting from the air stripping process shall be conveyed to a steam regenerable VPGAC system, treated and discharged via ductwork to the top of the air stripping tower.

**C. Vapor Treatment System**

1. Air emissions from the air stripping tower (9,300 scfm) shall be treated using a regenerable VPGAC system.
2. The VPGAC system shall be skid mounted and connected to steam, electricity, and water for process purposes.

**D. Treatment System Enclosure**

1. The CONTRACTOR, shall construct an appropriately sized structure and enclosure for the groundwater treatment system and appurtenances in accordance with the Construction Drawings. The enclosure shall be supported by a concrete foundation and built over a concrete floor and concrete clear well.
2. The enclosure shall include insulation, heating, ventilation, and lighting to maintain a standard operating environment in the enclosure.
3. The enclosure shall include an electrical control room.

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**E. Piping and Supports**

1. The CONTRACTOR shall install piping and appurtenances and connect all system piping to the appropriate equipment skids and system accessories.
2. The CONTRACTOR shall install all necessary piping supports for vapor ductwork, water, electrical conduit, and steam piping.

**F. Control Panel and Programmable Logic Controller.**

1. The CONTRACTOR shall provide a remote main control panel which shall serve as the main control center for all system operations.
2. Control instrumentation, switches, panel boxes, conduit, wiring, telemetry and all other items necessary to make the control system functional shall be supplied and installed by the CONTRACTOR.

**G. Electrical System**

1. The CONTRACTOR shall provide and install conduit, wiring, transformers, electrical panel boxes, Motor Control Center, and all related conduit and devices required to bring power from the Plant's 15 kVA power supply and distribute it to the three well houses and the treatment plant.

**1.07 RESPONSIBILITIES**

**A. CONTRACTOR's Responsibilities:**

1. Adhere to these Technical Specifications and the Construction Drawings.
2. Provide accurate schedules, adhere to the schedules, and modify the schedules, if necessary.
3. Submit shop drawings, product data, samples and test results for the products, components, and equipment to be used to the OWNER for approval as required in these Technical Specifications.
4. Prepare and implement a Site Health and Safety Plan.

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5. Perform testing, submit results, and receive approvals from the OWNER for all materials prior to delivery to the site.
6. Receive and unload materials and equipment at site; inspect for completeness or damage. Replace any items damaged after receipt.
7. Take all necessary precautions to ensure that all work under this contract shall be performed in such a manner that any adverse environmental impacts are reduced to a level that is acceptable to the OWNER.
8. Provide and maintain soil erosion and sediment control measures for any storm event during the construction.
9. Provide and install all materials and equipment as specified, and perform testing to document that installation meets contract requirements.
10. Receive and warehouse materials and equipment, as required.
11. Submit changes in the Work to the OWNER for written approval. Obtain written approval from the OWNER prior to the commencement of such Work.
12. Pay all permit and inspection fees.

**1.08 OWNERSHIP**

- A. Drawings and specifications prepared by the CONSULTANT/ENGINEER are the property of the OWNER. They are not to be used on other projects or extensions to this Project except by agreement in writing from the CONSULTANT/ENGINEER. Submissions or distribution to meet official regulatory requirements, or other purposes in connection with this Project, is not to be construed as publication in derogation of the CONSULTANT/ENGINEER's and OWNER's rights.

**1.08 CONTRACTOR'S USE OF SITE AND PREMISES**

- A. The CONTRACTOR is responsible for making sure the locations of all underground and overhead utilities and structures are known. Before doing any work at the site, the CONTRACTOR shall notify the OWNER of the locations of all utilities and structures in the area where construction activities will be taking place.

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- B. The CONTRACTOR shall take all steps necessary to minimize disruptions or interference to the area adjacent to the site.
- C. Construction Operations: Limited to areas noted on Construction Drawings and designated by the OWNER.

**1.10 OFFSETS**

- A. The Construction Drawings are diagrammatic in nature. Required size and termination of pipes, and suggested routings are shown to conform to the site requirements, avoid creating obstructions, and preserve clearances. However, it is not the intention of these documents to indicate all required offsets. It is the specific responsibility of the CONTRACTOR to provide for offsets, horizontal and vertical control points and other surveying requirements in such a manner as to conform to the site features, and make all equipment requiring inspection, maintenance, and repair accessible.

**1.11 QUALITY ASSURANCE**

The CONTRACTOR shall be responsible for quality assurance of the Work. The CONTRACTOR shall:

- A. Monitor quality control over SUPPLIERS, MANUFACTURERS, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with MANUFACTURERS' instructions, including each step in installation, startup, and operating sequence.
- C. Should MANUFACTURERS' instructions conflict with Contract Documents, request clarification from the OWNER before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have the Work performed by persons qualified to produce workmanship of specified quality.



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**1.12 OPERATION AND MAINTENANCE DATA**

- A. The CONTRACTOR shall provide operation and maintenance instruction manuals and warranty and service information from equipment manufacturers to the OWNER within fifteen (15) days of system startup. The CONTRACTOR shall prepare an operation and maintenance manual which addresses the following items:
1. Operating Procedures: start-up, break-in, and routine normal operating instructions and sequences; regulation, control, stopping, shut-down, and emergency instructions; summer, winter, and any special operating instructions.
  2. Maintenance Requirements: routine procedures and guide for trouble-shooting, disassembly, repair, and reassembly instructions, and alignment, adjusting, balancing, and checking instructions.
  3. MANUFACTURER's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
  4. MANUFACTURER's record drawings and any additional submittal information.

**1.13 WARRANTIES**

- A. Obtain warranties and bonds, executed in duplicate by responsible SUBCONTRACTORS, SUPPLIERS, and MANUFACTURERS, at least ten (10) days prior to shipment or completion of the applicable item of Work. Except for items put into use with OWNER's permission, leave date of beginning of time of warranty blank until the Date of Substantial Completion is determined.

**1.14 REFERENCES**

- A. Specific codes and standards are cited in each section.
- B. Other National Fire Protection Association (NFPA) codes that may apply shall also be adhered to.





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**1.15 SUBMITTALS**

**A. Submit as follows:**

- 1. Identify Project, OWNER or CONSULTANT/ENGINEER, CONTRACTOR or SUPPLIER; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.**
- 2. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.**

**B. Documents Required:**

- 1. Submit the number of copies which the CONTRACTOR requires, plus five copies which will be retained by the OWNER.**
- 2. Mark each copy to identify applicable products, models, options, and other data. Supplement MANUFACTURERS' standard data to provide information unique to this Project.**

**C. Proposed Products List: Submit information on all products and equipment specified for the Project.**

**D. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal. A listing of required shop drawings is provided at the end of this section.**

**E. Mark dimensions and values in units to match those specified.**

**F. Provide submittals in accordance with Section 01300 of the Technical Specifications.**

**1.16 PROJECT/SITE CONDITIONS**

**A. Install Work in locations shown on Construction Drawings, unless prevented by unforeseen conditions.**

**B. Prepare drawings showing proposed rearrangement of Work to meet project conditions, including changes to Work specified in other Sections. Obtain permission of the OWNER before proceeding.**

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**PART 2 - PRODUCTS**

- A. Products are referenced and specified throughout these specifications by registered trade names. This does not constitute a recommendation of these products to the exclusion of other products. Equivalent products must be approved by the OWNER before being used. Impact to system layout, cost, and project schedule must be accounted for by the CONTRACTOR in all requested changes in accordance with Section 01600 (Materials and Equipment).

**PART 3 - EXECUTION**

Not Used.

END OF SECTION

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**01010-11  
SUMMARY OF WORK**

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Table. Shop Drawing Submittal List for the Groundwater Interim Remedial Measure, Northrop Grumman Corporation, Bethpage, New York.

Specification Section	Shop Drawing Title	Item Description
02607-2 MANHOLES & COVERS	MH-A MH-B	Inlet-outlet configurations and cut-sheets. Inlet-outlet configurations and cut-sheets.
02831-2 CHAIN LINK FENCES	Fencing Detail 20' Gate 12' Gate	Fence and posts with fittings and hardware. Gate with accessories, fittings and hardware. Gate with accessories, fittings and hardware.
02672-2 EXTRACTION WELL INSTALLATION	Seive Analysis* Boring Logs, Well Details and Product Certifications Product Specifications*	Bentonite and Cement
05500-2 METAL FABRICATIONS	Pipe Supports Duct Supports	Saddle configuration, supports and weld lengths. Saddle configuration, supports and weld lengths.
05510-3 METAL STAIRS, HANDRAILS, HATCH AND SAFETY ACCESSORIES	Grating Safety Railing Stairs, Ladders, Platforms Hatch Weir Hoist Fire Extinguishers Eye Wash Station Air Mask and Case	Treatment Building pipe trench. Throughout Treatment Building. Throughout Treatment Building. In clear well. In clear well. In Treatment Building. In Treatment Building and well houses. In Treatment Building. In Treatment Building.
13121-3 PRE-ENGINEERED BUILDINGS	Treatment Building * Well Houses *	Drawing Set with all design and assembly information. Drawing Set with all design and assembly information.
15000 PROCESS PIPING	Ductile iron piping, fittings, and valves. Thrust Restraint Steam Piping 1/2-inch Condensate Piping Cooling Water Piping	Catalogue cuts. Joint restraint, retainer glands, and thrust blocking. Catalogue cuts for piping, fittings, valves, and traps. Catalogue cuts, connection to influent DIP. Catalogue cuts, retainer glands.

See last page for footnotes.

Table. Shop Drawing Submittal List for the Groundwater Interim Remedial Measure, Northrop Grumman Corporation, Bethpage, New York.

Specification Section	Shop Drawing Title	Item Description
15020-2 AIR STRIPPING SYSTEM	System Drawings Foundation Anchor Bolts *	Drawing Set with all design and assembly information. Cut sheets and design calculations and installation information.
15040-2 VAPOR PHASE TREATMENT SYSTEM	System Drawings Process Calcs and Utility Requirements *	Drawing Set with all design and assembly information. Drawing Set with critical design information, including required carbon capacity, regeneration requirements, and operations. Point to point contacts, PLC cut sheets, control layouts.
15060-4 PUMPS AND APPURTENANCES	Electrical Control Details *  Well Pumps Clear Well Pumps Cooling Water Pump Steam Condensate Return System	Catalogue cuts, pump motors and pumps, pump curves Catalogue cuts, pump motors and pumps, pump curves Catalogue cuts, pump motors and pumps, pump curves Drawing set with all design and assembly information.
15500-1 HEATING AND VENTILATION	Treatment Building Heaters Well House Heaters Treatment Building Louvers Treatment Building Ventilators Well House Louvers Well House Ventilators	Heater in Treatment Building. Heater in well house. Louvers in Treatment Building. Ventilators in Treatment Building. Louvers in well houses. Ventilators in well houses.
15950-2 HEATING AND VENTILATION CONTROLS	Treatment Building Controls Well House Controls	Thermostats and controls. Thermostats and controls.
16432-1 PAD MOUNTED TRANSFORMERS *	Elevation and Plan Views Installation Drawings	Catalogue cuts.
16470-1 PANELBOARDS *	Construction Details	Materials, dimensions, anchor bolt locations.

See last page for footnotes.



Table. Shop Drawing Submittal List for the Groundwater Interim Remedial Measure, Northrop Grumman Corporation, Bethpage, New York.

Specification Section	Shop Drawing Title	Item Description
16490-1 MOTOR CONTROL CENTER *	Elevation and Plan View Conduit Entrance Drawings Bus Arrangement Drawings Unit Summary Tables	Dimensions, layout, and connections.
16500-1 LIGHTING SYSTEM	Fixtures, Installation, and Mounting Diagrams	In Treatment Building and well houses.
161910- ELECTRICAL CONTROLS *	Construction Details	Materials, dimensions, panel face layouts, component locations, and ANSI/NEMA ICS1 internal control components.
<u>OTHER</u>		
01010-4 SUMMARY OF WORK		A complete set of marked-up contract drawings to reflect all field changes (as-builts).
01010-1 SUMMARY OF WORK		Shop drawings and product data grouped in a single submittal to include all system components, products, and accessories.
SUBSTITUTIONS TO BE DEFINED BY CONTRACTOR *		

Shop Drawings Shall Include:

- a. Complete arrangement and connection details.
- b. Control details.
- c. Detailed layout of skid, equipment, and piping with plan and elevation views.
- d. Design calculations.
- e. Manufacturer's warranties and performance testing.

Please refer to the Technical Specifications for complete descriptions of the required information for each shop drawing.

This list provides a summary of the primary shop drawings that are anticipated; other shop drawings may be required depending on the selected contractor's equipment installation methodology or contractor's changes to design.

Additional submittals are required but not listed, including but not limited to: schedule, operation and maintenance Information, descriptive literature, catalogues, and project record documents.

\* Shop drawings that should be reviewed by Owner's Representative.





**GROUNDWATER INTERIM REMEDIAL MEASURE  
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**SECTION 01012  
SPECIAL CONDITIONS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Utilities.
- B. Ordinances, Permits, Licenses.
- C. Emergency Responsibility.
- D. Environmental Protection.
- E. Equipment Adjustment and Calibration.
- F. System Start-up and Operation.
- G. Operation and Maintenance Instruction Manuals.
- H. Warranties.
- I. Engineer's Authority.

**1.02 UTILITIES**

- A. Repair of damaged utilities caused by the CONTRACTOR's work is the responsibility of the CONTRACTOR. Utilities such as sewer, water, natural gas, telephone and electric lines encountered in the work shall be protected from injury and maintained in service until removed, replaced, or abandoned as required for the complete work.

**1.03 ORDINANCES, PERMITS, AND LICENSES**

- A. The CONTRACTOR shall at all times follow all applicable local, state, and federal laws. Neither the CONSULTANT/ENGINEER, OWNER, nor any other party shall be liable or held responsible if CONTRACTOR violates any of the above laws.
- B. The CONTRACTOR must apply and pay for the cost of all local building permits.
- C. The required state environmental permits shall be in place before start of construction.
- D. The OWNER shall be responsible for obtaining the following permit:
  - a. Air permit.

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**1.04 EMERGENCY RESPONSIBILITY**

- A. In case of emergency which threatens damage of property and/or safety of life, the CONTRACTOR shall act, without previous instructions from the OWNER, or CONSULTANT/ENGINEER, as the situation may warrant. The Health and Safety Plan (HASP) shall contain all relevant information regarding emergency response and be completed per Part 3 of this section of the Technical Specifications. The CONTRACTOR shall notify the OWNER of any emergencies immediately thereafter. Any claim for compensation by the CONTRACTOR, together with substantiating documents regarding expenses, shall be submitted to the OWNER and the amount of compensation shall be determined by agreement between the CONTRACTOR and OWNER.

**1.05 ENVIRONMENTAL PROTECTION**

- A. General Requirements - The CONTRACTOR shall provide and maintain environmental protection during the life of the Contract. Environmental protection shall be provided to correct conditions that develop during all phases of construction. The CONTRACTOR's operations shall comply with all federal, state, and local regulations pertaining to water, air, solid waste, and noise pollution.
- B. Protection of Natural Resources - It is intended that the natural resources within the site and outside the limits of permanent Work performed under this Contract be preserved in their existing condition or be restored to an equivalent or improved condition upon completion of the Work. Construction activities shall be confined to areas defined by the Contract Documents.
1. The CONTRACTOR shall restore damaged areas of the site to "Original Conditions" as applicable after performing required work. An inspection by the OWNER shall determine completion of work and shall approve the repair and restoration prior to the acceptance of the work. All restoration operations shall be performed at the CONTRACTOR's expense.
  2. Signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction shall be eliminated in an approved way. Upon completion, all areas shall be clean and natural looking to the maximum extent possible.

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3. All Work under this contract shall be performed in such a manner that any adverse environmental impacts are reduced to a level that is acceptable to the OWNER and the New York State Department of Environmental Conservation (NYSDEC).
  4. Special measures shall be taken to prevent oily or hazardous substances from entering the ground, drainage areas, or local bodies of water.
- C. Erosion and Sediment Control Measures - Earthwork brought to final grade shall immediately be finished as indicated and specified. Side slopes and back slopes shall be protected immediately upon completion of rough grading. Earthwork shall be planned and conducted in such a manner as to minimize the duration of exposure of unprotected soils. Erosion and sediment control shall be utilized as necessary to effectively prevent erosion and control sedimentation, and includes, but is not limited to, the following:
1. The rate of runoff from the construction site shall be mechanically retarded and controlled. This includes construction of diversion ditches, benches, and berms, to retard and divert runoff to protected drainage courses.
  2. Borrow will not be permitted in areas where suitable environmental controls are not possible.
  3. Temporary protection will be provided on all side and back slopes as soon as rough grading is completed or sufficient soil is exposed to require protection to prevent erosion.
  4. All soil piles created as part of excavation activities shall be provided with temporary cover and run-off control in accordance with Section 02270 (Temporary Erosion and Sediment Control) of the Technical Specifications.
- D. Control of Wastes - Wastes shall be picked up and placed in containers which are emptied on a regular schedule. Handling shall be conducted in a way that prevents contamination of the site and any other areas.
1. All waste shall be transported and disposed of in a manner that complies with federal, state, and local requirements by the OWNER. The OWNER shall maintain a copy of any state and/or local permits or licenses which reflect such agency's approval and compliance with applicable solid waste disposal regulations. The permits or licenses and the location of the disposal area shall be provided prior to transporting any waste material.

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2. During construction, the CONTRACTOR shall use chemical toilets or comparably effective units with sanitary wastes periodically emptied into municipal or county sanitary sewage systems. Provisions shall be made for pest control and for elimination of odors.
  3. Fueling and lubricating of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spills and evaporation. Lubricants and waste oil shall be disposed of by the CONTRACTOR at his expense, in accordance with approved procedures meeting federal, state, and local regulations.
- E. Dust Control - Dust shall be suppressed at all times, including non-working hours, weekends, and holidays. Soil at the site, haul roads, and other areas disturbed by the construction operations shall be sprinkled with water as necessary to control dust. No dry power brooming will be permitted. Vacuuming, wet mopping, or wet power brooming shall be used instead. Air blowing will be permitted only for cleaning off nonparticulate debris, such as reinforcing bars. No sandblasting will be permitted unless the dust therefrom is confined. Only wet cutting of concrete blocks, concrete, and asphalt will be permitted. No unnecessary shaking of bags will be permitted where concrete mortar and plaster milling is done.
- F. Noise Control - The maximum use of "low-noise emission products" as certified by the Environmental Protection Agency shall be made when available. When not available, screens and/or barriers shall be used for noise control. No blasting or use of explosives will be permitted.

**1.06 EQUIPMENT ADJUSTMENT AND CALIBRATION**

- A. All mechanical equipment and electrical equipment, including related control systems, shall be subjected to preliminary operation and testing before the individual facilities and systems are put into operation. Tests shall be made to determine whether the equipment has been properly assembled, aligned, adjusted, wired, or connected.
- B. The demonstration test of each piece of equipment shall include check-out from each remote control point. All alarm systems and safety lockout systems shall also be demonstrated for proper function along with all process instrumentation and controls.

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- C. The CONTRACTOR shall coordinate and be present during all such tests. The equipment SUPPLIER shall be responsible for testing and demonstrating the equipment supplied in accordance with Section 01650 (Starting of Systems) and the relevant equipment specification section.

**1.07 SYSTEM START-UP AND OPERATION**

- A. The CONTRACTOR shall place the various items of equipment into operation, along with the related piping and metering systems. After satisfactory start-up of these individual systems, including all of the related equipment, they will remain in continuous or intermittent operation as required.
- B. All equipment and accessories shall be adjusted and calibrated prior to any start-up as specified under these Special Conditions. Any equipment placed into temporary operation prior to final completion of the total project shall be readjusted and/or calibrated.
- C. The CONTRACTOR shall supervise, control, and be responsible for the operation and maintenance of the new equipment and/or system after each individual item is placed into operation. An adequate number of competent start-up personnel shall be furnished until the equipment is functional and working properly. The CONTRACTOR shall remain responsible for making any required changes, repairs, or replacements to the new installation during the start-up period.

**1.08 OPERATION AND MAINTENANCE INSTRUCTION MANUALS**

- A. The CONTRACTOR shall prepare and submit a complete set of operation and maintenance instruction manuals for the overall project, covering all equipment furnished. Manuals shall include complete parts lists for all equipment. Manuals shall be prepared specifically for the particular equipment furnished and shall consider the specific operation of this equipment in the particular process system involved. Complete lubrication requirements shall be listed, including recommended lubricant and lubricating intervals or schedule.

**1.09 WARRANTIES**

- A. The CONTRACTOR shall obtain warranties and bonds, executed in duplicate by responsible SUBCONTRACTORS, SUPPLIERS, and MANUFACTURERS, within ten days after completion of the applicable item of Work. Except for items put into use with the OWNER's permission, the beginning of the time of warranty will be the Date of Substantial Completion.

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- B. The MANUFACTURER shall guarantee and furnish MANUFACTURER's warranty against manufacturing and mechanical defects on all equipment provided for a period of two (2) years from date of initial operation.

In the event any material, part, or equipment proves defective during this period, the MANUFACTURER shall, at his expense (including labor), furnish and replace the defective item.

- C. The MANUFACTURER shall guarantee in writing the structural integrity of all equipment for a period of five (5) years.
- D. The MANUFACTURER shall guarantee the performance of the equipment and its components for a period of two (2) years.
- E. All warranties shall be provided in writing, signed by an officer of the Manufacturing company.

1.10 OWNER's AUTHORITY

- A. When performing the work, the CONTRACTOR shall abide by all orders, directions, and requirements of the OWNER or duly authorized OWNER's representatives. The work shall be performed to the satisfaction of the OWNER at the times and places, the methods, and in the manner and sequence OWNER may require. The OWNER shall determine the amount, quality, and acceptability of all phases of the work. The OWNER shall interpret the plans, specifications, contract documents, and any extra work orders. The OWNER shall decide all other questions in connection with the work. Upon request, the OWNER shall confirm in writing any oral orders, directions, requirements, or determinations.

**PART 2 - PRODUCTS**

Not used.

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**PART 3 - EXECUTION**

**3.01 FIELD QUALITY CONTROL**

- A. The CONTRACTOR shall collect samples and conduct tests in accordance with Section 01400 (Quality Control) and all applicable standards related to the item or system being tested.

**3.02 HEALTH AND SAFETY**

- A. The CONTRACTOR shall develop and implement the HASP based on the HASP presently in place at the site. A copy of the existing HASP will be supplied after award of the Contract.
- B. The CONTRACTOR shall provide adequate health and safety personal protection equipment (PPE) for his/her employees and others who might be affected by excavation and construction activities.
- C. Work procedures shall conform to all applicable OSHA, State of New York, county, local government, and other federal regulations.

**3.03 PROJECT SCHEDULE**

- A. Time is of the essence for construction of the Groundwater IRM. The CONTRACTOR is responsible for meeting the system start-up deadline.
- B. The CONTRACTOR shall be responsible for achieving round-the-clock operation of the treatment system and address all punch list items within 166 working days of the notice to proceed.
- C. The CONTRACTOR shall develop, implement, and maintain a project schedule that runs 166 working days from notice to proceed to completion of all punch list items and fully automatic operation.
- D. The CONTRACTOR will be responsible for all fines and extra costs associated with the CONTRACTOR's failure to meet the deadline specified herein and in the Contract Documents.

**END OF SECTION**

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**PART 4 - REVISIONS TO CONSTRUCTION DRAWINGS**

**4.01 GENERAL**

- A. All bidders shall indicate on the bid form the receipt of this section of the specifications and that all items have been reviewed and included in the proposal.

**4.02 DRAWING P6**

- A. References to "Peabody Floway" pump on "TYPICAL WELL HOUSE PIPING SECTION" shall be changed to "Mid-South". Mid-South and other acceptable pump manufacturers are indicated in section 15060-5 1.06A in the project specifications.
- B. The 1" air release valve on the "TYPICAL WELL HOUSE PIPING PLAN" is changed to a 2" valve as indicated in section 15000-8 2.05D

**4.03 DRAWING E1**

- A. Electrical hand hole #12 and Switching Center #1 shall be located within the fenced air stripper enclosure.

**4.04 DRAWING E2**

- A. Conduit between 15 KV Disconnect Switch and HH # 11 & MH # 11 shall be rigid galvanized steel conduit.
- B. All other conduit between Well ONCT-3 and ONCT-1 shall be SCH 80 PVC with yellow warning tape placed 12" above conduit bank. All reinforced concrete encasement is deleted.
- C. Conduit between MH #4/HH #4 and the treatment system shall be SCH 80 PVC with 6" fill over conduit bank and 4" concrete cap over fill. Concrete cap shall be full width of conduit bank. Provide yellow warning tape over concrete cap. All reinforced concrete encasement is deleted.

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- D. Referencing Detail C, locate HH # 12 and Switching Center # 1 to a location within the fenced air stripper enclosure. ✓

**4.05 DRAWING E3**

Transformer T3 shall be supplied by the CONTRACTOR. The configuration shall be equal to transformers T2 & T4.

**4.06 DRAWING E4**

Delete reinforced concrete encasement from Sections 1 thru 6. See paragraph 4.04 for revised requirements.

Revise the "CABLE AND CONDUIT SCHEDULE" to indicate that conduit P9 shall have a cable size of #4/0 within a 2 1/2" conduit.

**END OF SECTION**

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SPECIAL CONDITIONS**

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**SECTION 01039  
COORDINATION AND MEETINGS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Site Progress Meetings.
- B. Weekly Progress Reports.

**1.02 RELATED SECTIONS**

- A. Section 01010 - Summary of Work.
- B. Section 01012 - Special Conditions.
- C. Section 01300 - Submittals.
- D. Section 01400 - Quality Control.

**1.03 SITE PROGRESS MEETINGS**

- A. The OWNER shall designate, as necessary, progress meetings that will be conducted to review the progress of the work, and any unexpected conditions or situations that may have arisen. The OWNER will ensure conformance with the financial plan. The CONTRACTOR shall be fully responsible for any and all of the SUBCONTRACTORS and shall be responsible for SUBCONTRACTOR attendance and/or input into the meetings.
- B. The meetings shall be documented by the OWNER and copies of the minutes of the meetings shall be distributed to the CONTRACTOR.
- C. Progress meetings shall be held approximately once a week, at which time the weekly progress report will be reviewed.

**01039-1  
COORDINATION AND MEETINGS**

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**1.04 WEEKLY PROGRESS REPORTS**

- A. The CONTRACTOR shall provide written weekly progress reports to the OWNER outlining the current status of the work, any projected budget impacts, unexpected conditions or situations, updated schedule, and any information pertinent to the progress of the work.

**1.05 COORDINATION**

- A. All on-site work shall be coordinated by the CONTRACTOR, with the approval of the OWNER.
- B. Site, facility, and utility access shall be coordinated through the OWNER's representative and/or the appropriate utility authority.
- C. Issues related to design and construction of the specified system shall be handled through the OWNER in accordance with Sections 01010 (Summary of Work), 01012 (Special Conditions), 01300 (Submittals), and 01400 (Quality Control).

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

Not used.

END OF SECTION

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COORDINATION AND MEETINGS**

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**SECTION 01090  
REFERENCE STANDARDS**

**PART 1 - GENERAL**

**1.01 REFERENCE STANDARDS**

Where standards of the following organizations or any other standards, codes, or specifications are referred to in the Technical Specifications, the reference is to the particular standard, code, or specification cited, together with all amendments applicable at the date of the opening of Bids; and shall apply except to the extent that said standards and requirements may be in conflict with applicable laws or ordinances.

<u>Acronym</u>	<u>Organization</u>
AASHTO	American Assn. of State Hwy. & Trans. Officials
ACI	American Concrete Institute
AI	The Asphalt Institute
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BOCA	Building Officials Conference of America
CRSI	Concrete Reinforcing Steel Institute
IEEE	Institute of Electrical and Electronic Engineers
JIC	Joint Industrial Council
NCMA	National Concrete Masonry Association
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
SSPC	Steel Structures Painting Council
UL	Underwriters Laboratories

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

Not Used.

END OF SECTION

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REFERENCE STANDARDS**

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**SECTION 01300  
SUBMITTALS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Submittal Procedures.
- B. Shop Drawings.
- C. Product Data.
- D. Construction Progress Schedules.
- E. Proposed Subcontractor List.
- F. Proposed Supplier List.
- G. Record Drawings.
- H. Health and Safety Plan (HASP).
- I. Product Test Results.
- J. Manufacturer's Instructions.

**1.02 RELATED SECTIONS**

- A. Section 01012 - Special Conditions
- B. Section 01039 - Coordination and Meetings.
- C. Section 01400 - Quality Control.

**1.03 SUBMITTAL PROCEDURES**

- A. Transmit five (5) copies of each submittal to the OWNER.
- B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphabetic suffix.

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- C. Identify project, CONTRACTOR, SUBCONTRACTOR or SUPPLIER, submission date, pertinent drawing sheet and detail number(s), and specification section number(s) as appropriate.
- D. Apply CONTRACTOR's stamp, signature or initials certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
- E. All submittals are to be submitted to and approved by the OWNER in writing prior to commencing work for the item which requires submittal.
- F. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
- G. Provide space for OWNER to place review stamp.
- H. Revise and resubmit submittals as required by the OWNER until approved; identify all changes made since previous submittal.

**1.04 GENERAL**

All submittals shall be complete, neat, and orderly. The MANUFACTURER shall submit for the OWNER's approval, all information and product data called for under the specifications or requested by the OWNER including but not limited to:

- 1. MANUFACTURER descriptions, specifications, and data for each component of the equipment specified.
- 2. Description of system operation including the operation of control equipment.
- 3. MANUFACTURER installation, start-up, operation, and troubleshooting instructions.
- 4. A minimum of seven (7) calendar days prior to delivery, MANUFACTURER shall provide the OWNER three (3) copies of detailed instructions for assembly and installation.
- 5. Submittals shall be provided according to the Contract Schedule.

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**1.05 SHOP DRAWINGS**

- A. The CONTRACTOR shall furnish five (5) sets of shop drawings to the OWNER for review and approval within 28 calendar days after award of contract.
- B. Shop drawings shall show how the CONTRACTOR intends to perform the work.
- C. The shop drawings shall include, but not be limited to:
  - 1. Complete arrangement and connection details of: equipment and accessories, controls, instrumentation, flow meters, piping and valves, system internals, access ports, skid footprint, and anchoring details.
  - 2. Electrical control details including, but not limited to: wiring diagram of sensors, cut-off switch, cut-off valve and switch and control panel; cut sheets and details for instrumentation, switches, relays, programmable logic controller (if applicable), motor starters, panel box, disconnects, transformers, etc.; and ladder logic drawing for system control and operation.
  - 3. Detailed layout of skid, equipment, and piping with plan and elevation views for the complete system and the location and elevation of all mechanical and electrical interfaces.
  - 4. Two (2) copies of the drawings and data submitted by the CONTRACTOR will be returned by the OWNER to the CONTRACTOR with comments such as, "No Exceptions Noted," "Exceptions Noted," or "Returned for Resubmission." The CONTRACTOR shall make all necessary revisions, corrections, or clarifications, if required, and resubmit five (5) copies of the revised drawings and data within (7) calendar days.
  - 5. Design calculations used to size/select system and system components. These calculations shall include, but shall not be limited to: process design calculations, equipment/vessel sizing, equipment components sizing calculations, structural design calculations, ladder/platform and access design calculations, instrumentation, vessels, media, etc. Computer-generated calculations are acceptable if references and the basis of the computer-generated calculations are provided.

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6. MANUFACTURER's warranties as specified in Paragraph 1.07.

1.06 PRODUCT DATA

- A. The CONTRACTOR shall supply the OWNER with a proposed products list within 7 calendar days after award of contract. This list shall be subject to approval by the OWNER.
- B. The proposed products list shall indicate all products that the CONTRACTOR believes will be incorporated. This list shall be interpreted as agreement by the CONTRACTOR to use the specified products. Omission from this list of any product required by the contract documents shall not relieve the CONTRACTOR of the responsibility for providing that product and completing the associated work as specified.
- C. All components of the system shall be inspected and factory tested by the MANUFACTURER prior to shipment to insure proper mechanical and electrical function as specified and intended. The CONTRACTOR shall provide a certificate indicating that the equipment was inspected and tested and functions as specified. The CONTRACTOR shall provide the OWNER with factory performance/testing data.

1.07 WARRANTY

- A. The CONTRACTOR shall provide all warranties in writing, in accordance with Section 01012 - Special Conditions.

1.08 CONSTRUCTION PROGRESS SCHEDULES

The CONTRACTOR shall:

- A. Submit initial project schedule within 7 calendar days after award of contract.
- B. Submit revised schedules as substantial variations are identified or as required by the OWNER.

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- C. Show complete sequence of construction by activity, identifying Work in separate stages and in logically grouped activities. Indicate the start and finish dates and duration. Presentation shall be neat and accurate utilizing MS Project or comparable project tracking software package.

**1.09 PROPOSED SUBCONTRACTOR LIST**

The CONTRACTOR shall:

- A. Submit a complete list of SUBCONTRACTORS and INSTALLERS with name, address, and experience within 7 calendar days after award of contract.
- B. No work on the contract shall commence until all the proposed subcontractors have been approved by the OWNER in writing.

**1.10 PROPOSED SUPPLIER LIST**

The CONTRACTOR shall:

- A. Submit a complete list of SUPPLIERS with product, name, and address within 14 calendar days after award of contract.

**1.11 RECORD DRAWINGS**

- A. The CONTRACTOR shall furnish drawings with all technical information (including product data, MANUFACTURER's instructions and certificates) and all field modifications clearly indicated to the OWNER. All information necessary for the generation of record drawings shall be provided by the CONTRACTOR within 14 calendar days of substantial completion of construction.

**1.12 OPERATION AND MAINTENANCE MANUAL**

- A. Four (4) copies of an operation and maintenance manual, including system instructions for operation and maintenance, troubleshooting, and cleaning, as well as a full spare and replacement parts list shall be provided for main system components (air stripping and vapor treatment systems), pumps, blowers, control systems, etc. Also, the manual shall include the following drawings and information:

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1. General arrangements of the systems.
2. As-built mechanical and electrical system detailed drawings.
3. Catalog cut sheets and performance data of equipment supplied.
4. Blank performance test data sheets.
5. Troubleshooting guide.

**1.13 HEALTH AND SAFETY PLAN**

- A. The CONTRACTOR shall prepare a construction health and safety plan (HASP) in accordance with the Health and Safety Plan Guidelines and submit the plan to the OWNER for review and comments, incorporate the comments, and submit the final plan. CONTRACTOR shall be responsible for implementing the HASP.
- B. No work shall commence at the Site until a HASP is in place.

**1.14 PRODUCT TEST RESULTS**

- A. On-site and laboratory testing shall be performed in accordance with Section 01400 (Quality Control).
- B. Test results shall be submitted to OWNER for review within 5 calendar days of receipt of results, but no later than 30 calendar days after sample is collected for testing.

**1.15 MANUFACTURER'S INSTRUCTIONS**

- A. MANUFACTURER shall submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, furnishing, and operations and maintenance to OWNER in quantities specified for product data.
- B. Submittals shall indicate that material or product conforms to or exceeds specified requirements. Submit supporting data or certifications as appropriate.

**PART 2 - PRODUCTS**

Not used.

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SUBMITTALS**

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**PART 3 - EXECUTION**

Not used.

**END OF SECTION**

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SUBMITTALS**

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**SECTION 01400  
QUALITY CONTROL**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Contractor Quality Control and Assurance of Installation.
- B. Workmanship.
- C. References.
- D. Field Inspection of Contractor's Work.
- E. On-Site and Laboratory Testing.
- F. Manufacturer's Field Services and Reports.

**1.02 RELATED SECTIONS**

- A. Section 01039 - Coordination and Meetings.
- B. Section 01300 - Submittals.

**1.03 CONTRACTOR QUALITY CONTROL AND ASSURANCE OF INSTALLATION**

The CONTRACTOR shall:

- A. Monitor quality control over SUPPLIERS, MANUFACTURERS, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with MANUFACTURER's instructions, including each step in installation and startup sequence.
- C. If MANUFACTURER's instructions conflict with Contract Documents, CONTRACTOR shall request clarification from OWNER before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

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- E. Perform Work by persons qualified to produce workmanship of specified quality.
- F. Secure products and equipment in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- G. During freezing or inclement weather, or other adverse conditions, no work shall be performed except that which can be performed in a manner which will ensure first class construction throughout.

**1.04 WORKMANSHIP**

- A. The intent of these Technical Specifications is to describe definitely and fully the character of materials and workmanship required with regard to all ordinary features, and to require first-class work and material in all particulars.
- B. For any unexpected features arising during the progress of the Work and not fully covered herein, the specifications shall be interpreted by the OWNER to require first-class work and materials; and such interpretation shall be accepted by the CONTRACTOR.
- C. All labor shall be performed in the best and most workmanlike manner by mechanics skilled in their respective trades. The standards of the Work required throughout shall be of such grade as will bring only first-class results.
- D. Materials and methods used in the assemblage of the equipment shall comply with relevant standards, codes, or specifications related to the manufacture and operation of the specified equipment.

**1.05 REFERENCES**

- A. Conform to current reference standards by contract documents' date of issue.
- B. Obtain copies of standards when required by contract documents.
- C. Should specified reference standards conflict with contract documents, request clarification from OWNER before proceeding.
- D. The contractual relationship of the parties to the Contract shall not be altered from the contract documents by mention or inference otherwise in any reference document.

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QUALITY CONTROL**

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- E. Where a field sample is specified to be removed in individual sections, clear area after field sample has been accepted by OWNER.

**1.06 FIELD INSPECTION OF CONTRACTOR'S WORK**

- A. The OWNER will provide periodic inspection of the CONTRACTOR's Work which will ensure that the Work is being performed in accordance with the Construction Drawings and specifications such that the end product will be in conformance with the Construction Drawings and Specifications.
- B. The CONTRACTOR is responsible for complete conformance to the Construction Drawings and Technical Specifications for all Work performed on the project, including all subcontractors.
- C. The CONTRACTOR will provide ample opportunity for safe and easy access to the inspectors for proper inspection of the Work.
- D. Inform the OWNER in advance of periods when the CONTRACTOR does not intend to work due to, but not limited to, inability to obtain materials or equipment or expected inclement weather.

**1.07 ON-SITE AND LABORATORY TESTING**

- A. The CONTRACTOR shall be responsible for collecting samples and conducting tests related to the work performed under this contract. Testing shall include, but not be limited to: concrete tests, compaction tests, pipeline and interconnecting piping pressure tests, metering, electrical and control devices, natural gas line, and steam pressure testing.
- B. Unless listed otherwise, all performance tests and field and laboratory analyses will be conducted by the CONTRACTOR as detailed in the relevant sections of the Technical Specifications.

**1.08 MANUFACTURERS' FIELD SERVICES AND REPORTS**

- A. When specified in individual specification sections, the CONTRACTOR is responsible for coordinating required material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces, conditions of installation, quality of workmanship, testing, as applicable, and to initiate instructions when necessary.

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QUALITY CONTROL**

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- B. **CONTRACTOR must report to the OWNER observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to MANUFACTURER's written instructions.**
- C. **Submit report under provisions of Section 01300 (Submittals) within 30 calendar days of observation, or as specified in relevant sections of the Technical Specifications, whichever is shorter, to OWNER for review.**
- D. **The MANUFACTURER, at his expense, shall furnish to the OWNER, two (2) copies of certificates, from suppliers/MANUFACTURERS showing that all units conform to the requirements of these specifications.**

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

Not used.

**END OF SECTION**

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**01400-4  
QUALITY CONTROL**

Revised: 3/5/96



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**SECTION 01500  
CONSTRUCTION FACILITIES**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES:**

- A. Field Conditions and Measurements.**
- B. Access and Drainage.**
- C. Temporary Sanitary Facilities.**
- D. Contractor Storage Area.**
- E. Erosion and Siltration Control Measures.**
- F. Staging Areas, Storage and Field Offices.**
- G. Security.**
- H. Project Identification and Signs.**

**1.02 FIELD CONDITIONS AND MEASUREMENTS**

- A. The CONTRACTOR shall base all measurements, both horizontal and vertical, from established benchmarks and monuments. The CONTRACTOR shall be responsible for field verification of all dimensions and conditions at the job site.**
- B. Should the CONTRACTOR discover any discrepancy between actual conditions and those indicated, which prevent following good practice or the intent of the Contract Drawings and Specifications, he shall notify the OWNER, request clarification and instructions, and shall not proceed with his Work until he has received the same from the OWNER; provided that such wait does not unduly delay the progress of the Work.**
- C. No claims shall be made for extra payment or extensions of Contract completion time if the CONTRACTOR fails to notify the OWNER of any discrepancy before proceeding with the aspect of the Work.**

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CONSTRUCTION FACILITIES**

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**1.03 ACCESS AND DRAINAGE**

- A. The CONTRACTOR shall keep all natural drainage and water courses unobstructed or provide equal courses effectively placed, and prevent accumulations of surface water. The CONTRACTOR shall construct grade and stabilize access roads, and provide temporary mobilization, parking and storage areas for his use during construction within areas approved by the OWNER.
- B. Access roads and mobilization, parking, and storage areas shall be maintained in a stable and smooth condition throughout the life of the Contract.

**1.04 TEMPORARY SANITARY FACILITIES**

- A. The CONTRACTOR shall furnish and maintain the necessary temporary self-contained sanitary facilities in accordance with all applicable regulations. The use of these facilities shall be available for the CONTRACTOR'S employees as well as the OWNER'S representatives on the site.

**1.05 CONTRACTOR STORAGE AREA**

- A. A storage area will be designated by the OWNER on the project site for use by the CONTRACTOR for storage of his materials, tools, equipment, office and other items necessary for construction. the exact limits of the storage area will be designated in the field by the OWNER. The CONTRACTOR shall be fully responsible for the preparation of this area, its maintenance, and its security, including fencing, watchmen, and other means of security. Under no circumstances will the OWNER be responsible for the security of any property belonging to the CONTRACTOR, his subcontractors, or any of his work forces.
- B. The CONTRACTOR shall be fully responsible for the payment of all utilities at no additional cost to the OWNER throughout the Work; these utilities include but are not limited to power, telephone, water and sanitary facilities.

**1.06 EROSION AND SILTATION CONTROL MEASURES**

- A. Adequate control of erosion and siltation of both a temporary and permanent nature on areas disturbed by the Work shall be provided under this Contract subject to the approval of the OWNER. As stipulated in Section 02270 there will be a joint on-site inspection prior to commencing work, with CONTRACTOR, and the OWNER or its representative to determine specific siltation control requirements.
- B. Erosion control shall comply with all applicable State and County Regulations.

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- C. Specific erosion control measures to be taken for this work include:
  - 1. Compliance with the provisions of the Nassau County Soil and Water Conservation District.
  - 2. Compliance with all rules and regulations as issued by the State of New York.

**1.07 STAGING AREAS, STORAGE AND FIELD OFFICES**

- A. The CONTRACTOR may, during the course of this project, start construction, store materials, or erect temporary field office only within areas approved by the OWNER. The CONTRACTOR shall not interfere with the operation of the adjacent OWNER facilities.

**1.08 SECURITY**

- A. Security for the purpose of this project will be defined as fencing and lighting. The existing fencing and outside lighting will provide adequate security for the project.
- B. Protect Work premises and operations from theft, vandalism, and unauthorized entry by fencing, gates, locks, and appropriate security measures.
- C. The right of access to this Work whether it is in preparation or progress shall be extended to the OWNER'S representatives as well as the NYSDEC, and local authorities.
- D. Allow entrance only to authorized persons with proper identification.

**1.09 PROJECT IDENTIFICATION AND SIGNS**

- A. The project shall consistently be referred to as:  
Northrop Grumman Groundwater IRM  
Bethpage, New York
- B. Signage shall be prepared by the CONTRACTOR and posted prominently at one key location to be designated by the OWNER. The sign shall be 3 feet by 5 feet and constructed of sheet metal or approved equal. The sign shall contain the information provided in Section A and the print shall be of 3 inch black lettering on a white background.
- C. Signage shall be specified and approved by the OWNER prior to installation.

**END OF SECTION**

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CONSTRUCTION FACILITIES**

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**SECTION 01600  
MATERIALS AND EQUIPMENT**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES:**

- A. Equipment and Products Specified.
- B. Storage and Maintenance of Materials.
- C. Equipment and Material Installation.
- D. Cutting, Patching, and Painting.

**1.02 EQUIPMENT AND PRODUCTS SPECIFIED**

- A. In the various detailed sections of the specifications where any item of equipment or product is specified by proprietary name or trade name, with the addition of such expressions as "or approved equal", it is to be understood that equal-quality equipment or products of either a MANUFACTURER named or of a MANUFACTURER not named which meet the detailed requirements of the Specifications, are intended, subject to the approval of the OWNER as to the equality thereof. The CONTRACTOR must also demonstrate that there will be no adverse impact to the project schedule and no additional cost to the OWNER.
- B. Substitutions after project initiation may also be considered when a product becomes unavailable through no fault of the CONTRACTOR.
- C. The OWNER shall review the technical data for substitutions and shall accept or reject the offered substitution.
- D. The CONTRACTOR is responsible for all delays in the project schedule associated with the review of offered substitutions. Such delays shall be incorporated into the CONTRACTOR's projected construction schedule and shall be compensated for such that the overall project schedule is not affected.

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**E. Substitution of components is allowed as follows:**

1. Where specified as "or equal" shall mean that the CONTRACTOR may use material of equal quality, function, and value.
2. Where specified as "or approved equal" means that substitution is allowed upon approval by the OWNER.
3. "No substitution," or unspecified, means substitutions will not be allowed unless compelling reasons exist to require the substitution, and the OWNER concurs with the CONTRACTOR and approves the substitution.

**F. A request for substitution constitutes a representation that the CONTRACTOR:**

1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
2. Will provide the same warranty for the Submission as for the specified Product.
3. Will coordinate installation and make changes to other Work, which may be required for the Work to be complete, with no additional cost to OWNER or delay to the project schedule.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Understands that the OWNER's approval of a requested change does not place the responsibility under this section on the OWNER.

**1.03 STORAGE AND MAINTENANCE OF MATERIALS**

- A. All materials provided and Work performed under this Contract shall be protected from damage before and after installation. The CONTRACTOR shall be responsible for Work, equipment, and materials until inspected, tested, and finally accepted in accordance with this Section and the General Conditions.**

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MATERIALS AND EQUIPMENT**

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- B. All arrangements for delivery, storage, and handling of equipment specified herein shall be the CONTRACTOR's responsibility. The CONTRACTOR shall store equipment and materials so as to ensure the preservation of their quality and fitness for work. When considered necessary, they shall be placed on wooden platforms, or other hard, clean surfaces and shall be placed under cover when directed. Stored materials shall be located so as to facilitate prompt inspection.
- C. Where materials or products called for under this Contract are installed before the erection of adequate protective structures, the CONTRACTOR without additional compensation therefore, shall provide approved, effective and durable covers for fully protecting such materials or products against damage from the elements or from any other causes and OWNER.
- D. All machinery, equipment, piping, and accessories and appurtenances shall be adequately supported and safeguarded against all damage or injury during performance of Work under this Contract. The CONTRACTOR shall be responsible for all damage or injury resulting from his operations and shall repair such damage immediately and to the satisfaction of the OWNER.
- E. The CONTRACTOR shall store and protect products in accordance with the MANUFACTURER's recommendations and the requirements specified in these Contract Documents and shall submit the MANUFACTURER's storage and maintenance instructions prior to delivery.
- F. The CONTRACTOR shall make all arrangements and provisions necessary for the storage of materials and equipment. All excavated material, construction equipment, and materials and equipment to be incorporated into the Work shall be placed so as not to injure any part of the Work or existing facilities, and so that free access can be achieved at all times to all parts of the Work, to all unrelated portions of the OWNER's facility, and to all public utility installations in the vicinity of the Work. Materials and equipment shall be kept neatly and compactly stored in locations that will cause a minimum of inconvenience to other contractors, public travel, adjoining owners, tenants, occupants and the OWNER.
- G. Areas available on the job site for storage of materials and equipment shall be as shown, specified or designated and approved by the OWNER. All materials and equipment must be consigned to the CONTRACTOR directly. No delivery of materials and equipment will be accepted by the OWNER, and all expenses incurred by the OWNER in handling materials or equipment which have been consigned or directed to the OWNER will be charged to the CONTRACTOR.

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- H. Materials and equipment which are to become the property of the OWNER shall be stored to facilitate their inspection and ensure preservation of the quality and fitness of the Work, including proper protection against damage by freezing and moisture. They shall be placed inside storage areas, unless otherwise shown, specified or acceptable to the OWNER.
- I. CONTRACTOR shall be fully responsible for loss or damage to stored materials.
- J. Any material or equipment which, in the opinion of the OWNER, has been damaged due to improper storage and/or handling and is unfit for its specified or intended use shall be properly removed from the site or Work. The CONTRACTOR shall receive no compensation for the damaged material or its removal or replacement. The CONTRACTOR shall be responsible for replacing any such materials with undamaged material as specified and shall be liable for any damages associated with removal and replacement of damaged materials, as well as damages - direct or consequential - resulting from delays in the project schedule that occur due to the damaged materials.

**1.04 EQUIPMENT AND MATERIAL INSTALLATION**

- A. Install per MANUFACTURER's instructions and specifications.
- B. Maintain plumbness and be within specified tolerances.
- C. Locate and install in accordance with plans and specifications.
- D. Install in accordance with accepted quality construction practice to assure proper operation and full design life of the system and components.

**1.05 CUTTING, PATCHING AND PAINTING**

- 1. The CONTRACTOR shall perform all cutting and patching required for the proper installation of the equipment. If cutting will harm the structural integrity or mar the appearance, consult the OWNER for approval before proceeding. Patching shall meet the approval of the OWNER.
- 2. Equipment furnished by the CONTRACTOR in a painted condition shall be free from scratches, blemishes, or rust spots. Equipment with painted

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surfaces cracked, chipped, rusted, or peeled shall be repaired as approved by the OWNER and as per Section 09900 - Painting, before final acceptance.

3. CONTRACTOR shall request OWNER's approval before cutting or altering items specified in Contract Documents.

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

Not used.

END OF SECTION

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MATERIALS AND EQUIPMENT**

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GERAGHTY & MILLER, INC.



**GROUNDWATER INTERIM REMEDIAL MEASURE  
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**SECTION 01650  
STARTING OF SYSTEMS**

**PART 1- GENERAL**

**1.01 SECTION INCLUDES**

- A. Scope.
- B. Division of Responsibilities.
- C. Process Testing.

**1.02 RELATED SECTIONS**

- A. Section 01010 - Summary of Work.
- B. Section 01012 - Special Conditions.
- C. Section 01039 - Coordination and Meetings.
- D. Section 01300 - Submittals.
- E. Section 01400 - Quality Assurance.
- F. Section 01600 - Materials and Equipment.

**1.03 SCOPE**

- A. This Job Instruction delineates the division of responsibilities between the OWNER and CONTRACTOR for activities which occur during the startup/shakedown and turnover period after substantial construction has been accomplished.

**1.04 DIVISION OF RESPONSIBILITIES**

- A. Certain specific activities are to be completed before the final Turnover Notice will be issued to the CONTRACTOR to signify substantial Completion of a portion (or all) of the work. Following issue of a Turnover Notice, the CONTRACTOR shall continue to complete all unfinished work covered by a "Punch-List" resulting from known deficiencies.

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- B. There will undoubtedly be a certain amount of "make-good" work required after issuance of a Turnover Notice; for example, insulation, paint, fireproofing, or paving may require repair through no fault of the OWNER. In such instances, the CONTRACTOR will be expected to make such repair promptly.
- C. CONTRACTOR shall be responsible for SUBCONTRACTOR and/or vendor representatives/ technicians being available on the site during the first run-in of equipment and is to arrange for MANUFACTURER's to check out equipment as required at the appropriate time. The CONTRACTOR shall provide SUBCONTRACTOR and vendor services at no charge to the OWNER for all SUBCONTRACTORS and vendors contracted through the CONTRACTOR.

**1.05 PROCESS TESTING**

- A. MANUFACTURER's representative shall perform functional testing during start-up. MANUFACTURER's representative shall be available (on-site) during start-up, in accordance with the relevant section(s) of the Technical Specifications.
- B. Instrumentation, controls, and complete system integration shall be tested by the CONTRACTOR under the observation of the OWNER and MANUFACTURER.
- C. OWNER shall collect samples for evaluation and/or laboratory analyses to verify the performance of the process equipment.

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

Not used.

END OF SECTION

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STARTING OF SYSTEMS**

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**INTERIM REMEDIAL MEASURE  
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**SECTION 01700  
CONTRACT CLOSEOUT**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedures
- B. Clean-up.
- C. Substantial Completion.
- D. Final Inspection.
- E. Project Record Documents.
- F. Contractor's Closeout Submittals.

**1.02 RELATED SECTIONS**

- A. Section 01300 - Submittals.

**1.03 PROCEDURES**

- A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

**1.04 CLEAN-UP**

- A. Remove all waste, debris, rubbish, tools, equipment, machinery and surplus materials to the satisfaction of the OWNER.
- B. Dispose all wastes, debris, and rubbish in accordance with applicable federal, state, and local regulations.
- C. Clean all sight-exposed surfaces. Leave work clean and ready for possession by the OWNER.

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**1.05 SUBSTANTIAL COMPLETION**

- A. When the CONTRACTOR considers that the work is substantially complete, he/she shall submit to the OWNER the following:
1. A written notice that the work, or designated portion thereof, is substantially complete.
  2. A list of items to be completed or corrected.
- B. Within a reasonable time after receipt of such notice, the OWNER will make an inspection to determine the status of completion.
- C. Should the OWNER determine that the work is not substantially complete, the following shall occur:
1. The OWNER will promptly notify the CONTRACTOR, in writing, giving the reasons thereof.
  2. The CONTRACTOR shall remedy the deficiencies in the work and send a second written notice of substantial completion to the OWNER.
  3. The OWNER will reinspect the work.
- D. When the OWNER finds that the work is substantially completed, the OWNER will:
1. Prepare and deliver to the OWNER a tentative Certificate of Substantial Completion with a tentative list of items to be completed or corrected before final payment.
  2. After consideration of any comments made by the OWNER as provided in Conditions of the Contract, the OWNER will execute and deliver to the CONTRACTOR a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

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**1.06 FINAL INSPECTION**

- A. When the CONTRACTOR considers the work to be complete, the CONTRACTOR shall submit written certification that:
1. The contract documents have been reviewed.
  2. Work has been inspected for compliance with Contract Documents.
  3. Work has been constructed in accordance with Contract Documents.
  4. Equipment and systems have been tested and are operational.
  5. Work is completed and ready for final inspection.
- B. The OWNER will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should the OWNER consider that the work is incomplete or defective, the following shall apply:
1. The OWNER will promptly notify the CONTRACTOR in writing, listing the incomplete or defective work.
  2. The CONTRACTOR shall take immediate steps to remedy the stated deficiencies and send a second written certification to the OWNER.
  3. The OWNER will reinspect the work.
- D. When the OWNER finds that the work is acceptable under the contract documents, the OWNER shall request that the CONTRACTOR make closeout submittals.

**1.07 PROJECT RECORD DOCUMENTS**

- A. The CONTRACTOR shall legibly mark on the Construction Drawings actual construction showing horizontal and vertical location of underground utilities, field changes of dimension and detail, and changes made by change orders and details not included on the original Construction Drawings.

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- B. The CONTRACTOR shall deliver record documents (as-builts), consisting of annotated Construction Drawings as indicated to the OWNER at the completion of the project to be used in preparation of the as-built drawings.

**1.08 CONTRACTOR'S CLOSEOUT SUBMITTALS**

- A. Evidence of payment and release of liens shall be done according to the requirements of the submittal procedures and Special Conditions.

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

Not used.

**END OF SECTION**

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CONTRACT CLOSEOUT**

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**SECTION 02211  
ROUGH/FINAL GRADING**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Clearing
- B. Topsoil
- C. Grading
- D. Field Engineering.

**1.02 RELATED SECTIONS**

- A. Section 01010 - Summary of Work.
- B. Section 01012 - Special Conditions.
- C. Section 01400 - Quality Control.
- D. Section 01600 - Material and Equipment.
- E. Section 02222 - Excavation.
- F. Section 02223 - Backfilling.

**1.03 CLEARING**

- A. All vegetation, shrubs, and brush within the construction area shall be removed. Stumps shall be removed entirely. Roots shall be grubbed out to at least 18 inches below the finished grade. Brush, refuse, roots, etc. shall be transported and deposited off the premises.

**1.04 TOPSOIL**

- A. Material from the excavation, suitable for topsoil, shall be deposited in piles separate from other excavated material. Piles of topsoil shall be located so that the material can be used readily for the finished surface grading in areas that were stripped of topsoil during construction. When used for finished surface grading, topsoil shall be spread uniformly (minimum four inches thick, if sufficient material is available) over the areas to receive it.



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**1.05 GRADING**

- A. Rough grading in preparation for construction of slabs on grade for treatment building, air stripper, and pump enclosures shall be performed at all places that are indicated on the Design Drawings, to within a vertical tolerance of 0.1 foot of final lines, grades, and slopes shown.
- B. Grade disturbed areas, to smooth uniformity between datum points. Form subgrade to proper shapes and contours, work out swales and other earth features, and complete the earthwork to receive fine grading, base coarse or topsoil.
- C. Rough grading and compaction shall meet the elevations and contours shown on the Design Drawings. Tolerance for rough grading shall be plus/minus 0.1 foot. Replace and compact excess excavation as specified.
- D. Final grades shall be carried to the lines, grades, and slopes shown on the Design Drawings, within a tolerance of 0.1 foot.
- E. All material encountered, of whatever nature, within the limits indicated, shall be used as backfill or removed and disposed as directed by the OWNER. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. The graded area shall be protected from surface water run-on.
- F. The right is reserved by the OWNER to make minor adjustments or revisions in lines or grades, if found necessary as the work progresses in order to obtain satisfactory construction.
- G. CONTRACTOR is responsible for protection and relocation, if necessary, of all above and below grade pipelines, utilities, adjacent existing structures, and, relocation, if necessary.
- H. New areas designated to be grassed and grassed areas disturbed by construction shall be graded with topsoil, as specified above, fertilized and seeded.
- I. All disturbed areas shall be restored to existing conditions unless otherwise specified.

**1.04 FIELD ENGINEERING**

- A. Employ a Land Surveyor registered in the State of New York and acceptable to the OWNER.
- B. CONTRACTOR to locate and protect survey control and reference points.
- C. Verify setbacks and easements, confirm drawing dimensions and elevations.

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**ROUGH/FINAL GRADING**

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- D. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
- E. Submit a copy of registered site drawing and certificate signed by the Land Surveyor that the elevations and locations of the Work are in conformance with the Contract Documents.

**PART 2 - PRODUCTS**

- A. Fertilizer shall be a suitable commercial 10-6-4 mixture (50% organic) spread evenly at the rate of 10 lbs. Per 1,000 square feet.
- B. Seed shall be one of the following mixtures spread at the rate of 8 lbs. per 1,000 square feet.
  - Primary - 45% Baron Kentucky Bluegrass  
25% RamI Kentucky Bluegrass  
15% Glade Kentucky Bluegrass  
15% Citation Perennial Ryegrass
  - Secondary - 40% Citation Perennial Ryegrass  
40% Adelphi Kentucky Bluegrass  
20% Creeping Red Fescue
  - Shade - 36% Penlawn Red Fescue  
32% Yorktown Perennial Ryegrass  
32% Jamestown Red Fescue
- C. Dolomite Limestone (granular type) shall be added to all newly seeded areas at the rate of 50 lbs. per 1,000 square feet.

**PART 3 - EXECUTION**

- A. The CONTRACTOR shall adhere to the following:
  - 1. All utilities that pass through the Work Area or structures in or adjacent to the Work area shall be maintained and protected.
  - 2. The CONTRACTOR shall take steps to control dust wherever the CONTRACTOR performs work.
  - 3. Where seed is placed on sloped surfaces, stabilizing must be employed to prevent erosion.

END OF SECTION

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ROUGH/FINAL GRADING



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**SECTION 02222  
EXCAVATION**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Excavation.
- B. Protection.
- C. Submittals.

**1.02 RELATED SECTIONS**

- A. Section 01010 - Summary of Work.
- B. Section 01012 - Special Conditions.
- C. Section 01400 - Quality Control.
- D. Section 01600 - Material and Equipment.
- E. Section 02211 - Rough/Final Grading.
- F. Section 02223 - Backfilling.

**1.03 EXCAVATION**

- A. This section covers excavation for all foundations, slabs, concrete trenches, concrete sumps, and underground piping.
- B. The excavations shall conform to the dimensions and elevations indicated on the Construction Drawings. Excavations shall be carried down to coarse sand and gravel. Excavations shall be kept free from water while construction therein is in progress. Any clay pockets, soft spots, vegetable and other foreign material shall be removed and replaced with sound material. Excavations carried below the depths indicated or specified, shall be refilled to the proper grade with suitable material and compacted as specified hereafter.
- C. Unless directed otherwise by the OWNER, all footings must rest on undisturbed soil.

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EXCAVATION**

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- D. Excavations for structures, pavements, and piping shall be excavated along straight lines. Unless indicated otherwise, excavations shall provide sufficient clearance between the outside of piping and the sides of the excavation or bracing to permit inspection, testing, and the application of protective coatings.
- E. Excavations shall be shored and sheeted as required, with material of sufficient size and arrangement to prevent injury to persons, damage to structures, injurious caving, or erosion. Shoring, sheeting, and bracing shall be removed as the excavations are backfilled; care shall be exercised to prevent injurious caving during the removal of the shoring and/or sheeting.
- F. Excavation shall be performed in such a manner that excavated areas and the area immediately surrounding the excavation for a distance of approximately 25 feet, including slopes and ditches, shall be continually and effectively drained. Any water which accumulates in the excavation shall be promptly removed and water shall not be allowed to pond at the extremities of the drainage area. Existing swales must be kept operational until new swales have been made operational and have been accepted by the OWNER.

**1.04 PROTECTION**

The CONTRACTOR shall:

- A. Comply with all federal, state and local codes, ordinances and laws governing excavation.
- B. Protect existing structures and paving from damage caused by execution of the Work and equipment.
- C. Protect above and below grade utilities that exist in the vicinity of the excavation.
- D. Protect excavation by the use of bracing and/or shoring where required to prevent side wall caving or excessive groundwater in-flow.
- E. Notify the OWNER of unexpected subsurface conditions interfering with normal construction methods and discontinue Work in the area until given written notice to resume Work.
- F. Repair any damages.

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**1.05 SUBMITTALS**

- A. For the treatment building excavation, CONTRACTOR shall submit drawings to OWNER showing locations and dimensions of excavation with details of the proposed construction techniques: sheeting and shoring equipment, etc. in accordance with the applicable rules and regulations.

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

**3.01 PREPARATION**

- A. Survey Controls - The CONTRACTOR shall identify the required benchmarks for horizontal and vertical control. Closures for vertical and horizontal control shall be  $\pm$  0.01 feet.
- B. Stripping - All portions of the area to be filled shall be stripped of vegetation, roots, topsoil peat, trash, or other deleterious materials.
- C. Excavation of Unsuitable Material - The CONTRACTOR shall remove and replace with compacted fill any subgrade material which is designated as "unsuitable" by the OWNER. Compaction of the fill placed in such areas will conform to the requirements for fill placement and compaction herein specified.
- D. Water Supply - The CONTRACTOR shall provide water on the site as required to maintain proper moisture content of fill and to suppress fugitive dust emissions.
- E. Before the start of any work, the CONTRACTOR shall do the following:
1. Identify all underground utilities. Identify and mark the location and depth of any existing underground pipelines and other utilities.
  2. Identify and mark the location of surface and overhead utilities.
  3. Identify and mark the areas that will be excavated.

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4. Identify and assess the impact of excavation on nearby utilities, pipelines, equipment, electrical poles and other surface features.
5. Maintain and protect the utilities and pipelines which pass through the Work area and are to remain in use.

**3.02 EXCAVATION**

- A. The CONTRACTOR shall identify and mark on the existing surface, the location of the proposed excavation Work.
- B. Excavated materials shall be transported and consolidated in the on-site areas as designated by the OWNER. Stockpiling excavated materials outside designated areas is prohibited.
- C. Should saturated materials containing free water be encountered, the CONTRACTOR shall notify the OWNER.
- D. The CONTRACTOR shall adhere to the following guidelines:
  1. Materials shall be excavated as directed by the OWNER. The CONTRACTOR may temporarily stockpile excavated materials on-site in areas approved by the OWNER.
  2. Excavation shall not be done in excess of that required by the technical specifications and construction drawings, unless authorized to do so in writing by the OWNER. Unnecessary and excessive excavation shall be backfilled with suitable structural fill at no expense to the OWNER.
  3. The CONTRACTOR shall take steps to control dust wherever the CONTRACTOR performs work. This includes using a water spray to moisten any areas where it is thought dust may be a problem.
  4. Excavated materials may be used for backfill if judged appropriate by the OWNER.
  5. Excavated material, not reused, shall be stockpiled as directed by the OWNER and shall be disposed of in a suitable manner in accordance with federal and state regulations by the OWNER.

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6. The CONTRACTOR shall adhere to the general guidelines as defined in Part 1 - GENERAL, 1.03 (EXCAVATION)

**3.03 FIELD QUALITY CONTROL**

- A. The CONTRACTOR shall conduct routine visual inspections of the excavation activities for compliance with the Technical Specifications and Construction Drawings.
- B. The CONTRACTOR shall conduct field monitoring of excavated soils to determine the presence of organic or petroleum contamination during excavation.

**END OF SECTION**

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**SECTION 02223  
BACKFILLING**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES:**

- A. References
- B. Filling

**1.02 RELATED SECTIONS**

- A. Section 01010 - Summary of Work.
- B. Section 01012 - Special Conditions.
- C. Section 01400 - Quality Control.
- D. Section 01600 - Material and Equipment.
- E. Section 02211 - Rough/Final Grading.
- F. Section 02222 - Excavation.
- G. Section 02225 - Trenching.
- H. Section 03300 - Cast-in-Place Concrete

**1.03 REFERENCES**

- A. ASTM D-1557 - Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb Rammer and 18-in. Drop.
- B. ASTM D-2922 - Density of Soil in Place by Nuclear Methods.
- C. ASTM D-422 - Standard Method for Particle Size Analysis of Soils.
- D. ASTM D-1556 - Density of Soil in Place by the Sand-Cone Method.

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**1.04 FILLING**

- A. With the exception of those stockpiles of materials or other sources of materials made available to the CONTRACTOR by the OWNER, the CONTRACTOR shall be responsible for procuring suitable materials for the performance of the Work.
- B. All fill and backfill shall be free from frozen particles, clay lumps, trash, roots, wood, metal, scrap material, other vegetable matter, and refuse. Fill or backfill shall also contain no stones larger than four inches in greatest dimension.
- C. Not more than seventy (70) percent by weight shall pass the No. 40 mesh sieve, and not more than ten (10) percent shall pass the No. 200 mesh sieve, as determined by washing through the sieves in accordance with ASTM Designation D-422.
- D. Fill and backfill shall be placed in layers not more than 8 inches in loose depth, and each layer shall be compacted as specified hereafter, at a moisture content suitable for obtaining the required density. Backfill around structures shall be placed to the extent practicable, as the work progresses. Backfilling against concrete shall be done only when directed by the OWNER. Backfilling of trenches shall progress as rapidly as the construction and testing of the work permits.
- E. Excavations for pipe shall not be backfilled until pipe has been tested and approved by the OWNER.
- F. After testing has been approved by the OWNER, fill around and over the pipe shall be compacted unless otherwise noted for the entire depth of the excavation. Backfilling to one foot above the top of the pipes shall proceed uniformly on each side of the pipe to prevent unbalanced loading.
- G. Provide 6" minimum of compacted non-frost susceptible base beneath exterior slabs and rigid and flexible pavements.
- H. If existing subbase is not well draining to a minimum depth of 3 feet, it shall be removed, replaced with non-frost susceptible material, and compacted as per Section 3.03.
- I. Any fill from an off-site location shall be a certified clean fill material acceptable to the OWNER and the New York State Department of Environmental Conservation. The CONTRACTOR shall submit the results of chemical analyses of all fill material from off-site to confirm that it is free of contamination, and will provide the OWNER with documentation of the material origin.

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**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Suitable fill material shall include on-site excavated material or borrow material which is capable of being compacted to the required density at the proper moisture content, containing a maximum of 30 percent by dry weight of particles passing a No. 200 sieve, and of such type and characteristics approved by the OWNER. No rock, broken concrete, demolition material, frozen material, top soil, nor any material designated as unsuitable in Paragraph B shall be used for fill material.
- B. Unsuitable material shall include, but not be limited to, all grass, weeds, vegetation of any type, roots, trash, rocks, boulders, debris, demolition materials, or any layer, strata, formation, or deposit of soil determined by the OWNER to be unsuitable for support of footings, slabs, or any other intended purpose. No material will be classified as unsuitable solely on the basis of excessive moisture content.
- C. Granular material shall be the same as defined for "Suitable Material" above, except that it shall contain a maximum of 12 percent by dry weight of particles passing the No. 200 sieve, and a maximum of 40 percent passing the No. 40 sieve.
- D. Borrow material shall be the same as defined for "Suitable Material" above, except that it shall be obtained from approved sources off the site. As specified in Section 01400 (Quality Control), the CONTRACTOR shall provide verification and documentation to the OWNER that proposed borrow material is certified clean fill.

**2.02 COMPACTED STRUCTURAL FILL**

- A. Material furnished shall be suitable and conform to the following requirements:

- 1. Gradation - the material shall have the following gradation:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
4-inch	100
No. 40	0 - 70
No. 200	0 - 15

- 2. Soundness - the material shall be substantially free of shale or other soft, poor durability particles.

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- B. The material shall be used for pipe bedding and bedding under slabs and footings.

**PART 3 - EXECUTION**

**3.01 INSPECTION**

Prior to actual placement of backfill materials, the following will be field verified:

- A. Verify that all materials have been approved for use by the OWNER.
- B. Verify that areas to be backfilled are free of miscellaneous debris, or standing water.

**3.02 PLACING FILL**

The CONTRACTOR shall:

- A. Fill lifts - Unless otherwise specified, all fill shall be placed in approximately horizontal lifts not exceeding 8 inches in loose thickness. So far as practical, each layer of materials shall extend the entire length and width of the area being filled.
1. Before compaction is started, the material shall be leveled by means of bulldozers, blade graders, or other equipment as approved by the OWNER.
  2. The use of dragline excavators or similar equipment which excavate and deposit material in large unit masses will not be permitted unless all materials excavated are spread in the manner and to the thickness specified herein.
  3. Do not place material on surfaces that are muddy, frozen, or which contain frost. No frozen fill shall be placed.
- B. Moisture Content - The moisture content of the fill shall be reduced by aeration or increased by uniform sprinkling of water as necessary, to achieve optimum moisture content to facilitate compaction. The moisture content of the fill shall be within  $\pm 2$  percentage points of optimum. Fill shall not be placed in water.
- C. Surface Drainage - The fill surface shall be sloped to facilitate the removal of run-off from the site and to prevent ponding of surface water. During periods of anticipated inclement weather, the surface of the fill shall be graded and sealed as directed by the OWNER to preclude percolation of surface water.

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- D. Place the backfill or bedding material in 8-inch lifts that conform to the dimensions as shown on the Construction Drawings.
- E. Compact the backfill using suitable compaction equipment such as rammers or plate compactors.
- F. The compaction effort to be employed shall be to the satisfaction of the OWNER to obtain a non-yielding surface on compaction.
- G. Remove and properly dispose of all surplus backfill materials.
- H. Do not place backfill during freezing or excessively wet field conditions.
- I. Backfill and compact the base for pipe supports and footings.
- J. Backfill and compact around the pipe supports and footings to grade.
- K. Backfill and compact the base for the structural slabs.
- L. Grade backfill to existing elevations or as shown on the Construction Drawings.
- M. Replace any asphalt concrete that is damaged from the excavation activities, and match the repaved area with the existing elevations.

**3.03 COMPACTION**

- A. Equipment - Steel wheel vibratory rollers shall be used for compaction of predominantly granular soils. The use of sheepsfoot or tamping rollers shall be limited to the compaction of fine grained, plastic soils.
- B. Compact each layer of material to a minimum of at least 85 percent of maximum dry density determined in accordance with ASTM D1557 (Modified Proctor) unless otherwise specified.
- C. Make sufficient passes in order to obtain the specified densities.
- D. As compaction of fill in each Work area has been completed, leave the area undisturbed for a reasonable period of time for testing in accordance with Section 01400 (Quality Control). Do not place fill over a layer which has not been tested and accepted by the OWNER.

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- E. Unsatisfactory Compacted Fill - The CONTRACTOR shall be directed by the OWNER to correct, at the CONTRACTOR's expense, any unsatisfactory compacted materials by removal and replacement or by scarifying, aerating, or sprinkling (as needed), and recompaction and retesting, in-place prior to placement of a new lift.
- F. Maintain moisture content of the exposed lift; desiccation cracking shall result in removal and reinstallation of affected area by the CONTRACTOR at his own expense.
- G. Fill and/or backfill in areas to receive structures, pavements, and piping shall be compacted for the full depth of the fill and/or backfill to not less than 90 percent of the maximum density as determined in accordance with ASTM D1557 (Modified Proctor) unless otherwise specified.
- H. All tests, including sieve analysis, will be performed by Grumman Aerospace Corporation.
- I. The moisture content of the specified densities shall be within 3 percent more or less than the optimum. When the required density cannot be obtained with the material in place, it shall be blended with appropriate binder soil and compacted.

END OF SECTION

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GRUMMAN AEROSPACE CORPORATION  
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**SECTION 02270  
TEMPORARY EROSION AND SEDIMENT CONTROL**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The Work covered by this Section consists of furnishing all materials, equipment, tools and labor to construct temporary erosion and sediment control systems.
- B. The Work to be performed includes, but is not limited to, silt fences, straw bales, conveyance channels, and site surface drainage.

**1.02 RELATED SECTIONS**

- A. Section 01300 - Submittals.
- B. Section 01500 - Construction Facilities.
- C. Section 02222 - Excavation.

**1.03 SUBMITTALS**

- A. Product data shall be submitted as indicated in Section 01300.

**PART 2 - PRODUCTS**

**2.01 SURFACE-WATER CONTROL MATERIALS**

- A. Silt Fence: The CONTRACTOR shall supply silt fence in sufficient quantities to control surface-water runoff and sediment. Acceptable silt fence material shall be as follows:
  - 1. Propex-Silt Stop;
  - 2. Mirafi 700X;
  - 3. Beltech 755; or
  - 4. An approved equal.

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TEMPORARY EROSION AND SEDIMENT CONTROL**

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The CONTRACTOR shall submit MANUFACTURER's product data to the OWNER for approval a minimum of one week prior to installation. Silt fence shall be replaced at a frequency consistent with the MANUFACTURER's directions, or as directed by the OWNER.

- B. Straw Bales: The CONTRACTOR shall supply straw bales in sufficient quantities to be used for sedimentation control as needed. Straw bales shall be replaced at a minimum of every two months, or as directed by the OWNER.

**PART 3 - EXECUTION**

**3.01 HANDLING**

- A. Materials shall be handled in such a manner as to prevent damage to the material. Materials shall not be dropped or dragged over the ground. Any materials damaged shall be replaced at no expense to the OWNER.

**3.02 SURFACE-WATER CONTROL STRUCTURES**

- A. Silt Fence: The CONTRACTOR shall install silt fence in accordance with these Specifications and installation instructions provided by the manufacturer or on the Construction Drawings, or as directed by the OWNER. Presiding authority shall be as follows, in descending order: OWNER's direction, Construction Drawings, Specifications, MANUFACTURER's installation instructions.
- B. Straw Bales: The CONTRACTOR shall install straw bales in the locations indicated on the Construction Drawings, or as directed by the OWNER.

END OF SECTION

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TEMPORARY EROSION AND SEDIMENT CONTROL**

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GRUMMAN AEROSPACE CORPORATION  
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**SECTION 02510  
ASPHALTIC CONCRETE PAVING**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. The Work covered by this Section consists of furnishing all equipment, tools, and labor necessary for the installation of asphaltic concrete paving including a base course, tack coat, and surface course at the locations shown on the Construction Drawings.

**1.02 RELATED SECTIONS**

- A. Section 01010 - Summary of Work.
- B. Section 01300 - Submittals.
- C. Section 02211 - Rough/Final Grading.

**1.03 REFERENCES**

- A. The Asphalt Institute - Manual MS-4 - The Asphalt Handbook.
- B. The Asphalt Institute - Manual MS-13 - Asphalt Surface Treatments and Asphalt Penetration Macadam.
- C. ASTM D-1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
- D. ASTM D-946 - Asphalt Cement for Use in Pavement Construction.
- E. New York State Department of Transportation (DOT) Specifications - Section 400: Bituminous Pavements, and Section 407 - Tack Coat.

**1.04 SYSTEM PERFORMANCE**

- A. Paving shall withstand the anticipated short-term daily use by construction equipment, and shall withstand medium-duty vehicular traffic after the completion of construction activities at the site.

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**1.05 QUALITY ASSURANCE**

The CONTRACTOR shall:

- A. Perform work in accordance with The Asphalt Institute specifications and the New York State DOT Standard Specifications for Road and Bridge Construction.
- B. Obtain materials from the same local, reputable supplier throughout the project.

**1.06 REGULATORY REQUIREMENTS**

- A. The CONTRACTOR shall conform to applicable local regulations for paving on private property.

**1.07 TESTS**

- A. Testing and analysis of the asphaltic concrete paving mix will not be required; however, the CONTRACTOR shall provide a performance guarantee for a minimum two-year period and repair any damage at no cost to the OWNER during the guarantee period.
- B. The CONTRACTOR shall submit proposed mix designs to the OWNER for review and approval a minimum of three weeks prior to the commencement of the Work.
- C. Asphalt used shall have a minimum field density of 95 percent of the required laboratory density (Marshall Method) for the mix used.

**1.08 SUBMITTALS**

The CONTRACTOR shall submit:

- A. All data in accordance with Section 01300.
- B. Technical product data to the OWNER a minimum of three weeks prior to commencement of the Work.
- C. Documentation for the asphalt pavement, which includes mix type, sealer, and other technical data to the OWNER for review and informational purposes a minimum of three weeks prior to the commencement of the Work.
- D. MANUFACTURER's instructions for asphalt repair prior to commencement of the Work.

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**1.09 ENVIRONMENTAL REQUIREMENTS**

- A. The CONTRACTOR shall not place asphalt when the base surface temperature is less than 50 °F, unless prior approval is given by the OWNER.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Base Course: Granular material or crushed stone, which is dry and free of deleterious materials. The base course shall conform to the State of New York DOT Specifications for Base Course "Type 2". The asphalt cement shall be AC-20.
- B. Surface Course: Sand type or approved substitute as per Asphalt Institute Manual MS-4. The surface course shall conform to the State of New York DOT Specification for Top Course "Type 7." The surface course asphalt cement shall be 85-100 penetration asphalt cement.
- C. The tack coat shall conform to the State of New York DOT Specification Material Designation 702-3401.
- D. The CONTRACTOR shall use primer, tackcoat, asphalt cement and aggregates conforming to ASTM D-946 and to those normally used in the geographical locality of the site.
- E. The asphaltic concrete shall consist of a combination of coarse aggregate, fine aggregate and mineral filler uniformly coated and mixed with asphalt cement.
- F. Aggregate and filler shall conform to the appropriate State DOT Specification and meet the requirements and gradations of the specified mix.

**2.02 ASPHALT PAVING MIX**

The CONTRACTOR shall use:

- A. Dry materials to avoid foaming and for uniform mixing.
- B. A base course that is between 4.5 to 6 percent of the asphalt cement by weight in mixture.
- C. A surface course that is between 5 to 7 percent of asphalt cement by weight in mixture.

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**2.03 EQUIPMENT**

- A. Compacting: A minimum of one steel wheel roller and a pneumatic-tired roller or (3) steel wheel rollers will be required in large areas.
- B. Steel Wheel Rollers: The steel wheel rollers shall be conventional 12-ton minimum weight, three wheel or tandem two-wheel types (approximately 400 lbs. per linear inch).
- C. Pneumatic-Tired Rollers: The pneumatic-tired roller shall be conventional self-propelled types (approximately 90 psi tire pressures) and shall consist of two axles on which are mounted multiple pneumatic-tired wheels having a minimum operating weight of 2,000 pounds per tire.
- D. Finishing: The finishing equipment shall consist of an approved self-propelled mechanical spreader to place the mix to grades required by the OWNER.

**PART 3 - EXECUTION**

**3.01 INSPECTION**

The CONTRACTOR shall:

- A. Stabilize any subbase to be paved a minimum of 12 inches below the bottom of the base material by compacting and tamping with heavy smooth-wheeled rollers.
- B. Verify that the compacted granular material or crushed stone base has been properly prepared and is dry and ready to support paving and imposed loads. The base shall be compacted in 6-inch lifts to 90 percent of the maximum dry density using Modified Proctor compaction effort (ASTM D-1557).
- C. Verify gradients and elevations of the base are correct prior to placing the asphaltic concrete mix.
- D. Accept the granular material or crushed stone base as suitable prior to the installation of asphalt.

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**3.02 BASE COURSE INSTALLATION**

- A. After the subbase has been compacted, and approved by the OWNER, an asphaltic concrete base course shall be constructed as herein specified to a compacted thickness as indicated on the Construction Drawings.
- B. Base Course Mixing, Transporting and Placing: The mixing, including the plant used in the preparation of the mix; transporting and placing of the mix, shall be in accordance with the New York State DOT Specification for Base Course Type 2 and in accordance with standard practices for quality work.
- C. The compaction of the mixture shall be accomplished by the steel wheel roller. Immediately following the initial rolling, the asphaltic concrete shall be compacted using pneumatic-tired or steel wheel rollers operating in a sequence to assure the most efficient results. Rolling of the mixture shall begin immediately behind the finishing or laying machine. For breakdown, the steel wheel roller shall be used. The pneumatic-tired roller, if utilized, shall be used for secondary rolling; the finish rolling shall be accomplished with the steel wheel roller.
- D. The speed of the rollers shall not exceed (2½) miles per hour and shall at all times be slow enough to avoid displacement of the hot mixture and any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall at once be corrected by the use of rakes and of fresh mixture where required. Rolling shall proceed continuously until all roller marks are eliminated and no further compression is possible. To prevent adhesion of the mixture to the roller, the wheel shall be kept properly moistened, but excess of either water or oil will not be permitted. The rollers shall be in good condition, capable of reversing without backlash. They shall be operated by competent and experienced rollermen and must be kept in continuous operation as nearly as practicable in such a manner that all parts of the pavement shall receive substantially equal compression.
- E. At all places not accessible to the roller, thorough compaction must be secured by means of hot tampers.

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- F. Surface Requirements: The course after final compression shall be smooth, of uniform texture, and true to the established grade. It shall have an average thickness as specified on the Construction Drawings. Any low or defective places shall immediately be remedied by cutting out the course at such spots and replacing it with fresh, hot mixture which shall be immediately compacted to conform with the surrounding area and shall be thoroughly bonded to it. The surface of the finished pavement shall be free from depressions exceeding one-eighth (1/8) inch as measured with a ten (10) foot straight edge.
- G. Asphaltic Concrete Mixture Density: After final compression, the finished course shall at no point have a density less than ninety-five (95) percent of the laboratory compacted density.
- H. Longitudinal and Transverse Joints shall be made in a careful manner. Well-bonded and sealed joints are required. Joints between old and new pavements or between successive days' work shall be carefully made in such a manner as to insure a thorough and continuous bond between the adjoining surfaces. The edge of the previously laid course shall be cut back to its full depth so as to expose a fresh surface, after which the hot mixture shall be placed in contact with it and raked to a proper depth and grade. Infra-red joint heaters shall be carefully employed in such a manner as to heat up all joints sufficiently (without burning) to insure a proper bond. Before placing mixture against them, all contact surfaces or longitudinal joints, shall be painted with a thin uniform coating of hot asphalt cement or asphalt cement dissolved in naphtha or emulsified asphalt.
- I. In making the joint along any adjoining pavement, and after the hot mixture is placed by the finishing machine, just enough of the hot material shall be carried back to fill any space left open. This joint shall be properly "set-up" with the back of a rake at proper height and beveled to receive the maximum compression under rolling. The work of "setting-up" this joint shall be performed always by competent workmen, who are capable of making a correct, clean and neat joint.
- J. Patching of Deficient Areas: For repairs at joints or other areas behind the paving machine, the mixture shall be hand raked immediately in a fan-shaped pattern and the loose mix left slightly higher than the surrounding mat and immediately rolled. Mix shall be dumped into areas deficient in material, carefully mixed, smoothed and rolled. "Broadcasting" of the mixture will not be permitted at any time.
- K. After compaction has been completed, joints shall be painted with RC liquid asphalt.

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**3.03 TACK COAT INSTALLATION**

- A. Tack coat shall be applied only when the existing surface is dry, and when the atmospheric temperature is above 50 °F. The liquid asphalt shall be applied at a uniform rate by an approved pressure distributor at a spraying temperature and application rate specified hereinafter.
- B. All equipment used in the distribution of the tack coat shall have measuring and recording devices in good working order so as to accurately measure and record the quantities of bituminous materials distributed.
- C. Immediately before applying the tack coat, the full width of surface to be treated shall be swept. Care shall be taken to remove all loose dirt, asphalt or other loose objectionable material.
- D. After the operation of removing the dust has been completed, and prior to the application of the tack coat, an inspection shall be made of the surface to determine its fitness to receive the asphalt cement. That portion of the surface of the course proposed for immediate treatment must be dry and altogether in a satisfactory condition.
- E. The tack coat shall be applied to the surfaces of existing pavement upon which surface course material will be placed as shown on the Construction Drawings and to exposed edges of existing pavement surfaces to be in contact with new pavement. Tack coat shall completely cover the surface to be paved and shall not be applied more than 12 hours before the overlaying course is laid. Rate of application shall be between 0.03 to 0.07 gallons per square yard. The exact amount will be determined in the field as directed by the OWNER.
- F. Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and settling of the tack coat. That period shall be determined by the OWNER. The surface shall then be maintained until the next course has been placed. Suitable precautions shall be taken by the subcontractor to protect the surface against damage during this interval, including any sand necessary to blot up excess asphalt cement.

**3.04 WEARING SURFACE INSTALLATION**

- A. After the tack coat or the stabilized base course has thoroughly cured, an asphaltic concrete wearing surface course shall be constructed, as herein specified, to a compacted thickness as indicated on the Construction Drawings.

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- B. Surface Course Mixing, Transporting and Placing: The mixing, including the plant used in the preparation of the mix; transporting and placing of the mix, shall be in accordance with the New York State DOT Specification for Top Course Type "7" and in accordance with standard practices for quality work.
- C. The compaction of the mixture shall be accomplished by the steel wheel roller. Immediately following the initial rolling, the asphaltic concrete shall be compacted using pneumatic-tired or steel wheel rollers operating in a sequence to assure the most efficient results. Rolling of the mixture shall begin immediately behind the finishing or laying machine. For breakdown, the steel wheel roller shall be used. The pneumatic-tired roller, if utilized, shall be used for secondary rolling; the finish rolling shall be accomplished with the steel wheel roller.
- D. The speed of the rollers shall not exceed (2½) miles per hour and shall at all times be slow enough to avoid displacement of the hot mixture and any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall at once be corrected by the use of rakes and of fresh mixture where required. Rolling shall proceed continuously until all roller marks are eliminated and no further compression is possible. To prevent adhesion of the mixture to the roller, the wheel shall be kept properly moistened, but excess of either water or oil will not be permitted. The rollers shall be in good condition, capable of reversing without backlash. They shall be operated by competent and experienced rollersmen and must be kept in continuous operation as nearly as practicable in such a manner that all parts of the pavement shall receive substantially equal compression.
- E. At all places not accessible to the roller, thorough compaction must be secured by means of hot tampers.
- F. Surface Requirements: The course after final compression shall be smooth, of uniform texture and true to the established grade. It shall have an average thickness as specified on the Construction Drawings and shall at no point vary more than one-quarter (1/4) inch from this thickness. Any low or defective places shall immediately be remedied by cutting out the course at such spots and replacing it with fresh, hot mixture which shall be immediately compacted to conform with the surrounding area and shall be thoroughly bonded to it. The surface of the finished pavement shall be free from depressions exceeding one-eighth (1/8) inch as measured with a ten (10) foot straight edge.

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- G. Asphaltic Concrete Mixture Density: After final compression, the finished course shall at no point have a density less than ninety-five (95) percent of the laboratory compacted density.
- H. Longitudinal and Transverse Joints shall be made in a careful manner. Well-bonded and sealed joints are required. Joints between old and new pavements or between successive days' work shall be carefully made in such a manner as to insure a thorough and continuous bond between the adjoining surfaces. The edge of the previously laid course shall be cut back to its full depth so as to expose a fresh surface, after which the hot mixture shall be placed in contact with it and raked to a proper depth and grade. Infra-red joint heaters shall be carefully employed in such a manner as to heat up all joints sufficiently (without burning) to insure a proper bond. Before placing mixture against them, all contact surfaces or longitudinal joints, shall be painted with a thin uniform coating of hot asphalt cement or asphalt cement dissolved in naphtha or emulsified asphalt.
- I. In making the joint along any adjoining pavement, and after the hot mixture is placed by the finishing machine, just enough of the hot material shall be carried back to fill any space left open. This joint shall be properly "set-up" with the back of a rake at proper height and beveled to receive the maximum compression under rolling. The work of "setting-up" this joint shall be performed always by competent workmen, who are capable of making a correct, clean and neat joint.
- J. Patching of Deficient Areas: For repairs at joints or other areas behind the paving machine, the mixture shall be hand raked immediately in a fan-shaped pattern and the loose mix left slightly higher than the surrounding mat and immediately rolled. Mix shall be dumped into areas deficient in material, carefully mixed, smoothed, and rolled. "Broadcasting" of the mixture will not be permitted at any time.
- K. After compaction has been completed, joints shall be painted with RC liquid asphalt.

**3.05 FIELD QUALITY CONTROL**

- A. The OWNER or OWNER's representative will perform a field inspection for conformance with these Specifications.

**3.06 PROTECTION**

- A. The CONTRACTOR shall, immediately after placement of the asphalt, protect the pavement from mechanical injury until the pavement has fully hardened and is capable of supporting vehicular traffic without sustaining damage.

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**3.07 REPAIR**

- A The CONTRACTOR shall repair all damage to existing asphaltic concrete paving which occurs during execution of the Work.

**END OF SECTION**

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ASPHALTIC CONCRETE PAVING**

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GERAGHTY & MILLER, INC.



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**SECTION 02607  
MANHOLES AND COVERS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. The CONTRACTOR shall install two (2) modular pre-cast reinforced concrete manholes (storm water inlets) with masonry transition to lid frame, grating (covers), anchorage, and accessories.
- B. Manhole construction shall be such that proper forming and sealing of pipe inlets and outlets is achieved by CONTRACTOR.

**1.02 RELATED WORK**

- A. Section 02222 - Excavation.
- B. Section 02223 - Backfilling.
- C. Section 02510 - Asphaltic Concrete Paving.
- D. Section 02722 - Site Storm Sewer System.

**1.03 REFERENCES**

- A. ASTM A48 - Gray Iron Castings.
- B. ASTM ~~2722~~ Pre-cast Reinforced Concrete Manhole Sections.
- C. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structure and Pipes.
- D. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specification for Cold-Weather Masonry Construction.

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**1.04 SUBMITTALS**

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate manhole locations, elevations, piping, and sizes and elevations of penetrations.
- C. Product Data: Provide manhole cover frame and grating, component construction, features, configuration, and dimensions.

**1.05 QUALIFICATIONS**

- A. MANUFACTURER: Company specializing in manufacturing products specified in this section.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Chosen within guidelines of Section 1.05 and upon approval by CONSULTANT/ENGINEER.

**2.02 MATERIALS**

- A. Manhole Section: Reinforced pre-cast concrete in accordance with ASTM C478. Pre-cast concrete shall be air-entrained, minimum 2000 psi compressive strength at 28 days.
- B. Grate and Frame (ASTM A49, Class 30B). Cast-iron construction, machined flat bearing surface, removable open grille lid design.
- C. Manhole Steps: One for each 1-foot drop. Cast-iron manhole steps; formed integral with manholes.

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**2.03 CONFIGURATION**

- A. Shape: Circular.
- B. Clear Inside Dimensions: As shown on construction drawing.
- C. Design Depth: As shown on construction drawing.
- D. Pipe Entry and Exit: Provide openings as required by existing sewer pipe.
- E. Steps: As required by code.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. CONTRACTOR shall verify that items provided are properly sized and located.
- B. CONTRACTOR shall verify that built-in items are in proper location and ready for roughing into Work.
- C. CONTRACTOR shall verify excavation for manholes is correct.

**3.02 PREPARATION**

- A. COORDINATE placement of inlet and outlet pipe or duct sleeves required by other sections.

**3.03 PLACEMENT OF MANHOLES**

- A. CONTRACTOR shall evacuate soil per Section 02222, install base material, and compact base material in accordance with technical specifications.
- B. CONTRACTOR shall place manhole sections plumb and level and to correct elevations.
- C. CONTRACTOR is responsible for placing manhole to incorporate existing storm sewer piping at present elevations and pitch so as not to disrupt proper hydraulic gradient.
- D. CONTRACTOR shall cut and fit manholes as required to connect storm-sewer pipe.

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- E. CONTRACTOR shall set cover frames and storm water inlet grilles level without tipping, to correct elevations.
- F. CONTRACTOR shall coordinate with other sections of Work to provide correct size, shape, and location.

**END OF SECTION**

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MANHOLES AND COVERS**

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**GROUNDWATER INTERIM REMEDIAL MEASURE  
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**SECTION 02672  
EXTRACTION WELL INSTALLATION**

The well specifications provided herein are required to meet New York State Department of Environmental Conservation (NYSDEC) requirements for an Interim Remedial Measure (IRM).

**1.1 LOCATION AND DESCRIPTION OF WORK**

The CONTRACTOR shall perform all operations, and provide all necessary manpower, materials, equipment, and services required to drill, install, and develop three on-site extraction wells at the Northrop-Grumman Corporation (OWNER) facility located in Bethpage, New York (hereinafter referred to as the site). Approximate well locations are shown on the Construction Drawings. Work required by these specifications shall be performed under the oversight of CONSULTANT/ENGINEER. CONTRACTOR shall coordinate Work with the OWNER, CONSULTANT/ENGINEER, and on-site Treatment Plant manager.

Extraction Wells shall be drilled and installed in the following order:

1. Drill pilot boreholes and collect split-spoon core samples.
2. Gamma log (to be conducted by CONSULTANT/ENGINEER) pilot boreholes and grain-size analyses to be conducted by CONTRACTOR of selected split-spoon samples.
3. Abandonment of pilot boreholes; design extraction wells; order and deliver extraction well materials.
4. Drill extraction well and Gamma log (to be conducted by CONSULTANT/ENGINEER) borehole.
5. Construct the extraction well, including setting the screen and casing and installing the backfill materials.
6. Preliminary development of the extraction well.
7. Drill, install, and develop the other extraction wells per Steps 4 through 6 above.
8. Complete extraction well development.

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**1.2 HYDROGEOLOGY**

In general, subsurface conditions (to approximately 550 ft. below land surface) at the OWNER facility are characterized as follows: outwash-plain deposits of fluvioglacial origin, consisting of well-sorted and stratified clay, sand, and gravel from approximately land surface to 130 ft. below land surface (Upper Glacial Formation). Underlying the Upper Glacial Formation is the Magothy Formation, which is chiefly composed of interbedded gray, buff, and white fine sand; clayey sand; and black, gray, white, buff, and red clay; with some scattered, discontinuous lenses of sand and gravel. The basal zone of the Magothy Formation is composed of coarse quartz sand and gravel and some layers of clay and sandy clay. Depth to water is approximately 50 ft. below land surface across the site. Additional information on the site hydrogeology is available from CONSULTANT/ENGINEER for inspection by interested bidders. It is the bidder's responsibility to be familiar with the site and conditions that shall affect his bid.

**1.3 EXPERIENCE AND QUALIFICATIONS**

The CONTRACTOR shall subcontract the extraction well installation to a licensed well driller in the State of New York. The drilling subcontractor must have experience in installing wells similar to those described herein. A statement of driller's experience and qualifications to perform the work must be provided with the bid. No portion of this work may be subcontracted by the licensed driller unless prior approval is granted by CONSULTANT/ENGINEER and/or OWNER, in writing. A statement of experience and qualifications may be requested before approval of subcontractors is granted.

The drilling subcontractor must have drilled a minimum of ten wells of the type and depth described herein, and shall furnish a list of these wells with the bid showing the owner, construction details, and construction methods. The Drilling Subcontractor shall be either:

- (1) Delta Well and Pump, Inc.  
Bob Devine  
97 Union Avenue  
Ronkonkoma, NY 11779  
Phone: (516) 981-2255
  
- (2) Hydro Group, Inc.  
Bill Varley/Bob Grecki  
1126 Lincoln Avenue  
Holbrook, NY 11741  
Phone: (516) 244-0025

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- (3) **CT&E Environmental Services, Inc.**  
**Environmental Drilling Division**  
**Art Becker**  
**P.O. Box 423**  
**West Creek, NJ 08092-0423**  
**Phone: (609) 294-1110 or (800) 962-7327**  
**Fax: (609) 296-8970**

**1.4 PERMITS AND REGULATIONS**

The CONTRACTOR, at his expense, shall procure all necessary access, permits, and/or licenses from the appropriate authorities to conduct the work described herein.

The CONTRACTOR shall comply with all local, state, and federal regulations. If the CONTRACTOR believes that the specifications provided herein are at variance with any law or regulation, he shall promptly notify CONSULTANT/ENGINEER, in writing, and any necessary adjustments shall be made as provided in the Contract or Agreement under "Changes in the Work".

**1.5 EQUIPMENT AND MATERIAL DELIVERY, STORAGE, AND HANDLING**

Arrangements for the delivery and handling of equipment and materials, throughout the prosecution of the work, shall be the CONTRACTOR's responsibility. The CONTRACTOR shall store equipment and materials so as to ensure the preservation of their quality and fitness for the work. When considered necessary, materials shall be placed on wooden platforms, or other hard, clean surfaces, and shall be placed under cover when directed. Materials shall be stored at the location(s) designated by OWNER, and shall be arranged so as to facilitate prompt inspection by the on-site CONSULTANT/ENGINEER representative.

**1.6 TECHNICAL INSPECTION**

Work conducted under these specifications shall be subject to inspection by CONSULTANT/ENGINEER; however, such inspection shall not relieve the CONTRACTOR from obligation to perform said work in accordance with specifications or any modification thereof, as herein provided. Work not done in strict accordance with the specifications or any modification thereof, as herein provided, shall be corrected and made good by the CONTRACTOR, at his expense, whenever so ordered by CONSULTANT/ENGINEER, without reference to any previous oversight or error in inspection.

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In the event that the CONTRACTOR should fail to drill a hole or place the well to the depth specified, or should abandon the hole or well because of fault, negligence, or incompetence of the drilling crew, loss of tools, equipment failure, or for any other cause attributable to the driller, he shall remove all salvageable casing and equipment and abandon the hole in accordance with NYSDEC regulations. The CONTRACTOR shall then move the drill rig to a new location, approved by CONSULTANT/ENGINEER, and begin drilling a new borehole. This work shall be done at the CONTRACTOR's expense who may use salvaged materials, if usable, at the discretion of CONSULTANT/ENGINEER. No payment shall be made to the CONTRACTOR for installing or abandoning unsuccessful borings or wells, as described above. CONSULTANT/ENGINEER shall act as sole arbitrator and their decision shall be final and binding.

Directions given to the CONTRACTOR by CONSULTANT/ENGINEER pertaining to the scope of work during routine inspection shall be binding on the CONTRACTOR.

**1.7 SUBMITTALS**

In addition to the items specified in this document, the CONTRACTOR shall submit the following items:

1. Well driller's logs.
2. Qualifications of drillers and welders (must be certified and licensed in NY State).
3. Well construction details.
4. Copies of certificates from suppliers/manufacturers showing that all casings, screens, backfill materials (i.e., gravel pack, bentonite, etc.) and well construction materials conform to the requirements and standards established by the American Society for Testing and Materials (A.S.T.M.).

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**2.1 EXTRACTION WELL DRILLING AND FORMATION SAMPLING**

A total of three extraction wells (ONCT-1, ONCT-2, and ONCT-3) shall be installed at the locations shown on the Construction Drawings. The table below and the Construction Drawings summarize the anticipated borehole diameters, well depths, screen intervals, and drilling methodologies; final well depths and construction details shall be determined by CONSULTANT/ENGINEER after pilot boreholes are drilled.

Well Designation	Anticipated Drilling Methodology	Approximate Total Depth (ft. below land surface)	Borehole Diameter (inches)	Approximate Screened Interval (ft. below land surface)
<u>Extraction Well:</u>				
ONCT-1	MR/RR	565	24	500-565
ONCT-2	MR/RR	565	24	500-565
ONCT-3	MR/RR	565	24	500-565

MR/RR Mud rotary/reverse rotary.

The pilot borehole for the three extraction wells shall be installed by the mud-rotary method. Formation samples shall be collected continuously with a split-spoon core sampler from approximately 20-feet above the proposed screen zone to the bottom of the borehole. Following the pilot borehole drilling, the borehole shall be geophysically logged by CONSULTANT/ENGINEER, and selected formation samples shall be submitted for grain-size analyses. The CONTRACTOR shall perform the grain-size analyses (i.e., sieve analyses) and provide sieve analysis results; cumulative percent retained curves, and make recommendations for the extraction well gravel pack and screen sizes. Grain-size analysis testing methods shall be chosen that are acceptable to CONSULTANT/ENGINEER. Final gravel pack and screen sizes shall be determined by CONSULTANT/ENGINEER. After the geophysical logging, the pilot boreholes shall be abandoned with a 95 percent cement/5 percent bentonite grout installed by tremie pipe, in accordance with NYSDEC protocols.

The three extraction wells shall be installed by the reverse rotary method using potable water, from an approved source, as the drilling fluid. For each drilling location, the CONTRACTOR shall identify the potable water source (i.e., hydrant), and shall supply all attachments, backflow apparatus, etc., including laying a water line, if necessary. If necessary, to minimize fluid loss, 100 percent polymer-free bentonite may be added to the drilling fluid. The MANUFACTURER's specifications for bentonite products must be submitted to and approved by CONSULTANT/ENGINEER prior to use.

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At each of the proposed extraction well locations, an approximate 24-inch diameter borehole shall be advanced by the reverse rotary method to the proposed well depth. Due to the size of the hole, a smaller diameter borehole(s) may be drilled initially and reamed to a final diameter of 24-inches. The extraction wells shall be drilled as close as possible to the pilot boreholes (approximately 10 to 20 feet). Upon completion of drilling the extraction borehole, the hole shall be geophysically logged by CONSULTANT/ENGINEER. Drilling fluids (i.e., mud) shall then be flushed from the borehole and mud pit and replaced with potable water (from an approved source).

**2.2 EXTRACTION WELL CONSTRUCTION/INSTALLATION**

In accordance with these specifications provided herein and the Construction Drawings, the well screen and casing, and backfill materials shall be installed within the open borehole for the extraction wells.

**2.2.1 Well Casing and Screen**

Extraction wells shall be constructed of approximately 18-inch diameter low carbon steel well casing and 10-inch to 8-inch diameter stainless steel (316) wire-wrapped screen. Final screen diameters shall be determined after sieve analyses are completed. Centralizers shall be installed on the top and bottom of the well screen to keep it plumb in the borehole. The screen shall be approximately 60-feet in length with slot size to be determined by grain-size analyses. Only new, undamaged, and domestically manufactured well casing and screen meeting with ASTM water well standards shall be used. The well shall be fitted with a steel (vented) well cap, and a stainless-steel bottom cap. The well casing shall be completed as shown on the Construction Drawings above land surface to allow for the installation of pumping equipment and well house.

**2.2.2 Well Casing and Screen Joints**

All casing and screen sections shall be properly welded per AWS procedures. No couplings, solvents, glues, or chemical cleaners shall be used in well construction.

**2.2.3 Gravel Pack**

After setting the well screen and casing, the appropriately-sized gravel pack shall be installed within the borehole annulus to approximately 30 ft. above the top of the screen. The gravel pack shall be continuously fed down the annulus and its depth carefully checked during emplacement to be sure that it has not bridged. If in the opinion of the on-site CONSULTANT/ENGINEER hydrogeologist, bridging has occurred (based on field measurements and the calculated volume of gravel pack required versus the volume used), the contractor shall be required to correct the situation, at his expense, either by using compressed air

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to remove the gravel pack, or by removing the well, cleaning the hole, and beginning well construction again. A 15-ft. thick fine sand (finer than gravel pack) layer shall be emplaced (continuously fed) in the annulus on top of the gravel pack in the same manner as the gravel pack.

**2.2.4 Well Seal**

At a minimum a 5-ft. thick, 100 percent (polymer-free) bentonite seal (thick slurry) shall be installed by a tremie pipe within the annular space above the fine sand layer. The remaining borehole annulus shall be backfilled with a 95 percent bentonite, 5 percent cement grout to 2 feet below land surface, using a tremie pipe. MANUFACTURER's specifications for bentonite and cement products must be submitted and approved by CONSULTANT/ENGINEER prior to use.

**2.2.5 Well Completion**

The extraction well shall be completed as shown on the Construction Drawings to allow for the installation of pumping equipment and well house by placing a 2-foot cement seal above the grout. A temporary hinged locking cover shall be installed until such time as the well house and pump are installed.

**2.3 WELL ALIGNMENT AND ACCEPTANCE**

The completed extraction wells, including well casing and screen, shall be free from mechanical defects and sufficiently straight and plumb to permit the installation of a suitable deep (vertical turbine) well pump. It is the responsibility of the CONTRACTOR to insure that the well construction meets the requirements of the pump supplier and these Technical Specifications. After completion of the well and before final acceptance, the CONTRACTOR shall test the well for roundness, alignment, and plumbness, by an approved acceptable method in the presence of the hydrogeologist. This test shall include a written statement by the CONTRACTOR giving complete details covering alignment tests and plotted results indicating horizontal deviations throughout the upper portion of the well. The cost of all work in plumbing the completed well shall be by and at the expense of the CONTRACTOR.

For purposes of the plumbness and alignment tests on the completed wells, the upper 150 feet shall be tested. A maximum of 4-inches per hundred feet of depth shall be allowed for the plumbness test. The maximum horizontal variation allowed in either direction from a straight line constructed so as to minimize any deviations from this line shall be 2.0 inches. The maximum total deviation shall be 4.0 inches. In addition to the specification provided herein, well development (preliminary and final) must be successfully completed before final well acceptance shall be granted (see Section 2.5 for Well Development).

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**2.4 ABANDONMENT OF BORINGS OR WELLS**

In the event that the CONTRACTOR should fail to drill a hole or place the well to the depth specified, or should abandon the hole or well because of fault, negligence, or incompetence of the drilling crew, loss of tools, equipment failure, or for any other cause attributable to the driller, he shall remove all salvageable casing and equipment and abandon the hole in accordance with NYSDEC regulations. The CONTRACTOR shall then move the drill rig to a new location, approved by CONSULTANT/ENGINEER, and begin drilling a new borehole. This work shall be done at the CONTRACTOR's expense who may use salvaged materials, if usable, at the discretion of CONSULTANT/ENGINEER. No payment shall be made to the CONTRACTOR for installing or abandoning unsuccessful borings or wells, as described above. CONSULTANT/ENGINEER shall act as sole arbitrator and their decision shall be final and binding.

**2.5 WELL DEVELOPMENT**

Following installation, extraction wells shall be developed by air lift mechanical surging and pumping (and backwashing). Development shall be conducted in two separate steps (preliminary and final, as explained below), and shall continue until the well responds to water-level changes in the formation, all traces of drilling mud are removed (if the mud rotary method is used), and the well produces clear, sediment-free water, to the extent practical. CONSULTANT/ENGINEER shall determine when development is complete.

Water, dispersing agents, acids, disinfectants, or other additives shall not be used during development. During development, water shall be removed throughout the entire column of water standing in the well by periodically lowering and raising the development tool.

Well development shall include rinsing the interior well casing above the water table by using only water from that well. The well shall be covered with a clean well cap, which shall be rinsed with distilled water prior to installation. The result of this operation shall be a well casing free of extraneous materials (grout, bentonite, sand, etc.)

In compliance with NYSDEC policy, every effort shall be made to develop wells until turbidity (as measured in the field) is less than 50 nephelometric turbidity units (NTUs). However, CONSULTANT/ENGINEER is aware that the 50 NTU standard may not be attainable, as the observed turbidity may be the result of the formation screened, and not inefficiencies in well design, installation, or development. Therefore, if after a 'best well development effort', the NTU standard cannot be attained and turbidity stabilizes (above the 50 NTU standard), the well shall be acceptable, provided the integrity of the well is satisfactorily proven. CONSULTANT/ENGINEER's decision shall be final and binding.

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**2.5.1 Preliminary Well Development**

Following installation, extraction wells shall be preliminarily developed by air lift and mechanical surging to remove drilling fluids and breakup the mud cake/affects on drilling on the borehole walls. The air lift/surging tool shall be moved throughout the entire screen zone during development. The anticipated pumping rate during this preliminary development step is 50 to 100 gallons per minute (gpm). During preliminary development, the CONTRACTOR shall provide 2 mobile tanks (6,000 gallon-min.) and a driver for temporary containment, settlement, and transport of development water to the on-site treatment plant designated by OWNER. Development water shall be screened to remove fine particles prior to discharge to the OWNER's on-site treatment plant.

**2.5.2 Final Well Development**

Following construction of the Groundwater Treatment Plant, the CONTRACTOR shall install a temporary vertical turbine pump in the extraction wells and pump approximately 1,600 gpm at a total dynamic head of 245 feet (max. in ONCT-3) to complete development. The pump shall have a throttling valve to control flow and a flow meter to measure flow. Development water shall be conveyed to the Groundwater Treatment Plant via the pipeline constructed as part of the treatment plant system. Following development, the CONTRACTOR shall remove the development pump from the well.

**2.5.3 System Inspection**

Upon completion of final development of all three extraction wells, the CONTRACTOR, in the presence of the OWNER's representative, shall inspect the air stripping tower distribution tray and the concrete clear well for excess silt and residues. If, in the opinion of the OWNER, such residues are present in sufficient quantities, the CONTRACTOR shall remove the residues for disposal in accordance with paragraph 4.0 of Section 02672 - Extraction Well Installation, of these Technical Specifications.

**3.0 DECONTAMINATION OF EQUIPMENT AND MATERIALS**

Downhole equipment and materials used to drill, install, and develop wells/borings shall be decontaminated on-site (via steam cleaning) prior to use, between boreholes and/or wells, and before leaving the site at the completion of work. The location of the decontamination site shall be designated by OWNER.

**4.0 DISPOSAL OF WASTE MATERIALS**

Drill cuttings generated from extraction well drilling and residues from well development shall be placed adjacent to the drill site (or in other on-site areas designated by OWNER) on plastic sheeting of sufficient thickness to prevent tearing and covered.

**02672-9  
EXTRACTION WELL INSTALLATION**

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Drilling and mud/water discharged during drilling shall be disposed of in a similar manner to preliminary development water (see Section 2.5.1). Solid residue from the well development/drilling muds shall be containerized and stored on-site or unloaded in the area designated by OWNER.

**5.0 SITE RESTORATION**

Prior to well acceptance, the CONTRACTOR shall be required to restore damaged areas of the site to original condition including, but not limited to, leveling of any trenches and/or pits, dispose of all materials, and restore the site to its original condition, to the extent possible (i.e., including but not limited to reseeded and repairing any asphalt or cement areas) as directed by CONSULTANT/ENGINEER. In addition, the CONTRACTOR shall keep the work site in a clean condition, and take special measures to prevent oily or hazardous substances from entering the ground or drainage areas.

**6.0 HEALTH AND SAFETY**

**6.1 PERSONAL PROTECTIVE EQUIPMENT**

Based on a hazard evaluation of the site, it is anticipated that all operations described herein shall be conducted using Level D or modified Level D protection, unless monitoring (by CONSULTANT/ENGINEER) indicates a necessity for upgrading. Level D protection consists of a hard hat, safety glasses, Tyvek coveralls (blue or green) or rain gear, rubber boots, and gloves (i.e., latex, nylon, or PVC). Modified Level D protection consists of Level D equipment plus the use of an inner glove, as well as taping coveralls to the boots and gloves. A copy of the site Health and Safety Plan is available, upon request, from CONSULTANT/ENGINEER for interested bidders; however, selected bidders must develop and implement their own health and safety plan, which is at least as effective as CONSULTANT/ENGINEER's.

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**02672-10  
EXTRACTION WELL INSTALLATION**

Revised: 3/5/96



**GROUNDWATER INTERIM REMEDIAL MEASURE  
GRUMMAN AEROSPACE CORPORATION  
BETHPAGE, NEW YORK**

**SECTION 02722  
SITE STORM SEWER SYSTEMS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. The CONTRACTOR shall furnish, install, and connect 200 feet of storm sewer drainage pipe between two manholes (Manholes MH-A and MH-B), as shown on the Construction Drawings, and any additional lengths damaged or otherwise necessary to form a complete, working drainage system.
- B. The CONTRACTOR shall also furnish, install, and connect approximately 22 feet of storm sewer drainage pipe between the new manhole (MH-A) and the treatment building, as shown on the Construction Drawings.
- C. The CONTRACTOR is responsible for proper restoration of the paved area and site surface drainage to the storm water inlets.
- D. The CONTRACTOR is responsible for proper installation, including bedding, pitch, elevation and hydraulic gradient per manufacturer's specifications, federal, state, and local regulations, and OWNER's instructions.

**1.02 RELATED WORK**

- A. Section 02222 - Excavation.
- B. Section 02223 - Backfilling.
- C. Section 02510 - Asphaltic Concrete Paving.
- D. Section 02607 - Manholes and Covers.

**1.03 REFERENCES**

- A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-Pound (4.54 Kg) Rammer and an 18-Inch (457 mm) Drop.
- B. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- C. ANSI/ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

**02722-1  
SITE STORM SEWER SYSTEMS**

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- D. ANSI/A [REDACTED] Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- E. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-Pound (2.49 Kg) Rammer and 12-Inch (304.8 mm) Drop.
- F. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound (4.54 Kg) Rammer and 18-Inch (457 mm) Drop.
- G. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- H. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

**1.04 DEFINITIONS**

- A. Bedding: Fill placed under, beside, and directly over pipe prior to subsequent backfill operations.

**1.05 SUBMITTALS**

- A. Submit under provisions of Section 01300.
- B. Product Data: Provide data indicating pipe class, size, and accessories.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

**1.06 PROJECT RECORD DOCUMENTS**

- A. Submit under provisions of Section 01700.
- B. Accurately record actual locations of pipe runs, connections to manholes, and elevations.

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SITE STORM SEWER SYSTEMS**

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- C. Identify and describe unexpected variations in subsoil conditions or discovery of uncharted utilities.

**1.07 REGULATORY REQUIREMENTS**

- A. CONTRACTOR must conform to all applicable codes for materials and installation of the Work in this section. References made herein are meant as a guideline; it is the responsibility of the CONTRACTOR to follow all applicable regulations.
- B. Verify that field measurements and elevations are as indicated or instructed by manufacturer and/or all federal, state, and local regulations.

**PART 2 - PRODUCTS**

**2.01 SEWER PIPE MATERIALS**

- A. Reinforced Concrete Pipe (RCP): ANSI/ASTM C76, [REDACTED] with wall [REDACTED], concrete strength of [REDACTED] psi, wall thickness of 2¼ inches, inside nominal diameter of 24 inches; bell and spigot end joints.
- B. Reinforced Concrete Pipe Joint Device: ANSI/ASTM C443, rubber compression gasket joint.
- C. Bedding: Fill type Class B as specified by manufacturer and/or federal, state, and local regulations.

**PART 3 - EXECUTION**

**3.01 PREPARATION**

The CONTRACTOR shall:

- A. Verify that excavation base is ready to receive work and that excavations, dimensions, and elevations are as indicated on Construction Drawings or as directed by OWNER.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

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**SITE STORM SEWER SYSTEMS**

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**GROUNDWATER INTERIM REMEDIAL MEASURE  
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**3.02 BEDDING**

- A. Excavate pipe trench in accordance with Section 02222 for work in this section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials and maintain optimum moisture content to attain required compaction density.

**3.03 INSTALLATION**

The CONTRACTOR shall:

- A. Install and seal joints watertight in accordance with manufacturer's instructions.
- B. Drill necessary openings in the manholes for installation of piping. After the piping has been installed, the openings shall be grouted with a non-shrink type of grouting cement.
- C. Waterproof exterior and interior joints, and patch areas at the pipe penetration points after the grouting or patching concrete has fully dried and/or cured.
- D. Install bedding at sides and over top of pipe and compact appropriately. Do not displace or damage pipe when compacting.

**3.04 QUALITY CONTROL**

- A. Field inspection will be performed under provisions of Section 01400.
- B. Request inspection prior to and immediately after placing bedding cover over pipe.
- C. If inspection and/or tests indicate Work does not meet specified requirements and/or federal, state, and local regulations, remove Work, replace and retest.
- D. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

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**02722-4  
SITE STORM SEWER SYSTEMS**

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**GROUNDWATER INTERIM REMEDIAL MEASURE  
GRUMMAN AEROSPACE CORPORATION  
BETHPAGE, NEW YORK**

**SECTION 02831  
CHAIN LINK FENCES AND GATES**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. The CONTRACTOR shall furnish and install, complete in every detail, all new galvanized chain-link fencing to enclose the well houses and treatment building as indicated on the Construction Drawings and as specified herein.
- B. In general this work shall include the furnishing and installation of the following:
  - 1. All new galvanized chain-link fence framework, fabric, and accessories.
  - 2. The excavation for post bases.
  - 3. Concrete anchorage for posts and center drop for gates.
  - 4. Manual gates and related hardware.

**1.02 RELATED SECTIONS**

- A. Section 02222 - Excavation.
- B. Section 03300 - Cast-in-Place Concrete.

**1.03 REFERENCES**

- A. ANSI/ASTM F567 - Installation of chain-link fence.
- B. ASTM A123 - Zinc (Hot Galvanized) coatings of products fabricated from rolled, pressed, and forged steel shapes, plates, bars and strips.
- C. ASTM A120 - Pipe, steel, black, and hot-dipped zinc-coated (Galvanized) welded and seamless, for ordinary uses.
- D. ASTM A121 - Barbed wire.

**02831-1  
CHAIN LINK FENCES AND GATES**

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**GROUNDWATER INTERIM REMEDIAL MEASURE  
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**1.04 QUALITY ASSURANCE**

- A. **MANUFACTURER:** Company specializing in commercial quality chain-link fencing with a minimum of two years experience.
- B. All equipment and materials furnished under this Contract shall be new, suitable for the conditions of service to which they will be subject and equal to the best of their respective classes. Grade and quality shall meet the applicable cited specifications and standards.
- C. Workmanship shall be of the highest quality and shall be carried out by competent and experienced workmen.

**1.05 SUBMITTALS**

- A. **CONTRACTOR** shall submit shop drawings, product data, and installation instructions prior to construction of fence according to Section 01300 (Submittals).
- B. Shop drawings shall include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.
- C. **CONTRACTOR** shall submit **MANUFACTURER's** installation instructions under provisions of Section 01300 (Submittals).

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. All posts and rails shall be hot dipped, zinc-coated steel meeting ASTM specifications A120-83, A128-78 or A153-82, whichever is applicable.
- B. The fence fabric shall be No. 9 gauge wire woven, heavily zinc coated or hot dip galvanized after weaving, meeting ASTM Specification A392-81.
- C. The barbed wire shall consist of a double strand of 12½ gauge, Class 3 zinc-coated steel wire. It shall be 4 point barbed wire and shall conform to the applicable requirements of ASTM designation A121-57.

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**GROUNDWATER INTERIM REMEDIAL MEASURE  
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**2.02 CONCRETE MIX**

- A. Concrete shall be as specified in Section 03300.

**2.03 COMPONENTS**

- A. Line posts shall be 2 -inch diameter galvanized steel pipe.
- B. Corner, terminal, and gate post sections shall be 3 - inch diameter galvanized steel pipe.
- C. Top rail shall be 2 - inch diameter, plain end, sleeve-coupled steel pipe.
- D. Brace rail shall be 1 5/8 - inch diameter, plain end, sleeve-coupled steel pipe.
- E. Bottom rail shall be 2 - inch diameter, plain end, sleeve-coupled steel pipe
- F. The fence fabric shall be 2-inch diamond-shaped mesh, interwoven, 9 gauge thickness. Top selvages are to have twisted and barbed ends. Bottom selvages shall be knuckled.
- G. Gate frames shall be the same height as the fence and shall be of the size and at locations shown on the Contract Drawings.
- H. Post top shall be steel or malleable iron, galvanized; sized to post dimensions with set screw.
- I. Fittings shall include: galvanized steel sleeves, bands, clips, rail end, tension bars, fasteners, and fittings.
- J. Top and bottom tension wires of the fence shall be No. 7 gauge galvanized wire.
- K. The gates shall be provided with suitable hinges, stops, latching, and locking devices.

**2.04 FINISHES**

- A. Galvanized: ASTM A123; 0.2 oz. / sq. ft. coating.
- B. Accessories: Same finish as framing.

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CHAIN LINK FENCES AND GATES**

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**GROUNDWATER INTERIM REMEDIAL MEASURE  
GRUMMAN AEROSPACE CORPORATION  
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**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Install framework, fabric, accessories, and gates in accordance with ANSI/ASTM F567.
- B. Set terminal gate and posts plumb, in concrete footings with top of footing at finished grade.
- C. Provide top rail through line post tops and splice with 7 inch long rail sleeves.
- D. Brace each gate and corner post back to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end and gate posts.
- E. Install center and bottom brace rail on corner and gate leaves.
- F. Stretch fabric between terminal posts.
- G. Position bottom of fabric 2 inches above finished grade.
- H. Fasten fabric to top rail, line posts, braces, and bottom tension wire with wire ties a maximum of 15 inches on center.
- I. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- J. Install bottom tension wire stretched taut between terminal posts.
- K. Install gates with fabric and barbed wire overhang to match fence. Install three hinges per leaf, latch, catches, retainer and locking clamp.
- L. Provide concrete center drop to foundation depth and drop rod retainers at center of double gate opening.
- M. Posts, fabric, and gate assemblies shall be erected in accordance with the MANUFACTURER's standard specifications, the Construction Drawings, and shall be subject to the approval of the OWNER.

**END OF SECTION**

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CHAIN LINK FENCES AND GATES**

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**GROUNDWATER INTERIM REMEDIAL MEASURE  
GRUMMAN AEROSPACE CORPORATION  
BETHPAGE, NEW YORK**

**SECTION 03200  
CONCRETE REINFORCEMENT**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. The CONTRACTOR shall furnish all required materials and shall properly place for imbedment in the concrete, at the specified locations and in the manner indicated on the Construction Drawings, or as directed by the OWNER, all required reinforcing steel for properly reinforcing all structures built under this Contract. In general, this shall include the steel reinforcing for the following:
1. Concrete slabs and foundations for the treatment building and equipment, and the well houses.
  2. Concrete storage basin and sump.

**1.02 RELATED SECTIONS**

- A. Section 03300, Cast-in-Place Concrete

**1.03 REFERENCES**

- A. ACI 301- Specification for Structural Concrete for Buildings.
- B. ACI 315 - Details and Detailing of Concrete Reinforcement.
- C. ACI 318 - Building Code Requirements for Reinforced Concrete.
- D. American Welding Society (AWS) D1.4- Structural Welding Code- Reinforcing Steel.
- E. ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- F. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
- G. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

**03200-1  
CONCRETE REINFORCEMENT**

Revised: 3/5/96



**GROUNDWATER INTERIM REMEDIAL MEASURE  
GRUMMAN AEROSPACE CORPORATION  
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**PART 2 - PRODUCTS**

**2.01 QUALITY AND GRADE**

- A. All bar reinforcement shall meet the requirements of ASTM A615, "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement," Grade 60. No rerolled or high carbon steel bars will be permitted in the Work.
- B. All wire mesh reinforcement shall be of approved make and of the minimum weight indicated on the Construction Drawings. Wire mesh shall meet the requirements of the "Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement", A.S.T.M. Designation: # 185-79.
- C. All steel used for reinforcement purposes shall be clean, new stock, and free from defects and bends not required by the Construction Drawings. Only corrugated or deformed bars, of an approved type, shall be used in the Work.
- D. No reinforcing steel shall be welded unless specifically approved by the OWNER. Welding of reinforcing bars shall be per AWS D 1.4.
- E. All structural steel (sole plates, angle seats, clips) shall be hot dip galvanized when surfaces will be exposed after the concrete is finished.
- F. Deformed steel bar mats shall be per ASTM A184.
- G. Steel bar dowels in the masonry wall which tie-in with the wall and slab of the clear well shall be coated with compatible epoxy.

**2.02 TESTS**

- A. The CONTRACTOR shall provide a copy of the reinforcing steel mill tests reports to the OWNER upon request.
- B. Reinforcement bars and wire mesh shall be inspected and tested at the mill at which they are rolled or fabricated, in accordance with A.S.T.M. Designation: A 615-82 and A 185-79, respectively, and two (2) certified copies of such tests shall be furnished to the OWNER.

**03200-2  
CONCRETE REINFORCEMENT**

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**GROUNDWATER INTERIM REMEDIAL MEASURE  
GRUMMAN AEROSPACE CORPORATION  
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**PART 3 - EXECUTION**

**3.01 BENDING**

- A. All reinforcement bars shall be cold bent as shown on the Construction Drawings or approved shop drawings.
- B. Bars of a single length shall be used in all cases, except where the length required is such that they cannot be so obtained, or where the OWNER shall give permission to use shorter lengths or allow lapping. Cold bends shall be made around a pin having a diameter at least six (6) times the least dimension of the reinforcing bar, for No. 3 through No. 8 bars, and around a pin having a diameter at least eight (8) times the least dimension of the reinforcing bar for No. 9 through No. 11 bars.
- C. Reinforcement partially embedded in concrete shall not be field bent without the prior permission of the OWNER.

**3.02 STORAGE AND PROTECTION**

- A. All steel for reinforcement shall be delivered to the site of the Work without rust, other than that which may have accumulated in normal transit. It shall be sorted for size and length and shall be properly tagged, with substantial tags securely attached to each bundle properly identifying the bars as to use intended.
- B. Bars shall be stored in racks and protected from the weather by housing. Reinforcing steel shall not be stored in contact with the ground.
- C. All steel shall be kept free from oil, grease, dirt, or other objectionable adhering substances, and it shall be satisfactorily cleaned of scale and heavy or flaky rust before being placed in the Work.
- D. If, after having been placed in the Work, the concreting shall be delayed or interrupted for any considerable number of days, the steel shall be well protected.

**3.03 PLACING/SPACING**

- A. All steel reinforcement shall be carefully placed and fastened in position so as to maintain the proper spacing between adjacent bars.

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CONCRETE REINFORCEMENT**

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- B. Joints shall be wired with annealed iron wire, of diameter not less than No. 18 U.S. Standard gauge, or by using acceptable clips.
- C. All reinforcement shall be firmly supported and properly spaced by the use of metal bolsters, bars, spacers, chairs, or hangers, or by the use of pre-cast concrete piers. Plastic tipped or stainless steel bolsters and chairs shall be used for support of reinforcement bars in all slabs, floors and decks built upon supported forms.
- D. Care shall be used in maintaining proper spacing between the forms and reinforcing steel.
- E. Welding of crossing bars shall not be permitted unless approved by the OWNER.
- F. The minimum clear distance between parallel bars in a layer shall equal the diameter of the largest bar, but shall not be less than one (1) inch.
- G. Parallel reinforcement placed in two (2) or more layers, shall be separated by a minimum distance of one (1) inch.

**3.04 CONCRETE COVER**

- A. Concrete cover over the principal reinforcing steel shall be as shown in the Construction Drawings. In general, the following shall apply:

Concrete in Contact with water and weather.	2 inches
Concrete cast against earth.	3 inches
Concrete not exposed to weather or not in contact with the ground.	¾ inch

**3.05 SPLICES**

- A. Lap splices are permitted as shown on the Construction Drawings, or where bar length is not sufficient to permit continuous reinforcing. All lap splices shall be clearly indicated on the shop drawings, and are subject to the approval of the OWNER. All lap splices shall be Class B as per ACI 318-89.

**03200-4  
CONCRETE REINFORCEMENT**

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- B. The following are the minimum tension lap splice lengths that are permitted, unless otherwise indicated on the Construction Drawings or specified herein.**

No. 3 Rebar: 24"  
No. 4 Rebar: 24"  
No. 5 Rebar: 28"  
No. 6 Rebar: 34"

- C. The following are the minimum compression lap splice lengths that are permitted, unless otherwise indicated on the Construction Drawings or specified herein.**

No. 3 Rebar: 18"  
No. 4 Rebar: 18"  
No. 5 Rebar: 20"  
No. 6 Rebar: 24"

- D. Welded splices are permitted only with the permission of the OWNER. All welding shall conform to the American Welding Society (AWS) "Structural Welding Code-Reinforcing Steel" (AWS #D1.4).**

**END OF SECTION**

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**03200-5  
CONCRETE REINFORCEMENT**

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**GROUNDWATER INTERIM REMEDIAL MEASURE  
GRUMMAN AEROSPACE CORPORATION  
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**SECTION 03300  
CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. Formwork, shoring, bracing and anchorage.
- B. Cast-in-place concrete foundation, slabs, pipe supports and trench.
- C. Concrete curing and finishing.

**1.02 RELATED WORK**

- A. Section 01400 - Quality Control.
- B. Section 03200 - Concrete Reinforcement.

**1.03 REFERENCES**

- A. ACI-318 - Building Code Requirements of Reinforced Concrete
- B. ACI-MCP-1-74 - Manual of Concrete Practice
- C. ASTM C 33 - Concrete Aggregates
- D. ASTM C 94 - Ready-Mixed Concrete
- E. ASTM C 150 - Portland Cement
- F. RP 4-6-1 - Reinforced Concrete Foundation

**1.04 QUALITY ASSURANCE**

- A. Perform testing and placement of concrete in accordance with Section 01400 and ACI 301.
- B. Obtain materials from same source throughout the Work.
- C. Defective Work: Any concrete found to be defective from any cause whatever, at any time before the final acceptance of the Work, shall be either repaired or removed and replaced at the expense of the CONTRACTOR.

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CAST-IN-PLACE CONCRETE**

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**D. Codes and Standards:**

1. ACI 301, "Specifications for Structural Concrete for Buildings."
2. ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."
3. ACI 308, "Standard Practice for Curing Concrete."
4. ACI 318, "Building Code Requirements for Reinforced Concrete."
5. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

**1.05 TESTS**

**A. Compression Tests:** During the progress of the work, compression tests shall be made in accordance with the "Standard Method of Making and Curing Concrete Test Specimens in the Field" (A.S.T.M. Designation: C 31-84) and Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens (A.S.T.M. Serial Designation: C 39-83b).

1. The CONTRACTOR shall arrange for laboratory testing of the compression cylinders by the construction quality assurance (CQA) laboratory.
2. Strength tests shall be performed not less than once a day, one per pour, and once for each 150 cubic yards of concrete.
3. The concrete used shall have an ultimate strength of 4,000 psi.

**B. Slump Tests:**

1. Slump tests shall be performed by the CONTRACTOR under the direction of the OWNER. The slump for all concrete shall be within plus or minus one inch of that determined for the design mix (2.02 E) and in no case shall the slump be more than four inches.
2. Obtain samples for one slump test for each pour in accordance with ASTM C-172.

**03300-2**

**CAST-IN-PLACE CONCRETE**

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3. Not less than four (4) specimens shall be made for each pour totaling fifty (50) or more cubic yards in any one day. Concrete used in making slump tests shall not be used to make test cylinders. No water shall be added to the batch after the test cylinders are taken.

**PART 2 - PRODUCTS**

**2.01 CONCRETE MATERIALS**

- A. Cement: ASTM C150 - Type I - All cement shall be dry, free from lumps, and its color shall be a uniform bluish-gray.
- B. Ready-Mix Concrete: Type I General Purpose
- C. Fine Aggregates: ASTM C 33 - The fine aggregate shall be clean, high-silica sand, having not more than three (3) percent by weight of foreign matter such as loam, clay, dirt, or other impurities and shall be free from injurious amounts of organic impurities. Fine aggregates shall be well graded from coarse to fine.
- D. Coarse Aggregates: ASTM C33 - Coarse aggregate, unless otherwise specified, shall be well graded.
- E. Admixtures: ASTM C260 - Admixtures to the concrete may be used to provide a benefit in water reduction, increased density, improved workability, control of shrinkage, or control of rate of setting, but only with the permission of the CONSULTANT/ENGINEER.
  1. The admixture selected shall produce an air content in the freshly mixed concrete of 6% plus or minus 1% as determined in accordance with "Standard Test Method for Air Content of Freshly Mixed Concrete By the Pressure Method", A.S.T.M. Designation C 231-82; or "Standard Test Method for Air Content of Freshly Mixed Concrete By the Volumetric Method", A.S.T.M. Designation: C 173-78.
  2. Acceptable evidence must be presented to the OWNER that such proposed admixtures, in addition to imparting the desired quality, shall cause no detrimental effect in any of the other desirable properties of the concrete.

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**CAST-IN-PLACE CONCRETE**

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3. The admixture, if used, shall be added by means of an approved dispenser, to accurately control the amount used in each batch of concrete.
- F. Water: The water used in mixing concrete shall be clean and accurately measured for each batch. In general, all water for mixing and curing purposes shall be obtained from a local municipality water supply. Water contaminated with sewage or oil, or water containing dirt, clay, filth or vegetable matter, or river or lake water, shall not be used.

**2.02 CONCRETE MIX**

- A. Proportions: Concrete shall be composed of a thorough mixture of cement and fine and coarse aggregates with mixing water. Prior to the beginning of concrete work, a statement of the proportions proposed for the concrete mixture shall be submitted to the OWNER in quadruplicate, for his information and appropriate action.
- B. Cement: Unless specifically permitted by the OWNER, the cement content of the concrete shall not be less than the following:

Class A - 6 bags per cubic yard

The weight of a bag of Portland cement will be taken as ninety-four (94) pounds.

- C. Aggregates: The relative volume of fine and coarse aggregates shall be subject to adjustments by the OWNER to obtain the concrete mix best suited to the use intended, but except as otherwise required, the fine aggregate shall constitute not less than thirty (30) percent nor more than fifty (50) percent of the total volume of aggregates.
- D. Water: The amount of water used in concrete, inclusive of free water contained in the aggregates but exclusive of water absorbed by the aggregates, shall not exceed five (5) gallons per sack of cement for Class A concrete. So long as the water-cement ratio is kept below this maximum, the water content may be varied by the OWNER to obtain desired consistencies measured by "slump," not to exceed 4 inches determined by the procedures of "Standard Test Method for Slump of Portland Cement Concrete," A.S.T.M. Designation: C 143-78.

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**2.03 FORMWORK**

- A. The forms for exposed surfaces shall be of metal or plywood, adequately supported, or shall be lined with plywood, masonite board or similar lining, and/or with metal. The design of the forms shall be satisfactory to the OWNER, but need not be submitted for approval unless specifically requested.
- B. Metal wall ties shall be of a type that will permit removal to a distance approximately 1½ inches from the face of the wall, free from spilling and allowing for patching immediately after removal of forms.
- C. Twisted wire ties will not be permitted: Concrete blocks or other approved means must be used to maintain proper distance between steel and forms.

**2.04 REINFORCING MATERIALS**

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
- B. Steel Wire: ASTM A82, plain, cold-drawn steel.

**2.05 ACCESSORIES**

- A. Non-shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 7,000 psi in 28 days.
- B. Joint Filler: Ram-Nek Plastic Joint Sealer or approved equal, thickness indicated on Construction Drawings.
- C. Epoxy: Mastic Coating.
- D. Moisture Barrier: Provide moisture barrier over prepared sub-base material in the concrete slab area. Use only materials which are resistant to decay when tested in accordance with ASTM E154 as follows: polyethylene sheet not less than 6 mils thick.
- E. Water Stop: Greenstack Dumbbell with Center Bulb water stop or equal.

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**PART 3 - EXECUTION**

**3.01 PREPARATION**

- A. Design, erect, support, brace, and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position.
- B. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
- C. Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, and level in finished structures. Provide for openings, offsets, keyways, anchorages, and inserts, and other features required in Work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
- D. Provide and install pipe penetrations as shown on the Construction Drawings or as directed by the OWNER.
- E. All forms shall be thoroughly cleaned and wetted just before placing the concrete, and if necessary to secure a smooth surface, they shall be coated with an approved nonstaining substance. Suitable moldings or bevel strips shall be placed in the forms to prevent inside or outside sharp edges. No sharp edges will be permitted in the finished Work. All exposed corners and edges of concrete shall have 3/4-inch chamfer unless otherwise shown on the Construction Drawings.
- F. Verify anchors, pre-cast sections, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.
- G. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with MANUFACTURER's instructions.
- H. At locations where new concrete is doweled to existing Work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

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**3.02 PLACING REINFORCEMENT**

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement at joints as shown on Construction Drawings and as herein specified.

**3.03 PLACING CONCRETE**

- A. Notify OWNER a minimum of 24 hours prior to commencement of concreting operations. Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.
- B. Delivery: Weigh-tickets shall be prepared for each truck showing the normal batch size; the actual weights of cement, aggregate and water, and the time of loading at the plant.
  - 1. A blank shall also be provided on the weigh ticket for the time of arrival at the site, to be filled in and initialed by the CONTRACTOR's Superintendent or Foreman.
  - 2. A copy of the weigh-ticket shall be delivered to the OWNER for each batch of concrete delivered to the site.
- C. Rejection of Concrete: Ready-mixed concrete (central-mixed and transit-mixed) will be rejected if there is evidence of any of the following:
  - 1. Improper proportions of ingredients, inclusive of water;
  - 2. Initial set;

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3. More than sixty (60) minutes transpires after batching or mixing before concrete is placed;
  4. Mixers or trucks are overloaded; and/or
  5. Successive batches are not uniform.
- D. Except as provided herein, water shall not be added to the concrete mixtures at the site unless approved by the OWNER for each instance.
- E. Consolidation: Concrete shall be consolidated by means of mechanical vibration equipment.
1. Vibrators shall be of the immersion type, and shall maintain a speed of not less than 7,000 impulses per minute when in operation submerged in concrete.
  2. They shall be used only by personnel experienced in their use, and shall be inserted and removed vertically (not dragged horizontally) at such regular intervals to insure uniform consolidation throughout the entire section of concrete being placed.
  3. In no case shall vibrators be used to transport concrete inside the forms.
  4. The number of vibrators used shall be sufficient to consolidate the concrete properly.
  5. At least one standby vibrator shall be on hand at all times.
- F. Sloped Surfaces: In special cases, as where concrete is deposited on slopes, a comparatively dry mixture may be used, but care shall be exercised to spread such concrete evenly, in layers not more than four (4) inches in thickness, and to ram it thoroughly. In general, the methods shall be such as to give a compact, dense and impervious concrete with a smooth surface.
- G. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- H. In no case shall the concrete have a free fall sufficient to cause segregation of the aggregate. In general, the limit of free fall shall be six (6) feet.

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**3.04 BONDING AND JOINTS**

- A. Joints, either vertical or horizontal, shall be made only where called for by the Construction Drawings or as permitted by the OWNER.
- B. If the CONTRACTOR chooses to make his major slab pours in sections smaller than those indicated on the Construction Drawings between expansion joints or between edges and expansion joints, he shall submit his schedule of pours for approval at the same time that the reinforcing bars for those pours are submitted. The CONTRACTOR shall take into account the location of reinforcing bar laps when determining the limits of each pour.
- C. All joints subject to hydrostatic pressure and all joints which are at or below finished grade shall be provided with plastic water stops.

**3.05 FINISHING**

- A. In general, forms shall not be removed until the concrete has attained sufficient strength to assure structural stability under all dead and construction loads, and until removal can be accomplished without marring concrete surfaces.
- B. All form ties shall be carefully snapped back, to a depth of at least one and one-half (1-1/2) inches below the concrete surface. The tie holes shall be patched with the driest 1:2 cement-sand mortar that can be made to stay in place.
- C. All horizontal surfaces shall receive the following initial floating operation:
  - 1. The concrete surface shall be accurately struck off and screened with a long straight edge to the required elevation; suitable guides shall be used, as necessary, to carry the proper grade, pitch or slope; and
  - 2. The surface shall be bull-floated to an even surface, with no unevenness exceeding 1/8-inch in 10 feet in any direction.
- D. The bottom slabs of all tanks, channels, conduits, sumps, pits and similar surfaces shall be given a non-slip, heavy-patterned finish with a wood float. All other floor slabs, decks or horizontal surfaces, unless otherwise indicated in the room finish schedule or elsewhere in these specifications, shall be given a non-slip, medium-patterned finish with an aluminum or magnesium float.

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- E. **Float Finish:** After screening, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane so that depressions between high spots do not exceed 5/16 inch under a 10-foot straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces as shown on Construction Drawings. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- F. Unless otherwise directed, all edges and corners which will be exposed in the finished Work shall be beveled or rounded by the use of appropriate forms or form inserts, and care shall be taken to prevent chipping or cracking of finished edges.

**3.06 FIELD QUALITY CONTROL**

- A. Field inspection and testing shall be performed under provisions of Section 01400 (Quality Control).
- B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

**3.07 CONCRETE CURING AND PROTECTION**

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Concrete shall be maintained above fifty (50) degrees Fahrenheit and in a continuously moist condition for a least the first seventy-two (72) hours after placement. Curing compounds shall not be used. Concrete curing shall be in accordance with ACI 308, "Standard Practice for Curing Concrete."

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**3.08 WEATHER CONDITIONS**

- A. When the temperature is below forty (40) degrees Fahrenheit, or predicted to go below thirty-six (36) degrees in the next twenty-four (24) hours, or predicted to go below thirty-two (32) degrees in the next seventy-two (72) hours, no concrete shall be poured without express permission of the OWNER. All concrete placed during cold weather shall conform to ACI 306R.
1. Permission so granted shall be for the day and location only, and must again be requested on subsequent days when temperatures are as above.
  2. When such permission is granted, no concrete shall be poured until adequate covering material is on site, and until a sufficient number of workmen are present to expedite finishing and covering to keep both as close behind the pouring as is practicable.
  3. The CONTRACTOR shall provide and use proper facilities for heating water and aggregates and protecting the newly mixed concrete from freezing, and satisfactory appliances shall be provided and used for covering and keeping the newly laid concrete warm.
  4. The use of chemicals in the concrete mix to reduce the temperature of freezing will not be permitted.
- B. All concrete materials, and all reinforcement, forms, inserts and ground with which the concrete is to come in contact, shall be free from frost.
- C. All concrete placed shall have a temperature of between fifty (50) and ninety (90) degrees Fahrenheit.
- D. The housing, covering or other protection used in connection with the curing shall remain in place and intact at least twenty-four (24) hours after artificial heating is discontinued.
- E. When concrete is mixed during extremely warm weather, the OWNER may require the CONTRACTOR to pre-cool aggregates with water sprays and to schedule the placing of successive layers of concrete so as to cause maximum release and dissipation of the heat of setting. All concrete placed during hot weather shall conform to ACI 305R.

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**3.09 INSERTS AND OPENINGS**

- A. The CONTRACTOR shall build into the concrete the steel reinforcement, pipes, slants, sleeves, anchor bolts, steps, castings, electrical conduits, and other inserts, and shall leave the small openings shown upon the Construction Drawings or as directed. Great care shall be taken to keep inserts and openings at proper lines and grade, and to thoroughly tamp under and around them so that there will not be a passage for water. Where inserts are placed in the floors for openings, the top of such shall be two (2) inches above the elevation of the finished floor, unless otherwise specified.

**3.10 EQUIPMENT BASES**

- A. Where the Construction Drawings or these specifications call for concrete foundations or bases above floor level to support equipment, such bases shall be formed as shown on the Construction Drawings but otherwise shall be symmetrical and with plan dimensions six (6) inches greater than the equipment base.
1. Anchor bolts, where required, shall be positioned by template (furnished under the equipment item) to proper elevation and secured in place. Upper edges shall be chamfered on all sides.
- B. After the equipment has been set in position and shimmed to elevation, the space between the concrete foundation and the equipment metal base shall be completely filled with a non-shrink, non-metallic grout, Masterflow 713 Grout by Master Builders, Supreme Grout by Gifford-Hill and Company, Inc., or approved equal.
1. Exterior edges of the fill shall be projected slightly beyond the equipment metal base and chamfered.
  2. Where practicable, mortar filling as described shall be placed in the presence of the erector of the equipment.

**END OF SECTION**

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**SECTION 05500  
METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. General standards and specifications related to the manufacture, supply, and installation of various carbon steel equipment and accessories.

**1.02 RELATED SECTIONS**

- A. Section 01300 - Submittals.
- B. Section 01600 - Material and Equipment
- C. Section 05510 - Metal Stairs, Grates, Handrails and Hatch, and Safety Accessories
- D. Section 09900 - Painting
- E. Section 13121 - Pre-Engineered Buildings
- F. Section 15000 - Process Piping and Accessories.
- G. Section 15020 - Air Stripping System.
- H. Section 15040 - Vapor treatment Systems.

**1.03 REFERENCES**

- A. ASTM A36 - Structural Steel.
- B. ASTM A53 - Welded and Seamless Steel Pipe.
- C. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.
- D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- F. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.

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G. AWS A2.0 - Standard Welding Symbols

H. AWS D1.1 - Structural Welding Code.

**1.04 SUBMITTALS**

A. The SUPPLIER shall submit information required under provisions of Section 01300 (Submittals).

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, gasket materials, anchorage, size and type of fasteners, and accessories. Include erection drawings and instructions, elevations, and details where applicable.

C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

**1.05 QUALIFICATIONS**

A. The SUPPLIER shall prepare Shop Drawings under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of New York.

B. Welders' Certificates: Submit under provisions of Section 01300 certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

**1.06 FIELD MEASUREMENTS**

A. The SUPPLIER shall verify that field measurements are as indicated on the Construction Drawings.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

A. Steel Sections: ASTM A36.

B. Plates: ASTM A283.

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- C. Pipe: ASTM A53, Grade B, Schedule 40- and 80 Carbon Steel.
- D. Fasteners: Galvanized, slotted strut channels (1 5/8 inch x 13/18 inch) with zinc plated steel pipe clamps from McMaster-Carr or equivalent.
- E. Bolts, Nuts, and Washers: ASTM A325, A307, galvanized to ASTM A153.
- F. Welding Materials: AWS D1.1; type required for materials being welded.

**2.02 FABRICATION**

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

**2.03 FINISHES**

- A. Shop prime all surfaces with standard coating for corrosion protection, and in accordance with Section 09900 - Painting.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Apply bitumastic coating to all surfaces in contact with concrete.

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**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. The SUPPLIER shall verify that field conditions are acceptable and are ready to receive work.

**3.02 PREPARATION**

- A. The SUPPLIER shall clean and strip primed steel items to bare metal where site welding is required.
- B. The SUPPLIER shall supply items required to be cast into concrete with setting templates, to appropriate sections.
- C. The SUPPLIER shall provide anchor bolt kits.

**3.03 INSTALLATION**

- A. The on-site CONTRACTOR shall be responsible for installing all equipment. The equipment SUPPLIER shall supervise and inspect the equipment installation in accordance with Section 11200 and relevant equipment specifications in Division 15 of these Technical Specifications. The CONTRACTOR shall:
  - 1. Install items plumb and level, accurately fitted, free from distortion and defects.
  - 2. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachment.
  - 3. Field weld components indicated on Construction Drawings.
  - 4. Perform field welding in accordance with AWS D1.1.
  - 5. Obtain OWNER's approval prior to site cutting or making adjustments not scheduled.
  - 6. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

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7. Anchor the equipment to the concrete base using 1/2-inch diameter anchor bolts at all corners unless otherwise specified.

**3.04 ERECTION TOLERANCES**

- A. Maximum offset from true alignment: 1/4-inch.

**END OF SECTION**

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**SECTION 05510  
METAL STAIRS, GRATES, HANDRAILS AND HATCH,  
AND SAFETY ACCESSORIES**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. The CONTRACTOR shall furnish and install, complete in every detail, all new structural aluminum or steel in accordance with these specifications and the Construction Drawings.
- B. In general this work shall include the furnishing and installation of the following:
1. Piping trench grate.
  2. Safety railings.
  3. Stairs, ladders, and platforms.
  4. Hatch.
  5. Weir.
  6. Hoist.
  7. Related hardware.
- C. The CONTRACTOR shall furnish and install all items related to the safety accessories in the buildings. The safety accessories as required are as follows:
1. Fire extinguishers.
  2. First aid kit.
  3. Eye wash station.
  4. Air mask and case.
  5. Safety chains.

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**1.02 RELATED SECTIONS**

- A. Section 01300 - Submittals.
- B. Section 01600 - Materials and Equipment.
- C. Section 01650 - Starting of Systems
- D. Section 03300 - Cast-in-Place Concrete.
- E. Section 05500 - Metal Fabrications.
- F. Section 09900 - Painting.
- G. Section 13121 - Pre-Engineered Buildings.
- H. Section 15020 - Air Stripping System.
- I. Section 15040 - Vapor Treatment System.

**1.03 REFERENCES**

- A. ASA B30.2 - Safety codes for cranes, derricks, and hoists.
- B. ASTM A36 - Structural Steel.
- C. ASTM A123 - Zinc (Hot Galvanized) coatings of products fabricated from rolled, pressed, and forged steel shapes, plates, bars and strips.
- D. ASTM A120 - Pipe, steel, black, and hot-dipped zinc-coated (Galvanized) welded and seamless, for ordinary uses.
- E. ASTM B-241 - Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
- F. Metal Building Manufacturer's Association - Metal Building Systems Manual.
- G. Aluminum Association - Aluminum Construction Manual.
- H. AWS A2.0 - Standard Welding Symbols.
- I. AWS D1.1 - Structural Welding Code.

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**1.04 QUALITY ASSURANCE**

- A. All equipment and materials furnished under this Contract shall be new, suitable for the conditions of service to which they will be subject and equal to the best of their respective classes. Grade and quality shall meet the applicable cited specifications and standards.
- B. Workmanship shall be of the highest quality and shall be carried out by competent and experienced workmen.

**1.05 SUBMITTALS**

- A. CONTRACTOR shall submit shop drawings, product data, and installation instructions prior to construction according to Section 01300 (Submittals).
- B. Shop drawings shall indicate sizes, types, and spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.
- C. CONTRACTOR shall indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Zinc-coated steel shall be hot dipped, meeting ASTM specifications A120-83, A128-78 or A153-82, whichever is applicable.
- B. Steel Sections: ASTM A36.
- C. Fasteners: Galvanized, slotted strut channels (1 5/8 inch x 13/18 inch) with zinc plated steel pipe clamps from McMaster-Carr or equivalent.
- D. Bolts, Nuts, and Washers: ASTM A325, A307, galvanized to ASTM A153.

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- E. **Welding Materials:** AWS D1.1; type required for materials being welded. Field welding of aluminum will not be permitted.

**2.02 STRUCTURAL ALUMINUM**

- A. **Structural aluminum shall be aluminum-alloy 6061-T6 unless otherwise noted. Fabrication and construction shall be in accordance with "Specifications for Aluminum Structures" of the Aluminum Association, Inc.**
- B. **Field welding of aluminum will not be permitted.**
- C. **Bolts shall be alloy 6061-T6 unless otherwise specified.**

**2.03 ALUMINUM RAILINGS AND HANDRAILS**

- A. **Aluminum railings and handrailings shall be 2-inch Schedule 40 pipe, aluminum-alloy 6061-T6 conforming to ASTM B-241, "Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube."**
- B. **Standard railing shall consist of a top rail, intermediate rail, and posts spaced not more than 7 feet on center. Top rail shall be continuous over posts, and posts continuous from base to top rail. Intersections of rails and posts shall be made by coping the pipe and continuously welding. All welds shall be ground smooth. Railing splices shall be butted and reinforced by a tight-fitting interior sleeve not less than 6 inches long.**
- C. **Handrails shall be mounted directly on walls by means of brackets attached to the lower side of the handrail so as to offer no obstruction to a smooth surface along the top and both sides of the handrail and provide at least 3-inch clearance between handrail and wall.**
- D. **Railing shall be installed as shown on the Construction Drawings.**
- E. **Portions of posts to be grouted in sleeves or in contact with concrete shall be coated with bituminous material.**

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**2.04 ALUMINUM GRATING AND STAIR TREADS**

- A. All interior grating and interior stair treads shall be aluminum serrated grating.
- B. Floor grating shall be constructed of straight parallel bearing bars. Unless otherwise shown on the Construction Drawings, serrated bearing bars shall be 1'4" x 3/16" centers, and cross bars shall be on 4" centers. Grating and treads shall be designed to support a uniform load of 200 pounds per sq. ft. and shall not deflect more than ¼ inch under a uniform load of 100 pounds per sq. ft. Grating and treads shall be as manufactured by IKG Industries, New York, NY or approved equal.
- C. Bearing bars shall be aluminum alloy 6063-T6 or 6061-T6. Cross bars shall be aluminum alloy 6063-T5.
- D. Cross bars shall be secured to bearing bars by a method that will prevent turning, twisting, or loosening. Notching, slotting, or cutting the top or bottom of bearing bars to receive cross bars will not be permitted. Ends of cross bars are to be trimmed flush with outside face of outside bearing bars. Ends of all grating panels shall be banded. Checkerboard plate nosing shall be provided at stairs.
- E. Stair treads shall have the same pattern as floor grating and shall have anti-slip checkered plate nosings.

**2.05 ALUMINUM HATCH**

- A. The aluminum access door shall be Type J-5AL as manufactured by the Bilco Company, New Haven, Connecticut. Door leaf shall be ¼-inch of aluminum diamond pattern plate to withstand a live load of 300 pounds per square foot. Channel frame shall be ¼-inch aluminum with an anchor flange around the perimeter.
- B. Door shall be equipped with heavy forged brass hinges, stainless steel pins, spring operators for easy operation, and an automatic hold-open arm with release handle. A snap lock with removable handle shall be provided. A 1½-inch drainage coupling shall be located in the front right corner of the channel frame, and shall be piped to drain into the clear well, as indicated on the Construction Drawings.

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- C. Hardware shall be cadmium plated and factory finish shall be prime coat of red oxide applied to steel doors and frames. Factory finish shall be mill finish with bituminous coating applied to exterior of frame that will be in contact with concrete.
- D. Cover leafs shall be equipped with heavy brass or bronze hinges, stainless steel pins, spring operators for easy operation and an automatic hold-open arm with release handle. A snap lock with removable trench lift handle shall be provided. Sizes of hatches, number of leaves, and location of hinges shall be as shown on the Construction Drawings.

**2.06 SAFETY CHAINS**

- A. Safety chains shall be constructed of galvanized wrought iron. Chains shall be straight link style, 3/16-inch diameter, with at least twelve links per foot, and with snap hooks on each end. Snap hooks shall be boat type, and eye bolts for attachment of chains shall be stainless steel 3/8-inch bolt with 3/4-inch eye diameter, anchored as indicated. Two chains four inches longer than the anchorage spacing shall be supplied for each guarded area.

**2.07 AIR MASK AND CASE**

- A. The CONTRACTOR shall furnish and install one (1) MSA Model 461704 Pressure-Demand Type Air Mask consisting of a spring-loaded exhalation valve, a pressure-demand regulator which supplies air to the face piece under positive pressure, an audible low pressure warning device, compressed air cylinder and harness. It shall have a rated service of 30 minutes. Air mask and tank shall be NIOSH approved TC13F-29.
- B. The air mask and air cylinder shall be stored in a plastic wall case. The case shall be Model 01-3320-01 as manufactured by Encon, Inc., a division of Penwalt, Inc.
- C. The location of the air mask, cylinder, and wall mounted case shall be determined by the OWNER.

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**2.08 FIRE EXTINGUISHERS**

- A. One (1) portable tank type fire extinguisher containing fifteen pounds of liquid carbon dioxide, complete with hanger, seat type valve, 3 feet of hose and non-shatterable discharge hose, complete with brackets for wall mounting; as manufactured by Walter Kiddie & Co. Model 15KS, or equal.
- B. Fire extinguisher shall be located where directed by the OWNER.

**2.09 FIRST AID KIT**

- A. One (1) industrial first aid kit as manufactured by Acme Products, Kit Number 25, or equal.
- B. First aid kit shall be located where directed by the OWNER.

**2.10 EYE WASH**

- A. One (1) eye wash station shall be installed in the building.
- B. Eye wash station shall be located where directed by the OWNER.

**2.11 WEIR**

- A. The rectangular weir plate shall be 304 stainless steel with minimum thickness of ¼-inch. The top edge of the weir plate shall be smooth-ground to form a sharp crest along the upstream edge of the plate such that the water discharges clear of the crest.
- B. The elevation of the plate shall be adjustable as shown on the Construction Drawings.
- C. The bolts, washers, and nuts shall be stainless steel.

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**2.12 HOISTS**

- A. The CONTRACTOR shall furnish, install, and test one (1) push type I-beam trolley and one (1) one-ton chain block hoist to run on the bottom flange of the monorail beam located in the treatment building.
- B. The hoist shall be one (1) ton capacity, equal to Budget Aluminum Chain Block hoists as manufactured by Dresser Industries, Inc., Catalog No. 262; with a minimum 25-foot, 0-inch lift (load) chain and safety hook. The trolley shall be easy rolling I-beam push type trolley model 82 as manufactured by Dresser Industries, Inc., or an approved equal.
- C. All hoist equipment shall be painted in accordance with Section 09900 (Painting). After painting, the hoisting equipment shall bear an inscription easily readable from the operating floor showing the capacity of the hoisting unit.
- D. Hoisting equipment shall be field tested to demonstrate capacity and ability to operate in compliance with the requirements of the Contract Documents. Test shall conform where applicable, to the A.S.A. Safety Codes for Cranes, Derricks, and Hoists, A.S.A. B30.2.

**2.13 FINISHES**

- A. Shop prime all surfaces with standard coating for corrosion protection, where applicable.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Apply bitumastic coating to all surfaces in contact with concrete.

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**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. The CONTRACTOR shall verify that field conditions are acceptable and ready to receive work.

**3.02 PREPARATION**

- A. The CONTRACTOR shall clean and strip primed steel items to bare metal where site welding is required.
- B. The CONTRACTOR shall supply items required to be cast into concrete with setting templates, to appropriate sections.
- C. The CONTRACTOR shall provide anchor bolt kits.

**3.03 INSTALLATION**

- A. The CONTRACTOR shall be responsible for installing all equipment. The equipment SUPPLIER shall supervise and inspect the equipment installation in accordance with Section 01650 (Starting of Systems) and relevant equipment specifications in Division 15 of these Technical Specifications. The CONTRACTOR shall:
1. Install items plumb and level, accurately fitted, free from distortion and defects.
  2. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachment.
  3. Field weld components indicated on Construction Drawings.
  4. Perform field welding in accordance with AWS D1.1.

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5. Obtain OWNER's approval prior to site cutting or making adjustments not scheduled.
6. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
7. Anchor the equipment to the concrete base using ½-inch diameter anchor bolts at all corners unless otherwise specified.
8. Installation shall be in accordance with MANUFACTURER's instructions. MANUFACTURER shall guarantee against defects in material or workmanship for a period of five years.

**3.04 ERECTION TOLERANCES**

- A. Maximum offset from true alignment: ¼-inch.

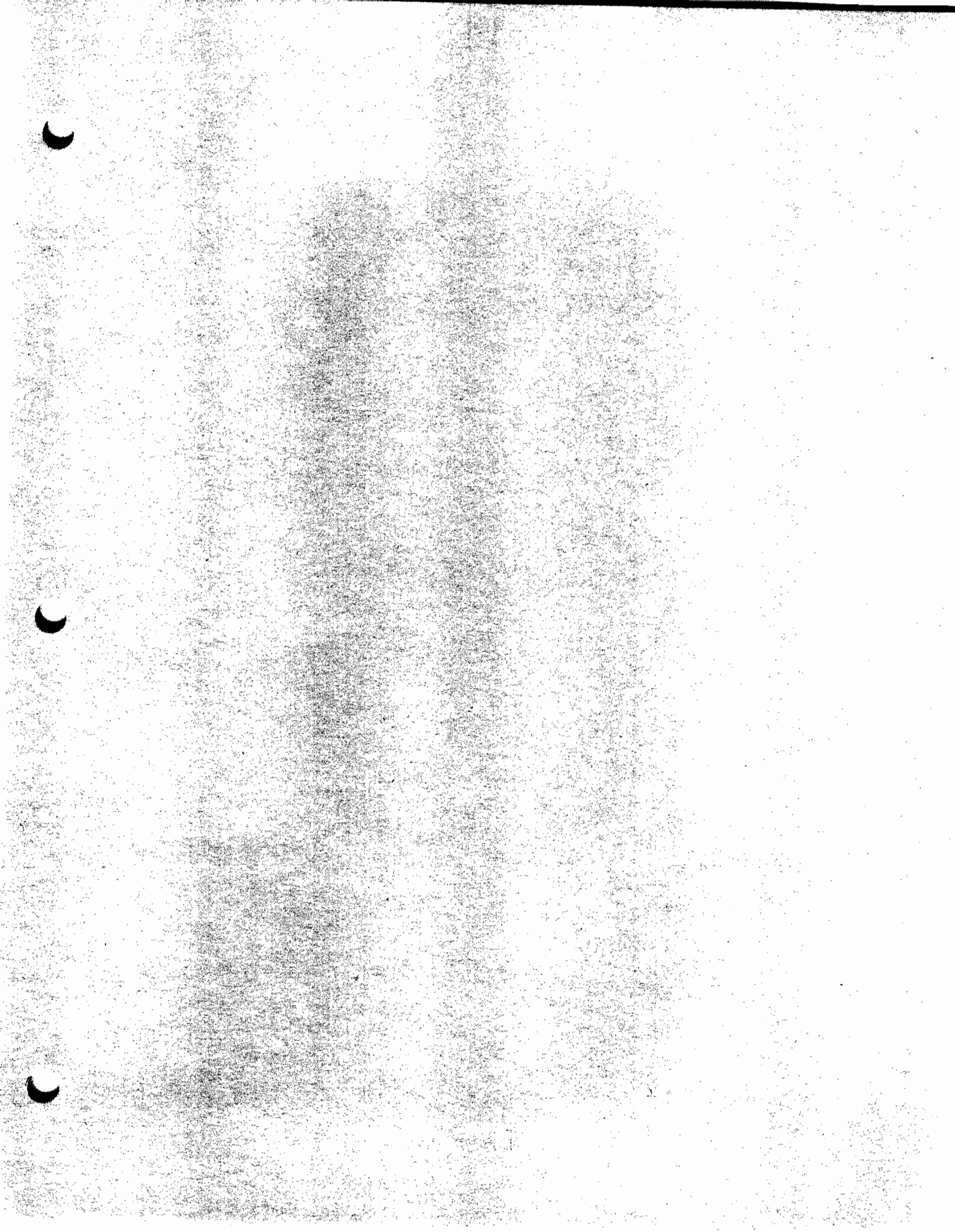
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**SECTION 09900  
PAINTING**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. This section includes requirements for the surface preparation and field application of paints and coatings. Materials and equipment requiring finish paints include, but are not limited to: process and wellhead piping, process equipment, equipment skids, steel pipe supports, structural supports, hoist, handrails, and ladders.

**1.02 RELATED SECTIONS**

- A. Section 01300 - Submittals.
- B. Section 01600 - Material and Equipment.
- C. Section 05500 - Metal Fabrications
- D. Section 05510 - Metal Stairs, Grates, Handrails, Hatch, and Safety Accessories.
- E. Section 15000 - Process Piping and Accessories.
- F. Section 15020 - Air Stripping System.
- G. Section 15040 - Vapor Treatment System.

**1.03 REFERENCES**

- A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. AWWA C204 - Chlorinated Rubber-Alkyd Paint Systems for the Exterior of Above Ground Steel Water Piping.
- C. NACE - Visual Standards for Surface Preparation.
- D. SSPC - Steel Structures Painting Council.

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**1.04 SUBMITTALS**

**A. General**

All submittals shall be complete, neat and orderly. The MANUFACTURER shall submit for the OWNER's approval, all information and product data called for under these specifications or requested by the OWNER including but not limited to:

1. MANUFACTURER instructions, specifications, and data for special surface preparation procedures, etc.
2. Product Data: Provide data on all finishing products.
3. Submittals shall be provided according to the schedule specified in Section 01300 (Submittals).

**1.05 QUALIFICATIONS**

- A. MANUFACTURER: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. APPLICATOR: Company specializing in performing the work of this section with minimum five years documented experience approved by MANUFACTURER.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. All arrangements for delivery, storage, and handling of products specified herein shall be the CONTRACTOR's responsibility.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container label to include MANUFACTURER's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Store paint materials at minimum ambient temperature of 45 degrees Fahrenheit (7 degrees Celcius) and a maximum of 90 degrees Fahrenheit (32 degrees Celcius), in ventilated area, and as required by MANUFACTURER's instructions.

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**1.07 ENVIRONMENTAL REQUIREMENTS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint MANUFACTURER.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product MANUFACTURER.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturers - Paint
  - 1. Benjamin Moore Paints.
  - 2. Glidden.
  - 3. Martin Senour.
  - 4. Sherwin Williams.
- B. Manufacturers - Caulking and Fillers
  - 1. General Electric.
  - 2. DAP Co.
  - 3. Glidden.

**2.02 MATERIALS**

- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- C. Patching Materials: Paint/Stain compatible filler.

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- D. **Caulking Compounds:** For general interior and exterior application, caulking shall be a silicone sealant "Silpruf" as manufactured by General Electric, Waterford, NY or DAP Co., or approved equal. For walking surfaces, caulking shall be a two component polyurethane (flow type, self-leveling). Colors of caulking compounds as selected by the OWNER from MANUFACTURER's standard color line.

**2.03 FINISHES**

- A. Refer to schedule at end of section for surface finish schedule.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Verify site conditions under provisions of Section 01039 (Coordination and Meetings).
- B. Verify that surfaces/substrate conditions are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop applied primer for compatibility with subsequent cover materials.

**3.02 PREPARATION**

- A. Equipment and appurtenances shall be shielded to prevent damage during surface preparation and painting operations. All openings including those that are flanged or threaded shall be sealed to prevent entry of abrasives, dust or coating materials.
- B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.
- C. Seal with shellac and seal marks which may bleed through surface finishes.
- D. **Impervious Surfaces:** Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

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- E. Surface preparation shall be SP-6.
- F. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- G. All mild steel structural components furnished or installed by the CONTRACTOR shall be cleaned as required (per SSPC-SP 1 Solvent Cleaning, SSPC-SP 2 Hand Tool Cleaning, and SSPC-SP 3 Power Tool Cleaning).
- H. All galvanized steel structural components furnished or installed by the CONTRACTOR, where cut, drilled, punched, or welded, shall be cleaned as required (per SSPC-SP 1 Solvent Cleaning, SSPC-SP 2 Hand Tool Cleaning, and SSPC-SP 3 Power Tool Cleaning), and primed with Rust-Oleum #2185 Cold Galvanizing Compound.

**3.03 APPLICATION**

- A. Apply products in accordance with MANUFACTURER's instructions.
- B. Apply a minimum of 2.0 mils dry film thickness per coat.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish.
- D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- E. Sand metal lightly between coats to achieve required finish.
- F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
- G. Allow applied coat to dry before next coat is applied.

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**3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT**

- A. Submit schedule of color coding and identification banding of equipment and piping to the OWNER for approval.
- B. Purchased equipment shall be coated by the equipment MANUFACTURER using his standard coating system. Damaged primer or finish coats shall be repaired with a compatible coating system.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Prime and paint pipes, boxes, ducts, hangers, brackets, collars and supports, except where items are prefinished.
- F. Color code equipment, piping, and exposed duct work in accordance with the OWNER's direction. Color band and identify with flow arrows, names, and numbering.

**3.05 FIELD QUALITY CONTROL**

- A. Field inspection and testing will be performed under provisions of Section 01400 (Quality Control).

**3.06 CLEANING**

- A. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

**3.07 SCHEDULE - EXTERIOR SURFACES**

- A. Steel - Unprimed:
  - 1. One coat of primer.
  - 2. Two coats of alkyd zinc chromate, semi-gloss.
- B. Steel - Shop Primed:
  - 1. Touch-up with alkyd zinc chromate primer.
  - 2. Two coats of alkyd enamel, semi-gloss.

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**3.09 SCHEDULE - COLORS/FINISHES**

**A. Colors:**

1. Color of paint for piping shall be in accordance with OWNER's selection.

**B. Finishes - Unless otherwise indicated:**

1. One coat of alkyd enamel, semi-gloss.

**END OF SECTION**

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**SECTION 13121  
PRE-ENGINEERED BUILDINGS**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

The CONTRACTOR shall furnish and install one pre-engineered treatment building and three pre-engineered well house enclosures. The treatment building shall include the following:

- A. All necessary structural steel of sufficient size and strength to support the building's ceiling panels, wall panels, and monorail hoist system.
- B. Insulated metal wall and double sloped roof system including gutters, downspouts, and splash blocks.
- C. Exterior doors, overhead steel roll-up door, exhaust fans, ventilating louvers, interior and exterior lighting, and steam heaters.
- D. Partitioned enclosure for electrical control room with clearview glass panel and roof.
- E. The roof of the electrical control room shall be used for storing materials.
- F. The well house enclosures shall include the following:
  - 1. All necessary structural steel of sufficient size and strength to support the building ceiling panels, wall panels, and roof hatch.
  - 2. Insulated metal wall and single sloped roof system including gutters, downspouts, and splash blocks.
  - 3. Exterior door, exhaust fan, interior and exterior lighting, and electric heater.

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**1.02 RELATED WORKS**

- A. Section 01300 - Submittals.
- B. Section 03200 - Concrete Reinforcement.
- C. Section 03300 - Cast-In-Place Concrete.
- D. Section 05500 - Metal Fabrications.

**1.03 REFERENCES**

- A. AISC - Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.
- B. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- C. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- D. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- E. ASTM A386 - Zinc-coating (Hot-Dip) on Assembled Steel Products.
- F. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- G. ASTM A490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
- H. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized by the Hot-Dip Process, General Requirements.
- I. ASTM A572 - High Strength Low Alloy Columbium-Vanadium Steel of Structural quality.
- J. AWS A2.0 - Standard Welding Symbols.
- K. AWS D1.1 - Structural Welding Code.
- L. SSPC - Steel Structures Painting Council.
- M. ASA B30.2 - Safety Codes for Cranes, Derricks, and Hoists.

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**1.04 SUBMITTALS**

- A. Submit under provisions of Section 01300.
- B. Shop Drawings:
  - 1. Indicate design loads, including dead loads, live loads, and applied safety factor.
  - 2. Indicate assembly dimensions, locations of structural members, connections, and openings.
  - 3. Indicate wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, and method of installation.
  - 4. Indicate framing anchor bolt settings, sizes, and locations from datum, and foundation loads.
  - 5. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
- C. Product Data: Provide data on profiles, component dimensions, and fasteners.
- D. Detailed instructions for the building assembly, maintenance instructions, and other data pertaining to proper upkeep and operation of the building.

**1.05 REQUIREMENTS**

- A. All work and materials shall be in full accordance with local and state ordinances, and with any other prevailing rules and regulations regarding potentially hazardous equipment or locations.
- B. Conform to applicable construction codes for submission of design calculations and reviewed shop drawings as required for acquiring building permits.
- C. Cooperate with regulatory agency or authority and provide data as requested.
- D. The structural design drawings shall be signed and sealed by a New York State-licensed professional engineer.



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**1.06 SYSTEM DESCRIPTION**

**Treatment Building:**

**The Treatment Building shall be:**

- A. Constructed with prefabricated modular structural members, wall and roof systems, and to have a minimum interior clearance of 50' - 0" in length, 40' - 0" in width, and 24' - 0" in height.**
- B. Well insulated, having a minimum R value of 24**
- C. Supplied with 4-inch thick wall panels with friction fit insulation.**
- D. Provided with a finished exterior of sand-tan polyester paint.**
- E. Furnished with one (1) 16' wide x 14' high steel, roll-up, insulated overhead door, two (2) 2-inch thick insulated personnel access doors, one (1) 2-inch thick insulated personnel access door with louvers, and one (1) 2-inch thick insulated double hinged solid door. All the doors shall have locking devices.**
- F. Equipped with exhaust fans and interior and exterior lighting and air intake and exhaust ducts as shown on the Construction Drawings.**
- G. Equipped with gutters, downspouts, and splash blocks.**
- H. Constructed to withstand snow and wind loads in accordance with the applicable construction codes. The supporting steel structure shall be designed by the CONTRACTOR of sufficient size and strength and, written approval must be obtained from the OWNER prior to fabrication.**
- I. Partitioned to form the electrical control room with clearview glass panel as shown on the Construction Drawings.**
- J. The electrical control room roof shall be capable of sustaining a uniformly distributed load of 250 pounds per square feet.**

**Hoists**

- A. The CONTRACTOR shall furnish, install, and test two (2) push type I-beam trolleys and two (2) 1-ton chain block hoists to run on the bottom flange of separate monorail beams located in the treatment building.**

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Well House Enclosures:

The Well House Enclosures shall be:

- A. Constructed with prefabricated modular structural members, wall and roof systems, and to have a minimum interior clearance of 15'-0" in length, 10'-0" in width, and 10'-0" in height.
- B. Well insulated, having a minimum R value of 24.
- C. Supplied with 3-inch thick wall panels with friction fit insulation.
- D. Provided with a finished exterior of sand tan polyester paint.
- E. Furnished with one (1) 2-inch thick insulated single narrow light personnel access louvered door with locking device, gutters, and downspouts and splash blocks.
- F. Equipped with exhaust fan, louvers, heating units, thermostat, and interior and exterior lighting as shown on the Construction Drawings.
- G. Equipped with a roof hatch as shown on the Construction Drawings.
- H. Constructed to withstand snow and wind loads in accordance with the applicable construction codes. The supporting steel structure shall be designed by the CONTRACTOR of sufficient size and strength and, written approval must be obtained from the OWNER prior to fabrication.

**1.07 QUALIFICATIONS**

- A. **MANUFACTURER:** Company specializing in manufacturing the products specified in this Section with minimum of 3 years experience.
- B. Design structural components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of New York.

**1.08 WARRANTY**

- A. The CONTRACTOR shall obtain at least a ten (10) year warranty from the MANUFACTURER and submit to the OWNER.

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- B. The warranty shall include coverage for exterior pre-finished surfaces against chipping, cracking or crazing, blistering, peeling, chalking, or fading.
- C. The warranty shall include coverage for weather tightness of the building enclosure after installation.

**PART 2 - PRODUCTS**

**A. MANUFACTURERS - MODULAR STRUCTURES**

- 1. Acceptable manufacturer: Bally Engineered Structures, Inc. or approved equivalent.

**B. MATERIALS**

**Panels:**

- 1. Exterior wall panels shall be a single continuous length from the base to the roof line of the building at the sidewalls and endwalls of the building except where interrupted by wall openings.
- 2. Wall panels shall be 16" wide with a 3" deep inward turned interlocking side rib. Wall panels shall contain two 3/4" deep by 3 1/8" wide fluted recesses, each starting 2 7/16" from the panel edge.
- 3. Wall panels shall be fastened internally to the base channel and wall cap of the building with 3/8" diameter electro-galvanized machine bolts placed within the panel interlock. The fastening system shall be designed so that no wall fasteners are exposed on the exterior surface of the walls.
- 4. Wall panels shall be a minimum of 24 gauge galvanized steel conforming to ASTM A-525 specifications with the galvanized coating conforming to G90 (1.25 ounce) standards. Minimum yield strength of panel material shall be 40,000 psi. Panel material shall be embossed with a random pattern pebble embossure of approximately .007 - .008" depth.
- 5. The bases of the wall panels shall be closed off with closure plugs conforming to the panel profile.

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**C. DOOR AND FRAME**

1. The door and frame shall be constructed with material equivalent or better in quality than the panels.
2. The door shall be sized and installed at the location shown on the Construction Drawings.
3. A thermoplastic gasket shall be mounted on the top edge and along both sides of the door to keep the door closed and the gasket shall form a tight seal.
4. Latch and strike assembly: The latch and strike assembly shall be satin-polished or chrome-finish. The latch shall be made to accommodate a padlock but must include an inside safety release mechanism.
5. Hinges: The hinges shall match the latch in general finish and design. Blades shall be no less than 9-inch long and hinges shall be of the up-lift type with Delrin cams on 3/8 inch diameter pins.
6. The bottom edge of the door shall contain a flexible, dual-blade wiper gasket.
7. The door shall be supplied with a metal shield above the door to divert rain and snow from the door opening.
8. An extruded aluminum sillplate shall be provided.
9. Mortise Lock: The lockset shall be Best model with Yale cylinder. Pull handle shall be provided on the exterior of the door for easy access.

**D. OVERHEAD STEEL ROLL-UP DOOR**

1. The door and frame shall be constructed with material equivalent or better in quality than the panels.
2. The door shall be sized 16' - 0" wide by 14' - 0" height with 4:1 reduction gear chain operator) and installed at the locations as shown on the Construction Drawings.
3. Framed opening for overhead door shall be constructed from minimum 14 gauge high strength galvanized steel.

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4. The jambs and head shall provide minimum 2-1/2" wide inside surface for field mounting of overhead door track and hardware.
5. Head and jamb covers to be 24 gauge, embossed, painted wall color.
6. The door shall include a latch and strike assembly to lock.
7. The door shall be insulated to the level of the building wall panels.

**E. ROOF**

1. Buildings shall have a minimum 1 1/2" pitch interlocking panel roof system. Roof panels shall be attached to the wall cap through factory punched holes.
2. Transmission of horizontal wind loads across the buildings shall be made through the panel roof system.
3. Roof panels shall be supplied in a single continuous length from eave line to eave line and be designed to tightly interlock so that no fasteners are required at intermediate points along the panel side laps.
4. Roof panels shall be 16" wide with a smooth surface between the interlocking side ribs. The interlocking ribs shall be 3" high and turned upward.
5. Roof panels shall be minimum 24 gauge steel coated on both sides with a coating of corrosion resistant aluminum zinc alloy applied by a continuous hot dipping process. Coating weight shall be a minimum of 0.32 ounce of aluminum zinc alloy per square foot of coated sheet (both sides) equivalent to about 0.80 mil thickness on each side. Minimum yield strength of panel material shall be 50,000 PSI.

**F. GUTTERS AND DOWNSPOUTS**

1. Rain gutters and downspouts shall be provided to match the exterior finish of the buildings.



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**G. ROOF HATCH**

1. Unit: 30 x 36-inch size, single leaf type.
2. Integral Steel Curb: 14 gauge galvanized steel with minimum 1-inch rigid insulation; integral cap flashing to receive roof flashing; extended flange for mounting as shown on the Construction Drawings.
3. Hardware:
  - a. Steel manual pull handle for interior and exterior operation.
  - b. Steel hold open arm with vinyl covered grip handle for easy release.
  - c. Hinges: Manufacturer's recommended type.

**H. HOIST**

1. The hoist shall be one (1) ton capacity Budgit Aluminum Chain Block hoist as manufactured by Dresser Industries Inc., catalog no. 262; with a minimum 25'-0" lift (load) chain and safety hook, or approved equal. The trolley shall be easy rolling I-beam push type trolley model 82 as manufactured by Dresser Industries Inc., or an approved equal.
2. All hoist equipment shall be painted in accordance with Section 09900 - Painting. After painting, the hoisting equipment shall bear an inscription easily readable from the operating floor showing the capacity of the hoisting unit.
3. Hoisting equipment shall be field tested to demonstrate capacity and ability to operate in compliance with the requirements of the Contract Documents. Test shall conform where applicable, to the A.S.A. Safety Codes for Cranes, Derricks and Hoists, A.S.A. B30.2.

**PART 3 - EXECUTION**

**A. EXAMINATION**

1. Verify that foundation, slab, mechanical and electrical utilities, and anchor bolts are in the correct positions.

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**B. ERECTION - WALL AND ROOFING SYSTEMS**

1. Install the structural steel, wall panels and roof system in accordance with MANUFACTURER's instructions.
2. Exercise care when cutting pre-finished material to ensure cuttings do not mar the finished surface.
3. Fasten the wall panels to the concrete curb with anchor bolts.
4. The finished building shall be free of rattles and noise due to thermal movement and wind whistles.

**C. ERECTION - GUTTER AND DOWNSPOUT**

1. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
2. Apply bituminous paint on surfaces in contact with cementitious materials.
3. Slope gutters a minimum of .06 inch/ft.
4. Install splash pans and direct the rain water to the existing storm water system.

**D. ELECTRICITY**

1. The electricity for the buildings shall be supplied from the sources specified in the Construction Drawings.

**E. INSTALLATION - ACCESSORIES**

1. Install door frames, doors, prefab roof, and exhaust fans in accordance with MANUFACTURER's instructions.
2. Install vents, stack, and interior and exterior lights in accordance with MANUFACTURER's instructions, the Construction Drawings and these Technical Specifications.
3. Seal wall and roof accessories watertight with sealant.

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PRE-ENGINEERED BUILDINGS**

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**F. INSTALLATION - ROOF HATCH**

1. Install in accordance with MANUFACTURER's instructions.
2. Coordinate with installation of roofing system and related flashings for weather-tight installation.

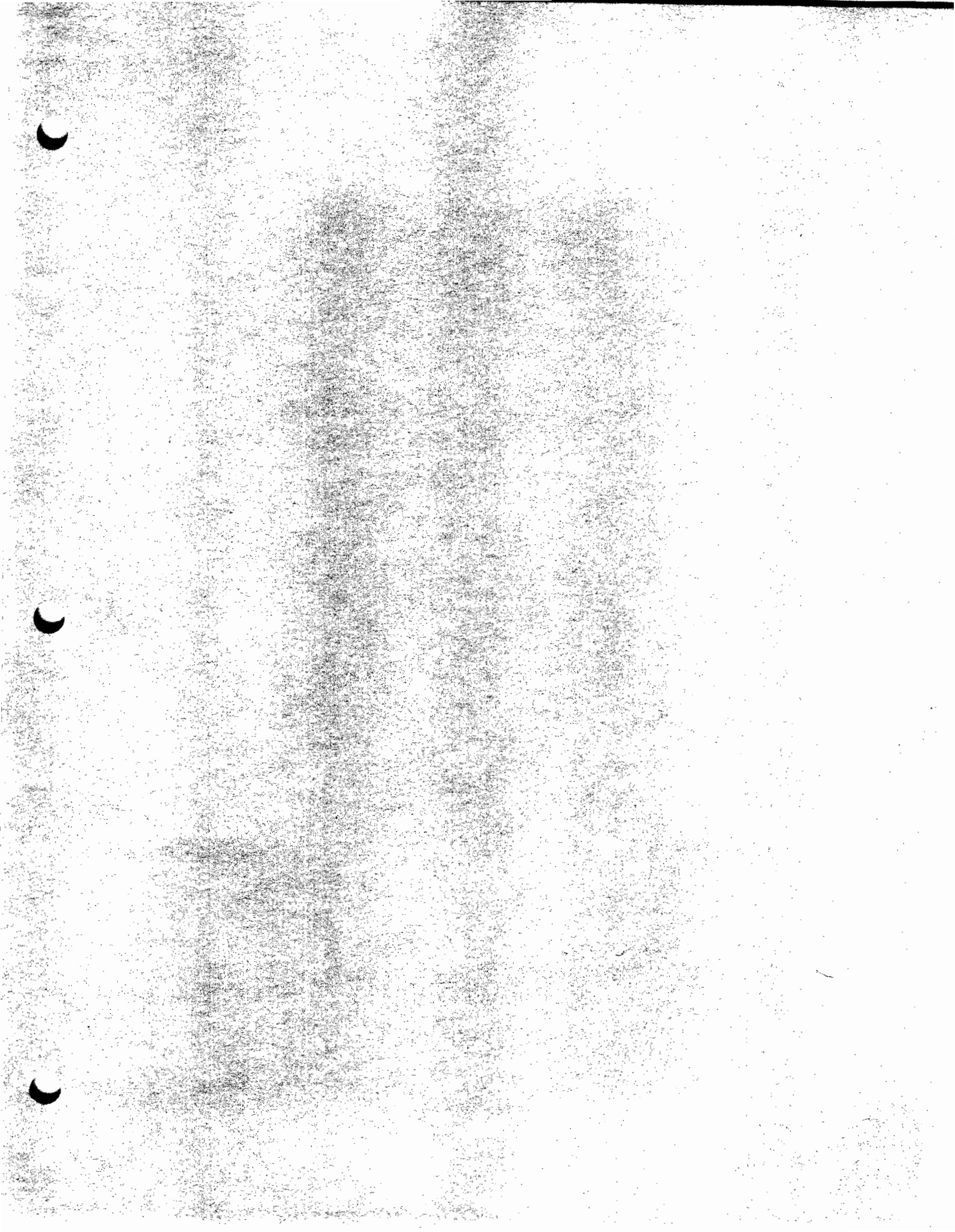
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**SECTION 15000  
PROCESS PIPING AND ACCESSORIES**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. The CONTRACTOR is responsible for the installation and testing of all inside and outside piping and accessories including, but not limited to, the following items, as shown on the Construction Drawings: pipe (steel and ductile iron), pipe fittings, pipe sleeves, pipe supports, valves, strainers, insulation, steam traps, flow meters, bends, tees, joint restraints, and pipe flanges, hangers and anchors for piping and ductwork., and identification tags.

**1.02 RELATED WORK**

- A Section 01010 - Summary of Work  
B Section 01300 - Submittals  
C Section 01600 - Material and Equipment  
D Section 03300 - Cast-In-Place Concrete  
E Section 05500 - Metal Fabrications  
F Section 15020 - Air Stripping System  
G Section 15040 - Vapor Treatment System  
H Section 15060 - Pumps and Appurtenances  
I Section 15500 - Heating and Ventilation System  
J Section 02222 - Excavation  
K Section 02223 - Backfilling  
L Section 16910 - Electrical Controls

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**1.03 REFERENCES**

The following standards shall be adhered to as applicable:

- A. ANSI/AWWA C104 - Cement mortar lining for ductile iron and gray iron pipe and fittings for water.
- B. ANSI/AWWA C110 - Ductile-iron and gray-iron fittings, 3 inches through 48 inches, for water and other liquids.
- C. ANSI/AWWA C111 - Rubber - Gasket joints for ductile iron and gray-iron pressure pipe and settings.
- D. ANSI/AWWA C151 - Ductile iron pipe, centrifugally cast in metal molds or sand-lined molds, for water and other liquids.
- E. ANSI/AWWA C153 - Ductile iron compact fittings, 3 inches to 16 inches for water and other liquids.
- F. ANSI/AWWA C500 - Standard for gate valves for water and sewerage systems.
- G. ANSI/AWWA C509 - Standard for resilient sealed gate valves for water and sewerage systems.
- H. ANSI/AWWA C600 - Installation of ductile iron water mains and their appurtenances.
- I. ANSI/AWWA C800 - Standard for underground service line valves and fittings.
- J. ASTM A53/A106 - Seamless carbon steel pipe.
- K. ASTM A105 - Carbon steel forgings and fittings.
- L. ANSI B16.9 - Factory-made wrought steel buttwelding fittings.
- M. ASTM A234 - Carbon steel seamless and welded fittings.
- N. ANSI B16.5 - Pipe flanges and flanged fittings.
- O. ANSI B16.1 - Cast iron flanges and flanged fittings.



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**1.04 TESTS**

- A. Process and equipment operational tests shall be performed by the CONTRACTOR and shall include the process pumps, pipes, valves, flow meters, float switches and all other appurtenant items.**
- B. Ductile iron piping and associated fittings shall be tested in accordance with the most current version of AWWA C600 described in Section 3.09.**
- C. Steam, condensate, and other piping and associated fittings shall be leak tested at 1.5 times the working pressure by the CONTRACTOR under the direct supervision of the OWNER.**
- D. The test shall be observed by the OWNER and written acceptances shall be given to the CONTRACTOR after successful test completion.**

**PART 2 - PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. Suggested manufacturers are indicated in some cases, however, the CONTRACTOR may substitute material and equipment that is equivalent in all respects to that indicated after receiving written authorization by the OWNER and in accordance with Section 01600 - Materials and Equipment, Part 1 - General.**

**2.02 DUCTILE IRON PIPE AND FITTINGS**

- A. All interior and exterior piping conveying water to or from the treatment system shall be ductile iron pipe manufactured in accordance with the requirements of ANSI/AWWA C151. All ductile-iron pipe shall have a rated working pressure of 350 psi, unless otherwise indicated on the Construction Drawings, or specified herein. The ductile iron pipe shall be manufactured by U.S. Pipe and Foundry Company or approved equal.**
- B. All ductile iron pipe and fittings, with the exception of pipe sleeves, shall be cement lined unless otherwise specified or approved. Linings shall conform to ANSI/AWWA C104. The mortar lining shall be protected with a non-toxic bituminous seal coat approved by the New York State Department of Health. All ductile iron pipe and fittings shall receive a shop coating of a standard bituminous coating on the exterior prior to shipment unless otherwise specified or approved.**

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- C. All ductile iron pipe joints below ground shall be push-on joint type and shall have a rated working pressure of 350 psi, and shall have a minimum thickness classification of Class 52. Push-on joints shall be manufactured in accordance with ANSI/AWWA C111. Unless indicated otherwise, all fittings shall be mechanical joint type, and shall also have a rated working pressure of 350 psi. Mechanical joints shall be furnished and installed with Megalug mechanical joint retainer glands, or approved equal. All joints and fittings shall be furnished complete with gaskets, and all accessories required for installation, as recommended by the manufacturer.
- D. All interior aboveground ductile iron pipe and fittings shall be screwed, flanged type joints and fittings. Flanged pipe and fittings in the well house shall have a Class 250 rating and flanged pipe and fittings in the treatment building shall have a Class 125 rating. All flanged pipe and fittings shall be manufactured in accordance with ANSI B16.1 and to the dimensions specified by the pressure classification of the joints and fittings specified. All interior ductile iron pipe shall have a minimum thickness classification of Class 53. All flanged joints and fittings shall be furnished complete with gaskets, and all accessories required for installation, as recommended by the manufacturer.
- E. The 16-inch discharge piping shall be ductile iron pipe with a rated working pressure of 350 psi, and shall have a minimum thickness classification of Class 53. All joints shall be push-on type joints manufactured in accordance with ANSI/AWWA C111. Unless otherwise indicated, all fittings shall be mechanical type joints with mechanical joint retainer glands. All joints and fittings shall be furnished complete with gaskets, and all accessories required for installation, as recommended by the MANUFACTURER. Piping shall be adequately supported using at least one pipe support under each length of pipe for stability. Pipe saddles shall have a 120° saddle angle and shall be located on each support. Adequate pipe restraint shall be provided as shown on the Construction Drawings.
- F. All piping shall be installed with joint restraint or thrust blocking wherever there is a change in direction of the pipe and at fittings, as specified and as noted on the Construction Drawings.
- G. Flanged joints shall be made with bolts or stud-bolts with a nut on each end and gaskets that shall extend at least to the inside of the bolt holes. Gaskets shall be 1/16 inch thick. Gaskets shall be rubber ring gaskets, Raybestos 635 C.I., Goodyear 140 C.I., Goodrich SBR-MC, Garlock 159, or approved equal.

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- H. Bolts, stud-bolts, and nuts for flanges shall be ANSI heavy dimension, semi-finish, with square heads and cold punched hexagonal nuts conforming to ASTM Des. A 307 (Grade B). Threads shall be rolled American Standard Screw Threads, Coarse Thread Series, Class 2 Fit. For bolts 1¼ inches in diameter and larger, stud-bolts shall be used. Bolt size shall be American Standard for ANSI Class 250 or Class 125 flanges, as appropriate.
- I. All piping which may be exposed to freezing temperatures during normal operations shall be heat traced and insulated along the exposed portions above land surface and down to 4 feet, 6 inches below grade. Heat tracing shall be furnished as specified in Section 16910 - Electrical Controls. Insulation shall be suitable for outdoor applications on both hot and cold surfaces, and shall be furnished as specified herein.

**2.03 STEAM AND CONDENSATE PIPING**

- A. All piping shall be ASTM A53/A106, Grade A or B, Type S or E, Schedule 40 for steam, Schedule 80 for condensate.
- B. Condensate return piping shall be Schedule 80 black steel pipe, ANSI B36.10/ASTM A53 Grade "B".
- C. Fittings used on the carbon-steel piping shall be of standard weight and long radius design and meet the ANSI Specification B16.9 for "Factory-Made Wrought Steel Buttwelding Fittings."
- D. All pipe 2½-inch diameter or larger shall have welded connections unless indicated otherwise on the Construction Drawings.
- E. Fittings 2 inches and smaller: 2000# forged steel, threaded connections, ASTM A105, ANSI-B16.11 for Schedule 40 pipe; 3000# for Schedule 80 pipe.
- F. Fittings 2½ inches and larger: 150# forged steel, butt weld ends, ASTM A234, Grade WPB, ANSI-B16.9, schedule to match pipe.
- G. Flanges shall be 150# forged steel, weld neck, raised face, ASTM A105, ANSI-B16.5.
- H. Unions shall be 150# forged steel, ground joint, threaded connections, ASTM A105, ANSI-B16.11.
- I. Gaskets shall be 1/16 inch compressed fiber, ring type.

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- J. The high and low pressure condensate pipes shall each enter the receiver tank independently, through separate connections. The high and low pressure condensate pipes shall not be connected in any manner.

**2.04 PIPE SLEEVES**

- A. All pipes passing through walls, floors, foundations, etc., shall be provided with sleeves. All pipe penetrations shall be made water tight as specified or indicated on the Contract Drawings.
- B. Pipe sleeves in concrete floors, partitions, foundations, etc., shall be of larger diameter standard weight pipe selected to give ample clearance around pipe and insulation and shall project one inch beyond the opening. On floor sleeves the annular space between pipe and sleeve shall be filled in with an approved mastic material.
- C. Pipe entrances into basement and pit walls shall be water-proof type, using Link Seal or approved equal.

**2.05 VALVES**

A. Interior Valves - General

1. All interior valves 2½ inches and larger shall be manufactured of ductile iron with flanged ends and all interior valves less than 2½ inches shall be manufactured as specified with threaded ends except as noted. Flanges shall be furnished as specified in the applicable portions of Section 2.02 - Ductile Iron Pipe and Fittings.
2. Where wrenches are required for operating valves, one wrench for each three valves of each size shall be provided.
3. All valves shall be provided with an external device which will clearly indicate the status of the valve (open-closed).
4. Manually operated valves shall be operable by an operating effort of no more than 25 pounds on handwheel, lever or chain. Valves 4 inches and larger shall be equipped with geared hand wheel operators.

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5. Where the horizontal centerline of any valve is 7 feet or more above the floor, chain wheels or chain levers shall be provided, as directed by the OWNER. Chain shall be of galvanized, smooth link type. Chain wheels, chain levers, and guards shall be galvanized. Sample chain shall be submitted to the OWNER for approval. Galvanized hooks shall be provided and installed to secure chains out of the way when not being used.
6. All similar valves shall be purchased from one manufacturer.
7. Valves shall be hydrostatically tested by the manufacturer before shipping and certification of successful testing shall be furnished by the manufacturer. Unless otherwise specified, all valves, where installed shall be deemed unacceptable if leakage through the valve exceeds 2 ounces per hour per inch of nominal diameter at the pressures specified for the pipe tests.

**B. Underground Gate Valves and Boxes**

1. All gate valves installed underground shall be mechanical joint type conforming to ANSI/AWWA C500 and shall be ductile iron body, bronze mounted, double disc. They shall have non-rising stems and standard 2-inch operating nuts. All gates shall open counter clockwise. They shall be Mueller Figure No. A-2380-20 or approved equal, proportioned for a working pressure of not less than 200 psi and shall be factory tested at a pressure of 400 psi. Each valve shall be provided with a valve box and cover. Boxes shall be two-piece, cast iron with 5½-inch shaft, screw-type and shall be manufactured by Tyler, or Bingham & Taylor, or approved equal.
2. Valves shall be supported by a concrete pier independent of the pipe. Valve boxes shall not transmit shock or stress to the valve and shall be centered over the operating nut of the valve, with the box cover flush with the surface of the finished area or such other level as may be directed by the OWNER.

**C. Check Valves**

Check valves shall be Model 681-02 as manufactured by Cla-Val Co., or approved equal. These valves shall be appropriately sized to match the pipe size, and as shown on the Construction Drawings. The valve body shall be constructed of ductile iron, with 150 lb. flanged connections, suitable for 250 psi working pressure. Flanges shall be furnished as specified in the applicable portions of Section 2.02 - Ductile Iron Pipe and Fittings. The valves shall be controlled (non-slam) closing check valves that open

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smoothly on demand, and close at a controlled rate of speed. The valves shall be installed in a horizontal position such that the main valve stem is in a vertical position. Where a vertical installation is required, the MANUFACTURER shall be advised of the mounting position before ordering so that the necessary adjustments can be made by the MANUFACTURER.

**D. Air Release Valves**

1. A 2" air release valve shall be installed on the discharge side of each vertical turbine pump, including each extraction well pump and each clear well pump, so that the volume of air exiting the pump along with the liquid can be easily vented and controlled without hampering the operation of the air release valve. An air release valve shall also be installed on the air stripper feed pipe, within the treatment building. This valve shall vent any air at the highest pipe elevation within the treatment building.
2. The valves shall be Cla-Val Model No. 33A iron body, stainless steel float ball as manufactured by Cla-Val Co. or approved equal.
3. The valves shall be 2-inch NPT screwed inlet and outlet; inlet connection with cast iron body and top, bronze and brass trim and stainless steel ball float. The valves shall satisfactorily withstand a hydrostatic pressure of 350 psi and be designed for a working pressure of 250 psi.
4. The air release valve at the well pumps shall be mounted on a 2-inch tee with a 2-inch ball valve on the tee branch. The ball valve shall be 2-inch NPT screwed inlet and outlet.

**E. Butterfly Valves**

1. All butterfly valves shall be short-body flanged joint type and shall be manufactured in accordance with ANSI/AWWA C504. Valve bodies and discs shall be manufactured of ductile iron. Valve seats shall be designed to provide tight shut-off in both directions in conformance with valve classification Class 150B. Flanges shall be manufactured in accordance with the applicable portions of Section 2.02 (Ductile Iron Pipe and Fittings) for Class 250 flanges. Butterfly valves shall be installed with gaskets, and all accessories required, and shall be installed in accordance with manufacturer's recommendations for the use specified.





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2. A 10-inch butterfly valve shall be installed on the discharge side of each extraction well pump and clear well pump. The butterfly valve will act as an isolation valve. Additional butterfly valves shall be installed as shown on the Construction Drawings.

**F. Pump Control Valve**

1. A 10-inch No. 60-32 HI pump control/back pressure sustaining valve, as manufactured by Cla-Val Co., shall be installed on the discharge side of each extraction well pump and each clear well pump.
2. The main valve body and cover shall be constructed of ductile iron, ASTM A-536 with stainless steel, Type 303 trim.
3. The main valve shall be equipped with a built-in lift type check feature to prevent reverse flow.
4. The flanges shall be 300 ASA, ANSI B16.42 rated for 400 psi.

**G. Pressure Relief Valve**

1. An 8-inch anticipating surge relief valve with blow-off to the clear well shall be installed to dissipate high pressure surges in the 16-inch discharge pipe. The main valve body and cover shall be constructed of ductile iron, ASTM A-536, with stainless steel, type 303 trim. The flanges shall be 300 ASA, ANSI B16.42 rated for 250 psi (min). The CONTRACTOR shall connect the sensing/pilot supply connection to the main (16-inch) header with minimum 3/4-inch pipe. The valve shall be No. 652G-03KCH1 anticipating surge relief valve, as manufactured by Cla-Val Co.

**H. Steam System Pressure Reducing Valves**

1. Pressure reducing valve shall be designed for inlet steam pressure of 150 psig, a reduced steam pressure of 15 to 30 psig, and a required steam flow of 2600 lb/hr.
2. Pressure reducing valve shall be a Spirax Sarco 1-inch, cast iron, 25P regulator or approved equal.

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**I. Steam System Safety Relief Valve**

1. Safety relief valve shall be a Spirax Sarco Model SVI-AKH-25 or approved equal, set to open at 10 psig higher than discharge pressure of regulator valve and not-to-exceed 10% over-pressure at maximum flow. Safety relief valve shall be sized to relieve the maximum flow of 150 psig steam which could be passed to the regulator valve, if wide open.

**2.06 FLOW METERS**

- A. Flow meters shall be the orifice-plate type, incorporating a stainless steel orifice plate with a carrier ring containing metering tips and integral gaskets. The primary element shall include various components for differential pressure measurement. The flow meters shall be Oripac Model 4150 for metering water, or approved equal.
- B. Five (5) flow meters shall be provided by the CONTRACTOR, and installed as shown on the Construction Drawings. The flow meters provided shall be installed as follows:

<u>Location</u>	<u>Model/Size</u>	<u>Quantity</u>	<u>Pressure Rating (min.)</u>
Wellhouse	Oripac 10-inch	3	250 lbs.
Air Stripper Feed	Oripac 12-inch	1	150 lbs.
Discharge Line	Oripac 16-inch	1	150 lbs.

- C. Each flow meter shall be equipped with the appropriate instrumentation, as specified in Section 16910 - Electrical Controls.

**2.07 STRAINERS**

- A. Steam system strainers 2 inches and smaller shall be Model 80 Y-type, as manufactured by Hayward Industrial Products, Inc. or approved equal, with 300# bronze body with threaded ends, 30 mesh stainless steel screen for steam, and 20 mesh stainless steel screen for condensate.
- B. Steam system strainers 2½ inches and larger shall be Model 85, as manufactured by Hayward Industrial Products, Inc. or approved equal, 150# cast steel body, stainless steel screen, Y-type, 30 mesh screen for steam, 20 mesh steam for condensate, flanged ends. Strainer shall be installed horizontally for steam service and vertically for condensate service.

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- C. A Simplex, basket-type cooling water strainer shall be installed, with 2-inch, NPT threaded inlet and outlet connections. Strainer shall be designed of carbon steel construction. Basket shall be constructed of brass and shall be adequately designed to strain all solids 1/16-inch and larger. Basket seats shall be machined to assure a uniform fit and prevent the passage of solids. Strainer shall be Model 30, as manufactured by Hayward Industrial Products, Inc., or approved equal.

**2.08 STEAM TRAPS**

- A. Steam traps shall be as follows:

<u>Location</u>	<u>Trap</u>
Heat Exchanger	Spirax Sarco ¾ inch FT15 or approved equal.
Riser in Main (30# steam)	Spirax Sarco ½ x ¾ inch BIH-15 or approved equal.
End of Main (30# steam)	Spirax Sarco ½ x ¾ inch BIH-15 or approved equal.
End of Main (150# steam)	Spirax Sarco ½ x ¾ inch BIH-180 or approved equal.
Unit Heaters	Spirax Sarco ½ x ¾ inch BIH-15 or approved equal.

**2.09 INSULATION**

- A. Pipe insulation shall be heavy density fiberglass with factory applied all service jacket and self sealing lap and butt strips. Fittings shall be covered with pre-molded insulation and finished with aluminum covers. Thickness shall be as follows:

<u>Pipe Size</u>	<u>Thickness</u>
¾ inch and smaller	1½ inch
1 inch through 2½ inch	2 inch
3 inch through 6 inch	3 inch
Greater than 6 inch	4 inch

**2.10 JOINT RESTRAINT**

- A. The CONTRACTOR shall provide and install concrete thrust blocks in locations where the process piping branches, changes direction, and at valve locations. All concrete shall meet the requirements of Section 03300 (Cast-in-Place Concrete).
- B. Additional joint restraint shall be provided with tie rods or retainer glands, as shown on the Construction Drawings.

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**2.11 HANGERS, SUPPORTS AND ANCHORS FOR PIPING AND DUCTWORK**

- A. All piping inside and outside shall be supported by means of an approved combination of hangers, supports, and building attachments, assuring that no weight is imposed upon the connected equipment. Suspended equipment shall be supported independently of ductwork or piping.

**2.12 IDENTIFICATION TAGS**

The CONTRACTOR shall identify all installed piping equipment with markers conforming to the following:

- A. Color: Unless specified otherwise, conform with ANSI-ASME A13.1.
- B. Plastic Nameplates: Laminated, three-layer plastic with engraved dark letters on light contrasting background color.
- C. Metal Tags: Brass or stainless steel with stamped letters; tag size minimum 1.5-inch diameter with smooth edges. Aluminum tags not acceptable.
- D. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, pre-formed to fit around pipe or pipe covering; minimum information shall indicate the flow direction with an arrow and the fluid being covered.

**PART 3 - EXECUTION**

**3.01 PIPE PREPARATION**

The CONTRACTOR shall:

- A. Mark pipe sections with required identification prior to assembly.
- B. Inspect for defective or damaged spool pieces prior to assembly.
- C. Remove scale and dirt, inside and outside, prior to assembly.
- D. Prepare piping connections to equipment with flanges or unions.



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**3.02 PIPE INSTALLATION**

- A. Pipe installation shall conform to the general requirements of ANSI concerning water supply piping.
- B. The CONTRACTOR shall:
  - 1. Route piping in an orderly manner and maintain the elevations shown on the Construction Drawings within  $\pm 0.2$  feet, or as directed by the OWNER.
  - 2. Cut pipe to exact measurement and install without forcing or springing.
  - 3. Install piping to conserve building space and not interfere with use of space.
  - 4. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

**3.03 PIPE FITTINGS AND VALVE INSTALLATION**

The CONTRACTOR shall:

- A. Install all piping and equipment as indicated on the Construction Drawings. In the event of an installation requirement that is unclear, the CONTRACTOR shall consult with the OWNER before proceeding with the work in question.
- B. Install valves with stems upright or horizontal, not inverted.
- C. Install check valves in the proper direction of flow.
- D. Install all couplings, elbows, tees, and caps as shown on the Construction Drawings.

**3.04 PIPE SLEEVE INSTALLATION**

The CONTRACTOR shall:

- A. Install pipe sleeves around pipes protruding through building walls prior to installing the pipe, as shown on the Construction Drawings.
- B. Grout all pipe sleeve openings with non-shrink, waterproof grout.



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- C. Rigidly anchor pipe to stable structures where necessary. Provide pipe guides so that movement takes place along the axis of pipe only.

**3.05 FLOW METER INSTALLATION**

The CONTRACTOR shall:

- A. Install as shown on the Construction Drawings.
- B. Conform to the recommended MANUFACTURER's installation instructions, with flow arrow on the meter properly aligned in the direction of fluid flow in the pipeline.

**3.06 HANGERS, SUPPORT, AND ANCHORS INSTALLATION**

- A. Hangers must be absolutely vertical and are to be secured to girders, beams, purlins, columns, grids or supplementary steel, using beam clamps as attachments, wherever possible. Where necessary to obtain the required vertical alignment, furnish and install angle or channel irons of ample strength and length to bridge between beams or purlins to receive hanger attachments or supports for piping, ductwork, and equipment. Structural building members shall not be drilled, otherwise weakened or overloaded. Hangers shall not be attached to roof deck, sag rod, cross bracing, or piping, and shall not pierce or be sustained from ductwork. Supplementary steel must be kept as high as possible. No trapeze hangers shall be used on ducts under 42 inches in width.
- B. Wire, rope, wood, perforated band iron, tape or other makeshift material shall not be used for hangers or attachments. Threaded hangers shall have lock nuts.
- C. Piping shall be supported, guided and anchored to maintain the required alignment and pitch, without sagging or swaying, and to provide controlled expansion, using adjustable split clevis or trapeze type hangers. Spacing of hangers and sizes shall be in accordance with ANSI B31.1
- D. On insulated pipe, clevis hangers shall be sized to include thickness of insulation. A 12" long half-round section of 18 gauge galvanized sheet metal shall be installed over the lower half of the insulation at each hanger to prevent deformation.
- E. A set of piping drawings shall be marked with approximate hanger locations and a standard hanger sheet showing typical random support arrangements shall be furnished for field guidance.

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- F. The OWNER shall have the option to direct the CONTRACTOR to either support piping from above or below at any time at no additional cost to the OWNER.
- G. Fittings with support bases cast with the fitting shall be used to support pipe from floors or walls whenever possible or as directed by the OWNER. Piping shall be supported from the floor by means of pipe stanchion saddles and U-bolts. Non-insulated copper piping shall be supported with copper hangers or provided with lead shield to separate the dissimilar metals. Maximum spacing of hangers shall comply with ASA B31.3. Arrangements and location of all anchors shall be submitted to the OWNER for approval before installation.

**3.08 IDENTIFICATION MARKER INSTALLATION**

The CONTRACTOR shall install:

- A. Valves: Identify valves on the system with tags.
- B. Piping: Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification so as not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and branch tee and at each point of penetration of enclosures, and at other obstructions to the pipe run.

**3.09 TESTING**

- A. After the pipe has been placed, it shall be subjected to a hydrostatic test in accordance with "AWWA Standards For Installation Of Ductile-Iron Water Mains and Their Appurtenances." Designation: AWWA C600-87, except that at no point shall the test pressure be less than one and one-half (1½) times the ~~working~~ <sup>operating</sup> pressure for ductile iron.

END OF SECTION

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**SECTION 15020  
AIR STRIPPING SYSTEM**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. This section includes requirements for the detailed mechanical design, fabrication, assembly, delivery, installation, and functional testing during initial start-up of a complete air stripping system as specified in these Technical Specifications and as shown on the Construction Drawings. The air stripping system shall include, but not be limited to: packed tower complete with internals; packing; attached piping, and duct work; ladder and platform assemblies; and miscellaneous appurtenances; instrumentation and appurtenances.

**1.02 RELATED SECTIONS**

- A. Section 01090 - Reference Standards.
- B. Section 01300 - Submittals.
- C. Section 01400 - Quality Control.
- D. Section 01600 - Material and Equipment.
- E. Section 01650 - Starting of Systems.
- F. Section 01700 - Contract Closeout.
- G. Section 15000 - Process Piping and Accessories.
- H. Section 15040 - Vapor Treatment System.
- I. Section 16000 - Electrical - General Provisions.

**1.03 SUBMITTALS**

- A. All submittals shall be complete, neat and orderly and provided in accordance with Section 01300 (Submittals).

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- B. Five (5) copies of shop drawings of the proposed equipment shall be submitted for the OWNER's approval prior to fabrication according to Section 01300 (Submittals). The information submitted shall include but not be limited to:
1. Complete arrangement and connection details of: air stripper and accessories; controls, instrumentation, flow meters, piping and valves, system internals, access ports, skid footprint, and anchoring details.
  2. Electrical control details including, but not limited to: wiring diagram of level sensors, cut-off switch, cut-off valve and switch and control panel; cutsheets and details for instrumentation, switches, relays, programmable logic controller (if applicable), motor starters, panel box, disconnects, transformers, etc.; and ladder logic drawing for system control and operation.
  3. Detailed layout of skid, equipment, and piping with plan and elevation views for the complete air stripping system and the location and elevation of all mechanical and electrical interfaces.
  4. Two (2) copies of the drawings and data submitted by the MANUFACTURER will be returned by the OWNER to the MANUFACTURER with comments such as, 'No Exceptions Noted', 'Exceptions Noted', or 'Returned for Resubmission'. The MANUFACTURER shall make all necessary revisions, corrections or clarifications, if required, and resubmit five (5) copies of the revised drawings and data, within (7) calendar days.
  5. Design calculations used to size/select system and system components. These calculations shall include, but shall not be limited to: process design calculations, equipment/vessel sizing, equipment components sizing calculations, structural design calculations, ladder/platforms and access design calculations, instrumentation, vessels, media, etc. Computer generated calculations are acceptable if references and the basis of the computer generated calculations are provided.
  6. MANUFACTURER's warranties as specified in Paragraph 1.07 (Warranty) and Section 01300 (Submittals).

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- C. Four (4) copies of an operation and maintenance manual, including system instructions for operation and maintenance, troubleshooting, and cleaning, as well as a full spare and replacement parts list shall be provided as specified in Section 01300 (Submittals). Also, the manual shall include the following drawings and information:
1. General arrangements of the complete air stripping system.
  2. As built mechanical and electrical system detailed drawings.
  3. Catalog cut sheets and performance data of equipment supplied.
  4. Blank performance test data sheets.
  5. Troubleshooting guide.

**1.04 QUALITY ASSURANCE/QUALITY CONTROL**

- A. Quality assurance/quality control measures shall conform to the requirements specified in Section 01400 (Quality Control) and herein.
- B. Materials and methods used in the assemblage of the equipment shall comply with relevant standards of the following organizations as well as any other standards, codes, or specifications related to the manufacture and operation of the specified equipment:
- a. American National Standard Institute (ANSI).
  - b. American Society of Testing and Materials (ASTM).
  - c. National Electrical Manufacturer's Association (NEMA).
  - d. American Society of Mechanical Engineers (ASME).
  - e. National Fire Protection Association (NFPA).
  - f. Underwriters Laboratories (UL).
  - g. Aluminum Association.
  - h. Air Moving and Conditioning Association (AMCA).

**1.05 PERMITS AND REGULATIONS**

- A. The CONTRACTOR shall comply with all Local, State, and Federal regulations.

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**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. All arrangements for delivery, storage, and handling of equipment shall conform to the specifications in Section 01600 (Material and Equipment) and shall be the CONTRACTOR's responsibility.

**1.07 WARRANTY**

- A. The MANUFACTURER shall provide guarantees and warranties in accordance with specifications in Section 01300 (Submittals).

**1.08 TECHNICAL INSPECTION**

- A. All components of the air stripping system shall be inspected and factory tested by the MANUFACTURER prior to shipment to insure proper mechanical and electrical function as specified and intended. The MANUFACTURER shall provide a certificate indicating that the equipment was inspected and tested and functions as specified. The MANUFACTURER shall provide the OWNER with factory performance/testing data.

**PART 2 - PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. The air stripping column shall be a Model PCS- 122.50 or approved equivalent, as manufactured by Hydro Group, Inc., Environmental Products Division, 97 Chimney Rock Road, Bridgewater, NJ 08807 (1-800-524-2725).

**2.02 GENERAL DESCRIPTION**

- A. An air stripping system shall be provided for the treatment of recovered groundwater. The air stripping system shall be capable of treating 2,300 gallons per minute (gpm) of groundwater contaminated with volatile organic compounds (VOCs).
- B. System equipment shall be suitable for operation in areas designated as unclassified by the National Electric Code (NEC). The installation of the air stripping system and accessories shall conform to local building and fire requirements.

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- C. The system shall be operated outdoors.
- D. Material and equipment specified for this work shall conform to the requirements of these Technical Specifications and Construction Drawings.

**2.03 PERFORMANCE AND DESIGN CRITERIA**

**A. Design Criteria:**

1.	Column Diameter:	10.2 feet
2.	Water Flow Rate:	2300 gpm
3.	Minimum Water Temperature:	50° F
4.	Airflow Rate:	9225 cfm
5.	Packing Media Size:	3.5 inches
6.	Packing Media Type:	Tripacks
7.	Total Minimum Packing Media Depth:	50 feet
8.	Number of Packed Beds:	2

**B. Influent Groundwater Concentrations:**

The influent groundwater concentrations listed below are estimates for design purposes and may not be all inclusive. Actual groundwater quality characteristics may vary. The air stripping system MANUFACTURER/SUPPLIER must guarantee the performance of the air stripping system to meet the effluent requirements and removal efficiencies specified herein. Evaluation of the treatment system's performance shall be conducted during start-up of the system.

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Parameter	Estimated Influent Concentration (ug/L)	Estimated Effluent Concentration (ug/L)	% Removal
Trichloroethene (TCE)	7,760	≤ 2.5	≥ 99.97
Tetrachloroethene (PCE)	650	≤ 2.5	≥ 99.61
1,2-Dichloroethene	1,700	≤ 2.5	≥ 99.85
1,1-Dichloroethene	770	≤ 2.5	≥ 99.67
1,1,1-Trichloroethane	660	≤ 2.5	≥ 99.62
Total	11,524		

- C. It is the responsibility of the column MANUFACTURER to select and size all components of the column to meet the removal criteria. The component sizes shall meet or exceed those given herein.

2.04 EQUIPMENT DESCRIPTION

A. General

1. The air stripping system shall be configured as shown on the Construction Drawings and as specified herein.
2. The CONTRACTOR shall install all system components in accordance with the MANUFACTURER's recommendations, Technical Specifications, and Construction Drawings.

B. Packed Tower Air Stripper

1. The air stripper shall be constructed in a fabrication shop which has an ASME "U" Stamp. Manufacturer shall submit a copy of his ASME Certificate of Authorization.

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2. Welding of the vessel and internals shall be performed by welders qualified in accordance with the latest ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
3. Due to the special nature of the equipment required for the removal of VOCs at this site only those manufacturers who have been active in the manufacture of air strippers for at least 10 years will be considered as suppliers. **Each bidder must attach to his bid a list of at least 10 installations fabricated from aluminum, 10' diameter or greater. This list shall also include location, customer with contact person and phone number, unit size, capacity in GPM, year installed.**
4. The equipment specified herein shall be provided as a package by a single manufacturer/supplier.

**C. Air Stripping Column Tower Shell**

1. The column shall have a minimum effective internal cross-sectional area of 81.5 square feet and a minimum overall height of 63'9". The column shall be constructed entirely of 5000 series structural grade aluminum designed and manufactured in accordance with the specifications of the Aluminum Association. Design snow and wind loads shall be as per relevant American National Standard Institution Codes; the design wind load shall not be less than 100 mph. Earthquake and vibrational effects shall also be considered. The column shall be completely self-supporting when anchored to a suitable concrete base. The tower shell shall have a minimum thickness of 3/16-inch throughout unless structural design calculation can be provided showing lighter material is sufficient. Under no circumstances shall less than 1/8-inch thick material be used. The tower shall be properly rolled, welded and reinforced where required. The tower shall be manufactured such that there are no crevices. All welds shall be continuous and shall seal both sides of structural members. The surface of weld joints shall be finished to eliminate roughness and crevices in the weld deposit. No undercut will be permitted.

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2. Sufficient anchoring points shall be provided to be compatible with the concrete slab design. Anchoring points shall be located in a continuous base ring around the tower base. The base ring shall be designed to safely transmit the maximum overturning moment loads imposed by the wind and earthquake loads specified above from the shell to the foundation. No guy wires or other supporting devices will be permitted.
3. The tower shell and anchoring system shall be designed to allow the insertion of up to a 10-foot long spool piece and associated ductwork, piping, ladder, and platform assembly in the future. The tower shall be structurally designed to allow the insertion of the spool piece without additional modifications to the base 63'9" high unit or the use of guy wires.
4. The tower shall be provided with the following connections:

<u>Quantity</u>	<u>Size</u>	<u>Description</u>
1	12"	Flanged influent nozzle.
1	14"	Flanged water effluent nozzle.
2	18"H x 33"W	Rectangular induced draft air inlet
1	24" diameter	Air outlet nozzle.
1	10"	Drain.
5	24"	Flanged manways.
2	4"	Flanged packing samplers.
1	4"	Flanged nozzle for level probes.

All necessary lifting lugs

All necessary pipe and air duct support brackets

5. The manways shall be located as follows:
  - (1) at the bottom of the lower packed bed
  - (1) at the top of the lower packed bed
  - (1) at the bottom of the upper packed bed
  - (1) at the top of the upper packed bed
  - (1) in the distributor section

Each manway shall be fit with an internal removable packing retaining screen fabricated from FRP or expanded stainless steel.

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6. A flanged joint shall be provided in the tower shell between the top of the upper packed bed and the bottom of the distributor tray. The flange shall allow for the installation of additional packed bed depth if required in the future.
7. A flanged joint shall be provided in the tower shell between the distributor tray and mist eliminator assembly such that the distributor assembly can be removed from the shell in one piece.
8. A cone discharge cap with a 24-inch diameter flanged nozzle centered in the top of the cone shall be provided. The mist eliminator shall be mounted within this cone cap section. The cone shall be designed to ensure even flow of air from the main body of the tower to the 24-inch diameter air discharge duct.

**D. Air Stripping Column Internals**

1. Sufficient high efficiency packing shall be provided to yield a total packing depth of 50 feet. The packing shall be 3.5 inches in diameter and made of polypropylene material. The packing shall have a surface area of approximately 38 square feet/cubic foot and 95% void space. The pressure drop, under an operating condition of 9225 cfm of air and 2300 gpm of water shall not exceed 0.025 inches of water/foot of packing. Packing shall be Jaeger Tripacks. Due to the various mass transfer properties of different packings, no substitutes shall be accepted. The packing shall be delivered to the job site in 10 cubic foot boxes for field installation by others.
2. Two packing support plates shall be provided and shall be compatible with the packing furnished. The support plates shall be made of fiberglass reinforced plastic (FRP) grating. The support plates will be designed and supported so that the maximum deflection in the tray is less than 1/2-inch when supporting a maximum load of 450 pounds per square foot at a maximum span of 30 inches.
3. A main distributor tray shall be provided to uniformly distribute the water flow over the surface of packing and uniformly collect the exhaust air. The distributor shall be capable of handling a water flow of 1500 to 3000 gpm. The distributor tray shall be constructed of 304 stainless steel and be

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complete with influent velocity breaker, air exhaust stacks, and distributor orifices. The air exhaust stacks will be sized to provide a gas velocity not exceeding 25 feet per second. The distributor orifices shall be sufficient in number to provide even distribution and sized to retain a static head of water in the tray over the full range of liquid flow rates anticipated. The tray shall be provided with a welded sidewall of a height 1" greater than the maximum water depth or 6", whichever is higher. The bottom of the tray shall be stiffened to withstand the maximum hydrostatic head anticipated without excessive deflection. The structural design shall conform to the standards of the AISC. The tray shall be completely self-supporting when mounted to a peripheral ledge around the inside diameter of the tower shell. The tray shall be removable through the top of the shell with the mist eliminator section removed. Welding of the tray assembly into the shell will not be permitted. Spray nozzles or pipe distributors will not be acceptable.

4. Liquid redistribution rings shall be provided at even intervals throughout the height of packing, as required for efficient packing performance. A minimum of eight (8) redistributors shall be provided, four (4) in each packed bed.
5. A moisture separation system shall be provided which will eliminate water droplets in the exhaust air stream. A polypropylene mesh-type mist eliminator shall be provided for this purpose.
6. Two air inlet openings shall be provided at the base of the tower in accordance with the Construction Drawings. The openings shall be provided with expanded metal gaskets with 24 mesh stainless steel screen covers that provide adequate open area to assure minimal headloss and even air flow.

**E. Air Stripping Column Painting**

1. **Surface Preparation:** The interior of the tower sump (including the floor and the tower shell up to the lower support grating) shall be prepared in accordance with SSPC-SP7 Brush Blast Cleaning followed by an acid wash. The exterior of the tower shell shall be furnished with a mill finish.

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2. **Coating Systems:** The interior of the sump and tower floor shall be coated with an epoxy painting system suitable for potable water. The coating shall be manufactured by Tnemec, Plasite or equal. The DFT shall be a minimum of 8 to 10 mils.

**F. Ladder and Platform Assembly**

1. **Description:** A caged safety ladder/work platform assembly shall be provided as indicated in the Construction Drawings for access to—and inspection of—the tower internals. The ladder/platform system shall meet all OSHA requirements. The ladder and platforms are intended to provide reasonably easy access to the manways for both the upper and lower packing beds as well as access to packing samplers and flanged piping and ductwork. The ladder and platform should be constructed to bolt onto brackets that are welded to the tower shell. The ladder/platform shall be provided as part of the packed tower by the tower manufacturer.
2. **Ladder:** The ladder shall be made up of rungs a minimum of 3/4 inches in diameter and 16 inches long. The rungs shall have a textured non-slip surface. The distance between rungs shall not exceed 12 inches and shall be uniform throughout the length of the ladder. The distance from the rungs to the tower shall not be less than 7 inches. The ladder shall run from the base of the tower to 3 feet 6 inches above each platform.
3. **Cage:** The ladder shall be provided with a continuous cage beginning no more than 8 feet above the base of the tower and running to 3 feet 6 inches above each platform. The bottom of the cage shall be flared at least 4 inches. The cage shall extend 27 inches from the centerline of the rungs and shall not be less than 27 inches wide. Vertical bars shall be located at a maximum spacing of 40 degrees around the circumference of the cage. The cage shall be provided with a locking door to prevent unwarranted access.
4. **Platform:** Two main landing platforms shall be provided. The upper main landing shall be located to access the main distributor tray and the top of the upper packing bed. The lower main landing shall be located to access both the bottom of the top packing bed and the top of the lower packing bed. Two intermediate landing platforms shall also be provided. The intermediate landings shall be located to provide access to the packing samplers. All four platforms shall be equipped with standard railings and

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toeboards meeting OSHA requirements and so arranged as to allow safe access to the ladder. The platforms shall be a minimum of 3 feet wide. The upper main landing shall be large enough to allow easy access to the air ductwork and shall be no less than 5-feet wide. The step across distance from the ladder to the platform shall be between 3 and 12 inches.

5. The ladder and platform assembly shall be fabricated from structural grade aluminum.
6. Each platform shall be fitted with flood light(s) and a 110V outdoor electrical outlet. The lights and outlets shall be supplied and installed by the ELECTRICAL CONTRACTOR.

**G. Inlet Piping**

1. The inlet piping shall be 12-inch diameter steel and shall extend from inside the tower at the center of the water distribution tray to a plain end 5 feet above the bottom of the tower.
2. The GENERAL CONTRACTOR shall provide a mechanical coupling, Dresser or equal, to join the piping attached to the tower and the influent piping from the wells and treatment building.

**H. Fasteners**

1. All fasteners used to bolt the tower shell, piping, accessories and ductwork shall be stainless steel type 304.
2. Stainless steel type 304 cast-in-place anchor bolts and plastic anchor bolt sleeves shall be provided and installed by the GENERAL CONTRACTOR. Since the bolts are an integral part of the concrete pad the design of their embedment length is the responsibility of the concrete pad supplier. However, it is the responsibility of the packed column manufacturer to supply the concrete pad designer with the size (diameter) and number of bolts which will safely transmit the operational and environmental loads from the packed column to the concrete pad. The minimum number and size of anchor bolts are defined on the Construction Drawings.

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3. A bitumastic coating shall be applied to all surfaces in contact with concrete.

**I. Gasketing**

1. All flanged tower connections shall be gasketed with closed cell neoprene sponge.
2. All flanged piping connections shall be gasketed with red rubber. All threaded piping connections shall be sealed with Teflon tape.

**J. Blower**

1. The blower shall be provided as part of the vapor treatment system skid by the vapor treatment system MANUFACTURER/SUPPLIER.
2. Blower sizing requirements for the air stripping system shall be provided by the air stripping system MANUFACTURER to ensure appropriate blower selection and design for the complete system. The air stripping system MANUFACTURER shall provide the required pressure loss associated with the air stripper and ductwork to the vapor phase granular activated carbon (VPGAC) system supplier
3. An allowance of 9 inches water column vacuum has been specified for the packed column and 24-inch diameter ductwork to the vapor phase system battery limits. An allowance of 2 inches water column has been specified for the 30-inch diameter ductwork from the vapor phase system to the discharge point at the top of the tower.

**K. Piping and Appurtenances**

1. All piping, duct work, and appurtenances shall be provided as shown on the Construction Drawings and as specified in Section 15000 (Process Piping and Accessories). All provided piping, duct work, and appurtenances shall be supported from the skid/foundation or equipment in such a manner to ensure safe shipment and proper support during system installation and operation.

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2. Valves, fittings, and piping appurtenances shall meet the requirements of Section 15000 (Process Piping and Accessories) of these Technical Specifications and shall be located and mounted for ease of access and operation.

L. Air Effluent/Discharge Ductwork

1. The air stripper MANUFACTURER shall supply the 24-inch diameter air discharge ductwork from the top of the air stripping tower to a point at the battery limits of the vapor phase system skid, as shown on the Construction Drawings.
2. The air stripper MANUFACTURER shall supply the 30-inch diameter air discharge duct from the battery limits of the vapor phase system skid to the top of the air stripping tower as shown on the Construction Drawings.
3. The ductwork shall be fabricated from minimum 10-gauge structural grade aluminum and welded in conformance with Part 2.04C of this section of specifications.
4. The ductwork shall be supported by brackets integral with the tower shell. These duct support brackets shall be located at a minimum of 10'0" center to center distance along the height of the tower or at smaller intervals if required to support the duct.
5. Fasteners welded to the duct or stainless steel U-bolts shall be used to fasten the duct to the tower duct support brackets.
6. Flanges shall be provided at approximate intervals for ease of assembly and maintenance. The flanges shall be gasketed with neoprene foam and fastened with 304 stainless steel nuts, bolts, and washers.
7. The ductwork between the tower and vapor phase system inlet blower shall be insulated in order to minimize condensation in the ductwork. A minimum 2-inch thick weather resistant, closed cell foam insulation shall be used. Insulation shall be Type 475 ThermaZip insulation as manufactured by Accessible Products company or approved equal. The insulation shall be installed in accordance with MANUFACTURER's recommendations by the CONTRACTOR or air stripper system MANUFACTURER/SUPPLIER.

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8. The ductwork will terminate at a flange at the vapor phase skid to allow easy assembly. The GENERAL CONTRACTOR shall coordinate the manufacture of the air stripping and vapor phase system to ensure compatibility.
9. The ductwork shall be supported with coated steel or aluminum channel and I-beams properly sized and anchored to the air stripper concrete support pad. The ductwork shall also be supported within the building from the building wall's structure members at the wall penetrations.
10. The ductwork shall be pitched to allow drainage of condensate into the building.
11. The ductwork shall be fitted with an expanded aluminum bird screen providing a minimum 70% open area.

**2.05 INSTRUMENTATION AND CONTROLS**

**A. General**

1. Instrumentation and controls shall be provided as specified herein and as shown on the Construction Drawings. The air stripper MANUFACTURER is responsible for providing the necessary fittings and supports for instrumentation attached to the air stripping tower.
2. All instrumentation and controls shall be suitable for operation in areas designated as unclassified per NEC.
3. All instrumentation, controls, and control panels shall be supplied and installed by the GENERAL CONTRACTOR or electrical subcontractor.
4. A central control panel, located in the treatment building, shall house a programmable logic controller (PLC) to monitor and integrate the operation of the complete IRM system (well pumps, VPGAC system, clear well pumps, and air stripper system). The panel shall be connected to each major component in the IRM system and will provide an interface to the Grumman steam plant to enable the IRM system to be operated remotely and monitored directly from the steam plant. This panel shall be supplied by the GENERAL CONTRACTOR or electrical subcontractor.

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- B. The air stripper sump shall be provided with a level switch high (LSH) that shall indicate excessively high water level in the sump and trigger the level alarm high (LAH) by relaying a signal to the PLC.

**PART 3 - EXECUTION**

**3.01 INSTALLATION AND INSPECTION**

- A. The CONTRACTOR shall install the complete air stripping system and appurtenances at the locations indicated on the Construction Drawings, according to the MANUFACTURER's recommended installation instructions. The CONTRACTOR shall provide all field labor and equipment for installation of the tower (on the CONTRACTOR's concrete foundation). The CONTRACTOR shall install the tower shell, tower packing, and the air duct assemblies under the direct supervision of the MANUFACTURER's Field Representative. Electrical connection to the blowers and any instruments or monitoring devices shall be provided by the Electrical Contractor as specified elsewhere.
- B. A template shall be delivered to the GENERAL CONTRACTOR by the manufacturer to insure accurate setting of the anchor bolts.
- C. The tower manufacturer shall provide a field technician as required for installation supervision, and one (1) day of operator training.
- D. The installation shall be in accordance with OSHA specifications.

**3.02 PRESSURE TESTING**

- A. The packed tower shell will be pressure tested at 21 inches water column at the manufacturer's facility to insure the shell is free of imperfections such as cracks, pinholes or incomplete welds. The tower shell will hold the required pressure for one hour. Soap solution will be used to positively locate imperfections. All such problems shall be corrected and the unit re-tested before approval.
- B. Manufacturer shall notify Owner five (5) days before any such tests are conducted to provide the opportunity for direct inspection by the OWNER's representative. An accurate log of the test should be kept for submittal prior to shipment.

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**3.03 TESTING AND START-UP**

- A. After installation, assembly, and inspection, MANUFACTURER's representatives shall perform functional testing during start-up.
- B. The MANUFACTURER shall provide a field technician for a minimum of two (2) consecutive days of system startup/shakedown. During startup, on-site tests shall be performed with a portable gas chromatograph to provide immediate data on the packed column system's performance. Confirmatory laboratory analysis will be provided by the Owner.
- C. The air stripping system shall be tested for leaks when all proper piping connections are complete. The air stripping system and appurtenances shall also resist all stresses which normally arise during transportation and installation.
- D. The air stripping system shall be tested by the CONTRACTOR and the MANUFACTURER under the supervision of the OWNER.
- E. If the system fails to perform as specified, the MANUFACTURER and CONTRACTOR shall propose to the OWNER what adjustments, if any, are required to bring the system into compliance. After such adjustments are approved, the CONTRACTOR and MANUFACTURER shall make the changes necessary at no additional cost to the OWNER and retest the system at no additional cost to the OWNER. Such adjustments and testing will continue at no additional cost to the OWNER until the system meets the performance specifications.

**3.04 DOCUMENTATION/REPORTING**

- A. MANUFACTURER's representative shall provide verbal reports to the OWNER regarding the results of the MANUFACTURER's installation/inspection and testing/start-up. The verbal reports shall be made immediately upon completion of the inspection and the start-up. Within seven (7) calendar days after the installation/inspection, MANUFACTURER shall provide OWNER with a letter stating whether the system installation and assembly was satisfactory or unsatisfactory. Any problems identified during MANUFACTURER's inspection shall be fully described, along with corrective actions required, in MANUFACTURER's letter. Within fourteen (14) calendar days after the testing/start-up, MANUFACTURER shall provide OWNER with a letter stating whether the system operation/performance was satisfactory or unsatisfactory. Any problems identified during MANUFACTURER's

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testing/start-up shall be fully described, along with corrective actions required, in MANUFACTURER's letter.

- B. The MANUFACTURER shall provide the OWNER with process/performance testing data.
- C. All correspondence shall be transmitted through the CONTRACTOR.

**END OF SECTION**

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AIR STRIPPING SYSTEM**

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**SECTION 15040  
VAPOR TREATMENT SYSTEM**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. This section includes requirements for the detailed design, fabrication, assembly, delivery, installation, and functional testing during initial start-up of a complete vapor treatment system as specified in these Technical Specifications and as shown on the Construction Drawings. The vapor phase treatment system shall include, but not be limited to, the following:
1. Vapor phase granular activated carbon (VPGAC) units, regenerable VPGAC, system supports, and appurtenances.
  2. Process air heat exchanger.
  3. Process air blower and accessories.
  4. VPGAC steam regeneration system, including but not limited to condenser, decanter, saturated condensate storage tank, and free product storage tank.
  5. System steam piping, valves, and fittings.
  6. Air compressor and associated piping and valves, if necessary.
  7. Cooling blower and associated ductwork and electrical devices, if necessary.
  8. Condensate pump, free phase product pump, and accessories.
  9. Associated piping, ductwork, valves, and fittings.
  10. Instrumentation, skid-mounted control panel, skid conduit and wiring, and associated appurtenances.

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**1.02 RELATED SECTIONS**

- A. Section 01090 - Reference Standards.
- B. Section 01300 - Submittals.
- C. Section 01400 - Quality Control.
- D. Section 01600 - Material and Equipment.
- E. Section 01650 - Starting of Systems.
- F. Section 01700 - Contract Closeout.
- G. Section 15000 - Process Piping and Accessories.
- H. Section 15020 - Air Stripping System.
- I. Section 15060 - Process Pumps and Appurtenances.
- J. Section 15090 - Steam Piping.
- K. Section 16000 - Electrical - General Provisions.

**1.03 SUBMITTALS**

- A. All submittals shall be complete, neat and orderly and provided in accordance with Section 01300 (Submittals).
- B. Five (5) copies of shop drawings of the proposed equipment shall be submitted for the OWNER'S approval prior to fabrication according to Section 01300 (Submittals). Information shall be submitted within 4 weeks of authorization to proceed. The information submitted shall include but not be limited to:
  - 1. Skid arrangement details with the location of all equipment components, control panel and duct work, piping and electrical interfaces. The skid foot print and anchoring details shall be provided. Plan and elevation views shall be used to define battery limits of the skid.
  - 2. Detailed process calculations defining carbon capacity, regeneration frequency, utility requirements for regeneration and operation.
  - 3. Electrical control details including programmable logic controller cut sheet, control panel location, and ladder logic diagram for system control and operation.

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4. MANUFACTURER's warranties as listed in Paragraph 1.07 (Warranty) and Section 01300 (Submittals).
  5. Two (2) copies of the drawings and data submitted by the MANUFACTURER will be returned by the OWNER to the MANUFACTURER with comments such as, "No Exceptions Noted", "Exceptions Noted", or "Returned for Resubmission". The MANUFACTURER shall make all necessary revisions, corrections or clarifications, if required, and resubmit five (5) copies of the revised drawings and data, within (7) calendar days.
- C. Record copies of the following additional details shall be provided within 6 weeks of authorization to proceed:
1. Complete arrangement, sizing, materials of construction and connection details of: VPGAC units, internals and accessories; knock out drum, moisture reduction system, condenser, decanter, saturated condensate storage tank, free product storage tank, pumps, blower, VPGAC steam regeneration system, control panel, instrumentation, flow meters, piping and valves, system internals, access ports, skid footprint, and anchoring details.
  2. Electrical control details including, but not limited to: wiring diagram of level sensors, cut-off switches, automatic valves and switches and control panel; cutsheets and details for instrumentation, switches, relays, programmable logic controller, motor starters, panel box, disconnects, transformers, etc.; and ladder logic drawing for system control and operation.
  3. Detailed layout of skid, equipment, and piping with plan and elevation views for the complete vapor treatment system and the location and elevation of all mechanical and electrical interfaces.
  4. Design calculations used to size/select system and system components. These calculations shall include, but shall not be limited to: process design calculations, equipment/vessel sizing, equipment components sizing calculations, blowers, pumps, instrumentation, vessels, media, etc. Computer generated calculations are acceptable if references and the basis of the computer generated calculations are provided.

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- D. Four (4) copies of an operation and maintenance manual, including system instructions for operation and maintenance (including VPGAC steam regeneration), troubleshooting, and cleaning, as well as a full spare and replacement parts list shall be provided as specified in Section 01300 (Submittals). Also, the manual shall include the following drawings and information:
1. General arrangements of the complete vapor treatment system.
  2. As built mechanical and electrical system detailed drawings.
  3. Catalog cut sheets and performance data of equipment supplied.

**1.04 QUALITY ASSURANCE/QUALITY CONTROL**

- A. Quality assurance/quality control measures shall conform to the requirements specified in Section 01400 (Quality Control) and herein.
- B. Materials and methods used in the assemblage of the equipment shall comply with relevant standards of the following organizations as well as any other standards, codes, or specifications related to the manufacture and operation of the specified equipment:
- a. American National Standard Institute (ANSI).
  - b. American Society of Testing and Materials (ASTM).
  - c. National Electrical Manufacturer's Association (NEMA).
  - d. American Society of Mechanical Engineers (ASME).
  - e. National Fire Protection Association (NFPA).
  - f. Underwriters Laboratories (UL).
  - g. Air Moving and Conditioning Association, Incorporated (AMCA).

**1.05 PERMITS AND REGULATIONS**

- A. The CONTRACTOR shall comply with all Local, State, and Federal regulations.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. All arrangements for delivery, storage, and handling of equipment shall conform to the specifications in Section 01600 (Material and Equipment) and shall be the CONTRACTOR's responsibility.



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**1.07 WARRANTY**

- A. The MANUFACTURER shall provide guarantees and warranties in accordance with specifications in Section 01300 (Submittals).

**1.08 TECHNICAL INSPECTION**

- A. All components of the vapor treatment system shall be inspected and factory tested by the MANUFACTURER prior to shipment to insure proper mechanical and electrical function as specified and intended. The MANUFACTURER shall provide a certificate indicating that the equipment was inspected and tested and functions as specified. The MANUFACTURER shall provide the CONSULTANT/ENGINEER with factory performance/testing data.

**PART 2 - PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. The MANUFACTURER/SUPPLIER of the vapor treatment system shall be one of the following or approved equal:

VIC Environmental Systems  
c/o I.E.C.  
5 Johnson Drive  
P.O. Box 130  
Raritan, New Jersey 08869-0130  
(908) 526-1001, Ext. 469

RaySolve, Inc.  
P.O. Box 207  
100 W. Main Street  
Bound Brook, New Jersey 08805  
(908) 981-0500

Vara International  
1201 19th Place  
Vero Beach, Florida 32960  
(407) 567-1320

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**2.02 GENERAL DESCRIPTION**

- A. A VPGAC vapor treatment system shall be provided for the treatment of volatile organic compounds (VOCs) in air stripper off-gas (vapor). The VPGAC system shall be capable of treating 9,225 standard cubic feet per minute (scfm) from the air stripper (as specified in Section 15020). The relative humidity in the vapor from the air stripper shall be reduced with a heat exchanger prior to contact with the VPGAC. In-place steam regeneration shall be used to reestablish the adsorptive capacity of the VPGAC. All steam used in the regeneration shall be passed through a condenser. The condensate shall be recycled to the air stripper influent line and the free phase product shall be stored for off-site disposal. The system shall be configured as shown on the Construction Drawings and as described in these specifications.
- B. The installation of the vapor phase treatment system and accessories shall conform to local building, fire, and electrical codes and requirements.
- C. The system shall be operated indoors.
- D. Due to the potentially corrosive nature of the regenerant stream, resulting from the desorption of chlorinated organics such as TCE, the vapor phase treatment system shall be designed of corrosion resistant material.
- E. Material and equipment supplied for this work shall conform to the requirements of these Technical Specifications and Construction Drawings.

**2.03 PERFORMANCE AND DESIGN CRITERIA**

- A. General:
  - 1. The MANUFACTURER/SUPPLIER of the complete vapor treatment system shall comply with the performance and design criteria specified herein. It is the responsibility of the MANUFACTURER/SUPPLIER to adequately size and design the entire system to perform as specified and to operate within the limitations dictated herein.
  - 2. The complete skid-mounted vapor treatment system shall be designed as specified in these Technical Specifications and as shown on the Construction Drawings. Components of the complete skid-mounted vapor treatment system shall measure no more than 40'L x 15'W x 16'H and shall fit within a to-be-constructed treatment building, as shown on the Construction Drawings.

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3. Piping and conduit shall terminate at skid boundaries proximate to those shown in the Construction Drawings to ease connections to off-skid piping and ductwork. Electrical and instrumentation wiring connections to off-skid power and instrumentation wiring shall be made at the skid-mounted control panel.
4. The MANUFACTURER shall provide a complete battery limits system to the site. The GENERAL CONTRACTOR shall coordinate all interface between the battery limits skid and all off-skid connections to ensure proper and efficient operation and maintenance.

**B. Influent Vapor Concentrations and Treatment Efficiency:**

1. The MANUFACTURER must guarantee the performance of the VPGAC treatment system to meet the effluent requirements for 9,225 scfm of vapor with VOC concentrations as specified herein. Evaluation of the VPGAC treatment system's performance will be conducted during start-up of the system.
2. The VPGAC treatment system shall have an overall demonstrated removal efficiency of at least 95% for each organic compound listed in the table below.
3. The influent vapor characteristics listed below are estimates for design purposes only and may not be all inclusive. Actual vapor characteristics may differ. The MANUFACTURER/SUPPLIER shall be responsible for meeting the design performance requirements stated herein.

Parameter	Design Influent Concentration (ppmv)	Design Influent Loading (lb/hour)
Trichloroethene (TCE)	53.1	8.9
Tetrachloroethene (PCE)	3.4	0.7
1,2-Dichloroethene	14.0	2.0
1,1-Dichloroethene	6.3	0.9
1,1,1-Trichloroethane	4.0	0.8
Total	80.8	13.3

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**C. Influent Vapor Characteristics:**

- |    |  |              |
|----|--|--------------|
| 1. | Flow rate                                  | 9,225 scfm   |
| 2. | Temperature (influent to heat exchanger)   | 50° to 60° F |
| 3. | Relative Humidity                          |              |
|    | - Influent to heat exchanger               | 100 %        |
|    | - Influent to VPGAC (after heat exchanger) | 40 %         |
| 4. | Pressure                                   | -0.33 psig   |

**D. Operating Criteria:**

1. System shall operate 24 hours per day.
2. Parallel unit(s) shall be provided so that the system will provide continuous operation during regeneration cycles.
3. Automatic, adjustable timer shall control regeneration cycle. Manual override shall be provided.
4. Existing, on-site steam supply shall be used for regeneration.

**E. Available Utilities:**

Utilities that shall be available on-site are listed below. Additional utilities required for the operation of the complete vapor treatment system shall be provided by the MANUFACTURER/SUPPLIER.

- |    |                 |   |
|----|-----------------|---|
| 1. | Steam:          | 2,300 pounds per hour (lb/hr) at 30 pounds per square inch gauge (psig) at skid limits of system. |
| 2. | Electricity:    | 480V, 3ph, 60 cycle, 225 A.   |
| 3. | Cooling Water:  | 165 gpm, 50 to 60°F.  |
| 4. | Compressed Air: | Not available on-site.  |

Piping, ductwork, conduit connections, and skid/battery limit cutoffs are shown in the Construction Drawings.

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**2.04 EQUIPMENT DESCRIPTION**

**A. General**

1. The vapor treatment system shall be configured as shown on the Construction Drawings and as specified herein. Modifications to the conceptual layout are permissible, as long as such changes do not interfere with overall system access, operation and maintenance, and no additional costs to the OWNER and no extensions to the project schedule shall result.
2. Piping and valves shown within the limits of the equipment skid on the Construction Drawings shall be provided as specified herein, in Section 15000 (Process Piping and Accessories) and on the Construction Drawings.
3. Controls and instrumentation shown within the limits of the equipment skid on the Construction Drawings shall be provided as a minimum. The MANUFACTURER/SUPPLIER is responsible for supplying all the instrumentation and controls necessary for the automatic, safe, reliable, flexible, long-term operation of the VPGAC system.
4. The CONTRACTOR shall install all system components in accordance with the MANUFACTURER's recommendations, Technical Specifications, and Construction Drawings.

**B. Ductwork Transition and Moisture Knock Out System**

1. The VPGAC skid system MANUFACTURER/SUPPLIER shall provide an aluminum or epoxy-coated steel transition fitting to connect the 24-inch diameter aluminum air stripper discharge ductwork to the VPGAC system inlet ductwork. A flexible connection shall be provided by the VPGAC skid supplier between the air stripper discharge ductwork and the VPGAC transition fitting. It is the responsibility of the MANUFACTURER/SUPPLIER and CONTRACTOR to coordinate this and other interfaces between the air stripper and VPGAC systems.
2. A moisture knockout system shall be provided on the inlet ductwork. The system shall allow for the collection of condensate formed in the air stripper discharge duct and the automatic transfer of the collected condensate to the saturated condensate storage tank on the VPGAC skid.

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3. At a minimum the knockout system shall consist of a knockout/storage drum where the air flow must make a 180° turn and a level switch used to indicate high water condition in the knockout, initiate and then shut down the transfer of collected condensate.
4. A suitably sized centrifugal pump shall be used to transfer collected condensate from the knockout drum to the saturated condensate storage tank. The pump shall be manufactured from materials capable of withstanding the high organic concentrations present in the condensate. In lieu of the pump, an appropriate gravity transfer approach is acceptable. Alternate approaches must be acceptable to the OWNER and be approved as part of the shop drawing review process.
5. A high water condition in the knockout shall initiate a VPGAC system shutdown.

**C. Process Air Heat Exchanger (Moisture Reduction System)**

1. A heat exchanger shall be installed at the location shown on the Construction Drawings in order to reduce the relative humidity of the influent vapor prior to contact with the VPGAC beds. The heat exchanger shall be located on the VPGAC skid in the air inlet ductwork prior to the process air blower.
2. A steam/air heat exchange coil shall be used for preheating. Steam will be available at the skid limits at 30 psig. Steam condensate from the heat exchanger shall be transferred under operating system pressure to an off-skid duplex condensate return system located in accordance with the contract drawings. The heat exchange coil shall consist of Heresite coated copper coils with copper fins enclosed in an epoxy-coated carbon steel housing.
3. The heat exchanger shall be capable of reducing the relative humidity of the influent vapor stream (9,225 scfm at 50 to 60 °F) from 100% to approximately 40% prior to contact with the VPGAC beds in order to optimize the carbon bed adsorption cycle.
4. The flow through the heat exchanger shall be operated under a vacuum as shown on the Construction Drawings. The heat exchanger shall be rated to handle two times the maximum anticipated vacuum.

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5. The heat exchanger shall be compatible with contaminated vapor conditions as specified in these Technical Specifications. The heat exchanger and appurtenances shall be suitable for operation under the full range of expected conditions.
6. The CONTRACTOR shall install the heat exchanger and appurtenances in accordance with MANUFACTURER's specifications. The heat exchanger and appurtenances shall be installed and anchored to ensure safe and effective operation.
7. The heat exchanger shall be mechanically connected to the low pressure steam and low pressure condensate lines at the battery limits of the skid with flanged connections as shown on the Construction Drawings. At a minimum the heat exchanger shall be equipped with temperature controls as indicated on the Construction Drawings and in accordance with these Technical Specifications.
8. The MANUFACTURER shall guarantee the performance of the heat exchanger (moisture reduction system) to reduce the relative humidity of the influent vapor stream as specified.

**D. Blower and Accessories**

1. A blower shall be provided to induce a vacuum across the air stripper, pulling air through the air stripper, air stripper discharge ductwork, VPGAC system knock out drum, inlet plenum, and heat exchanger, and pushing the air stripper off-gas (vapor) through the vapor treatment system and discharge ductwork to discharge to atmosphere.
2. The blower shall be capable of delivering 9,225 scfm at a minimum of 32 inches water column. The MANUFACTURER shall determine the appropriate blower sizing based on the Technical Specifications, Construction Drawings, and actual system design and shall coordinate with the air stripper system supplier to insure that adequate capacity is available from the skid-mounted blower. An allowance of 9 inches water column vacuum is required to draw air through the air stripper and stripper discharge ductwork and 2 inches water column to force air through the 30 inch diameter discharge ductwork.

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3. The blower shall be a centrifugal type, heavy duty industrial blower, with spark resistant construction and suitable for moving organic vapor laden air. The blower housing shall be continuously welded in compliance with ASME Section 9 standards. The housing shall be coated with a corrosion resistant epoxy. The wheel shall be mounted to the fan shaft with a split taper bushing. The shafts shall be ground and polished. The fan bearings shall be heavy duty, self-aligning ball depending on fan size, motor HP, and performance, and relubricable for continuous service. They shall have a minimum L10 life of 50,000 hours. The blower shaft shall be medium carbon steel (1040-45 SAE) and shall not operate above 70% of the first critical speed. The belts shall be an oil, heat and static-resistance type oversized for continuous duty. The belt drive shall be sized with a service factor not less than 2.0. Drives shall be of the V-belt type with constant pitch. Lifting lugs shall be provided for ease of handling and installation. The blower shall be supplied with a weather cover which combines guarding of the drive as well as protection from the weather, a drain connection, outlet flanges, adjustable motor baseplate, intake guard, inlet flange.
4. The blower assembly shall be dynamically balanced at the factory prior to shipping. All blowers shall meet the balance requirements of the Acoustical Society of America Standard ASA STD2-1975 (ANSI S2 19-1975). Grade G6.3. The fan performance shall be based on tests conducted in the MANUFACTURER's AMCA certified laboratory, and conducted in accordance with the latest Revision of AMCA Test Codes #210 (AIR) and AMCA #300 (Sound). Air and sound performance is AMCA certified and is licensed to bear the AMCA seal.
5. The blower shall be fitted with a unitary base with vibration isolators.
6. A variable inlet vane damper shall be mounted on the blower inlet.
7. The materials of construction shall be compatible with the VOCs in the vapor stream and mechanical seals shall be used to ensure air-tight operation.
8. The performance curves for the blower and motor assembly shall be included in the shop drawings submittal, and shall be subject to approval by the OWNER.
9. The blower housing shall be provided with a drain and removable access door.

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10. The blower shall be operated using automated system controls as specified on the Construction Drawings and in Paragraph 2.05 (Instrumentation and Controls) and as required to insure a fully automated, safe and efficient system.
11. The blower motor shall be a 75 HP designed for 460/230 volt, 3 phase, 60 Hz service. The motor shall be a TEFC motor with a service factor of not less than 1.15. The motor shall be a high efficiency and energy conserving design, manufactured in accordance with NEMA specifications, NEMA B torque requirements, and Class F non-hydroscopic insulation. The motor shall be manufactured by a recognized domestic manufacturer.
12. The blower manufacturer shall be New York Blower, Hartzell, or equal.

**E. Cooling Blower**

1. A cooling blower shall be supplied to provide an ambient conditioned air stream for the purpose of drying the regenerated carbon beds.
2. The blower shall be of adequate capacity to dry a single regenerated carbon bed in a short enough period of time to allow subsequent regenerations to take place without a system shut down.
3. A centrifugal single width blower with outlet damper and flanged inlet and outlet shall be provided. The blower shall be complete with a unitary base with vibration isolators. The blower shall meet the standards defined in Section 15040-2.04, D-3, D-4, D-5, D-9, and D-12.
4. A cooling air preheater shall be supplied to condition the ambient air to achieve an air temperature of approximately 140° F. The preheater shall be an air/steam heat exchanger constructed with Heresite coated, copper tubes and copper fins, and an epoxy coated carbon steel housing.
5. All the necessary ductwork and valves required to operate the cooling air system shall be supplied as part of the VPGAC system skid. Ductwork shall be epoxy lined mild steel.
6. All of the cooling air that passes through the carbon bed shall be captured and shall pass through the condenser to remove and collect the latent moisture in the cooling air system.



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**F. VPGAC Adsorbers**

1. A minimum of two (2) VPGAC adsorbers shall be provided. One unit shall remain on-line during regeneration to ensure continuous system operation. Each unit shall be capable of handling 9,225 scfm and reducing VOC concentrations in the vapor as specified in these Technical Specifications.
2. Each unit shall be provided with VPGAC suitable for the application specified in these Technical Specifications. The granular activated carbon shall be Calgon BPL 4x6 mesh or approved equal. A minimum total carbon load of 12,400 lbs shall be provided and evenly distributed between the carbon vessels. A minimum bed depth of 2.3 feet shall be maintained in each vessel.
3. The materials of construction of the VPGAC units shall be resistant to the corrosive environment that is expected due to the desorption of chlorinated organics (like TCE). The material of construction shall be minimum 12 gauge Hastelloy C-276. Carbon support screens shall be minimum 11 gauge titanium.
4. Each vessel shall be complete with the necessary duct connections and duct supports, two carbon access plates, steam and air distribution headers, and steam connections. The vessels shall be fully supported and anchored to the system skid.
5. Each vessel shall be fitted with one graphite rupture disk set at 5 psig.
6. The adsorbers and internals shall be designed to handle a minimum 5 psig operating pressure and the maximum deliverable pressure from the blower. The steam regeneration piping shall be designed for the maximum operating pressure of the VPGAC system as defined by the vendor and approved by the OWNER's representative.
7. The VPGAC adsorbers shall be provided with all components required for the safe and effective operation of the VPGAC system, including but not limited to, dampers, drains, access ports, valves, piping, controls, and instrumentation.
8. The vessels shall be supplied with a minimum 2-inch fiberglass insulation jacket and protective aluminum covering.

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**G. VPGAC Regeneration System**

1. The MANUFACTURER/SUPPLIER shall provide a VPGAC regeneration system for the on-site regeneration of VPGAC. VPGAC shall be regenerated on-site using steam. The regeneration shall be accomplished by heating the VPGAC with saturated steam (available on-site). As the bed heats up, the VOCs shall be desorbed from the VPGAC and the steam/VOCs mixture shall flow into a condenser where vapors shall be condensed and subcooled by non-contact heat exchange with treated process water at 55° to 60° F. The condensed steam/VOCs mixture shall flow into a decanter where the condensed water (condensate) shall be physically separated from the free phase VOCs (product). The separated condensate and product shall flow by gravity to separate storage tanks.
2. VPGAC regeneration shall be automatically controlled with an adjustable timer. The timer shall automatically operate in-line valves to divert flow from the VPGAC adsorber in need of regeneration. Vapor flow shall be diverted to the alternate VPGAC adsorber. The system shall be configured to stay in operation during regeneration (one unit kept in use at all times). The system shall be equipped with a manual override to allow for manual regeneration of the units.
3. The VPGAC system shall also include a condenser, decanter, saturated condensate storage tank, free product storage tank, condensate pump and free phase product pump. The MANUFACTURER/SUPPLIER shall design all components to be compatible with the specific VPGAC regeneration system and the anticipated flow rates and contaminant streams. The materials of construction shall be resistant to the corrosive environment that is expected due to the desorption of chlorinated organics (like TCE). The condenser, decanter, and the condensate and free product storage tanks shall be constructed from Hastelloy C-276. The condensate and product transfer pumps shall be manufactured from materials that will provide comparable design lives.
4. The saturated condensate storage tank shall be a minimum 250 gallon tank and the free product storage tank shall be a minimum 150 gallon tank. Each tank shall be provided with secondary containment equal to or greater than 110% of the volume of the tank.

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5. The operation of the transfer pumps shall be controlled by level and pressure sensors as shown on the Construction Drawings and specified in the Technical Specifications. The transfer pumps shall not operate unless the well pumps are on-line. An interlock shall be provided from the main PLC to indicate well pump operation.
6. The condensate pump shall be capable of pumping 1 gpm at 55 psig and the free phase product pump shall be capable of pumping 1 gpm at 20 psig. The air stripping tower has been sized to handle a continuous flow of 0.5 gpm of saturated condensate; therefore, any increases in the saturated condensate flow rate must be accounted for in the air stripper design by the VPGAC MANUFACTURER/SUPPLIER, the CONTRACTOR, and the air stripper system MANUFACTURER/SUPPLIER.
7. Cooling water for the condenser operation shall be available on-site. Cooling water shall be available at a maximum of 165 gpm, 30 psig TDA at 55° F. Effluent cooling water from the condenser shall be transferred to the clear well under normal system pressure.
8. The MANUFACTURER shall guarantee the performance of the complete VPGAC regeneration system including all system components for the operation specified in these Technical Specifications.
9. Secondary containment shall be provided for all piping and pumps that carry condensate and product to/from the storage tanks. Secondary containment shall take the form of drip pans with appropriate level switches and alarms to indicate leakage, and double containment piping. All components of the VPGAC system that transfer or hold liquids shall be supplied with appropriate containment and alarms.

**H. Condensers and Decanter**

1. The system condensers shall be manufactured from Hastelloy C-276 and shall be designed to condense and subcool the organic laden steam produced during regeneration. The condensers shall be capable of condensing the steam and subcooling the condensate using cooling water from the clear well. The clear well water will be available at a flow rate of 165 gpm and a temperature of 55° to 60° F. The condenser shall be capable of achieving an approach temperature less than 10° F above that of the cooling water supply.

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2. The decanter shall be a gravity type single stage unit constructed from Hastelloy C-276. It shall be designed to insure complete separation of free product from condensed water.
3. Both the condenser and decanter shall be complete with the necessary connections, fittings, and instruments to insure efficient, safe operation and ease in maintenance.

**I. Piping and Appurtenances**

1. All water, steam, vapor, and process piping within the battery limits of the system shall be skid mounted and supported from the skid or equipment in such a manner to ensure safe shipment and proper support during system installation and operation.
2. Valves, fittings, and piping appurtenances shall meet the requirements of Section 15000 (Process Piping and Accessories) of these Technical Specifications and shall be located and mounted for ease of access and operation.

The following materials of construction shall be used for the piping valves and ductwork in the VPGAC system:

Solvent laden air stream duct:	Epoxy lined mild steel or structural grade aluminum.
Treated air duct:	Epoxy lined mild steel or structural grade aluminum.
Process air inlet and outlet dampers:	316L stainless steel housings, Teflon gaskets, viton seals, Hastelloy C-276 seats and plates.
Vapor lines and valves to condenser:	Teflon lined Schedule 40 pipe and Teflon lined steel valves.
Fluid lines from condenser to decanter and from decanter to storage tanks:	Teflon lined Schedule 40 pipe and Teflon lined steel valves.

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Fluid lines from storage tanks to disposal point      Teflon lined Schedule 40 pipe, Teflon lined steel valves and Teflon tubing.

Cooling water pipe:      Galvanized steel.

Steam header, traps, strainers, and Pressure reducing station if required.      Insulated, black iron.

3. All piping connections shall terminate at the skid limits with fittings and pipe sizes matching those described on the Construction Drawings. All terminations shall be located to match those shown on the Construction Drawings.
4. All piping and ductwork subject to temperatures in excess of 90° F shall be insulated.
5. Vent lines from all process vessels associated with the VPGAC system shall be provided to assure no solvent laden vapors are released from the system.
6. Gaskets shall be Teflon or Viton. All nuts, bolts, and washers shall be 304 stainless steel, 316L stainless or Hastelloy C-276 to suit the environment in which the fasteners are used.
7. All automatic valves shall be electronically or pneumatically operated. If pneumatically operated, the VPGAC MANUFACTURER/SUPPLIER must provide an appropriately sized, skid mounted and fully integrated compressor to operate the pneumatic solenoids.

**J. Support Skid**

1. All components of the VPGAC system shall be skid mounted prior to shipment.
2. The system shall be completely pre-piped, pre-wired, and mounted to the skid within the battery limits described in these Technical Specifications and on the Construction Drawings.
3. The skid shall be sand blasted carbon steel with an epoxy primer and high build epoxy finish. A minimum 8-10 DFT shall be provided. The CONTRACTOR shall touch-up the skid after installation.

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**2.05 INSTRUMENTATION AND CONTROLS**

**A. General**

1. Instrumentation and controls shall be provided as specified herein and as shown within the limits of the equipment skid on the Construction Drawings. Additional instrumentation and controls may be required; the MANUFACTURER/SUPPLIER shall provide all instrumentation and controls that will ensure the automatic, efficient, safe, and effective operation and maintenance of the system.
2. All instrumentation and controls shall be suitable for the operation intended.
3. All instrumentation, controls, switches, and control panels shall be pre-wired and mounted on a common skid with the mechanical equipment. Sensitive instrumentation shall be carefully and securely packed and supplied for installation in the field. Conduit and wiring shall be provided pre-installed and terminated at the designated instrumentation mounting location.
4. A central control panel, located in the treatment building, will house a programmable logic controller (PLC) to monitor and integrate the operation of the complete IRM system (well pumps, VPGAC system, and air stripper system). The panel shall be connected to each major component in the IRM system and will provide an interface to the Grumman steam plant to enable the IRM system to be operated remotely and monitored directly from the steam plant.
5. The VPGAC control panel shall interface with the central control panel and provide a single failure signal upon shutdown of the VPGAC for any reason. The VPGAC control panel shall be complete with indicator tabs to allow for quick and easy troubleshooting upon system shutdown.

**B. Alarm Conditions**

A single common failure signal shall be provided at the main control panel for any shutdown condition at the vapor treatment skid. At a minimum, the VPGAC vapor treatment system shall shutdown under the following conditions and send a signal to the main PLC indicating that there has been a failure at the vapor treatment skid:

1. Process blower (540) failure as indicated by low pressure in blower discharge duct.

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2. Process air flow interrupt as is directed by high pressure in the blower discharge duct.
3. Low air inlet temperature as indicated by a low temperature after the heat exchanger.
4. Loss of condenser cooling water flow.
5. High saturated condensate level in Saturated Condensate Storage Tank.
6. High saturated condensate level in Knock Out Drum.
7. High product level in Free Product Storage Tank.
8. Loss of steam pressure for regeneration.
9. All additional fail safe shutdown within the VPGAC skid which would render the system inoperable, inefficient, or unsafe.
10. At a minimum, these additional alarm points shall be provided:
  - a. Adsorbers - high temperature.
  - b. Decanter - high temperature.
  - c. Cooling water return - high temperature.
  - d. Recycle vent - high temperature.
  - e. Instrument air failure (if required).
  - f. Steam low flow.
  - g. Valves out of sequence.

The instrumentation and alarm conditions indicated on the Construction Drawings are considered the minimum required to insure safe operation and do not include the instrumentation and process logic necessary for normal operation of the VPGAC system. It is the responsibility of the VPGAC system MANUFACTURER to select, design, and define all other instrumentation required for the system.

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**C. Process and Instrumentation Submittals**

1. As part of the shop drawings review process, complete process and instrumentation diagrams and ladder logic diagrams shall be provided for review by the OWNER.

**D. Process Monitoring**

At a minimum the following shall be provide to monitor the system:

1. A flow element (FE) and flow indicator (FI) shall be provided on the VPGAC effluent line to monitor the rate of vapor discharge to atmosphere.
  - a. The air measuring station shall be FMS-W Air Sentinel unit, manufactured by Farr Company, Los Angeles, CA. The air measuring station shall be equipped with a dry-type volume meter (magnahelic gauge) calibrated to read air volume in cfm.
  - b. The air flow measuring station shall measure airflow by sensing total and static pressure. It shall consist of single or multiple extruded sensors factory positioned and connected, to produce an averaged velocity pressure. The measured velocity pressure converted to airflow (cfm) shall have an accuracy with  $\pm 2\%$  of the full scale throughout the velocity range of 700-5000+ FPM.
  - c. The airflow measuring station shall be installed to meet at least the MANUFACTURER's minimum installation recommendations and shall not amplify the sound level within the duct. The airflow measuring station shall be no deeper than 6 inches. the maximum resistance to airflow shall not exceed 12% of the velocity head at any given airflow. The unit shall be suitable to 220° F continuous operation with intermittent exposure to 250° F.
  - d. The airflow measuring station shall consist of 16-gauge galvanized steel, extruded aluminum sensor(s) for total and static pressure, and copper collectors. All interconnecting tubing shall be internal to the unit with the exception of one total pressure and one static pressure connection. An array of total and static sensing ports shall be positioned in the aluminum sensor on an equal area basis, with a maximum of 16 square inches per total pressure port on units smaller than 4 square feet of face area. Units of 4 square feet and

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larger shall have a maximum of 36 square inches per total sensor port, but need not exceed 64 ports, and a maximum of 144 square inches per static pressure port, but need not exceed 16 ports.

- e. Interconnected extruded sensors and their collectors shall average and relate each type of pressure measurement into one total pressure and one static pressure metering port.
  - f. A highly accurate, economical manometer that mounts directly to the FMS-W or at any convenient remote location shall be provided. The gauge shall be logarithmically curved to provide wider increments for ease of reading at lower values, and shall be calibrated to read volume (cfm) and velocity (fpm).
2. The effluent line of the condensate pump shall be equipped with a pressure indicator (PI) to monitor pressure and a flow element (FE) and flow quantity indicator (FQI) to monitor the rate and quantity of condensate.
  3. The programmable logic controller in the VPGAC control panel shall be an Allen Bradley SLC-5 Series system to be compatible with the central control panel PLC and insure ease of operator understanding of the control systems.
  4. At a minimum, local temperature indicators shall be provided for the adsorber carbon beds, cooling water supply and return, process vapors to condenser/cooler, decanter, and SLA inlet duct and SLA to adsorbers.
  5. At a minimum, local pressure indicators shall be provided for the blower inlet/outlet, cooling water supply, steam supply header, and pump discharges.
  6. The following accessories shall be provided: adsorption steam flow meter, control valve solenoid valves (as required), proximity switches for positive valve position indication, cooling blower damper, steam traps, and decanter and surge compartment level gauges.
  7. At a minimum, panel-mounted temperature indication shall be provided for the following: SLA to cooling coil, SLA to adsorbers, adsorbers, cooling water return, decanter, and recycle vent.

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**PART 3 - EXECUTION**

**3.01 INSTALLATION AND INSPECTION**

- A. The CONTRACTOR shall install the complete vapor treatment system and appurtenances at the locations indicated on the Construction Drawings, according to the MANUFACTURER's recommended installation instructions.
- B. MANUFACTURER's representative shall be present for a minimum of three (3) days to inspect/supervise the complete installation of the equipment by the General CONTRACTOR.
- C. The installation shall be in accordance with OSHA specifications.

**3.02 TESTING AND START-UP**

- A. After installation, assembly, and inspection, MANUFACTURER's representatives shall perform functional testing during start-up.
- B. The vapor treatment system shall be tested for leaks when all proper piping connections are complete. The vapor treatment system and appurtenances shall also resist all stresses which normally arise during transportation and installation.
- C. The vapor treatment system shall be tested by the CONTRACTOR under supervision of the MANUFACTURER and OWNER.
- D. A MANUFACTURER's representative shall be on site for a minimum of 5 days of startup and system performance testing. The OWNER shall collect and analyze samples to demonstrate system performance.
- E. If the system fails to perform as specified, the MANUFACTURER and CONTRACTOR shall propose to the OWNER what adjustments, if any, are required to bring the system into compliance. After such adjustments are approved, the CONTRACTOR and MANUFACTURER shall make the changes necessary at no additional cost to the OWNER and retest the system at no additional cost to the OWNER. Such adjustments and testing will continue at no additional cost to the OWNER until the system meets the performance specifications.





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**3.03 DOCUMENTATION/REPORTING**

- A. MANUFACTURER's representative shall provide verbal reports to the OWNER regarding the results of the MANUFACTURER's installation/inspection and testing/start-up. The verbal reports shall be made immediately upon completion of the inspection and the start-up.
- B. Within seven (7) calendar days after the installation/inspection, MANUFACTURER shall provide OWNER with a letter stating whether the system installation and assembly was satisfactory or unsatisfactory. Any problems identified during MANUFACTURER's inspection shall be fully described, along with corrective actions required, in MANUFACTURER's letter.
- C. Within fourteen (14) calendar days after the testing/start-up, MANUFACTURER shall provide OWNER with a letter stating whether the system operation/performance was satisfactory or unsatisfactory. Any problems identified during MANUFACTURER's testing/start-up shall be fully described, along with corrective actions required, in MANUFACTURER's letter.
- D. The MANUFACTURER shall provide the OWNER with process/performance testing data based on the OWNER's analytical data and the MANUFACTURER's field data.

**END OF SECTION**

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**SECTION 15060  
PUMPS AND APPURTENANCES**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. This specification applies to the design, fabrication, delivery, and installation of pumps and associated drivers. All components necessary for the safe and satisfactory operation of the specified equipment which are not specifically included shall be considered to be a part of this specification.
- B. The CONTRACTOR shall furnish all labor, materials, equipment, incidentals, supervision, and services and perform all operations required to complete all work of this section and related work as indicated on the Construction Drawings and specified herein, including, but not necessarily limited to the following:
1. Installation of vertical line shaft, multistage pumps of the turbine type, suitable for extracting groundwater from Extraction Wells ONCT 1, 2, and 3, complete and operational with electric motors for constant speed operation, control equipment including motor starters, and accessories as shown on the Construction Drawings and specified herein.
  2. Installation of vertical line shaft, multi-stage pumps of the turbine type, suitable for conveying treated groundwater from the clear well to the OWNER's cooling water distribution system, complete and operational with electric motors for constant speed operation, control equipment including motor starters, and accessories as shown on the Construction Drawings and specified herein
  3. Installation of cooling water pump (vertical turbine sump pump) suitable for conveying treated groundwater from the clear well to the VPGAC skid. The pump shall be complete and operational with electric motor for constant speed operation, control equipment including motor starter, and accessories as shown on the Construction Drawings and specified herein.

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4. Installation of single stage pumps, suitable for the services as specified herein, complete and operational with electric motors for constant speed operation, control equipment including motor starters and accessories as shown on the Construction Drawings and specified herein.
5. Furnishing and installation of pump control panel and control wiring from the pumps to the control panel.
6. Installation, pressure testing, and start-up of the pumps and appurtenances.

C. Design Criteria

	Well Pumps ONCT-1, ONCT-2 and ONCT-3 Vertical <u>Turbine Pumps</u>	Clear Well Nos. 401, 402, and 403 Vertical <u>Turbine Pump</u>	<u>Clear Well Sump Pump</u>
Design Point - GPM	1,200	1,500	165
Design Point - TDH - FT	250	200	70
Minimum Efficiency	80	80	54
Maximum Shut-off Head - FT	460	370	112
Maximum No. of Stages	5	5	-
Max HP	100	100	5
Max RPM	1770	1770	1750
Motor Voltage	230-460	230-460	230
Full Load Power Factor	87% <sup>A</sup>	88%	-
Discharge Size - Inch	10	10	2
Manufacturer	J-Line Mid South	Floway	J-Line Mid South or Crane Deming
Model No. - Bowl Assembly	12 MC	12 JKH	4511-1½ M

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**1.02 RELATED SECTIONS**

- A. Section 03300 - Cast-in-Place Concrete
- B. Section 15000 - Piping and Accessories
- C. Section 16000 - Electrical General Provisions

**1.03 QUALITY ASSURANCE/QUALITY CONTROL**

- A. Quality assurance/quality control measures shall conform to the requirements of the conditions of the contract, as follows:

- 1. The CONTRACTOR, at his expense, shall furnish to the OWNER, certified copies of all pump performance test curves, pump hydrostatic test reports and electric motor test reports.

These data shall be submitted to the OWNER for approval prior to shipment of these products from their respective factories.

The equipment shall not be shipped until the OWNER has approved the test curves and test reports.

- 2. The CONTRACTOR shall comply with applicable provisions and recommendations of the following standards except as otherwise shown on the Construction Drawings or specified herein:
  - a. AWWA/ANSI E101 Vertical Turbine Pumps - Line Shaft Type.
  - b. American Petroleum Institute Standard for Centrifugal Pumps (API 610 -For pump test tolerances only).
  - c. Hydraulic Institute Standards.
  - d. National Electric Code (NEC).
  - e. National Electrical Manufacturer's Association (NEMA).
  - f. Institute of Electrical and Electronic Engineers (IEEE).
  - g. Anti-Friction Bearing Manufacturer's Association (AFBMA).

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- h. American National Standards Institute (ANSI).
- i. Steel Structures Paints Council (SSPC).

**1.04 PERMITS AND REGULATIONS**

- A. The CONTRACTOR, at his expense, shall procure all necessary permits and licenses to conduct the work specified herein.
- B. If the CONTRACTOR believes that the specifications are at variance with any law or regulation, he shall promptly notify the OWNER in writing, and any necessary adjustments shall be submitted to the OWNER for approval.

**1.05 SUBMITTALS**

- A. The CONTRACTOR shall submit information on the following items that may be requested by the OWNER.
  - 1. Certified performance test curves and reports of the tests performed on each pump and motor prior to shipment to the site.
  - 2. Templates to insure accurate setting of the anchor bolts.
- B. Shop drawings shall be submitted to the OWNER for all equipment specified herein in accordance with the requirements specified under submittals.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. All arrangements for delivery and handling of equipment and materials throughout the execution of the work shall be the CONTRACTOR's responsibility.
- B. The CONTRACTOR shall store equipment and materials so as to ensure the preservation of their quality and fitness for the work. When considered necessary, they shall be placed on wooden platforms, or other hard, clean surfaces and shall be placed under cover when directed. Stored materials shall be located, so as to facilitate prompt inspection.



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**1.07 GUARANTEES**

- A. The CONTRACTOR shall guarantee and furnish MANUFACTURER's warranty against manufacturing and mechanical defects on all equipment provided for a period of two (2) years from the date of initial operation, not to exceed 30 months from date of shipment.
- B. In the event any material, part, or equipment proves defective during this period, the CONTRACTOR shall, at his expense (including labor), furnish and replace the defective item.

**1.08 TECHNICAL INSPECTION**

- A. All work shall be subject to inspection by the OWNER, but such inspection shall not relieve the CONTRACTOR from obligation to perform said work in accordance with these specifications and MANUFACTURER's requirements, or any modifications thereof, as herein provided, shall be corrected and made good by the CONTRACTOR whenever so ordered by the OWNER, without reference to any previous oversight or error in inspection.
- B. All directions given to the CONTRACTOR by the OWNER or MANUFACTURER's representative, pertaining to the scope of work during routine inspection, shall be binding on the CONTRACTOR.
- C. During installation and startup of the pumps and equipment, a MANUFACTURER's representative shall be available on-site.

**1.09 ACCEPTABLE MANUFACTURERS**

- A. The pumps shall be manufactured by those companies specified or specifically approved equal by the OWNER. Other acceptable manufacturers include the following:
  - 1. Extraction Well Pumps:
    - J-Line Mid South Pump Company
    - Peerless Pump Company
    - Johnson Pump Company

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2. Clear Well Pumps:
  - Floway Pumps
  - J-Line Mid South Pump Company
  - Peerless Pump Company
  - Johnson Pump Company
3. Cooling Water Pump
  - Crane-Deeming Pump Company
  - J-Line Mid South Pump Company

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

**A. Vertical Turbine Pumps**

1. Discharge Head - An above-base discharge head, made of ASTM A-4B Class 30, high grade cast iron, shall be provided for mounting the drive and supporting the pump column. The discharge outlet shall be flanged, unless otherwise indicated on the Construction Drawings. Flanges shall be rated for 250 psi working pressure for the extraction well pumps, and 125 psi working pressure for the clear well pumps. Flanges shall be manufactured in accordance with ANSI standards for ductile iron fittings.
2. Pump Bowls and Suction Bells - The castings shall be of close grained Class 30 Cast Iron Equivalent to ASTM A 48, smooth and free of all casting imperfections. Bowls shall be cast iron and lined with fired-on ceramic enamel on the interior unless otherwise indicated on the Construction Drawings.
3. Impellers - The impellers shall be ASTM B 584, Alloy 836 bronze of the fully enclosed type, polished, statically and dynamically balanced. They shall be securely fastened to the impeller shaft with stainless steel taper lock bushings. They shall be adjustable vertically by means of an adjusting nut located in the hollow-shaft motor. Under no circumstances shall the rated point exceed the nameplate horsepower of the motor. The horsepower curve shall reach a maximum at or near the best efficiency point on the performance curve.

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4. Impeller Shaft - The impeller shaft shall be of ANSI 416 Stainless Steel. The shaft diameter shall be sized for the total axial thrust plus the weight of all rotating parts supported by it and the horsepower transmitted. The maximum combined shear stress shall not exceed 30 percent of the elastic limit in tension nor more than 18 percent of the ultimate tensile strength of the shafting material. The shaft shall rotate in pumpage lubricated, sleeve bearings made only of ASTM B505, Alloy 932 bronze in the top bowl and suction bell, and identical material dual upper bronze with neoprene rubber lower bearings in intermediate bowls. The suction bell bearing shall be permanently lubricated by a non-water soluble grease.
5. Line Shafts - The line shafts shall be of ANSI Type 416 stainless steel unless otherwise indicated on the Construction Drawings. Surface finish shall not exceed RMS 40. Shafting shall be furnished in lengths not greater than specified with the ends faced squarely to assure perfect alignment after installation. The shafting shall be coupled with ANSI Type 416 stainless steel threaded couplings, designed with a safety factor of one and half times the shaft safety factor and shall be left-hand thread to tighten during pump operation. Minimum size of the line shaft shall be determined in accordance with the requirements of AWWA Standard E101, but in no case less than 1½ inches. Line shaft lengths shall not exceed column pipe section lengths.
6. Line Shaft Bearings - The shaft bearings shall be water lubricated and mounted in bronze bearing retainers held in position in the column joints by means of butted threaded pipe ends. The bearings shall be located at intervals not to exceed 10 feet.
7. Lower Head Shaft - Extends through stuffing box to the upper head shaft. Connects to the upper head shaft with a threaded sleeve-type two-piece top shaft coupling.
8. Wear Rings - Bowls shall be fitted with replaceable wear ring fabricated of either bronze or neoprene with steel core.
9. Discharge Column Pipe - The column pipe for each pump shall be as specified on the pump data sheet. The ends of each section shall be flanged. Column pipe shall be made of ASTM A-53, Grade B, or better carbon steel, 8-inch size for all vertical turbine pumps, and 2-inch size for clear well sump pump; and weigh a minimum of 24.69 lb. per foot of length.

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10. Discharge Head Assembly - The discharge head assembly shall be provided with a cast iron shaft packing box. Case iron shall meet ASTM A48, Class 30 specification. Head shaft with two-piece construction shall be suitable for reversing the ends to renew the stuffing box wearing surface. Packing shall be graphited non-asbestos. An ASTM B505, Alloy 932 bronze, pumpage and grease lubricated sleeve bearing shall be provided in the stuffing box immediately below the packing. It shall be at least 2 1/2 times the shaft diameter in length. Gland bolts or studs and nuts shall be 18-8 stainless steel.
11. Provide removable, adjustable water slinger fitted to pump shaft to prevent pressurized leakage from the stuffing box from entering the motor enclosure.
12. Anchor bolts, nuts and inserts shall be furnished under this Section and shall be sized and installed in accordance with the pump MANUFACTURER's recommendations. The bolts and nuts shall be constructed of Type 18-8 stainless steel.
13. A heavy detachable sole plate of carbon steel construction with a rubberized gasket between sole plate and discharge head shall be furnished for each pump. Each sole plate shall have a Blanchard ground top surface, tapped holes for mounting the pump discharge head and plain holes for the anchor bolts. 18-8 stainless steel fasteners shall be supplied for securing the pump discharge head to the sole plates.
14. All machine bolts, nuts and cap screws shall have hexagon heads and be of 18-8 stainless steel.
15. Stainless steel nameplates giving the MANUFACTURER's name, model and serial number, rated capacity, head, speed and all other pertinent data shall be attached to the pump.
16. Discharge of each pump shall be equipped with appropriately sized NPT connection with pressure gauge, necessary elbow, pipe nipples and shut-off valve.
17. Gauges shall have a minimum 3½ inch dial, 0-250 psig range.

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**B. Motors**

1. Motors shall be NEMA design "B", TEFC, Class 1, Group D, hollow-shaft vertical, premium efficiency type. Motors shall be equipped with non-reversible ratchet and corrosion resisting chemical duty features.
2. Motors shall operate on voltage as specified, 60 Hz, 3 phase electric power.
3. Motors shall be squirrel cage induction type, of sufficient size so that there will be no overload on the motor above rated nameplate horsepower under any condition of operation from shut-off to zero head, unless otherwise specifically permitted in this Section.
4. Motors shall be premium efficiency type. Guaranteed minimum efficiency at full load shall be 85%.
5. Provide terminal box, adequately sized, for conduit and leads.
6. Motors shall be capable of carrying full load current continuously without injurious temperature rise at an ambient temperature of 40° C.
7. Motors shall be provided with a 1.15 service factor. The service factor may be considered in sizing motors to cover the horsepower requirement of the pump through the entire capacity range with the design impeller diameter. The brake horsepower required at the rated capacity shall under no circumstances exceed the nameplate value of the motor.
8. Locked rotor currents shall be as specified in NEMA standards.
9. Motor thrust bearings shall be high thrust capacity. Bearings shall have a minimum B-10 life of 20,000 hours, based upon pump design operating conditions.
10. Lubrication of motor bearings shall be as recommended by the motor manufacturer.
11. Motors shall be manufactured by U.S. Motors or approved equal.

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**C. Controls**

1. The pump controls shall maintain pump operation as described in Section 16910-Electrical Controls.

**D. Cooling Water Pump**

1. The pump shall be Crane Deming, Model 4511-1½M or approved equal.
2. The pump liquid end including casing, impeller suction head, strainer and bearing housing shall be of cast iron having minimum tensile strength of 30,000 lbs.
3. Impeller shall be semi-open type, secured to shaft with key, washer and lock nut and shall be fully adjustable, without dismantling the pump, by means of an adjusting nut located above the thrust bearing in the motor support.
4. Flanged column pipe shall be full weight steel pipe with a machined register fit at all assembly points to assure proper alignment.
5. Pump shaft shall be of a high grade carbon steel of sufficient size to transmit required horsepower.

**2.02 CONDENSATE RETURN PUMP**

- A. Steam condensate return pump shall be Federal Pump Corporation Model VRC-270-2 or approved equal.
- B. Unit shall have a single piece cast iron receiver tank designed for a maximum internal pressure of 5 psi.
- C. Unit shall be rated for 3 gallons per minute at a discharge pressure of 70 psi.
- D. Pump shall be bronze fitted centrifugal design, flanged to the receiver with a leakless mechanical seal.
- E. Motors shall be 2 HP rated for 3-phase, 208-230/480 Volt service.
- F. Unit shall have an alternating float switch to automatically alternate the operating cycles of the pumps and provide simultaneous operation when required.

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- G. Unit shall be furnished with motor starters for each motor mounted on the unit and wired to the motor and float switch.
- H. Unit shall be furnished with a gauge glass, and pump discharge pressure gauges.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Installation shall be completed in the presence of the MANUFACTURER and the OWNER.
- B. All pumping units shall be installed on concrete bases and secured with anchor bolts. The concrete bases shall be poured up to 1 inch below the soleplates. The soleplate with the equipment mounted thereon shall then be accurately shimmed to grade and the spaces between filled with an approved nonshrink grout. After the grout has reached its initial set, exposed edges shall be cut back 1/3 inch and the edges neatly finished with 1 to 2 cement mortar.
- C. Neatly placed 1/2 inch hard copper pipe shall be provided on each pump to convey leakage to designated drainage inlet.
- D. Installation shall include furnishing and applying an initial supply of grease and oil, of a type recommended by the pump and motor manufacturers.

**3.02 TESTING**

**A. Shop Tests**

**1. Pumps:**

- a. Performance Testing: Each pump as specified herein on the pump data sheet, shall have its bowl assembly given a performance test in the pump MANUFACTURER's test laboratory. It shall be performed utilizing the MANUFACTURER's test laboratory column pipe, shafting, discharge head and dynamometer or calibrated test motor.



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- b. Pump bowl assembly(s) shall be operated from zero to maximum capacity as shown on the approved, preliminary, submittal curve, but in no case less than 125% of flow at best efficiency point (BEP). Readings shall be taken at a minimum of 6 evenly spaced flows, including shutoff, design point and 125% of BEP. Results of the test(s) shall be plotted to show capacity versus head, horsepower and efficiency. When actual submergence over the suction bell is expected to be less than 110% of that recommended by the pump manufacturer, tests shall be conducted using the actual submergence expected.
  - c. Factory laboratory bowl assembly performance test(s) data shall be corrected for column and discharge head pipe friction losses and for column pipe bearing friction horsepower losses to show the true field performance of the complete pump(s). Additionally, bowl assembly efficiency at the design point shall be stated and certified.
  - d. Performance test tolerance shall be those of the American Petroleum Institute Standard 610, latest edition.
    - At design capacity: -2 to +5% of design head, -1/2% percentage point on bowl efficiency, +4% on horsepower.
    - At zero capacity: -10% to +10 of shutoff head.
  - e. All test measurements shall be taken with properly calibrated instruments and all procedures shall conform to Hydraulic Institute Standards. The test(s) shall be witnessed by a Registered Professional Engineer, who may or may not be an employee of the manufacturer, and he shall sign and seal all copies of the test curves.
  - f. Hydrostatic Tests: All pump discharge heads and bowl assemblies shall be hydrostatically tested to twice the design point total head or one and one-half times shutoff head, whichever is greater. The requirement for witnessing, sealing and signing of the test report(s) by a Registered Professional Engineer also applies here.
2. Motors:
- All motors shall be given a non-witnessed routine type test as described in NEMA MG1-20.46 in the motor MANUFACTURER's test laboratory.

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3. Certified Copies of all pump performance test curves, pump hydrostatic test reports and electric motor test reports shall be submitted to the OWNER for approval prior to shipment of these products from the respective factories. The equipment shall not be shipped until the OWNER has approved the test curves and test reports.

**B. Field Tests**

1. The CONTRACTOR shall furnish all facilities, certified calibrated instruments, personnel, and the service needed for their preparation and execution.
2. The OWNER, at his own and exclusive option, may provide substitutes for some or all of the instruments supplied by the CONTRACTOR. Proper calibration of every measuring device shall be checked and agreed upon between the CONTRACTOR and the OWNER before running any test.
3. There shall be one 8-hour witnessed field test under actual operating conditions for each pump and motor. The field testing shall be done in the presence of the OWNER.
4. The results of the tests shall be computed and agreed upon with the pump manufacturer or his representative as acceptable before the test can be considered terminated and the test equipment removed.
5. A preliminary field test shall be made to determine the adequacy of the instruments and apparatus. When conditions do not permit such a preparatory run, operations may be started, and later when conditions are satisfactory, the test shall be made.
6. A careful inspection shall be made before, during and after the field tests to insure the proper operation of each pump. The following items shall be inspected:
  - a. Alignment of pump and driver.
  - b. Direction of rotation.
  - c. Electrical connections.
  - d. Gauge openings.

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- e. Operation of lubricating system.
- f. Liquid passages.

The liquid passages of the pumps should be inspected before installation to guard against error during the test caused by obstructions clogging the passage. If obstructions are found in the pump, the test shall be re-run.

The actual dimensions of the discharge opening where pressure readings are to be taken shall be determined so that proper velocity head corrections can be made.

- 7. Complete records shall be kept of all information relevant to all field tests, with test report copies to be submitted to all interested parties.

**3.03 START-UP**

- A. CONTRACTOR shall verify that structures, pipes and equipment are compatible.
- B. Make adjustments required to place system in proper operating condition.
- C. A pump MANUFACTURER's representative or direct employee shall check and approve the installation before operation. He shall observe the test operation of the system in the presence of the OWNER and verify that the pumps conform to requirements, and instruct plant personnel on care and maintenance of the equipment. He shall revisit the job site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

**3.04 TOOLS, SPARE PARTS, AND MAINTENANCE MATERIALS**

- A. Each pump shall be furnished with a manufacturer's repair kit which shall include the following as a minimum:
  - 1. Special tools required for maintenance and operation (a common set of tools for all pumps).
  - 2. Complete set of gaskets and packing (for each set of identical pumps).
  - 3. A complete set of all fasteners, bolts, nuts, pins, keys, washers, and the like which are not of standard manufacture (for each set of identical pumps).

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4. All bearing grease, and any other lubricants required for initial operation, properly labeled and boxed.

B. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location.

**3.05 PROTECTIVE COATINGS AND PAINT**

A. All equipment shall be painted in accordance with MANUFACTURER's standard painting specifications. A minimum of one primer coat and one finish coat is required. All surfaces to be painted shall be thoroughly cleaned and prepared prior to painting by power tool methods. All scale, oxides, weld flecks, grease, etc. shall be removed prior to priming and painting.

**3.06 CONSTRUCTION AND PERFORMANCE**

A. In accordance with the Construction Drawings and information which has been provided, it is the CONTRACTOR's responsibility to ensure that the equipment conforms in every respect with the specifications. It is to be assumed that the vendor is in complete compliance with the specification if no exceptions are so stated.

**END OF SECTION**

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PUMPS AND APPURTENANCES**

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**SECTION 15500  
HEATING AND VENTILATION**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. Furnish and install two downward projection type, steam unit heaters in the treatment building. Furnish and install one main electric unit heater in each well house.
- B. Furnish and install two wall exhausters in the treatment building. Furnish and install one wall exhauster in the treatment building control room. Furnish and install one wall exhauster in each well house.
- C. Furnish and install four motor operated intake louvers in the treatment building. Furnish and install one motor operated louver in each well house.

**1.02 RELATED SECTIONS**

- A. Section 15000 - Process Piping and Accessories
- B. Section 15950 - Heating and Ventilating Controls

**1.03 QUALITY ASSURANCE**

- A. Equipment: Manufacturer's name and ratings marked on a permanently attached stamped metal label.

**1.04 SUBMITTALS**

- A. Submit product data and shop drawings under provisions of Section 01300.
- B. Submit manufacturer's installation instructions under provisions of Section 01300.

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HEATING AND VENTILATION**

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**PART 2 - PRODUCTS**

**2.01 TREATMENT BUILDING UNIT HEATERS**

- A. Unit heaters shall be steam operated, Trane Model 122-P or approved equal. Heaters shall each be capable of providing 138,084 BTUH using 15 psi steam.
- B. Unit heaters shall be downward projection type and shall each be equipped with louver cone diffusers.
- C. Unit heaters shall each have an electric fan of 1/8 HP rated for 115 Volt, Single phase electrical service. Both unit heater fan motors shall be controlled by a single thermostat.

**2.02 WELL HOUSE UNIT HEATERS**

- A. Each well house shall be equipped with an electric unit heater. The heater shall be Qmark Model MUH-05-41 or approved equal. Heaters shall be furnished with mounting brackets and louver diffusers.
- B. Each heater shall be capable of providing 17,065 BTUH and operate from 480 Volt, Three phase service. Heater contractor coil voltage shall be 24 Volt.
- C. Each heater shall be controlled by a wall mounted thermostat..

**2.03 TREATMENT BUILDING INTAKE LOUVERS**

- A. Intake louvers shall each have a free area of over 14 square feet and shall have outside dimensions of 66 inches by 66 inches. Louvers shall be equipped with bird screen and electric automatic operators.
- B. Treatment building louvers shall be electrically interlocked with the wall exhausters. Intake louvers shall be opened when the exhaust fans are operating. Intake louvers shall be closed when exhaust fans are not operating.
- C. Acceptable manufacturer: Penn Ventilator Co., or approved equal.



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**2.04 WELL HOUSE INTAKE LOUVERS**

- A. Intake louvers shall each have a free area of over 14 square feet and shall have outside dimensions of 66 inches by 66 inches. Louvers shall be equipped with bird screen and electric automatic operators.
- B. Well house intake louvers shall be electrically interlocked with the well house wall exhauster. Intake louvers shall be opened when the exhaust fan is operating. Intake louver shall be closed when exhaust fan is not operating.
- C. Acceptable manufacturer: Penn Ventilator Co., or approved equal.

**2.05 TREATMENT BUILDING EXHAUST VENTILATORS**

- A. Exhaust ventilators shall be wall mounted as shown on the Construction Drawings and both shall be controlled by a single wall mounted thermostat.
- B. Exhaust ventilators shall be Penn Ventilator Co., Breezway Model BC30T1 or approved equal. Exhaust ventilators shall be equipped with wall sleeves, back guards, and gravity operated wall shutters.
- C. Exhaust ventilator motors shall be one HP, 115 Volt, Single phase.

**2.06 WELL HOUSE EXHAUST VENTILATOR**

- A. Exhaust ventilators shall be wall mounted as shown on the Construction Drawings and each shall be controlled by a wall mounted thermostat.
- B. Exhaust ventilators shall be Penn Ventilator Co., Breezway Model P24T or approved equal. Exhaust ventilators shall be equipped with wall sleeves, back guards, gravity operated wall shutters, weathershields and weathershield front guards.
- C. Exhaust ventilator motors shall be 3/4 HP, 115 Volt, Single phase.



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2.07 TREATMENT BUILDING CONTROL ROOM WALL EXHAUSTER

- A. Exhaust ventilators shall be wall mounted as shown on the Construction Drawings and each shall be controlled by a wall mounted thermostat.
- B. Exhaust ventilators shall be Penn Ventilator Co., Breezway Model P24T or approved equal. Exhaust ventilators shall be equipped with a wall sleeve, back guard, gravity operated wall shutter, weathershield and a weathershield front guard.
- C. Exhaust ventilator motors shall be 3/4 HP, 115 Volt, Single phase.

**PART 3 - EXECUTION**

3.01 INSTALLATION

- A. Heaters shall be suspended securely with provisions for easy removal.
- B. Route piping in orderly manner and maintain gradient.
- C. Units shall hang level vertically and horizontally.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Provide unions adjacent to unit heaters in both steam supply and condensate return lines.
- H. Install equipment in accordance with the Construction Drawings and the MANUFACTURER'S recommendations.

END OF SECTION

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HEATING AND VENTILATION**

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**SECTION 15950  
HEATING AND VENTILATION CONTROLS**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. Furnish and install one thermostat in the treatment building to control both unit heater fan motors. Furnish and install one thermostat in the treatment building to control both exhaust ventilators and motor operated louvers. Furnish and install one thermostat in the treatment building to control the electrical control room exhaust ventilator.
- B. Furnish and install one thermostat in each well house to control the unit heater. Furnish and install one thermostat in each well house to control the exhaust ventilator and the motor operated louver.

**1.02 RELATED SECTIONS**

- A. Section 01300 - Submittals
- B. Section 01400 - Quality Control
- C. Section 15500 - Heating and Ventilation
- D. Section 16000 - Electrical - General Provisions

**1.03 REFERENCES**

- A. UL - Underwriters Laboratory
- B. Meet the requirements of Section 01400 - Quality Control

**1.04 QUALITY ASSURANCE**

- A. Equipment: Manufacturer's name and ratings to be marked on a permanently attached stamped metal label.

**1.05 SUBMITTALS**

- A. Submit product data and shop drawings under provisions of Section 01300.
- B. Submit manufacturer's installation instructions under provisions of Section 01300.

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**PART 2 - PRODUCTS**

**2.01 UNIT HEATER THERMOSTATS**

- A. Treatment building unit heater fans shall be controlled by one wall mounted thermostat. Thermostats shall be electric line voltage type. Thermostat shall have a minimum temperature rating of 45 degrees F.
- B. Well house unit heaters shall be controlled by a wall mounted thermostat. Thermostats shall be electric line voltage type. Thermostats shall have a minimum temperature rating of 45 degrees F.

**2.02 VENTILATION THERMOSTATS**

- A. Treatment building ventilators and operable louvers will be operated by one thermostat. Thermostats shall have a maximum temperature rating of 90 degrees F.
- B. Treatment building control room ventilator shall be operated by one thermostat. Thermostats shall have a maximum temperature rating of 90 degrees F.
- C. Well house ventilators and operable louvers shall be controlled by a wall mounted thermostat. Thermostats shall have a maximum temperature rating of 90 degrees F.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Thermostats shall be securely mounted as indicated on the Construction Drawings at an accessible elevation approximately 5 feet above the floor.
- B. Route conduit in orderly manner and maintain gradient.
- C. Install all equipment in accordance with the Construction Drawings and the MANUFACTURER'S recommendations.

END OF SECTION

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**15950-2  
HEATING AND VENTILATION CONTROLS**

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**GROUNDWATER INTERIM REMEDIAL MEASURE  
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**SECTION 16000  
ELECTRICAL - GENERAL PROVISIONS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The CONTRACTOR shall furnish all materials and labor, tools, plant, equipment, and incidentals required to furnish and install, complete and ready for operation, a complete electrical system for groundwater interim remedial measure at the Grumman Aerospace Corporation, (Bethpage, New York site) as required by the contract documents and required by the work to be done.
- B. The work shall include furnishing, installing, and testing the equipment and materials specified in other Sections of the Division 16 Specifications and/or shown on the Drawings.
- C. The work shall include, but not be limited to, furnishing and installing the following:
  - 1. Electrical service to the treatment building and to three (3) well houses from the Grumman's distribution system.
  - 2. Furnish and install complete the following outdoor located equipment:
    - a. Fifteen (15KV) kilovolt switching centers.
    - b. Fifteen (15KV) kilovolt to four hundred and eighty/two hundred and seventy-seven (480/277) step-down transformers.
    - c. Underground system of ducts and manholes.
  - 3. Electrical power distribution and control equipment.
  - 4. Grounding and lightning protection systems.





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5. Conduit, wire, and grounding and field connections for the motor control center, all motors, motor controllers, power and control devices, control panels, and "packaged" equipment furnished under other Divisions of these Specifications.
  6. Field wiring for all heating, ventilating, and air conditioning equipment furnished under other Divisions of these Specifications, including field wiring for unit heater motors and thermostats.
  7. Miscellaneous items.
- D. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at the sole cost and expense of the CONTRACTOR.

**1.02 RELATED WORK**

- A. Excavation and backfilling, including gravel or sand bedding for underground electrical work, is included in Division 2.
- B. Concrete work, including concrete electrical duct encasement, is included in Division 3.
- C. All automatic temperature control wiring for heating, ventilating, and air conditioning equipment (thermostats, duct switches, P-E switches, dampers, automatic temperature control panels, etc.) shall be furnished and installed under Division 15, unless indicated otherwise on the Drawings.

**1.03 SUBMITTALS**

- A. As specified under Section 01300, shop drawings for all materials, equipment, apparatus, and other items as required to establish compliance with the Specifications shall be submitted to the OWNER.
- B. Prior to submittal, all shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This statement shall also list all discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted will be returned.



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- C. Submit complete operations and maintenance data for all equipment furnished under this Section, in accordance with Section 01300. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, complete parts lists, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.
- D. The CONTRACTOR shall submit complete wiring diagrams showing designation and numbering of each individual wire, terminal block, binding post, or any other connection, for approval by the OWNER and the authorities having jurisdiction, before fabricating equipment. Fabrication of equipment shall not be started until written acceptance by the OWNER has been received by the CONTRACTOR.

**1.04 REFERENCE STANDARDS**

- A. All electrical equipment, materials, and installation shall be in accordance with the National Electrical Code (NEC) (1996 edition) and with the latest edition and practice of the following codes, standards and organizations:

NESC	National Electrical Safety Code
OSHA	Occupational Safety and Health Act
NFPA	National Fire Protection Association
NEMA	National Electrical Manufacturers Association
ANSI	American National Standards Institute
ICEA	Insulated Cable Engineers Association

- B. All electrical equipment and materials shall be listed by Underwriters Laboratories, Inc., and shall bear the appropriate U.L. listing mark or classification marking.

**1.05 ENCLOSURE TYPES**

- A. Unless otherwise specified or shown on the Drawings, electrical enclosures shall have the following ratings:
  - 1. NEMA 1A for indoor locations.
  - 2. NEMA 12 for damp locations.



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3. NEMA 4 for outdoor locations, in rooms below grade (including basements and buried vaults), and for wet locations, including treatment building excepting control room.
4. NEMA 4X for corrosive locations.

**1.06 SERVICE AND METERING**

- A. The power serving this project will be supplied and distributed at thirteen thousand eight hundred (13,800) volts, three (3) phase, three (3) wire, sixty (60) hertz to be obtained from the fifteen (15KV) kilovolt switchgear of the OWNER located in the Plant 2 switching building.
- B. The OWNER will be responsible for the furnishing two (2) fifteen (15KV) feeder circuit breaker for this project power supply.
- C. The CONTRACTOR shall be responsible for the following work:
  1. Make all arrangements with the OWNER for obtaining electrical services to this project, and furnish all materials and labor, tools, plant, and equipment required to install the electrical services.
  2. Furnishing and installing concrete pads for the switching centers and outdoor step-down transformers.
  3. Installation and termination of fifteen (15KV) kilovolt cables as required by the contract drawings.
  4. No installation of a revenue metering is required.

**1.07 CODES, INSPECTION, AND FEES**

- A. All equipment, materials, and installation shall be in accordance with the requirements of the local authorities having jurisdiction.
- B. Obtain all necessary permits and pay all fees required for permits and inspections.



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**1.08 TESTS AND SETTINGS**

- A. Test all systems furnished under Division 16 and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the personnel of the OWNER in the proper operation of the systems.
- B. Tests and checks prior to energizing electrical equipment shall include, but not be limited to, the following:
  - 1. Mechanical inspection, testing, and setting of all circuit breakers, disconnect switches, motor starters, control equipment, etc. for proper operation.
  - 2. Test grounding system as specified in Section 16660.
  - 3. Test the motor control center as specified in Section 16490.
  - 4. Test wires and cables as specified in Section 16120.
  - 5. Check all wire and cable terminations for tightness.
  - 6. Field set all transformer taps as required to obtain the proper secondary voltage.
  - 7. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.
  - 8. Check the ampere rating of all thermal overload relays for low voltage motors and submit a typed record of same, including nameplate service factor, horsepower, and full load current, as well as location and designation, to the OWNER. If inconsistencies are found, new thermal elements shall be supplied and installed by the CONTRACTOR at the sole cost and expense of the CONTRACTOR.
  - 9. Check rotation of all motors after obtaining the approval of the OWNER to start the motors, and correct as necessary. Take all necessary precautions not to damage any equipment.



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10. Verify all terminations at transformers, equipment, panels, and enclosures by producing a 1-2-3 rotation on a phase sequence meter when connected to "A", "B", and "C" phases.
  11. Carefully check interlocking and control wiring for each system and/or part of a system, to ascertain that the system shall function properly as indicated by schematic and wiring diagrams.
  12. Provide all instruments, equipment, and personnel required to perform the above tests.
  13. Testing of protective relays and circuit breakers for calibration and proper operation.
  14. Over potential, high potential, insulation resistance, and shield continuity tests for cables
  15. Mechanical inspection of air interrupter switches, circuit breakers, controllers, and starters to ensure proper operation.
  16. Testing of ground fault protection systems on site.
- C. All testing shall be scheduled and coordinated by the CONTRACTOR. Notify the OWNER at least two (2) weeks in advance of conducting tests. The CONTRACTOR shall have qualified personnel present during all testing.

**1.09 SLEEVES AND FORMS FOR OPENINGS**

- A. All sleeves for conduits penetrating floors, walls, partitions, and similar structures shall be furnished and installed. Locate all necessary slots for electrical work and form before concrete is poured.
- B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, request shop drawings, equipment location drawings, foundation drawings, and any other data required to locate the concealed conduit before the floor slab is poured.



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- C. Where such data is not available in time to avoid delay in scheduled floor slab pours, the OWNER may elect to allow the installations of such conduit to be exposed. No additional compensation for such change will be allowed.
- D. Seal all openings, sleeves, penetrations, and slots as specified in Sections 16110 and 16120.

**1.10 CUTTING AND PATCHING**

- A. All cutting and patching shall be done in a thoroughly workmanlike manner.
- B. Core drill holes in existing concrete floors and walls as required.
- C. Install work at such time as to require the minimum amount of cutting and patching.
- D. Do not cut joists, beams, girders, columns, or any other structural members without first obtaining written approval from the OWNER.
- E. Cut opening only large enough to allow easy installation of the conduit.
- F. Patching shall be of the same kind of material as was removed.
- G. The completed patching work shall restore the surface to its original appearance.
- H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.
- I. Remove rubble and excess patching materials from the premises.

**1.11 INTERPRETATION OF DRAWINGS**

- A. The Drawings are not intended to show exact locations of conduit runs.
- B. Each three (3) phase circuit shall be run in a separate conduit unless shown otherwise on the Drawings.
- C. Unless approved otherwise by the OWNER, conduit shown exposed shall be installed exposed and conduit shown concealed shall be installed concealed.



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- D. Where circuits are shown as "home-runs", all necessary fittings and boxes shall be furnished and installed for a complete raceway installation.
- E. Verify with the OWNER the exact locations and mounting heights of lighting fixtures, switches, and receptacles prior to installation.
- F. Any work installed contrary to or without approval by the OWNER shall be subject to change as directed by the OWNER, and no extra compensation will be allowed for making these changes.
- G. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the OWNER during construction. Obtain in the field all information relevant to the placing of electrical work, and in case of any interference with other work proceed as directed by the OWNER and furnish all labor and materials necessary to complete the work in an approved manner.
- H. The horsepower ratings of motors and the ratings of other items of equipment shown on the drawings are presented only as the best information available as to the magnitude of the capacity ratings of the various items of equipment to be served or controlled by the electrical equipment and devices furnished. The attention of the CONTRACTOR is directed to the fact that equipment actually furnished may differ somewhat in capacity ratings from those shown on the drawings and the sizes and capacities of all equipment and devices, including wiring, furnished and installed by him shall be adequate and proper for the capacity ratings of equipment actually furnished and no additional payment will be made therefore.
- I. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
- J. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown.
- K. All connections to equipment shall be made as required, and in accordance with the approved shop and setting drawings.



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- L. Redesign of electrical or mechanical work, which is required due to the use by the CONTRACTOR of a substitute item, arrangement of equipment, and/or layout other than specified herein, shall be done at the sole cost and expense of the CONTRACTOR. Redesign and detailed plans shall be submitted to the OWNER for approval. The review by the OWNER of substitute items shall be paid for by the CONTRACTOR. No additional compensation will be provided for changes in the work caused by such redesign, either to the CONTRACTOR or to others.

**1.12 SIZE OF EQUIPMENT**

- A. Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, the MANUFACTURER shall be required to ship his material in sections sized to permit passing through any restricted areas in the structure.
- B. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the MANUFACTURER shall be required to brace the equipment suitably, to ensure that the tilting does not impair the functional integrity of the equipment.

**1.13 RECORD DRAWINGS**

- A. As the work progresses, legibly record all field changes on a set of project contract Drawings, hereinafter called the "record drawings".
- B. Record drawings shall accurately show the "as-built" condition of the following items:
  - 1. Power distribution one-line diagrams.
  - 2. Motor control center one-line diagrams.
  - 3. Equipment elevations (front views).
  - 4. Panel schedules.
  - 5. Control wiring diagrams.
  - 6. Lighting fixture schedules.





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7. Service, feeder, branch circuit conduit and conductor sizes.
  8. Lighting fixture, receptacle, and switch outlets.
  9. Underground raceway routing.
  10. Plan views, sizes, and locations of switching centers, distribution transformers, the motor control center, control panels, and panelboards.
- C. In addition to these record drawings, submit point-to-point connection diagrams showing wire numbers, including the following information:
1. Circuit origin, destination, and wire numbers.
  2. Field wiring terminal strip names and numbers.
- D. Submit the record drawings and the point-to-point connection diagram to the OWNER for approval.

**1.14 COMPONENT INTERCONNECTIONS**

- A. Analyze all systems components and their shop drawings. Identify all terminals and prepare drawings or wiring tables necessary for component interconnection. Furnish two (2) copies of interconnection wiring diagrams and tables to the OWNER.
- B. Furnish and install all component interconnections.

**1.15 SERVICES OF THE MANUFACTURER**

- A. Furnish services of the MANUFACTURER for testing and start-up of the motor control center located in the new treatment building - two (2) days, one (1) trip minimum.



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**1.16 MATERIALS**

- A. The materials used in all systems shall be new, unused, and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or specifications of the MANUFACTURER shall be submitted for approval as required by the OWNER.
- B. Electrical equipment shall be adequately protected against mechanical injury or damage by water at all times during construction. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry shelters. If any apparatus has been damaged, such damage shall be repaired at no additional cost to the OWNER. If any apparatus has been subject to possible injury by water, it shall be replaced at the sole cost and expense of the CONTRACTOR.
- C. Any damage to factory applied paint finish shall be repaired using touch-up paint furnished by the equipment MANUFACTURER. The entire damaged panel or section shall be repainted per the field painting specifications in Section 09902, at the sole cost and expense of the CONTRACTOR.

**1.17 EQUIPMENT IDENTIFICATION**

- A. All equipment (disconnect switches, separately mounted motor starters, control stations, etc.) furnished under this Section shall be identified by the name of the process, HVAC, etc. equipment it serves. Motor control and switching centers control panels, panelboards, junction or terminal boxes, etc. shall have nameplates as identified on the Drawings.
- B. The identification method shall be laminated plastic nameplates. Nameplates shall be not less than one-sixteenth by three-fourths by two and one-half (1/16" x 3/4" x 2-1/2") inches with three-sixteenths (3/16") inch high white letters on a black background.
- C. Nameplates shall be screw mounted to NEMA 1A enclosures. Nameplates shall be cemented to all other enclosure types using epoxy or other approved adhesive. Where the equipment size does not have space for mounting a nameplate the nameplate shall be cemented to the adjacent mounting surface. Cemented nameplates shall not be drilled.



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**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

Not used.

**END OF SECTION**

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ELECTRICAL - GENERAL PROVISIONS**

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**SECTION 16110  
RACEWAYS, BOXES, AND FITTINGS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The CONTRACTOR shall furnish all materials and labor, tools, plant, and equipment required to furnish and install complete raceway systems as required by the contract documents and required by the work to be done.

**1.02 SUBMITTALS**

- A. The Contractor shall submit samples of each type of conduit he proposes to use for raceways to the OWNER for approval, in accordance with the requirements of Section 01300. No materials shall be ordered or fabricated until samples have been approved by the OWNER.

**1.03 REFERENCE STANDARDS**

- A. American Society for Testing and Materials (ASTM).
  - 1. ASTM E814-83 - Standard Test Methods for Fire Tests of Through-Penetration Fire Stops.
- B. National Electrical Code (NEC), 1996 Edition.
- C. Underwriters Laboratory (UL).
  - 1. UL - 1479.

**1.04 RACEWAY APPLICATIONS**

- A. Except where otherwise shown on the Drawings or specified, all wiring shall be furnished and installed in rigid steel conduit.

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- B. PVC coated rigid steel conduit shall be furnished and installed as a transition section where concrete embedded conduit stubs out of floor slabs, concrete walls, or where shown on the Drawings.
- C. PVC conduit shall be furnished and installed for concrete encased underground duct banks.
- D. All conduit of a given type shall be the product of one (1) MANUFACTURER.

**1.05 BOX APPLICATIONS**

- A. All boxes shall be metal, unless otherwise specified hereinafter, or shown otherwise on the Drawings.
- B. Exposed switch, receptacle, and lighting outlet boxes and conduit fittings shall be cast or malleable iron, except where otherwise shown on the Drawings.
- C. Concealed switch, receptacle, and lighting outlet boxes shall be pressed steel.
- D. Terminal boxes, junction boxes, and pull boxes shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.

**1.06 FITTINGS APPLICATIONS**

- A. Combination expansion-deflection fittings shall be furnished and installed where conduits cross structure expansion joints and/or where shown on the Drawings. Refer to Structural Drawings for expansion joint locations.
- B. Conduit wall seals shall be furnished and installed where underground conduits penetrate walls, or at other locations shown on the Drawings.
- C. Conduit sealing bushings shall be furnished and installed to seal conduit ends exposed to the weather, and at other locations shown on the Drawings.



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**PART 2 - PRODUCTS**

**2.01 MATERIALS**

**A. Rigid metal conduit**

1. Rigid metal conduit shall conform to the requirements of NEC Article 346.
2. Rigid steel conduit, shall be hot-dipped galvanized after threading and shall be as manufactured by the Carnegie Conduit Co.; Wheatland Tube Co.; Triangle PWC Inc.; or approved equal.
3. PVC coated rigid steel conduit shall have a forty-thousandths (0.040") inch thick, polyvinyl chloride coating permanently bonded to hot-dipped galvanized steel conduit and an internal urethane coating, and shall be "Plasti-Bond Red" as manufactured by Robroy Industries; Triangle PWC Inc.; Perma-Cote Industries; or approved equal.

**B. Rigid nonmetallic conduit**

1. Rigid nonmetallic conduit shall conform to the requirements of NEC Article 347.
2. PVC conduit shall be rigid polyvinyl chloride Schedule 40, unless otherwise shown on the Drawings, as manufactured by Carlon, an Indian Head Co.; Kraloy Products Co., Inc.; Highland Plastics Inc.; or approved equal.

**C. Liquidtight flexible metal conduit and fittings**

1. Liquidtight flexible metal conduit shall conform to the requirements of NEC Article 351A.
2. Liquidtight flexible metal conduit shall be Sealtite, Type UA, manufactured by the Anaconda Metal Hose Div., Anaconda American Brass Co.; American Flexible Conduit Co., Inc.; Universal Metal Hose Co.; or approved equal.



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3. Fittings used with liquidtight flexible metal conduit shall be of the screw-in type as manufactured by the Thomas and Betts Co.; Crouse-Hinds Co.; or approved equal.

**D. Flexible couplings**

1. Flexible couplings shall be as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; Killark Electric Manufacturing Co.; or approved equal.

**E. Flexible metallic tubing**

1. Flexible metallic tubing shall conform to the requirements of NEC Article 349.
2. Flexible metallic tubing shall be hot-dipped galvanized steel strips shaped into interlocking convolutions firmly joined to one another ensuring a complete lock similar to Tristeel as manufactured by Triangle - PWC, Inc. or approved equal.
3. Flexible metallic tubing shall be furnished and installed indoors only, for connection to lighting fixtures in NEMA 1 administration and office areas.
4. Furnish and install insulated bushings at terminations for conductor protection.

**F. Boxes and fittings**

1. Pressed steel switch and outlet boxes shall be hot-dipped galvanized as manufactured by the Raco Manufacturing Co.; Adalet Co.; O-Z/Gedney Electric Co.; or approved equal.
2. NEMA 1 terminal boxes, junction boxes, pull boxes etc., shall be sheet steel unless shown otherwise on the Drawings. Boxes shall be galvanized and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall be not less than 14 gauge metal and covers shall be not less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel screws. Terminal boxes shall be furnished with

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hinged doors, terminal mounting straps, and brackets. Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; ASCO Electrical Products Co., Inc.; or approved equal.

- 3 NEMA 4 terminal boxes, junction boxes, pull boxes, etc., shall be sheet stainless steel unless shown otherwise on the Drawings. Boxes shall have continuously welded seams. Welds shall be ground smooth. Boxes shall be flanged and shall not have holes or knockouts. Box bodies shall be not less than 14 gauge metal and covers shall be not less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel clamps. Terminal boxes shall be furnished with hinged doors, terminal mounting straps, and brackets. Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; ASCO Electrical Products Co., Inc.; or approved equal.
4. NEMA 4X terminal boxes, junction boxes, and pull boxes shall be fiberglass reinforced plastic with stainless steel hardware and gasketed covers. Terminal boxes shall be furnished with hinged doors, terminal mounting straps, and brackets. Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; ASCO Electrical Products Co., Inc.; or approved equal.
5. All boxes and fittings used with PVC coated conduit shall be furnished with a PVC coating bonded to the metal, the same thickness as used on the coated steel conduit.
6. Cast or malleable iron device boxes shall be Type FD. All cast or malleable iron boxes and fittings shall have cadmium-zinc finish with cast covers and stainless steel screws as manufactured by the Crouse - Hinds Co. or approved equal.
7. Boxes installed in floor slabs shall have a checkered brass cover, set flush with the finished floor.
8. Steel elbows and couplings shall be hot-dipped galvanized. Elbows and couplings used with PVC coated conduit shall be furnished with a PVC coating bonded to the steel, the same thickness as used on the coated steel conduit.





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9. Conduit hubs shall be as manufactured by Myers Electric Products, Inc.; Raco Inc.; Appleton Electric Co.; or approved equal.
10. Conduit wall seals for new concrete walls below grade shall be O-Z/Gedney Co. Type WSK; Spring City Electrical Manufacturing Co. Type WDP; or approved equal.
11. Conduit wall seals for cored holes shall be type CSML as manufactured by the O-Z/Gedney Co. or approved equal.
12. Conduit wall and floor seals for sleeved openings shall be type CSMI as manufactured by the O-Z/Gedney Co.; Spring City Electrical Mfg. Co.; or approved equal.
13. Combination expansion-deflection fittings shall be Type XD as manufactured by the Crouse-Hinds Co.; O-Z/Gedney Co.; Spring City Electrical Mfg. Co.; or approved equal.
14. Conduit sealing bushings shall be O-Z/Gedney Type CSB or approved equal.

**G. Conduit mounting equipment**

1. In dry indoor areas, hangers, rods, backplates, beam clamps, channel, etc. shall be hot-dipped galvanized iron or steel.
2. PVC coated channel or fiberglass channel, and stainless steel hardware shall be furnished and installed in wet and corrosive areas and in outdoor locations. Fiberglass channel shall be resistant to the chemicals present in the area in which it is used.

**H. Wall and floor slab opening seals**

1. Wall and floor slab openings shall be sealed with "FLAME-SAFE", per ASTM E814 and UL-1479, as manufactured by the Thomas and Betts Corp.; Neer Mfg. Co.; Specified Technologies, Inc.; or approved equal.



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**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. No conduit smaller than three-fourths (3/4") inch diameter electrical trade size shall be used, nor shall any conduit have more than three (3) ninety (90°) degree bends in any one (1) run. Pull boxes shall be furnished and installed as required or directed.
- B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.
- C. The ends of all conduits shall be capped or plugged tightly to exclude dust and moisture while the buildings are under construction.
- D. Conduit supports, other than for underground raceways, shall be spaced at intervals of eight (8') feet or less, as required to obtain rigid construction.
- E. Single conduits shall be supported, by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than three-eighths (3/8") inch diameter. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a minimum of one-half (1/2") inch clearance between wall and equipment.
- F. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot or continuous slot type shall be furnished and installed.
- G. All conduit shall be run as straight and direct as possible, in order to reduce the number of bends.
- H. Unless otherwise specified on the contract drawings, conduit and raceway shall be run exposed.

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- I. All conduits on exposed work shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.
- J. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.
- K. Conduit terminating in gasketed enclosures, NEMA 3R, 4, 4X, and 12 enclosures, shall be terminated with conduit hubs.
- L. Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat grounding bushings.
- M. Conduits shall be installed using threaded fittings.
- N. Liquidtight flexible metal conduit shall be furnished and installed for all motor terminations, the primary and secondary of transformers, generators, and other equipment where vibration is present.
- O. Where conduits pass through openings in walls or floor slabs, the remaining open area shall be sealed against the passage of flame and smoke.
- P. Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.
- Q. Flexible metallic conduit shall be furnished and installed to connect recessed fluorescent fixtures in hung ceilings to the conduit system.
- R. Where no type or size is indicated for junction boxes, pull boxes, or terminal cabinets, they shall be sized in accordance with the requirements of NEC Article 370.
- S. Miscellaneous steel for the support of fixtures, boxes, transformers, starters, contactors, panels, and conduit shall be furnished and installed.
- T. Steel channels, flat iron, and channel iron shall be furnished and installed for the support of all electrical equipment and devices, where required, including all anchors, inserts, bolts, nuts, washers, etc. for a rigid installation.



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- U. Conduits shall not cross pipe shafts, access hatches, or vent duct openings. They shall be routed to avoid such present or future openings in floor or ceiling construction.
- V. Running threads shall not be used. Where such threads are approved, a three (3) piece union shall be used.
- W. Conduits passing from heated to unheated spaces, shall be sealed with "Duxseal" as manufactured by Manville or approved equal, to prevent the accumulation of condensation.
- X. Conduits shall be located a minimum of three (3") inches from steam or hot water piping. Where crossings are unavoidable, the conduit shall be kept at least one (1") inch from the covering of the pipe crossed.
- Y. All conduit entering or leaving a switching center, motor control center, or other multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other MANUFACTURER designated area, directly below the vertical section in which the conductors are to be terminated.
- Z. Conduits noted as spare shall be capped or plugged at both ends with easily removable fittings.
- AA. Mandrels shall be pulled through all new conduits two (2") inches in diameter and larger, prior to installing conductors.
- BB. A three-sixteenths (3/16") inch polypropylene pull line shall be furnished and installed in all conduits noted as spares or designated for future equipment.

END OF SECTION

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**SECTION 16120  
WIRES AND CABLES**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The CONTRACTOR shall furnish all materials and labor, tools, plant, and equipment required to furnish, install, and test all wire, cable, and appurtenances as required by the contract documents and required by the work to be done.

**1.02 SUBMITTALS**

- A. Samples of proposed wire shall be submitted to the OWNER, in accordance with Section 01300, for approval. Each sample shall have the size, type of insulation, and voltage stencilled on the jacket.
- B. Approved samples will be sent to the project location for comparison by the Resident OWNER with the wire actually installed.
- C. Installed, unapproved wire shall be removed and replaced at no additional cost to the OWNER.

**1.03 REFERENCE STANDARDS**

- A. National Electrical Code (NEC), 1996 Edition
- B. Underwriters Laboratory (UL)

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Wires and cables shall be of annealed, ninety-eight (98%) percent conductivity, soft drawn copper.
- B. All conductors shall be stranded, except for lighting and receptacle wiring may be solid.

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- C. Wire for lighting, receptacles, and other circuits not exceeding one hundred and fifty (150V) volts to ground in dry and damp locations shall be NEC type THHN/THWN.
- D. Wire for circuits not exceeding one hundred and fifty (150V) volts to ground in wet locations and for circuits over one hundred and fifty (150V) volts to ground shall be NEC type XHHW.
- E. Wire for single conductor one hundred and twenty (120) volt control circuits shall be NEC type THHN/THWN or XHHW, stranded.
- F. Multi-conductor analog signal cables, designated as STSP for single twisted shielded pairs on the Drawings shall consist of insulated and individually shielded twisted pair(s), stranded and tinned copper conductors with drain wire and PVC jacket. Conductor size and number of pairs shall be as shown on the Drawings.
- G. Equipment grounding conductors installed in raceways shall be green color coded. Grounding electrode conductors shall be uninsulated, tinned copper, unless shown otherwise on the Drawings.
- H. Except for control, signal, and instrumentation circuits, wire smaller than No. 12 AWG shall not be used.

**2.02 600 VOLT OR LESS WIRE AND CABLE**

- A. Types THHN/THWN and XHHW wire shall be as manufactured by the American Insulated Wire Co.; Cablec Corporation; Pirelli Cable Corp.; or approved equal.
- B. Multi-conductor control and signal cables shall be as specified hereinbefore in paragraph 2.01, and shall have a six hundred (600) volt polyvinyl chloride conductor insulation with a nylon jacket over insulation, and a polyvinyl chloride overall jacket. The cables shall be rated for a ninety (90°C) degrees Centigrade (194°F) temperature rise, Type TC, U.L. approved, and shall be as manufactured by Alpha Wire Corporation; Belden Corp., or approved equal.

**2.03 CABLE COLOR CODING**

- A. A different color cable shall be used for each phase of a three (3) phase circuit: for two hundred and eight/one hundred and twenty (208/120) volts - red for phase "A", blue for phase "B", black for phase "C", white for the neutral, and

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green for the ground wire; for four hundred and eighty/two hundred and seventy-seven (480/277) volts brown for phase "A", orange for phase "B", yellow for phase "C", white for the neutral, and green for the ground wire. This color code shall follow throughout the entire system for lighting and power wiring.

**2.04 600 VOLT WIRE SPLICES AND TERMINATIONS**

- A. Six hundred (600) volt wire splices shall be made with copper mechanical or compression connectors.
- B. Six hundred (600) volt wire splice insulators shall be PST Cold Shrink as manufactured by the 3M Co. or approved equal.
- C. Six hundred (600) volt wire lugs shall be tin plated copper, long barrel compression type for wire sizes #8 AWG and larger. Lugs for #10 AWG and smaller wire shall be locking spade type with insulated sleeve. Lugs shall be as manufactured by the Thomas and Betts Co. or approved equal.

**2.05 15000 VOLT CABLE**

- A. Fifteen thousand (15,000V) volt cable shall be copper four twisted conductor consisting of three (3) fifteen (15KV) kilovolt cables, high temperature, double permashield, semiconductor tape, solid tinned copper concentric wires and PVC jacket and six hundred (600V) volt rated insulation, PVC jacketed ground conductor.
- B. The cables shall be Kerite Cable Company Catalog Number 150C15-59430 (for 500 Kcmil cables) and Catalog Number 121C15-594 (for 2/0 AWG cables). No substitution will be permitted.
- C. The cables shall be supplied on returnable reels. The reels shall have reel numbers and footage notes.
- D. The fifteen (15) KV cables MANUFACTURER'S warranty shall be extended to the life of the plant.



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**2.06 15000 VOLT CABLE TERMINATIONS**

- A. Terminations shall be preformed stress cones. Stress cones shall be Type 35 MSC as manufactured by Elastimold or approved equal.
- B. Outdoor terminations shall be Type 16 THG as manufactured by Elastimold or approved equal.

**2.07 15000 VOLT CABLE SPLICES**

- A. Splices shall be universal splicing system, straight, or wye. Splices shall be suitable for manhole or direct-burial installation, and shall be rated for the cable current carrying capacity.
- B. Splices shall be CE-CE or CE-CE-CE type where indicated on the contract drawings and shall be as manufactured by G & W Electric Company. No substitution will be permitted.

**2.08 WIRE AND CABLE MARKERS**

- A. Wire and cable markers shall be "Omni-Grip" as manufactured by the W.H. Brady Co.; Thomas & Betts Co.; 3M Co.; or approved equal.
- B. Wire and cables with diameters exceeding the capacity of the "Omni-Grip" shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by the W.H. Brady Co.; Panduit Corp.; or approved equal.

**2.09 FIRE-PROOFING TAPE**

- A. Fire-proofing tape shall be Scotch No. 77 with Scotch No. 27 binding, all as manufactured by 3M Co. or approved equal.

**2.10 DIRECT BURIED CABLE WARNING TAPE**

- A. Tape shall be as specified in Part 2 of SECTION 16600.

**2.11 WALL AND FLOOR SLAB OPENING SEALS**

- A. Wall and floor slab openings shall be sealed with "FLAME-SAFE" as manufactured by the Thomas and Betts Corp. or approved equal.

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WIRES AND CABLES**

Revised: 2/23/96





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**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. All conductors shall be handled carefully to avoid kinks or damage to insulation.
- B. All wires, cables, and each phase of three (3) phase power circuits (except lighting and receptacle wiring) shall be identified uniquely at each end and in manholes, handholes, junction and pull boxes, with wire and cable markers. Each cable marker shall bear the number of the corresponding circuit or instrumentation loop and shall agree with the as-built record Drawings.
- C. Lubrications shall be used to facilitate wire pulling. Lubricants shall be as recommended by Kerite Cable Company and shall be U.L. approved for use with the insulation specified.
- D. Shielded control and signal cables shall be installed from terminal to terminal with no splicing at any intermediate point.
- E. Fire-proof fifteen (15 KV) kilovolt cables exposed in manholes, vaults, pull boxes, switchgear, and other areas where cables are not protected by conduit. Use fire-proofing tape and glass tape in accordance with the instructions of the manufacturer. Fire-proofing methods will not use asbestos tapes.
- F. Openings in slabs and walls through which wires and cables pass shall be sealed.
- G. Splices shall not be made to utilize short, left over lengths of cable nor shall they be made to provide correct lengths on cable initially cut too short for a particular circuit. Shields may be spliced only where necessary to permit connections to the station ground.
- H. Splices in power conductors shall be made with compression type connectors. Splices in control or signal conductors shall be made with compression type ring tongue terminal lugs. The ring tongue terminal lugs shall be connected using bolts, tooth lock washers, and hex nuts of copper or copper bearing metal. Splices in lighting conductors smaller than #8 AWG shall be made with twist type insulated spring connectors. Splices in lighting conductors #8 AWG and larger shall be made with compression type connectors, bolted compression type ring tongue terminal lugs, or bolted cast ring tongue terminal lugs.

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WIRES AND CABLES**

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- I. Wiring devices shall not be used as splices. Receptacles or looping wiring shall be wired with pigtails (phase line, neutral, and grounding wire) to allow replacement or removal without opening circuit.
- J. That portion of control and instrument leads between conduit ends and terminal blocks located in switchboards, control panels, cabinets, and similar locations shall be laced together neatly with non-releasing nylon ties.
- K. All spare and signal conductors shall be left at their maximum length for possible use as replacements. Each spare conductor shall be neatly coiled and then taped to the conductors being used.
- L. The crimping hand tools used in securing the conductor in the compression type connectors or terminal lugs shall be those made for that purpose and for the conductor sizes involved. The crimping tools shall be of the ratchet type which prevents the tool from opening until the crimp action is completed. Such tools shall be a product of the connector MANUFACTURER.
- M. Cable placement
  - 1. Immediately prior to the placement of each cable or cable group, the raceway route to be followed shall be inspected and ascertained to be complete in installation and free of all materials detrimental to the cable or its placement. All cable assigned to a particular duct or conduit shall be grouped and pulled in simultaneously, using cable grips and approved lubricants.
  - 2. If at any time during the progress of the work, raceways appear inadequate to accommodate the assigned cable, notify the OWNER at once and discontinue any further work on the questionable raceway until advised by the OWNER as to how to proceed.
  - 3. All cable shall be carefully checked both as to size and length before being pulled into conduits or ducts. Cable pulled into the wrong conduit or duct or cut too short to rack, train, and splice as specified herein, shall be removed and replaced at the sole cost and expense of the Contractor. Cable removed from one (1) conduit or duct shall not be pulled into another conduit or duct without approval of the OWNER.

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- N. Connectors for lighting fixtures from branch circuit wiring shall be either pressure indent type with an insulating cover or of the pre-insulated, permanent pressure, electrical spring connector type encased in a metal housing with insulating cover, Scotchlock Type "R" by 3M Co.; Buchanan Electric Products; or approved equal.
- O. All motor connections shall be made with ring type mechanical compression terminations installed on both the branch circuit wires and the motor leads and secured with suitable size bolt, nut, and springwasher. Insulation of the termination shall be a heat shrink boot especially made for motor termination use. The termination kits shall be Raychem; MCK; or approved equal (wire nuts, split bolts, etc. shall not be used).

**3.01 TESTS**

- A. All wire and cable insulation shall be tested with a megohm meter after installation. Tests shall be made in accordance with ANSI, NEMA, and ICEA standards.
- B. The OWNER will witness these tests. These data shall be submitted to the OWNER for review even though the tests are witnessed. All cables, coolant oil, and equipment not passing this test shall be replaced by the CONTRACTOR at his own cost and expense.

**END OF SECTION**

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**16120-7  
WIRES AND CABLES**

Revised: 2/23/96



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**SECTION 16191  
MISCELLANEOUS EQUIPMENT**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all materials and labor, tools, plant, and equipment required to furnish and install all miscellaneous equipment as required by the contract documents and required by the work to be done.

**1.02 APPLICATIONS**

- A. Equipment enclosures shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.
- B. All motor starters shall be adequately sized to operate within the mid-range of the rated load at the required design capacities.

**1.03 SUBMITTALS**

- A. Copies of all materials required to establish compliance with these Specifications shall be submitted to the OWNER in accordance with Section 01300. Submittals shall include, as a minimum, the following:
  - 1. Certified shop and erection drawings showing materials, details of construction, dimensions, and anchor bolt locations.
  - 2. Descriptive literature, bulletins, and catalogs of the new equipment.
  - 3. A complete bill of materials for all equipment.
- B. Submit the Certificate of Installation of the equipment MANUFACTURER in accordance with Section 01300.
- C. Submit operating and maintenance data manuals in accordance with Section 01300.



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- D. Submit equipment warranty of the MANUFACTURER as specified in Section 01012.

**1.04 REFERENCE STANDARDS**

- A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE).
  - 1. ANSI/IEEE C57.12.91-1979 - Test Code for Dry-Type Distribution and Power Transformers.
- B. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA).
  - 1. ANSI/NEMA ST20-1992 - Dry Type Transformers for General Applications.
- C. National Equipment Testing Agency (NETA).
  - 1. NETA AT5-1987.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Disconnect Switches
  - 1. Disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, six hundred (600) volt, three (3) pole with full cover interlock.
  - 2. NEMA 4 enclosures shall be stainless steel.
  - 3. NEMA 4X enclosures shall be fiberglass reinforced polyester, unless otherwise shown on the drawings.
  - 4. Switches shall be as manufactured by General Electric; Cutler-Hammer; Square D Co.; or approved equal.



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**B. Manual Motor Starters**

1. Manual starters shall be suitable for the voltage and number of phases shown on the Drawings and shall be of type shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. Manual starters shall have motor overload protection in each phase.
2. NEMA 4 enclosures shall be stainless steel.
3. NEMA 4X enclosures shall be fiberglass reinforced polyester, unless otherwise shown on the drawings.
4. Manual motor starters shall be as manufactured by Allen-Bradley. No substitution will be permitted.

**C. Magnetic Motor Starters**

1. Motor starters shall be two or three (2 or 3) pole, one or three (1 or 3) phase as required, sixty (60) hertz, six hundred (600) volt, magnetically operated, full voltage, non-reversing, single-speed, unless as shown otherwise on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings.
2. Each motor starter shall have a one hundred and twenty (120) volt operating coil, and control power transformer where required. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be furnished and installed as shown on the Drawings. A minimum of one (1) normally open and one (1) normally closed auxiliary contacts shall be furnished and installed in addition to the contacts shown on the Drawings.
3. Overload relays shall be adjustable and manually reset.
4. Control power transformers shall be sized for additional load where required. Transformer primaries and secondaries shall be equipped with time-delay fuses.



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5. Built-in control stations and push-to-test, low voltage, transformer operated indicating lights shall be furnished in all AC control circuits.
6. NEMA 4 enclosures shall be stainless steel.
7. NEMA 4X enclosures shall be fiberglass reinforced polyester, unless otherwise shown on the drawings.
8. Magnetic motor starters shall be as manufactured by Allen-Bradley. No substitution will be permitted.

**D. Combination Magnetic Motor Starters**

1. Motor starters shall be a combination motor circuit protector and contactor, two or three (2 or 3) pole, one or three (1 or 3) phase as required, sixty (60) hertz, six hundred (600) volt, magnetically operated, full voltage, non-reversing, single-speed, unless shown otherwise on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be designed specifically for use with magnetic motor starters. Motor circuit protectors shall be current limiting type, with additional current limiters if required. Disconnect handles shall be lockable in the OPEN position and shall have operating mechanisms mounted on the fixed portion of the enclosure. Door-mounted mechanisms shall not be used.
2. Each motor starter shall have a one hundred and twenty (120) volt operating coil and control power transformer where required. Three (3) phase starters shall have three (3) overload relays. One (1) normally open and one (1) normally closed auxiliary contact shall be furnished and installed as spares for each starter in addition to contacts shown on the Drawings. When the number of contacts required exceeds the auxiliary contact capability of the starter, a control relay shall be wired in parallel with the starter coil to derive the additional contacts. Control relay shall be as specified herein and installed within the starter enclosure.
3. Overload relays shall be adjustable and manually reset.



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4. Overload relays for submersible pump motors shall be ambient compensated, "quick-trip", class 10.
5. Built-in control stations and push-to-test, low voltage, transformer operated, indicating lights shall be furnished where shown on the Drawings.
6. NEMA 4 enclosures shall be stainless steel.
7. NEMA 4X enclosures shall be fiberglass reinforced polyester, unless otherwise shown on the drawings.
8. Combination magnetic motor starters shall be as manufactured by Allen-Bradley. No substitution will be permitted.

**E. Control Stations**

1. Control stations shall be heavy-duty type, with full size operators.
2. NEMA 4 enclosures shall be stainless steel.
3. NEMA 4X enclosures shall be fiberglass reinforced polyester, unless otherwise shown on the drawings.
4. Control stations shall be Bulletin 800 as manufactured by Allen-Bradley. No substitution will be permitted.

**F. General Purpose Dry Type Transformers**

1. Transformers shall be dry type, two (2) copper winding and copper bus bar, common core with KVA and voltage ratings as shown on the Drawings. Cores shall be constructed from steel with low hysteresis and eddy current losses. Core flux density shall be well below the saturation point to prevent core overheating caused by harmonic voltage distortion.
2. Four (4) full capacity taps shall be furnished, two and one-half (2-1/2%) percent above and two and one-half (2-1/2%) percent below rated primary voltage.





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3. Maximum temperature rise shall be one hundred and fifteen (115°C) degrees Centigrade. Windings shall be copper. Secondary neutral terminal shall be sized for two hundred (200%) percent of the secondary phase current.
4. Transformers shall be built in accordance with ANSI/IEEE C57.12.91 and ANSI/NEMA ST-20.
5. Transformers shall be furnished and installed with mounting hardware.
6. Transformers shall be type NL as manufactured by the Square D Co.; GE; or approved equal.
7. The maximum temperature hot spot temperature shall not exceed two hundred and twenty (220° C) degrees Centigrade for a K-factor of four (4) as defined per ANSI/IEEE C57.110.

**G. Lightning Arrester and Surge Capacitor**

1. Lightning arrester shall be six hundred and fifty (650) volt, three (3) phase, "Tranquell" type, General Electric Co. Catalog No. 9L15ECC001 or approved equal.
2. Surge capacitor shall be six hundred and fifty (650) volt, three (3) phase, non-toxic liquid insulated, General Electric Company Catalog No. 9L18BAB301 or approved equal.

**H. Wireway**

1. NEMA 1 wireway shall be painted steel with screw covers.
2. NEMA 4 wireway shall be stainless steel with gasketed clamped covers.
3. NEMA 4X wireway shall be fiberglass with gasketed screw covers and stainless steel screws.
4. Wireway shall be as manufactured by Hoffman Engineering Co. or approved equal.



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**I. Control Relays**

1. Control relays shall be heavy duty machine tool type, with ten (10) ampere, three hundred (300) volt convertible contacts. General use relays shall be General Electric Co. Cat. No. CR120A; Allen-Bradley Co.; or approved equal. Latching relays shall be General Electric Co. CR120C; Allen-Bradley Co.; or approved equal.
2. Time delay relays shall be pneumatic, six hundred (600) volt, twenty (20) ampere contacts, with calibrated knob operated adjustment. On delay and off delay types and timing ranges shall be as shown on the Drawings. Relays shall be Agastat Model 7012 or 7022; Allen-Bradley Co.; or approved equal.

**J. Warning Tape**

1. Warning tape shall be as specified in Part 2 of Section 16600.

**K. Terminal Blocks**

1. Terminal blocks shall be six hundred (600) volt, channel mounted, with tubular screw and pressure plate.
2. Terminal blocks shall be Bulletin 1492 as manufactured by the Allen-Bradley Co. or approved equal.

**L. Combination Solid State Motor Controller**

1. Combination solid state motor controllers shall include circuit breakers and microcomputer controlled heavy duty SMC PLUS controllers rated for four hundred and fifty (450%) percent full load amperes for thirty (30) seconds.
2. The unit shall be provided with the following features:
  - a. Overload protection.



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- b. **Start/Stop Modes:** soft start with kick start; current limit; full voltage; soft stop.
  - c. **HAND-OFF-AUTO selector switch.**
  - d. **Start/Stop pushbuttons.**
  - e. **ON-OFF pilot lights.**
  - f. **Line side protective module providing phase loss, undervoltage and phase sequence protection.**
  - g. **Control circuit transformer.**
3. The unit shall be Allen-Bradley Bulletin 150 smart motor controller housed in NEMA Type 12 enclosure. No substitution will be permitted.

**M. Circuit Breakers**

1. Where individual circuit breakers are indicated on the drawings, they shall be three (3) pole, molded case, ampere rating as indicated with a minimum short circuit rating of twenty-two thousand (22,000) symmetrical amperes, in a surface-mounted enclosure with handle-thru-cover, provisions for padlocking in the OFF position, and necessary line and load lugs.
2. NEMA 4 enclosure shall be stainless steel.
3. NEMA 4X enclosure shall be fiberglass reinforced polyester, unless otherwise shown on the drawings.
4. Breakers shall be wall-mounted four feet six inches (4'-6") above finished floor (to handle) unless otherwise noted.
5. Engraved plastic nameplates shall be furnished and installed on each circuit breaker.
6. Short-circuit interrupting capacity shall be the same as specified for panelboard circuit breakers on the same system.



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7. Breaker manufacturer shall be General Electric; Cutler-Hammer; or approved equal.
- N. Pushbuttons, Selector Switches, and Indicating Lights
1. Pushbuttons and selector switches shall be oil-tight, maintained or momentary contact, as shown on the drawings.
  2. Indicating lights shall be transformer type with push-to-test feature and lens color as shown on the drawings. Exception: in DC circuits, indicating lights shall be the resistance type.
  3. Pushbuttons, selector switches, and indicating lights shall be bulletin 800H as manufactured by Allen-Bradley Company; General Electric; or approved equal.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Floor-mounted equipment shall be levelled and anchored directly to a concrete equipment pad or finished floor as shown on the Drawings. Furnish hardware and metal shims for installation. Grout and caulk all voids beneath the equipment base. Anchor bolts shall be one-half ( $\frac{1}{2}$ " ) inch galvanized steel.
- B. Mount boxes for surface mounted equipment so there shall be at least one-half ( $\frac{1}{2}$ " ) inch air space between the box and the wall.
- C. Install all equipment in accordance with the instructions of MANUFACTURER.
- D. Remove temporary lifting angles, lugs, and shipping braces. Touch-up damaged paint finishes.



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**3.02 FIELD TESTING**

- A. The CONTRACTOR shall engage the services of a recognized independent testing firm, approved by the OWNER, to inspect and test the installed equipment prior to energization. The testing firm shall furnish all material, labor, equipment, and technical supervision to perform the tests and inspection. Notify the OWNER at least two (2) weeks prior to scheduling any testing.**
- B. Equipment testing and inspection shall be performed in accordance with NETA Standard AT5-1987 and shall include the following as a minimum:**
- 1. Visual and mechanical inspection.**
  - 2. Ground resistance test.**
  - 3. Insulation resistance tests.**
  - 4. Over-potential test (switches).**
  - 5. Insulation resistance test for surge arresters.**
  - 6. Manual operation of motor starters.**
  - 7. Checking of indicating lights and selector switches, overload relays, and operation of all accessories to verify a complete, satisfactory operating unit.**
- C. In the event of an equipment fault, notify the OWNER immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the CONTRACTOR, the OWNER, and the factory service technician of the equipment MANUFACTURER. At his sole cost and expense, the CONTRACTOR shall repair or replace the equipment as directed by the OWNER prior to placing the equipment back into service.**



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**3.03 ADJUSTMENT**

- A. Make all adjustments necessary for proper operation.

**3.04 CLEANING**

- A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum clean, or clean with lint-free rags. Do not use compressed air.

**3.05 START-UP AND TEMPORARY OPERATION**

- A. The CONTRACTOR shall properly maintain and service all equipment and systems until the particular equipment or the system has been approved by the OWNER.
- B. This maintenance shall include compliance with the operating and maintenance instructions of the MANUFACTURER as well as periodic checking and cleaning, the lubrication of moving parts, and all required adjustments.
- C. Records of all maintenance and lubrication work performed by the CONTRACTOR shall be maintained at the construction or installation site and be available at all times for a review by the OWNER or OWNER. Copies of these records shall be submitted to the OWNER for information and/or review.

**3.06 PAINTING**

- A. Unless otherwise specified in this Section of the Specifications, all machinery, factory finished equipment, and other items of manufacture shall have a factory applied finish, color as standard with the MANUFACTURER or a hot-dipped galvanized finish. All supporting steel, hangers, rods, and all other uncoated or non-galvanized steel shall have a shop coat consisting of a suitable primer and finish coat. If not factory applied the prime coat shall be one of the zinc chromate or red lead-iron oxide oil vehicle primers listed in the Painting Sections of the Specification. All items not factory or shop primed prior to installation shall be suitably cleaned of rust and mill scale by wire brushing, sanding, or other means, and prime painted, immediately after installation.



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- B. The CONTRACTOR shall be responsible for the repair of all defects, blemishes, and the like apparent in coatings of the MANUFACTURER and shall ensure that materials used for such repair shall match or be compatible with the standard color, coatings, and practices of the MANUFACTURER. Care shall be taken not to paint over name plates.

**END OF SECTION**

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MISCELLANEOUS EQUIPMENT**

Revised: 3/5/96



**GROUNDWATER INTERIM REMEDIAL MEASURE  
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**SECTION 16432  
PAD MOUNTED OIL FILLED TRANSFORMERS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all materials and labor, tools, plant, and equipment required to furnish and install the outdoor, liquid filled, pad mounted transformers as required by the contract documents and required by the work to be done.

**1.02 RELATED WORK**

- A. Concrete equipment pads are included in Division 3.
- B. Excavation and backfill are included in Division 2.

**1.03 SUBMITTALS**

- A. Submit shop drawings and product data to the OWNER, in accordance with Section 01300, as follows:
  - 1. Equipment sectional and plan views, bottom plan showing conduit openings and anchor bolt pattern, bushing arrangement, dimensions, weight, and construction details.
  - 2. Winding and core arrangement, materials, ratings, and insulation details.
  - 3. Transformer diagrammatic nameplate information.
  - 4. Itemized bill of materials for accessories.
  - 5. Certified shop test reports.
  - 6. Field test reports.
  - 7. Installation and maintenance manuals in accordance with Section 01730.





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**1.04 REFERENCE STANDARDS**

- A. Transformers shall be designed, built, and tested in accordance with the latest revision of the following standards:
1. ANSI/IEEE C57.12.00-1980 - Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.
  2. ANSI/IEEE C57.12.90-1980 - Test Code for Liquid Immersed Distribution, Power and Regulating Transformers.
  3. ANSI C57.12.26-1986 - Requirements for Pad-Mounted Compartmental Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 24 940 Grd Y/14 400 Volts and Below; 2500 kVA and Smaller.
  4. ANSI C119.2.
  5. NETA AT5-1987.
  6. Western Underground Committee Guide 2.13 for vandal resistance.
  7. NEMA Standard TR1 - Transformers, Regulators, and Reactors.
  8. IEEE Sta. 462A, B-1978 "Short Circuit Requirements Supplement to ANSI C57.12.00-1973".
  9. ANSI C53.93 - Guide for the Installation and Maintenance of Oil-Immersed Transformers.
  10. ANSI C2 - National Electrical Safety Code.
  11. ANSI C1 - National Electrical Code.
  12. Occupational Safety and Health Administration, (OSHA).
  13. Environmental Protection Agency (EPA).

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- B. Where reference is made to one (1) of the above standards, the revisions in effect at the time of bid opening shall apply.

**1.05 QUALITY ASSURANCE**

- A. The equipment furnished and installed under this Section shall be the product of a MANUFACTURER who has produced the same type of equipment for a period of at least ten (10) consecutive years.
- B. Transformers shall be designed, assembled, and tested by the MANUFACTURER of the core and coil assemblies used in the transformer.

**1.06 SYSTEM DESCRIPTION**

- A. The primary windings of the transformers shall be delta-connected into the existing plant thirteen thousand eight hundred (13,800V) volt distribution system.
- B. The secondary windings of the transformer shall be wye-connected with a solidly grounding neutral to supply four hundred and eighty/two hundred and seventy-seven (480/277V) volt power into a radial distribution feeder.

**1.07 MANUFACTURERS**

- A. Transformers shall be as manufactured by the ABB; Square D Co.; Bulteau Standard; Virginia Transformer Corp.; or Howard Industry.

**PART 2 - PRODUCTS**

**2.01 RATINGS**

- A. The power transformers shall be outdoor, oil-immersed with the self-cooled, fifty-five (55°C) degrees Centigrade rise over forty (40°C) degrees Centigrade ambient rating indicated on the contract drawings.
- B. Winding temperature rise shall not exceed sixty-five (65°C) degrees Centigrade above a thirty (30°C) degree Centigrade average ambient temperature, with a maximum ambient not to exceed forty (40°C) degrees Centigrade, operating at full rated KVA load.

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**PAD MOUNTED OIL FILLED TRANSFORMERS**

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**C. Primary windings shall have the following ratings:**

1. Voltage: Thirteen thousand eight hundred (13,800V) volts, three (3) phase, sixty (60) hertz.
2. Connection: Delta
3. Basic Impulse Level (BIL): 95 KV

**D. Secondary windings shall have the following ratings:**

1. Voltage: Four hundred and eighty/two hundred and seventy-seven (480/277V) volts.
2. Connection: Grounded wye
3. Basic Impulse Level (BIL): Thirty (30) KV

**E. Both primary and secondary windings also shall satisfy the minimum industry standards for low frequency, chopped, and full wave impulse test.**

**F. The transformer rated impedance shall be five and seventy-five hundredths (5.75%) percent, plus or minus seven and five-tenths ( $\pm 7.5\%$ ) percent of rated impedance, as per ANSI Standard C57.12.10.**

**G. Transformers shall be designed to have maximum sound level of sixty-two (62) dB.**

**2.02 CONSTRUCTION**

**A. Transformers shall be compartmental type, liquid filled, self-cooled, tamper resistant, weatherproof, and suitable for outdoor mounting on a concrete pad.**

**B. Transformer tanks shall utilize welded steel construction, sealed to withstand an internal pressure of up to seven and five-tenths (7.5 psi) pounds per square inch without distortion, and top oil temperatures ranging from fifty to one hundred and five (50-105°C) degrees Centigrade. Tank cover shall be designed to permit access to internal components for inspection or repair. Heavy duty, non-removable lifting lugs, and jacking pads shall be provided. Welded cooling panels or radiators shall**

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be furnished and installed on the back and sides of the tank, as required by the heat dissipation requirements of the transformers. The transformer tank to be sealed with a nitrogen head.

- C. The high and low voltage compartments shall be located side by side, separated by a steel barrier. Terminal compartments shall be air filled, with individual doors. The high voltage door fastenings shall not be accessible until the low voltage door has been opened. The low voltage door shall have a three (3) point latching mechanism with vault type handle having provisions for a single padlock. The doors shall be equipped with lift-off type stainless steel hinges, and door stops to hold the doors open when working in the compartments. The front sill of the compartment shall be removable to allow the transformer to be rolled or skidded into position over conduit stubs. ANSI tank grounding provisions shall be furnished and installed in each compartment.
- D. The transformer core and coil assembly shall be baked and oil impregnated under vacuum.
- E. Transformer insulating oil shall be Exxon Univolt 33 Hydrofined (R) oil, or approved equal. Insulating oil shall be free of P.C.B. contamination or any E.P.A. listed toxic chemical. The transformer MANUFACTURER shall test the insulating oil for P.C.B. after filling the tank.
- F. The oil preservation method shall be of the sealed tank system type. The transformer shall be supplied with the necessary oil. The oil supplied shall contain a suitable inhibitor of sufficient quantity to minimize oil breakdown, and sludge and water build-up.
- G. Furnish and install a no-load, externally operated, lockable, five (5) position primary winding tap changer located in the secondary (preferred) or primary terminal compartment. Tap setting shall be clearly visible with the compartment door in the open position. Tap adjustments shall be two (2) two and five-tenths (2.5%) percent above, and two (2) two and five-tenths (2.5%) percent below rated primary voltage.
- H. The transformer core windings, bus bars, terminal pads and wire connections shall be copper.

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**I. Terminations**

1. High voltage bushings shall be porcelain type with 2-hole NEMA terminal pads. Terminal pads shall be copper. Bushings shall be externally clamped to allow external replacement.
2. Low voltage secondary bushings shall be externally clamped, porcelain type with NEMA standard two (2) hole arrangement. Neutral shall be brought out through an insulated bushing and grounded to the tank wall with a removable grounding strap. Terminal pads shall be copper. The transformer housing shall have minimum two (2) grounding pads.

- J. Furnish and install three (3) ten (10 KV) kilovolts distribution class lightning arresters mounted in the high voltage primary compartment for surge protection.

**2.03 ACCESSORIES**

**A. Each transformer shall be furnished and installed with the following accessories:**

1. Stainless steel nameplate in the low voltage compartment.
2. One (1") inch drain valve with sampling device.
3. One (1") inch upper filter press and filling plug.
4. Dial type thermometer with maximum temperature indicator, mounted in a sealed drywell in the low voltage compartment.
5. Pressure-vacuum gauge mounted in the low voltage compartment.
6. Pressure relief valve.
7. Magnetic liquid level gauge located in the low voltage compartment at the twenty-five (25°C) degree Centigrade level mark.
8. Hook stick for the operation of the primary load-break switch.

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**B. Nameplates and Danger Signs**

1. Nameplates shall be furnished and installed on front of each unit door designating its purpose.
2. Nameplates shall be of laminated plastic, black core, white surface, minimum three thirty-seconds (3/32") inch thick, four (4") inches high, and length as required, with black engraved two (2") inch high lettering. Nameplates shall be centered over front of enclosure door with self tapping sheet steel metal screws, adhesive shall not be used.
3. "DANGER HIGH VOLTAGE" signs shall be provided on the high and low voltage compartment doors in compliance with the National Electrical Code.

**2.04 SURFACE PREPARATION AND SHOP COATINGS**

- A. All welds shall be ground smooth and all metal surfaces cleaned of oil, grease, and weld spatter using a hot phosphate chemical treatment. A zinc-rich, heat cured epoxy primer shall be applied to inhibit rust.
- B. The equipment shall receive an intermediate coat of heat cured epoxy finish color, followed by an air dried finish coat of Outdoor Green, Munsell No. 7GY3.29/1.5 or approved equal. After finish painting, all bottom surfaces, and sides up to a minimum of one (1") inch above the ground shall be protected against corrosion by an epoxy tar coating.

**2.05 SHOP TESTING**

- A. Perform manufacturers standard production testing and inspection in accordance with ANSI Test Code C57.12.90 and/or NEMA TR1. Testing shall include the following as a minimum:
  1. Resistance measurements of all windings on the rated voltage connection of each unit and at the tap extremes of one (1) unit only of a given rating on this project.
  2. Ratio tests on the rated voltage connection and on all tap connections.
  3. Polarity and phase-relation tests on the rated voltage connections.

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4. No-load loss at rated voltage on the rated voltage connection.
  5. Exciting current at rated voltage on the rated voltage connection.
  6. Impedance and load loss at rated current on the rated voltage connection of each unit and on the tap extremes of one (1) unit only of a given rating on this project.
  7. Temperature test or tests shall be made on one (1) unit only of a project covering one (1) or more units of given rating. Tests shall not be required when there is available a record of a temperature test on an essentially duplicate unit.
  8. Applied potential test.
  9. Induced potential tests.
  10. Toxic chemical (e.g. P.C.B.) test.
  11. Pressure leak test.
- B. Results of the above tests including no load loss data shall be submitted with final drawings, in the form of certified test reports.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. The equipment shall be leveled and anchored directly to a concrete equipment pad as shown on the Drawings. Furnish and install hardware and metal shims for installation. Anchor bolts shall be one-half (1/2") inch galvanized steel.
- B. Install the equipment in accordance with the instructions of the MANUFACTURER.
- C. Remove temporary packing and shipping braces. Touch-up damaged paint finishes.

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- D. Set the no-load tap-changer for proper secondary voltage: four hundred and eighty (480V) volts phase-to-phase and two hundred and seventy-seven (277V) volts phase-to-neutral.

**3.02 FIELD TESTING**

- A. Engage the services of an independent testing firm, approved by the OWNER, to inspect and test the installed equipment prior to energization. The testing firm shall provide all material, labor, equipment, and technical supervision to perform the tests and inspection. Notify the OWNER at least two (2) weeks prior to scheduling any testing.
- B. Equipment testing and inspection shall be performed in accordance with NETA Standard AT5-1987 and shall include the following:
  - 1. Visual and mechanical inspection.
  - 2. Ground resistance test.
  - 3. Insulation resistance tests, winding-to-winding and winding-to-ground, using a megohmmeter, at nominal tap position with all cables disconnected.
  - 4. Insulation power factor tests or dissipation factor tests on all windings and bushings. Test voltage shall be limited to the line-to-ground voltage rating of the windings.
  - 5. Sample and test insulating liquid for dielectric breakdown voltage, acid neutralization number, specific gravity, interfacial tension, color, and visual condition.
- C. In the event of an equipment fault, notify the OWNER immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the CONTRACTOR, the OWNER, the OWNER, and the factory service technician of the equipment MANUFACTURER. The CONTRACTOR shall repair or replace the equipment, at his sole cost and expense, as directed by the OWNER prior to placing the equipment back into service.

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**3.03 CLEANING**

- A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean lint-free rags. Do not use compressed air.

**END OF SECTION**

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**SECTION 16450  
15KV SWITCHING CENTERS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The CONTRACTOR shall furnish all materials and labor, tools, plant, and equipment required to furnish and install the outdoor, pad mounted switching centers as required by the contract documents and required by the work to be done.
- B. The designations for the switching centers shall be as follows:
  - 1. Switching Center No. 1
  - 2. Switching Center No. 2

**1.02 RELATED WORK**

- A. Concrete equipment pads and pits are included in Division 3.
- B. Excavation and backfill are included in Division 2.

**1.03 SUBMITTALS**

- A. Submit shop drawings and product data to the OWNER, in accordance with Section 01300, as follows:
  - 1. Equipment sectional and plan views, bottom plan showing conduit openings and anchor bolt pattern, bushing arrangement, dimensions, weight, and construction details.
  - 2. Separable connector arrangements, materials, ratings, and insulation details.
  - 3. Diagrammatic nameplate information.
  - 4. Itemized bill of materials for accessories.
  - 5. Certified shop test reports.

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6. Field test reports.
7. Installation and maintenance manuals in accordance with Section 01730.

**1.04 REFERENCE STANDARDS**

- A. Switching centers shall be designed, built, and tested in accordance with the latest revision of the following standards:
  1. ANSI C37.72 - Manually-operated, deadfront pad mounted switchgear with load interrupting switches and separable connectors for alternating current system.
  2. ANSI/IEEE 386.1985.
  3. NETA 1995.
  4. Western Underground Committee Guide 2.13 for vandal resistance.
  5. IEEE Sta. 462A, B-1978 "Short Circuit Requirements Supplement to ANSI C57.12.00-1973".
  6. ANSI C2 - National Electrical Safety Code.
  7. ANSI C1 - National Electrical Code.
  8. Occupational Safety and Health Administration, (OSHA).
  9. Environmental Protection Agency (EPA).
- B. Where reference is made to one (1) of the above standards, the revisions in effect at the time of bid opening shall apply.

**1.05 QUALITY ASSURANCE**

- A. The equipment furnished and installed under this Section shall be the product of a MANUFACTURER who has produced the same type of equipment for a period of at least ten (10) consecutive years.

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- B. The complete units shall be assembled and tested by the MANUFACTURER of the switching centers.

**1.06 SYSTEM DESCRIPTION**

- A. The switching centers shall be deadfront design and vacuum-in-oil construction.
- B. The units shall provide energy limiting overcurrent protection where shown on the drawings and required by the contract documents.

**1.07 MAINTENANCE**

- A. The CONTRACTOR shall furnish the OWNER with a list of spare parts which the MANUFACTURER considers desirable to be maintained in the stock of the OWNER. The spare parts list provided shall also show the unit price applicable to each spare part or assembly recommended.

**1.08 MANUFACTURERS**

- A. The switching centers shall be as manufactured by A-B Chance Company, a subsidiary of Emerson Electric Co. No substitution will be permitted.

**PART 2 - PRODUCTS**

**2.01 RATINGS**

- A. The switching centers shall be rated for outdoor installation.
- B. The electrical rating for the switching centers shall be as follows:
  - 1. Nominal voltage 15KV
  - 2. Maximum Design Voltage 15.5KV
  - 3. BIL 95KV
  - 4. One Minute Withstand (60 Hz)  
Switch & Terminators 35KV
  - 5. DC 15 Minute Withstand 53KV

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6.	Continuous and Load Interrupting Current Main Switch	600 amp
	Tap switch	200 amp
7.	Momentary Current, amperes rms	12,000 symm. 20,000 asymm.
8.	Minimum Partial Discharge Extinction Voltage	11KV, rms
9.	Cable Charging Interrupting Current	12 amp, rms
10.	Magnetizing Interrupting Current	
	Main switch	21 amp, rms
	Tap switch	7 amp, rms

**2.02 CONSTRUCTION**

- A. Load centers shall be a true deadfront design for low profile padmounted applications.
- B. Load centers shall utilize vacuum interrupters and oil as the insulating media. All energized parts shall be enclosed in a ground shield system where separable connectors are in place.
- C. The units shall be applicable for three (3) phase and configurations shown on the contract drawings.
- D. The units shall be vandal resistant and meet the requirements of the Western Underground Committee Guide 2.13 "Security for Padmount Equipment Enclosures". Each unit door shall be equipped with pad-locking provisions and security bolts.
- E. Each three (3) phase gang-operated switch shall be provided with its own external operating mechanism. The external operator shall have a provision to be pad-locked in either the opened or closed position.
- F. The CONTRACTOR shall provide a protection package. The package shall engage Chance K-MATE SL current limiting fuses in series with load sensing expulsion elements. The fuses shall have fifteen (15) KV allowed ampacity levels as shown on the contract drawings and rated at sixty (60°C) degrees Centigrade oil environment.

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- G. The units shall be equipped with the following standard equipment:
1. Side-operator per 600A line switch with the operating handle and pad-locking provisions.
  2. Externally-replaceable 600A deadbreak apparatus bushings for 600A terminations.
  3. Externally-replaceable 200A bushing wells for 200A terminations.
  4. Phase identification: A-B-C-C-B-A.
  5. Two (2) mounted eyebolt connectors per side for grounding provisions.
  6. Insulating oil is to be included and shipped with the units.
  7. Permanently mounted fuse operating instructions, safety labels and circuit diagrams.
  8. Stainless steel hinges.
  9. Stainless steel parking stands (one (1) per bushing) and mounting hardware (except for the bushing retainer).
  10. Rain gutter on fuse side.
  11. Door stops to secure the door in the open position, fuse-side also latches in a forty-five (45°) degree position to shield fuse wells.
  12. Penta-head locking arrangement and Western Underground tamper-proofing.
  13. Lifting provisions.
  14. Oil level sight gauge.
  15. Oil sample and drain plug.
  16. Pull ring pressure relief device.

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17. Fuse well bayonets.
  18. Removable bolted drip trays.
  19. Door lifting handles.
- H. The switching centers shall be furnished and installed with two (2) (one (1) on each side) ground rods.
- I. Switching Center No. 1 shall be AB Chance LVS-9B Catalog No. CM1CP664400. Switching Center No. 2 shall be AB Chance LVC-12B, Catalog No. CM1CP644400.

**2.03 SEPARABLE CONNECTORS**

- A. The separable connectors shall be fully shielded and therefore suitable for deadfront cable to equipment applications.
- B. Furnish and install two hundred (200A) ampere, fifteen (15) KV rated loadbreak bushing inserts as required by the contract drawings. The loadbreak bushing inserts shall be Elastimold Part No. 1601A3R; or accepted equal.
- C. Furnish and install two hundred (200A) ampere, fifteen (15) KV rated loadbreak elbow connectors with test point. The loadbreak elbow connectors shall be Elastimold Part Number 168LR-G250; or accepted equal.
- D. Furnish and install six hundred (600A) ampere, fifteen (15) KV rated deadbreak elbows as required by the contract drawings. The deadbreak elbow shall be either Elastimold Part No. 655LRK0330 (for 500 kcmil conductors), or Elastimold Part No. 655LRG0250 (for 2/0 AWG conductors); or accepted equal.
- E. Furnish and install cable shield adapters. The shield adapters shall be either Elastimold Part Number 21MA-6-A (for 2/0 AWG conductors) or 21MA-HB (for 500 kcmil conductors); or accepted equal.
- F. The CONTRACTOR shall verify Elastimold product catalog numbers by the insulation diameter of the cables actually furnished.



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**2.04 NAMEPLATE AND DANGER SIGNS**

- A. Nameplates shall be furnished and installed on front of each switching center.
- B. Nameplates shall be of laminated plastic, black core, white surface, minimum three thirty-seconds (3/32") inch thick, four (4") inches high, and length as required, with black engraved two (2") inch high lettering. Nameplates shall be centered over front of enclosure door with self tapping sheet steel metal screws, adhesive shall not be used.
- C. "DANGER HIGH VOLTAGE" signs shall be provided on the doors in compliance with the National Electrical Code.

**2.05 SURFACE PREPARATION AND SHOP COATINGS**

- A. All welds shall be ground smooth and all metal surfaces cleaned of oil, grease, and weld spatter using a hot phosphate chemical treatment. A zinc-rich, heat cured epoxy primer shall be applied to inhibit rust.
- B. The equipment shall receive an intermediate coat of heat cured epoxy finish color, followed by an air dried finish coat of Outdoor Green, Munsell No. 7GY3.29/1.5 or approved equal. After finish painting, all bottom surfaces, and sides up to a minimum of one (1") inch above the ground shall be protected against corrosion by an epoxy tar coating.

**2.06 SHOP TESTING**

- A. Perform MANUFACTURERS standard production testing and inspection in accordance with ANSI Test Code C57.12.90 and NETA. Testing shall include the following as a minimum:
  - 1. Voltage Drop Test (IR). Each line direction of the switch configuration shall be tested.
  - 2. High Potential Testing. In addition to the initial hi-pot tests, each switch shall be tested phase-to-phase and phase-to-ground across the insulation system with the vacuum bottles in the open and closed positions.

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3. **Leak Test.** After each tank is welded, all seams shall be checked for leaks with a penetrating dye. Each switch shall be pressurized for twenty-four (24) hours after the oil has been added. At the end of the twenty-four (24) hour period a visual inspection shall be performed.
- B. Results of the above tests shall be submitted with final drawings, in the form of certified test reports.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. The equipment shall be leveled and anchored directly to a concrete equipment pad. Furnish and install hardware and metal shims for installation. Anchor bolts shall be one-half (1/2") inch galvanized steel.
- B. Install the switching centers in accordance with the instructions of the MANUFACTURER.
- C. Remove temporary packing and shipping braces. Touch-up damaged paint finishes.

**3.02 FIELD TESTING**

- A. Engage the services of an independent testing firm, approved by the OWNER, to inspect and test the installed equipment prior to energization. The testing firm shall provide all material, labor, equipment, and technical supervision to perform the tests and inspection. Notify the OWNER at least two (2) weeks prior to scheduling any testing.
- B. Equipment testing and inspection shall be performed in accordance with NETA Standard and shall include the following:
  1. Visual and mechanical inspection.
  2. Ground resistance test.
  3. Insulation resistance tests, phase-to-phase and phase-to-ground, using a megohmmeter with all cables disconnected.



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- C. In the event of an equipment fault, notify the OWNER immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the CONTRACTOR, the OWNER, the OWNER, and the factory service technician of the equipment MANUFACTURER. The CONTRACTOR shall repair or replace the equipment, at his sole cost and expense, as directed by the OWNER prior to placing the equipment back into service.

**3.03 CLEANING**

- A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean lint-free rags. Do not use compressed air.

**END OF SECTION**

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15KV SWITCHING CENTERS**

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**SECTION 16470  
PANELBOARDS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all material and labor, tools, plant, and equipment required to furnish and install all panelboards as required by the contract documents and required by the work to be done.

**1.02 SUBMITTALS**

- A. Copies of all materials required to establish compliance with these Specifications shall be submitted to the OWNER in accordance with Section 01300. Submittals shall include, as a minimum, the following:
  - 1. Certified shop and erection drawings showing materials, details of construction, dimensions, and anchor bolt locations.
  - 2. Descriptive literature, bulletins, and catalogs of the new equipment.
  - 3. A complete bill of materials for all equipment.
- B. Submit the Certificate of Installation of the equipment MANUFACTURER in accordance with Section 01300.
- C. Submit operating and maintenance data manuals in accordance with Section 01300.
- D. Submit equipment warranty of the MANUFACTURER as specified in Section 01012.

**1.03 REFERENCE STANDARDS**

- A. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and with the following.



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**B. American National Standards Institute (ANSI)**

1. ANSI Z55.1.61 - Gray Finishes According to ANSI Z55.1.-1967 (R1973) - Color Chips for No. 61, Light Gray.

**PART 2 - PRODUCTS**

**2.02 GENERAL**

**A. Rating**

1. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.
2. Circuit breaker panelboards shall be fully rated for the specified circuit breaker fault current interrupting capacity. Series connected short circuit ratings shall not be used.

**2.03 MATERIALS**

**A. Interiors**

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.
2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors, and the design shall allow changing of the circuits without machining, drilling, or tapping.
3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the MANUFACTURER.
4. A nameplate shall be furnished and installed, listing panel type, number of circuit breakers, and ratings.

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**B. Buses**

1. Bus bars for the mains shall be copper. Neutral bus shall be included with its size doubled to accommodate harmonic loads on transformers with a K-factor rating of 4.0 (minimum). Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction. Cross connectors shall be copper.
2. Neutral bussing shall have suitable lugs for each outgoing feeder requiring a neutral connection.
3. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.
4. Equipment ground bars shall be furnished and installed.

**C. Boxes**

1. Recessed boxes shall be made from galvanized code gauge steel having multiple knockouts, unless noted otherwise. Boxes shall be of sufficient size to provide a minimum gutter space of four (4") inches on all sides.
2. Surface mounted boxes and trims shall have an internal and external finish as hereinafter specified in Paragraph 2.01.D.4. Surface mounted boxes shall be field punched for conduit entrances.
3. At least four (4) interior mounting studs shall be furnished.
4. All boxes shall be NEMA 1A type (gasketed), except otherwise shown on the Drawings.

**D. Trim**

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.



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2. Doors shall have semi flush type cylinder lock and catch, except that doors over forty-eight (48") inches in height shall have a vault handle and three (3) point catch, complete with lock, arranged to fasten door at top, bottom, and center. Door hinges shall be concealed. Furnish two (2) keys for each lock. All locks shall be keyed alike; directory frame and a typed circuit directory card having a transparent cover shall be furnished and installed on each door.
3. The trim shall be fabricated from code gauge sheet steel.
4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint shall adhere.
5. Trim for flush panels shall overlap the box by at least three-fourths (3/4") inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

**E. Manufacturer**

1. Three (3) phase, four (4) wire and single (1) phase, three (3) wire AC panelboards shall be Type AQ and Type CCB as manufactured by the General Electric Company; Cutler-Hammer; or approved equal.

**2.03 CIRCUIT BREAKERS**

- A. Panelboards shall be furnished and installed with circuit breakers with frame size and trip settings as shown on the Drawings.
- B. Circuit breakers shall be molded case, bolt-on type.
- C. Each circuit breaker used in panelboards shall have an interrupting capacity of not less than shown on the Drawings.
- D. A ground fault circuit interrupter (GFCI) shall be furnished and installed for circuits where shown on the Drawings. GFCI units shall be single (1) pole, one hundred and twenty (120) volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device, five (5) milliamp

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sensitivity, twenty-five (25) millisecond trip time, and an interrupting capacity of twenty-two thousand (22,000) amperes, rms symmetrical.

- E. Circuit breakers shall be as manufactured by the panelboard MANUFACTURER.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Mount boxes for surface mounted panelboards so there shall be at least one-half (1/2") inch air space between the box and the wall.
- B. Connect panelboard branch circuit loads so that the load shall be distributed as equally as possible between the phase busses.
- C. After completion of wiring, type circuit directories for all panelboards, giving location and nature of the load served. Install circuit directories in each panelboard. Handwritten directories will not be permitted.
- D. Furnish and install markers on the front cover of all panelboards which identify the voltage rating. Markers shall be made of self sticking B-500 vinyl cloth printed with black characters on an Alert Orange background, two and one-fourth (2-1/4") inch high by nine (9") inches wide, Style A as manufactured by W.H. Brady Co. or approved equal.
- E. Furnish and install a one by three (1" x 3") inch laminated plastic nameplate with one and four-tenths (1.4") inch white letters on a black background on each panelboard. Nameplate lettering shall be as shown on the Drawings. Nameplates shall be mounted with stainless steel screws.

**END OF SECTION**

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**SECTION 16490  
MOTOR CONTROL CENTER**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all materials and labor, tools, plant, and equipment to furnish, install, and test the motor control centers required by the contract drawings and required by the work to be done.

**1.02 RELATED WORK**

- A. Concrete for equipment pads are included in Division 3.

**1.03 SUBMITTALS**

- A. Submit shop drawings and product data to the OWNER in accordance with Section 01300, as follows:
1. Equipment outline drawings showing elevation and plan views, dimensions, weight, shipping splits, and metering layouts. Indicate all options, special features, ratings, and deviations from the Specifications.
  2. Conduit entrance drawings.
  3. Bus arrangement drawings.
  4. Unit summary tables showing detailed functional description and nameplate data for each compartment.
  5. Product data sheets and catalog numbers for circuit breakers, solid state and magnetic starters, transformer and miscellaneous items. List all options, trip adjustments, and accessories furnished specifically for this Project.
  6. Instruction and renewal parts books.
  7. Itemized list of spare parts furnished specifically for this Project, including quantities, description, prices, and part numbers.

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8. Test and inspection reports.
9. Operating and maintenance manuals in accordance with Section 01730.

**1.04 REFERENCE STANDARDS**

- A. Motor control centers shall be designed, built, and tested in accordance with the latest editions and revisions of NEMA Standard ICS-2 and Underwriters' Laboratories Standard No. UL-845. Equipment shall conform to ANSI C19.3 test standards and the requirements of the National Electrical Code.

**1.05 QUALITY ASSURANCE**

- A. Motor control centers shall be designed, assembled, and tested by the MANUFACTURER of the motor control equipment included in the control center assembly.
- B. All units and sections shall be U.L. labeled.

**1.06 SYSTEM DESCRIPTION**

- A. One line and control schematic diagrams are shown on the Drawings.

**1.07 MAINTENANCE**

- A. Provide the following spare parts in the quantities specified:
  1. One (1) dozen (12) each size of cover bolts, cage nuts, and door fasteners.
  2. Two (2) cans of aerosol touch-up paint.
  3. One hundred (100%) percent replacement fuses, all types and sizes.
  4. Ten (10) dozen (12) replacement lamps for pilot lights.
  5. Ten (10) of each color lens caps for pilot lights.
  6. Two (2), three (3) pole sets of replacement overload heaters of each size range used.

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- B. Spare parts shall be boxed or packaged for long term storage. Identify each item with name, description, and part number of the MANUFACTURER on the exterior of the package.

**PART 2 - PRODUCTS**

**2.01 RATING**

- A. Service: Two hundred and seventy-seven/four hundred and eighty (277/480) volt, three (3) phase, four (4) wire, sixty (60) hertz.
- B. The overall short circuit withstand rating of the equipment and devices shall be forty-two thousand (42,000) amperes rms symmetrical at four hundred and eighty (480) volts. Main and feeder circuit protective devices shall be fully rated for the specified short circuit duty. Systems employing series connected ratings for main and feeder devices will not be permitted. Motor starter units shall be tested and UL labeled for the specified short circuit duty in combination with the motor branch circuit protective device.
- C. The continuous current rating of the main horizontal bus shall be as shown on the Drawings. Vertical buses shall be sized for the structure load and shall have a minimum rating of three hundred (300) amperes. Bus bracing shall equal or exceed the specified equipment short circuit rating.
- D. Motor control centers, including devices, shall be designed for continuous operation at rated current in a forty (40°C) degree Centigrade ambient temperature.

**2.02 CONSTRUCTION**

- A. General
  - 1. The general arrangement of the motor control center is shown on the Drawings. The motor control center shall be Allen-Bradley Co. "Centerline". Substitution will not be permitted.



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**B. Structure**

1. The motor control center shall consist of a series of metal enclosed, free-standing, dead front vertical sections bolted together to form double wall construction between sections. Individual vertical sections shall be nominally ninety (90") inches high, twenty (20") inches wide, and twenty (20") inches deep unless shown otherwise on the Drawings. Removable bottom channel sills shall be mounted front and rear of the vertical sections extending the full width of each shipping split. Top of each section shall have removable plates with lifting angle. Make provisions for field installation of additional sections to either end.
2. Furnish and install continuous top and bottom horizontal wireways extending the full width of the line-up, isolated from the horizontal bus. Furnish and install a four (4") inch wide, full height, vertical wireway in each section, equipped with a hinged door and cable supports. Vertical wireway shall be isolated from the bus and device compartments. Wireways openings shall have rolled edges or protective grommets.
3. Furnish and install individual, flange formed, pan type door with concealed hinges and quarter-turn latches for each device compartment and future space. Doors shall be removable. Door removal shall not be required to withdraw starter units or feeder tap devices.
4. All covers, doors, and openings shall be gasketed to meet UL/NEMA Type 1A requirements, unless shown otherwise on the Drawings.

**C. Unit Compartments**

1. Furnish and install individual, removable, unit device compartments for each combination starter unit and each feeder tap device. Each vertical section shall accommodate a maximum of six (6) unit compartments. Steel barriers shall isolate the top, bottom, and sides of each unit from adjacent units and wireways. Units shall connect to the vertical bus in each section with tin plated, self aligning, pressure type copper plug connectors. Removable units shall be aligned in the structure on guide rails or shelves and secured with a cam latch mechanism or racking screw.

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2. Furnish and install individual isolated compartments for fixed mounted devices, cable lugs, metering, relaying, and control devices. Main circuit breaker shall be bolted directly to the main horizontal bus. All bus connections shall be fully rated.
3. Furnish and install the following safety interlock features:
  - a. Provision to padlock removable units in a partially withdrawn TEST position, with the bus stabs disengaged.
  - b. Provision to padlock unit disconnect handles in the OFF position with up to three (3) padlocks.
  - c. Mechanical interlock to prevent opening unit door with disconnect in the ON position, or moving disconnect to the ON position while the unit door is open.
  - d. Mechanical split-type terminal blocks for disconnecting external control wiring.

**D. Bus Systems**

1. Main horizontal bus: Silver plated copper, bolted joints, accessible from the front of the structure, fully rated throughout the lineup.
2. Vertical section bus: Silver plated copper, full height, totally insulated and isolated by glass polyester sandwich type barriers with shutters to cover stab openings when units are withdrawn. Furnish and install fishtape barriers to isolate bottom wireways from lower ends of vertical bus.
3. Horizontal ground bus: Furnish and install one-fourth by two (1/4" x 2") inch uninsulated copper ground bus in each section, equipped with lugs for termination of feeder and branch circuit equipment grounding conductors. Connect to ground bus in adjacent sections with splice plates.
4. Vertical ground bus: Furnish and install one hundred and fifty (150) ampere tin-plated copper vertical ground bus in each section, connected to the horizontal ground bus. Furnish and install ground stabs in all unit compartments.

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**E. Wiring**

1. **Wiring:** Stranded copper, minimum size No. 12 AWG, with six hundred (600) volt, ninety (90°C) degree Centigrade, flame retardant, Type MTW thermoplastic insulation, NEMA Class II-S, Type C with top mounted terminal boards. Line side power wiring shall be sized for the full rating or frame size of the connected device.
2. **Identification:** Sleeve type wire markers at each termination point, color coding per NEMA Standards and NEC. Foreign voltage control wiring shall be yellow.

**F. Marking and Identification**

1. The motor control center shall be furnished and installed with a sign marked "DANGER - 480 VOLTS - KEEP OUT". Signs shall be attached to the sections of the respective ratings. Letters shall not be less than one (1") inch high, one-fourth ( $\frac{1}{4}$ ") inch stroke. Signs shall be laminated plastic, engraved white letters with a red background.
2. Compartments with voltages from sources outside of the compartment shall have a sign mounted inside the compartment door marked "CAUTION - THIS UNIT CONTAINS A VOLTAGE FROM AN EXTERNAL SOURCE". Letters shall be black on a high visibility yellow background.
3. Furnish and install a two by six (2" x 6") inch engraved master nameplate reading "MCC", screw fastened to the top wireway of the MCC.
4. Furnish and install a one by three (1" x 3") inch engraved unit nameplates of two (2) ply thermoplastic material, black face, white core, fastened to each door with stainless steel screws. Equipment names shall be as shown on the one-line diagrams (e.g. Pump No. 401, etc.).

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**2.03 COMPONENTS**

**A. General**

1. The Drawings indicate the approximate horsepower, the estimated NEMA size of the starters, and the intended control scheme of the motor driven equipment. Furnish and install the NEMA size starter, circuit breaker trip ratings, control power transformers, and thermal overload heater element ratings matched to the motors and control equipment actually supplied, in compliance with NEC and the heater selection tables of the MANUFACTURER. All variations necessary to accommodate the motors and controls as actually furnished shall be made at the sole cost and expense of the CONTRACTOR.
2. Circuit breaker frame and trip sizes shown on the Drawings are tentative, and are based on the best information available about the specified equipment load. All variations required to conform to the applicable NEC rules, as may be applied to the equipment actually furnished, shall be made at the sole cost and expense of the CONTRACTOR.
3. The main and all feeder circuit protection devices shall be equipped with properly time-current coordinated ground fault interrupters.

**B. Circuit Breakers**

1. The main circuit breaker in the motor control center, shall be stationary type, power circuit breaker.
2. All outgoing feeder circuit breakers in the motor control center shall be molded case, thermal magnetic trip, bolt-on type, except where specified otherwise.
3. Power circuit breakers shall be one hundred (100%) percent equipment rated, six hundred (600) volt, insulated case circuit breakers with integral fully adjustable solid state protective trip device. The protective trip device shall be temperature insensitive and shall have the following characteristics and functions:
  - a. Independently adjustable long time pick-up and delay.
  - b. Independently adjustable short time pick-up and delay.

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- c. Adjustable instantaneous.
  - d. Independently adjustable ground fault pick-up and delay suitable for four (4) wire service.
  - e. Trip mode targets for overload, short circuit, and ground fault.
  - f. Long time pick-up light.
4. The power circuit breaker shall be equipped with a neutral current sensor designed to work with the solid state protective device in supplementing ground fault detection required for a four (4) wire service. Controls for "CLOSE" and "TRIP" operations shall be activated by manual operation. Control voltage shall be one hundred and twenty (120) volts, sixty (60) hertz, and shall be derived for a built-in four hundred and eighty/one hundred and twenty (480/120) volt control power transformer.
5. Molded case circuit breakers: Thermal-magnetic trip type, six hundred (600) volt, three (3) pole, labeled in accordance with UL Standard 489. Provide a ground fault interrupter for each feeder circuit breaker.

**C. Combination Magnetic Starter Units**

- 1. Magnetic starters shall be of NEMA, not IEC design
- 2. Combination magnetic starters shall include a motor circuit protector (MCP) in series with a motor controller and an overload protective device. The MCP shall have a ground fault interrupter and an adjustable magnetic trip range up to one thousand (1,000%) percent of rated continuous current and a trip test feature. MCPs shall be labeled in accordance with UL489.
- 3. Magnetic motor starters: Three (3) pole, six hundred (600) volt, electrically operated, of the types shown on the Drawings. Furnish and install NEMA sizes as required for the horsepower of the motors actually furnished and installed. Minimum size shall be NEMA Size 1. Fractional size starters shall not be used. Starters shall have one hundred and twenty (120) volt encapsulated operating coils; individual control power transformers with fuses, and silver-to-silver renewable line contacts.

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4. Combination solid state motor controllers shall include a circuit breaker and microcomputer controller heavy duty SMC PLUS controller rated for four hundred and fifty (450%) percent full load amperes for thirty (30) seconds. The units shall be provided with the following features:
  - a. Overload protection.
  - b. Type B wiring.
  - c. Start/Stop Modes: soft start with kick start; current limit; full voltage; soft stop.
  - d. ON-OFF pilot lights.
  - e. Line side protective module providing phase loss, undervoltage and phase sequence protection.
  - f. HAND-OFF-AUTO selector switch.
  - g. The units shall be suitable for installation in the MCC line-up without a rear access requirement.
5. Motor overload protection: Standard adjustable, three (3) pole, thermal bi-metallic type, with push-to-test feature. Overload relays shall be reset manually from outside the enclosure by means of an insulated pushbutton. Furnish and install auxiliary alarm contacts where called for on the Drawings.
6. Auxiliary contacts: Form C, NEMA A600 rating, as required by the control schemes on the Drawings. Furnish and install two (2) normally open and two (2) normally closed spare contacts on each starter. Additional auxiliary contacts shall be furnished and installed as shown on the Drawings or as required by the control scheme. When the number of contacts exceed the starter auxiliary contact capacity, a control relay shall be wired in parallel with the starter coil to derive the additional contacts. The control relay shall be installed within the starter enclosure.
7. Control power transformers: Two (2) winding type, one hundred and twenty (120) volt secondary, fused in accordance with the NEC.

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**D. Instrumentation and Metering**

1. **Current and voltage metering:** microprocessor-based monitoring and protective device, Bulletin 2190 digital meter (DM), Allen-Bradley or approved equal.
2. **Instrumentation transformers:** Indoor, six hundred (600) volt, butyl-rubber molded, metering class designed in accordance with ANSI and NEMA standards. Window type current transformers, with burden capacity as low as fifty (50 VA) volt-amperes, may be furnished and installed where such capacity is sufficient. Current transformer accuracy ratings shall be at least equal to NEMA standard requirements for the particular application.
3. **Elapsed time hour meters:** Five (5) digit, non-reset type, with one hundred and twenty (120) volt synchronous motor.

**E. Control and Time Delay Relays**

1. **Control relays:** Heavy duty machine tool type, with ten (10) ampere, six hundred (600) volt convertible contacts, Allen-Bradley; General Electric Co. CR120 Series; or approved equal.
2. **Time delay relays:** electro-pneumatic, front connected, suitable for mounting inside or on front surface of control panels or other enclosures, fifteen (15) ampere, one hundred and twenty (120) volt contacts, "on-delay" or "off-delay" type as shown or noted on the Drawings, AGASTAT 7000 series, as manufactured by Amerace Corporation, Control Products Division, Allen-Bradley; or approved equal.

**F. Pilot Devices**

1. **Control operators:** Heavy duty, full size, oiltight, with NEMA A600 contact rating.
2. **Indicator lights:** Full size, oiltight, low voltage, with push-to-test feature.

**G. Lighting Transformer**

1. **Insulation shall be Class H for eighty (80°C) degrees Centigrade rise.**
2. **Three (3) phase with the ratings shown on the drawings.**

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3. Tape arrangement shall be two (2) two and one-half (2-1/2%) percent FCAN.

**H. Lighting Panel**

1. The panel shall be three (3) phase, four (4) wire one hundred and twenty/two hundred and eight (120/208) volt with main circuit breaker.
2. Branch breakers shall have an interrupting capacity of ten thousand (10,000) amperes symmetrical.
3. All branch breakers shall be bolt-on type.

**I. Miscellaneous Units**

1. Bus connected surge protection: Six hundred (600) volt, three (3) phase lightning arrestor and surge capacitor, General Electric "Tranquell" Series, or approved equal.

**2.04 SURFACE PREPARATION AND SHOP COATINGS**

- A. All non-current carrying metal parts of the motor control center assembly shall be cleaned of all weld spatter and other foreign material and given a heat cured, phosphatized chemical pre-treatment to inhibit rust.
- B. The Motor Control Center shall be finish painted with one (1) coat of standard electrocoated, heat cured enamel of the MANUFACTURER.
- C. Unpainted non-current carrying parts shall receive a protective zinc plating to prevent corrosion. All device contacts shall be gold or silver plated.

**2.05 SHOP TESTING**

- A. Perform standard production testing and inspection of the MANUFACTURER in accordance with NEMA and ANSI standards. The MANUFACTURER shall submit certified copies of test results to the OWNER.



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**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Motor control center floor sills shall be bolted directly to the equipment pad. Structure shall be leveled and plumb. Anchor bolts shall be one-half (1/2") inch. Furnish and install hardware and shims for installation.
- B. Install the equipment in accordance with the instructions of the MANUFACTURER.
- C. Remove temporary lifting angles, lugs, and shipping braces. Touch-up damaged paint finishes.
- D. Install bus splice plates and torque connections.

**3.02 FIELD TESTING**

- A. Make the following minimum tests and checks before the representative of the MANUFACTURER is called in for testing and adjustment.
  - 1. Megger incoming line terminals and buses, phase-to-phase and phase-to-ground, after disconnecting devices sensitive to megger voltage.
  - 2. Remove current transformer shunts after completing secondary circuit. Check polarity and continuity of metering and relaying circuits.
  - 3. Check mechanical interlocks for proper operation.
  - 4. Test ground connections for continuity and resistance.
  - 5. Adjust unit compartment doors.
  - 6. Check control circuit interlocking and continuity with starters in the TEST position. Provide external source of control power for this test.
  - 7. Adjust motor circuit protectors and voltage trip devices to their correct settings.
  - 8. Adjust overload heaters or relays for actual motor nameplate currents.



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- B. In the event of an equipment fault, notify the OWNER immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the CONTRACTOR, the OWNER, and the factory service technician of the equipment MANUFACTURER. The CONTRACTOR shall repair or replace the equipment at his sole cost and expense, as directed by the OWNER prior to placing the equipment back into service.

**3.03 ADJUSTMENT**

- A. The motor control center manufacturer shall provide the services of a factory trained service technician for the time period specified in Section 16000. The trip, as specified in Paragraph 1.15 of Section 16000, shall be coordinated with the equipment testing, start-up and to instruct the designated personnel of the OWNER. In addition to the time specified in Paragraph 1.15 of Section 16000 for instruction purposes, the CONTRACTOR shall include in his estimate sufficient time to accomplish any necessary follow-up or punch list work. The service technician of the MANUFACTURER shall demonstrate and test all operational features of the installed equipment to the satisfaction of the OWNER. Submit a certified copy of the field inspection to the OWNER. No equipment shall be energized without the approval of the OWNER.
- B. The factory service technician of the control center MANUFACTURER shall make the following inspection, tests, and adjustments:
1. Calibrate and test main and feeder circuit breaker trip devices and protective relays.
  2. Inspect the installation for compliance with the recommended installation practices of the MANUFACTURER and report all deviations to the OWNER.

**3.04 CLEANING**

- A. Remove all rubbish and debris from inside and around the control center. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint-free rags. Do not use compressed air.

**END OF SECTION**

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**SECTION 16500  
LIGHTING SYSTEM**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The CONTRACTOR shall furnish all materials and labor, tools, plant, and equipment required to furnish and install complete lighting systems including lighting fixtures, receptacles, switches, and all necessary accessories and appurtenances required by the contract documents and required by the work to be done.

**1.02 SUBMITTALS**

- A. Copies of all materials required to establish compliance with these Specifications shall be submitted to the OWNER in accordance with Section 01300. Submittals shall include, as a minimum, the following:
1. Certified shop drawings showing materials, details of construction, dimensions, and anchor bolt locations.
  2. Descriptive literature, bulletins, and catalogs of the lighting fixtures.
  3. A complete bill of materials for all equipment.
- B. Submit equipment warranty of the MANUFACTURER as specified in Section 01012.

**1.03 STANDARDS**

- A. All lighting fixtures shall be in accordance with the NEC and shall be constructed in accordance with the latest edition of the Underwriters Laboratories "Standards for Safety, Electric Lighting Fixtures." All lighting fixtures shall be UL labeled.



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**PART 2 - PRODUCTS**

**2.01 MATERIALS**

**A. Switches**

1. Furnish and install wall switches of the toggle action, surface mounting quiet type. All switches shall conform to Federal Specification WS896-E.
2. Wall switches shall be of the following types and MANUFACTURER or approved equal.
  - a. Single pole - Hubbell Catalog No. HBL 1221I; General Electric; or approved equal.
  - b. Double pole - Hubbell Catalog No. HBL 1222I; General Electric; or approved equal.
  - c. Three way - Hubbell Catalog No. HBL 1223I; General Electric; or approved equal.
  - d. Weatherproof cover for standard toggle switches - Crouse-Hinds Catalog No. DS181; Appleton Electric Co.; L.E. Mason Co.; or approved equal.

**B. Receptacles**

1. Furnish and install receptacles of the following types and MANUFACTURER or equal. Receptacles shall conform to Federal Specification WC596-F.
  - a. Duplex, twenty (20) ampere, one hundred and twenty-five (125) volt, two (2) pole, three (3) wire, Hubbell Catalog No. 5362; General Electric; or approved equal.
  - b. Ground fault interrupter, duplex, twenty (20) ampere, one hundred and twenty-five (125) volt, two (2) pole, three (3) wire, Hubbell Catalog No. GF 5362I; General Electric; or approved equal.



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- c. Stainless steel indoor mounting plate for G.F.I. receptacle; Arrow-Hart Catalog No. 97061; Harvey Hubbell, Inc.; Pass & Seymour, Inc.; or approved equal.
- d. Weatherproof cover for G.F.I. receptacle in FS box; Arrow-Hart Catalog No. 4501-FS; Hubbell; General Electric; or approved equal.

**C. Device Plates**

- 1. Plates for surface mounted device boxes shall be of the same material as the box.

**D. Lighting Fixtures**

- 1. Furnish and install lighting fixture types as shown on the "Lighting Fixture Schedules" on the Drawings. The catalog numbers listed are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other MANUFACTURERS may be submitted for approval.

**E. Lamps**

- 1. Fluorescent lamps furnished and installed shall be medium bi-pin and recessed double contact, rapid start, standard cool white, and biaxial types all as shown on the "Fixture Schedules".
- 2. Fluorescent ballasts furnished and installed shall be energy saving, Class P, rapid start, high power factor, CBM certified by E.T.L. and listed by Underwriters Laboratories, Inc., for operation on one hundred and twenty (120) volts or as shown on the "Lighting Fixture Schedules".
  - a. Ballasts shall be as manufactured by Advance Transformer Co.; MagneTek Universal Manufacturing; Holophane Lighting; or approved equal.
- 3. Metal halide lamps furnished and installed shall be clear and of the size and type as shown on the "Lighting Fixture Schedules".



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4. Metal halide ballast furnished and installed shall be of the constant voltage auto-transformer type of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture Schedule". All ballasts shall be as manufactured by Holophane Lighting; MagneTek Universal Manufacturing; Advance Transformer Co.; or approved equal.
  5. All lamps shall be of one (1) MANUFACTURER and shall be as manufactured by Sylvania Electric Products, Inc.; General Electric Co.; North American Philips Lighting Corp.; or approved equal.
- F. Vapor-Tight Handlamp
1. A vapor-tight handlamp with reflector shall be furnished with fifty (50') foot cord and grounding plug. The handlamp shall be Catalog No. 1203R-B163 as manufactured by Daniel Woodhead Co.; Appleton Electric Co.; or approved equal.
- G. Photo Electric Controls
1. Photo electric control shall be furnished and installed with time delay for outdoor lighting and shall be completely self-contained and not affected by moisture, vibration, or temperature changes.
  2. ON/OFF adjustments shall be made by movement of a light level selector, without the use of tools, in a range from two to fifty (2 to 50) footcandles.
  3. Photo electric control device shall be SPST, shall have two thousand (2,000) watt tungsten capacity, and shall be Catalog No. 2101 (120V) as manufactured by Tork; Intermatic Inc.; Carlon; or approved equal.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Each fixture furnished and installed shall be a completely finished unit with all components, mounting and/or hanging devices, necessary for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.
- B. Flexible fixture hangers shall be used for all pendant mounted fixtures.

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**3.02 REPLACEMENT**

- A. Lamps (except for H.I.D.) used during the building construction, prior to two (2) weeks from completion of the work, shall be removed and replaced with new lamps.

**3.03 CLEANING UP**

- A. Plastic dust cover bags, furnished and installed with new parabolic reflector lighting fixtures, shall be removed after all construction activity that may cause dust formation on reflector surfaces has been completed.
- B. All fixtures shall be left in a clean condition, free of dirt and defects, before approval by the OWNER.

**END OF SECTION**

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LIGHTING SYSTEM**

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**SECTION 16502  
LIGHTNING PROTECTION SYSTEM**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The CONTRACTOR shall furnish all materials and labor, tools, plant, and equipment required to furnish and install a complete system of lightning protection for the air stripper and treatment building as required by the contract documents and required by the work to be done.
- B. Items of work required shall include, but are not necessarily limited to, the following:
  - 1. Air terminals and interconnecting conductors.
  - 2. Grounding and bonding needed for lightning protection.

**1.02 SYSTEM DESCRIPTION**

- A. The lightning protection system shall be in accordance with the latest edition of Lightning Protection Code (NFPA 78) U.L. 96A, and ANSI/LPI 175 and 176 code requirements, and shall consist of air terminals on roof of the treatment building and on top of the air stripping tower, bonding of structure, and other metal objects, grounding electrodes, and interconnecting conductors.
- B. The lightning protection system shall be furnished and installed with Class I materials per the provisions of NFPA 78.
- C. Underwriters Laboratories Master Label shall be furnished as evidence that the installation has met with U.L. requirements.

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LIGHTNING PROTECTION SYSTEM**

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**1.03 SUBMITTALS**

- A. Complete installation details and product data shall be submitted to the OWNER under the provisions of Section 01300, and shall include, as a minimum, the following:
1. Shop drawings showing layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects, including the sizes of all constituent components, and details of connection and termination.
  2. Product data complete with material descriptions and physical dimensions of each component, as well as listing of each component per ANSI/UL 96.
  3. Installation instructions and guidelines in accordance with Section 01730.

**1.04 REFERENCE STANDARDS**

- A. American National Standards Institute/Lightning Protection Institute (ANSI/LPI).
1. ANSI/LPI 175.
  2. ANSI/LPI 176.
- B. National Fire Protection Association (NFPA).
1. NFPA 78-1986 - Lightning Protection Code.
- C. American National Standards Institute/Underwriters Laboratories, Inc. (ANSI/UL).
1. ANSI/UL 96-1981 - Safety Standard for Lightning Protection Components.
- D. Underwriters Laboratories, Inc. (UL).
1. UL 96A - Installation Requirements for Lightning Protection Systems.

**1.05 PROJECT RECORD DOCUMENTS**

- A. The CONTRACTOR shall submit project record documents under the provisions of Section 01700.



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- B. The CONTRACTOR shall prepare and submit "as-built" drawings, showing the actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

**1.06 QUALITY ASSURANCE**

- A. The lightning protection equipment furnished under this Section shall be the product of a MANUFACTURER who has produced the same type of protective system for a period of at least ten (10) documented consecutive years, and who is a member of the Lightning Protection Institute.
- B. The lightning protection equipment shall be installed by an authorized installer of the MANUFACTURER, with a minimum of three (3) years documented experience.

**1.07 SEQUENCING AND SCHEDULING**

- A. The CONTRACTOR shall coordinate work in accordance with the provisions of Section 01012.
- B. All work of this Section shall be coordinated with other trades engaged in roofing, and in interior and exterior installations.

**1.08 CERTIFIED INSTALLERS**

- A. The CONTRACTOR shall engage the services of an experienced firm specializing in this type of work and certified by Underwriters' Laboratories, Inc. Certified installers are Heary Bros. Lightning Protection Co., Inc.; Independent Protection Co., Inc.; Thompson Lightning Protection, Inc.; or other certified approved equals.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. All components of the lightning protection system shall be in accordance with ANSI/UL 96. Air terminals shall be as specified hereinafter. All materials shall be Class I.
- B. Air terminals shall be of material and diameter shown on the contract drawings, and extending not less than twenty-four (24") inches above the object which they protect.

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- C. Lightning grounding rods shall be copper-clad steel electrodes, one (1") inch diameter, ten (10') feet long.
- D. Conductors shall be as shown on the Drawings and described thereon.
- E. Ground plates, if used, shall be copper.
- F. Connectors and splicers shall be standard approved type.
- G. Conductor fasteners shall be an approved type of non-corrosive metal having ample strength to support conductor and shall be spaced on maximum three (3') foot centers.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Before commencing installation, the CONTRACTOR shall verify the following:
  - 1. Surfaces are ready to receive work.
  - 2. All field dimensions are as shown on the shop drawings.
- B. Commencing installation implies acceptance of existing conditions by the CONTRACTOR.

**3.02 PROTECTION OF SURROUNDING ELEMENTS**

- A. All elements surrounding the work area specified under this Section shall be effectively protected from damage and/or disfiguration.

**3.03 INSTALLATION**

- A. All installation shall be in accordance with the instructions of the MANUFACTURER and in compliance with all applicable rules and provisions of UL 96A and NFPA 78.
- B. Air terminals shall be furnished and installed with proper base supports for the surface on which they are used, and shall be securely anchored to the protected surface.

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- C. Conductors shall be coursed to provide a two (2) way path to ground from each air terminal.
- D. Furnish and install down conductors as evenly distributed as possible on outer walls of building.
- E. Lightning grounding rods shall be driven to a minimum depth of ten (10') feet, and more if necessary, to reach permanent moisture. In case of rock ledge or other conditions making it impossible to comply with the above, trench or other grounding will be permitted, providing it meets U.L. requirements.
- F. Furnish and install necessary common bonding between the lightning protection system, electric grounding system, and underground metallic water piping systems.
- G. All ungrounded sizeable metallic objects within six (6') feet of the system, or metal connected to the system, shall be bonded to the system with approved fittings and conductor. Connections between dissimilar metals shall be made with approved bimetallic connectors.

**3.04 FIELD QUALITY CONTROL**

- A. The complete installation shall be inspected and certified by a representative of the Underwriters' Laboratories under provisions of UL 96A, and after acceptance, a U.L. Master Label shall be issued. The U.L. Master Label shall be attached to the building at the location as directed by the OWNER.

**END OF SECTION**

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**SECTION 16600  
UNDERGROUND SYSTEM**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The CONTRACTOR shall furnish all materials and labor, tools, plant, and equipment required to furnish and install a complete underground system of ducts, manholes, and handholes, all as required by the contract documents and required by the work to be done.

**1.02 RELATED WORK**

- A. Excavation and backfilling, including gravel and sand bedding, is included in Division 2.
- B. All concrete and reinforcing steel is included under Division 3.

**1.03 REFERENCE STANDARDS**

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM C478-90b - Standard Specification for Precast Reinforced Concrete Manhole Sections.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Ducts shall be rigid galvanized steel (RGS) conduit or Schedule 40 polyvinyl chloride (PVC) conduit encased in concrete, and shall be of the types and sizes called for on the Drawings.
- B. Conduits shall be buried below the frost line, but under no condition at depths less than thirty (30") inches below finished grade, and shall be covered by six (6") inches of sand on all sides.

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- C. Cable racks, supports, standard pulling-in irons, and hardware shall be galvanized steel manufactured by Line Materials Co. or approved equal.
- D. Precast manholes and handholes shall be heavy duty type, designed for a Class H20 wheel load and shall conform to ASTM C478. Precast manholes and handholes shall be as manufactured by John E. Potente & Son Co.; or approved equal, and constructed to dimensions as shown on the Drawings.
- E. Manhole and handhole frames and covers shall be heavy duty type for Class H-20 wheel loading, and shall be of type shown on the drawing and shall have raised letters "ELECTRIC".
- F. Fireproofing tape shall be Irvington No. 7700 or approved equal.
- G. Bell ends shall be as manufactured by Carlon or approved equal.
- H. Marker tape installed over all direct burial cables, conduits, and ductbanks shall be six (6") inches in width, and shall be Terra Tape "D" detectable as manufactured by Griffolyn, Inc. or approved equal. The tape shall be an inert, bonded layer plastic material with a metallized foil core, so that cable, conduit, and ductbank locations can be determined with a metal detector. The color of the tape shall be bright red with the following imprints:

"CAUTION! BURIED ELECTRIC LINE BELOW!" (for ductbanks with electric cables)

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Ducts shall be installed to drain away from buildings; ducts between manholes or handholes shall drain toward the manholes or handholes. Ductbank slopes shall be not less than three (3") inches per one hundred (100') feet.
- B. Ductbanks shall be laid in trenches on mats of bank gravel not less than six (6") inches thick and well graded.

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- C. All concrete envelopes encasing the ducts shall be steel-reinforced under provision of Section 03800 and as detailed on the Drawings.
- D. Plastic spacers shall be used to hold the ducts in place. Spacers shall provide not less than seven and five-tenths (7.5") inches clearance center-to-center between ducts. Spacers shall be installed four (4') feet apart. Tie wires shall be No. 16 black annealed iron wire, of length sufficient to tie the complete ductbank together. Tie wires shall be spaced a maximum of four (4') feet apart along the length of the duct system.
- E. The minimum cover for ductbanks shall be thirty-six (36") inches unless approved otherwise by the OWNER; however, under no circumstance shall the duct structures be so placed as to have their tops above the frostline.
- F. Duct entrances to buildings and vaults shall be made with steel conduit not less than ten (10') feet long. Conduits run below floor slabs in slab-on-grade construction shall be rigid steel.
- G. Duct terminations at manholes shall be with end bells for PVC conduit, and insulated throat grounding bushing for steel conduit.
- H. Where bends in ducts are required, long radius elbows, sweeps and offsets shall be used.
- I. In placing the concrete envelopes for ducts, concrete shall not be placed directly on the ductbank, but shall be directed carefully by splashboards in and around the duct layers. Exposed duct ends shall be protected, by caps or temporary plugs, during concrete placing.
- J. All ducts shall be swabbed clean before cable installation.
- K. Spare or empty ducts and duct stub-ups shall be plugged and sealed watertight at all manholes, buildings, and structures.
- L. Ducts in use shall be sealed watertight at all manholes, buildings, and structures.
- M. Pulling-in irons shall be installed opposite all duct entrances to manholes.



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- N. Cables shall be trained in manholes and handholes supported on racks and hooks. Furnish inserts on all manhole walls for mounting future racks as well as racks required for present installation.
- O. Fireproofing shall be furnished and installed for all fifteen (15KV) kilovolt cables in manholes. Each individual fifteen (15KV) kilovolt cable shall be wrapped with an arc-proofing tape. The tape shall be applied in accordance with the recommendations of the MANUFACTURER. The wrapping shall extend into the end bells.

END OF SECTION

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**SECTION 16660  
GROUNDING SYSTEM**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The CONTRACTOR shall furnish all materials and labor, tools, plant, equipment, and incidentals required to furnish and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (NEC), as required by the contract documents and required by the work to be done.
- B. At the option of the OWNER, the underground system shall be furnished and installed with a concrete envelope as specified or without a concrete envelope. The CONTRACTOR shall bid alternate prices for the underground system as follows:
  - 1. Furnish and install the underground system as required by the contract documents.
  - 2. Furnish and install the underground system as required by the contract documents with the following exceptions:
    - a. Do not furnish and install a concrete envelope.
    - b. Furnish and install ducts of the types and sizes required by the contract documents with the exception that ducts under roadways shall be rigid galvanized steel (RGS).

**1.02 REFERENCE STANDARDS**

- A. National Electrical Code (NEC)
- B. Underwriters Laboratory (UL)
  - 1. UL 467

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**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Conduit shall be as specified under Section 16110.
- B. Wire shall be as specified under Section 16120.
- C. Ground rods shall be one (1") inch diameter by ten (10') feet copper clad steel and constructed in accordance with UL 467. The minimum copper thickness shall be twenty-five hundredths (0.25 mm) millimeters. Ground rods shall be Copperweld or approved equal.
- D. Grounding conduit hubs shall be malleable iron type similar to Thomas and Betts Co. Cat. No. 3940, three-fourths (3/4") inch conduit size; Burndy; O-Z/Gedney Co.; or approved equal, and of the correct size for the conduit.
- E. Waterpipe ground clamps shall be cast bronze saddle type, similar to Thomas and Betts Co. Cat. No. 2; Burndy; O-Z/Gedney Co.; or approved equal, and of the correct size for the pipe.
- F. The plant ground grid shall consist of a buried two hundred and fifty (250) kcmil bare stranded copper cable of not less than ninety-eight (98%) percent conductivity at twenty (20°C) degrees Centigrade.
- G. Buried grounding connections shall be by Cadweld process, or accepted equal exothermic welding system.
- H. Ground wire connections to structural steel columns shall be made with long barrel type one-hole heavy duty copper compression lugs, bolted through one-half (1/2") inch maximum diameter holes drilled in the column web, with stainless steel hex head cap screws and nuts.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Grounding electrode conductors shall be buried at a depth of not less than eighteen (18") inches below finished grade. Grounding cables that penetrate equipment slabs shall be run in Schedule 80 PVC conduits.

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- B. Equipment grounding conductors shall be run with all feeders and in all conduits.
- C. All steel building columns shall be bonded together with ground wire in polyvinyl chloride (PVC) conduit and connected to the distribution equipment ground bus. Conductors shall be installed in slabs between columns.
- D. Conduits stubbed into equipment, such as motor control center, shall be fitted with insulated grounding bushings and connected to the equipment ground bus. Boxes mounted below or above motor control center shall be bonded to the equipment ground bus. The grounding wire shall be sized in accordance with Table 250-95 of the NEC, except that a minimum No. 12 AWG shall be used.
- E. Liquid-tight flexible metal conduit in sizes one and one-half (1-1/2") inch and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled), and fastened with plastic tie wraps.
- F. All transformers not provided with neutral grounding resistors shall have their neutrals grounded to the nearest available grounding electrode with a conductor sized in accordance with Article 250-94 of the NEC.
- G. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel, and all other equipment and materials required by the NEC to be grounded, shall be grounded and bonded in accordance with the NEC.
- H. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A or approved equal.
- I. All underground conductors shall be buried not less than eighteen (18") inches below finished grade and laid slack, and where exposed to mechanical injury, shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard. Connections shall be made as hereinbefore specified.
- J. Care shall be taken to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed. A code sized equipment grounding conductor shall be included in all conduits and bonded to equipment frames at each end.

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- K. All grounding type receptacles shall be grounded to the outlet boxes with a #12 THW green conductor connected to the ground terminal of the receptacle, and fastened to the outlet box by means of a grounding screw.

**3.02 TESTS**

- A. Test the resistance of the ground-grid system of the new facility area. All test equipment shall be provided under this Section and as approved by the OWNER. Dry season ground-grid resistance of the system shall not exceed five (5) ohms. If such resistance - values cannot be obtained with the systems shown, provide additional grounding as approved by the OWNER, at the sole cost and expense of the CONTRACTOR.

**END OF SECTION**

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**SECTION 16910  
ELECTRICAL CONTROLS**

**PART 1- GENERAL**

**1.01 SCOPE OF WORK**

- A. The Work covered by this Section consists of furnishing all materials, tools, equipment and labor necessary to complete the treatment system controls necessary to monitor and control electric motors, lighting and provide indication, communication, and alarm. Control devices shall be provided as described in this Section. Items to be provided and installed by the CONTRACTOR include the Main Control Panel (MCP), Remote Control Panels (RCP's), remote Clear Well Pump Controls, flow and pressure element transmitters, level sensors, and all associated enclosures and disconnecting devices.

**1.02 SUBMITTALS**

- A. Copies of all materials required to establish compliance with these specifications shall be submitted to the OWNER in accordance with Section 01300 - Submittals. Submittals shall include, at a minimum, the following:
1. Certified shop drawings showing materials, details of construction, dimensions, panel face layouts, and locations of components of all internal control components as described in ANSI/NEMA ICS 1. This documentation shall be submitted prior to commencing with fabrication of any control panel(s).
  2. Descriptive literature, bulletins and catalogs of new equipment and major components.
  3. Complete, separate bills of material for all control panels, systems and equipment.
  4. Documentation of purchase of specified control components from vendors specified elsewhere in this section.
- B. Submit operating and maintenance data manuals in accordance with Section 01300 - Submittals.

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- C. Submit equipment warranty of the manufacturer as specified in Section 01300 - Submittals.

**1.03 STANDARDS AND REFERENCES**

- A. All control components shall be deployed in accordance with the NEC and shall be constructed utilizing UL Listed components and techniques. Upon completion, all control panels shall be inspected and certified as UL Listed, and a label indicating this certification shall be affixed to all assemblies.
- B. The following references are applicable for this section:
  - 1. NEMA 250- Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 2. ANSI/NEMA ICS 1- Industrial Controls and Systems.
  - 3. ANSI/NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems).
  - 4. ANSI/NEMA ICS 6 - Enclosures for Industrial Control Equipment and Systems.

**PART 2 - PRODUCTS**

**2.01 RATING**

- A. Service: The Main Control Panel (MCP) and Remote Control Panels (RCP) shall operate on 115 Volts ac, single phase power.
- B. All control panels, both main and remote, shall be rated for continuous duty from 0 to 40 degrees C ambient temperature.

**2.02 CONSTRUCTION**

- A. All control devices shall conform to the National Electrical Code (NEC) 1996 Edition, as well as all applicable state and local codes.
- B. All control panels shall be provided with protective pocket(s) inside the door with schematic diagram, connection diagram, and layout drawing of control wiring and components within the enclosure.

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- C. All construction/fabrication methods must conform with ANSI/NEMA ICS 1 regarding construction of industrial control systems.

**2.03 COMPONENTS**

- A. Panelboards are included in Section 16470.
- B. Transformers are included in Section 16432.
- C. Conduit is included in Section 16120.
- D. Wire is included in section 16120.
- E. Programmable Logic Controller and associated components.
  - 1. The Main Control Panel (MCP) of the system shall consist of a programmable logic controller (PLC) with a minimum capacity of 16 local inputs, and 32 local outputs. The CONTRACTOR shall provide an Allen-Bradley SLC-5/03 Programmable Logic Controller, or equal, approved in advance by the OWNER. Inputs and outputs shall use 115 VAC control circuits for all digital functions, and 4-20 mA circuits for all analog functions.
  - 2. The SLC-5/03 PLC shall be supplied with a modular chassis backplane, Allen-Bradley # 1746-A7, containing 7 modular expansion slots.
  - 3. Local inputs will utilize 16 input I/O modules, Allen-Bradley part # 1746-IA16, or approved equal. Local outputs will utilize Allen-Bradley #1746-OA16 output modules (or approved equal), for all local indicators and motor controllers.
  - 4. Communication with remote (wellhead) inputs and outputs will be accomplished via shielded twisted pair. Communication at the PLC will utilize a single Allen-Bradley series 1747-SN communication module, connected with remote wellheads (3) utilizing a single "daisy-chain" shielded twisted pair.
  - 5. Remote location hardware at each wellhead will include Allen-Bradley remote communication module 1747-ASB or approved equal, interfacing with remote I/O device 1791-16AC, mounted within din rail mounted rack.

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**F Indicators, Switches, and Pushbuttons**

1. Pushbuttons and selector switches shall be oil-tight, maintained or momentary contact, as shown on the Drawings.
2. Indicating lights shall be transformer type with push-to-test feature, and the lens color indicated on the Drawings.
3. Pushbuttons, indicating lights and selector switches shall be Bulletin 800 H as manufactured by Allen-Bradley or approved equal.

**G. Control Relays**

1. Time delay relays shall be pneumatic, six hundred (600) volt, twenty (20) ampere contact rating, with calibrated knob operated adjustment. On delay and off delay types and timing ranges as indicated on the Drawings. Relays shall be Allen-Bradley Bulletin 700 or approved equal.
2. Control relays shall be heavy duty machine tool type, with ten (10) ampere three hundred (300)volt convertible contacts. General use relays shall be General Electric Co., Cat. No. CR120A; Allen-Bradley Co., or approved equal.

**H. Interiors**

1. All interiors shall be entirely factory assembled with circuit breakers, wire connectors, terminal blocks, din rails, etc. All wire connectors except screw terminals shall be of the anti-turn solderless type, and shall be suitable for copper and aluminum wire of the sizes indicated.
2. All nameplates used to identify components shall be machine printed, and affixed immediately below each appropriate component.

**I. Enclosures**

1. All control enclosures at wellhead locations shall be NEMA 4 rated, and of 304 stainless steel construction, in enclosures manufactured by Hoffman or approved equal.

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2. Main control enclosure shall be of NEMA 3 construction, manufactured by Allen-Bradley, Hoffman, or approved equal. It shall be of carbon steel construction, and painted with grey baked enamel as described elsewhere in the Specifications.
- J. Supplier
1. The recommended vendor for supplying Allen-Bradley system control components is: Standard Electric Supply Co., Inc, 14 Jewel Drive, Wilmington, MA 01887. Phone number: (508)658-5050.
- K. Terminal Blocks
1. All terminal blocks will be provided as described in ANSI/NEMA ICS 4, and UL Listed.
  2. Power terminals shall be of unit construction type, closed back type, with tubular pressure screw connectors, rated for 600 volts.
  3. Signal and control terminals shall be of modular construction type, channel mounted; tubular pressure screw connectors, rated for 300 volts.
  4. All control panels shall be equipped with 30% spare space on all signal and control terminal strips.
- L. Flow Meters and Recorders
1. Each flow meter installed as specified in Section 15000 - Process Piping and Accessories, shall be equipped with a differential pressure transmitter and a flow rate totalizer with local readout as manufactured by Honeywell Part # STD 924-E1H-0000-MB, S2, TC, SM, ZS, F1D3+XXXX, or approved equal.
  2. The 10-inch wellhouse flow meters and the 16-inch treatment building discharge flow meter shall each be equipped with a circular chart recorder, Part # DR 45AT-1000-00-000-A-000000-0, to provide printed chart data and continuous digital indication of process variables, as manufactured by Honeywell, or approved equal.

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3. An ultrasonic flow meter shall be installed to measure depth/flow in the clear well at the location shown on the Construction Drawings in accordance with the MANUFACTURER's instructions. The unit shall be capable of calculating depth/flow without any external devices for verifying outputs and calibrations. The unit shall be a Badger Meter model 2100 or approved equal.
4. All instrumentation as specified in this subsection shall operate using standard 120 volt electrical service.

**M. Heat Tracing**

1. Heat tracing shall be installed on all piping exposed to freezing temperatures during normal operating conditions, as specified in Section 15000 - Process Piping and Accessories. Heat tracing shall be parallel, self-regulating heat cable designed with adequate power supply for freeze protection in industrial environments, as manufactured by Cooperheat, Inc., Chromalox, or approved equal. Heat tracing shall be mounted as shown on the Construction Drawings and in accordance with the MANUFACTURER's instructions.
2. Heat tracing shall have automatic controls for continuous operation. Thermostat bulbs for automatic on/off operation shall be attached to the pipe in accordance with the MANUFACTURER's instructions.
3. To protect outdoor pipelines from freezing in case of heat tracing failure, alarms shall be provided for low temperature conditions, with an Electroflash amber strobe failure light indicator, 5½ inch diameter, or equal, mounted on the pipe or the building wall in a visible location.
4. A MANUFACTURER's representative shall provide in writing the heat tracing design calculations for review and approval by the OWNER, and shall submit such information in accordance with these Technical Specifications.



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**2.04 SHOP TESTING**

**A. General**

1. All control equipment shall be pre-tested as a complete unit prior to being brought to the site for installation. All functions of the control system will be confirmed to be operational prior to transport to the site. All testing will be performed in accordance with NEMA and ANSI standards, and certified documentation of the test results shall be submitted to the OWNER by the manufacturer.
2. The OWNER shall be given at least 5 working days notice prior to performance of shop test, in order to be present to witness the shop test procedure.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. The CONTRACTOR shall provide all power and control connections from the control panels, panelboards, etc. to the required motors and equipment as specified herein and/or as indicated on the Construction Drawings. All control items shall be mounted and connected, whether furnished under this or other sections, except as otherwise specified. All control items shall be plainly marked by an engraved phenolic nameplate, stating the motor and equipment that is controlled, to the approval of the OWNER.
- B. All controls and associated components shall be installed in strict accordance with instructions and recommendations of the MANUFACTURER. Any additional inventory required for installation, but not specifically identified on the Construction Drawings or within these Technical Specifications, is the responsibility of the CONTRACTOR.
- C. All wires terminated as part of the installation of the control systems shall be clearly labelled with machine-printed labels, and noted appropriately on the associated submittals and as-built Construction Drawings.
- D. All wires shall be installed so that no strain is placed on any wiring devices, trays or terminal strips within the control panel(s), and that wire bends are accomplished in an aesthetic manner.

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**3.02 ASSEMBLY**

**A. Standards**

1. All control panel assemblies shall conform to applicable NEMA, ANSI, IEEE, and JIC standards.
2. Check ground connections for continuity and resistance.
3. Adjust unit compartment doors, hinges and latching mechanisms.
4. Simulate all interlocks once installed, and verify that system controls respond appropriately as indicated on the Construction and Submittal Drawings.
5. Perform function test(s) of all field-wired input sensors, including all pressure switches, flow switches, level sensors, and remote contacts from peripheral equipment and interfaces.

- B. In the event of an equipment fault, the OWNER shall be notified immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the CONTRACTOR, the OWNER, and the MANUFACTURER's factory service technician.**

**3.03 FIELD TESTING**

- A. Make the following minimum checks and tests prior to calling on the representative of the manufacturer for startup, testing and adjustment.**

1. Check electrical and mechanical interlocks for proper operation

**3.04 CLEAN UP**

- A. All rubbish, cuttings, scrap and slag shall be removed from in and around the control systems upon completion of installation. All spare wires shall be bundled, secured and labelled. Compressed air may not be used to removed dirt, dust or debris from in or around the controls.**

**16910-8  
ELECTRICAL CONTROLS**

Revised: 3/5/96



**GROUNDWATER INTERIM REMEDIAL MEASURE  
GRUMMAN AEROSPACE CORPORATION  
BETHPAGE, NEW YORK**

**B. Methods**

1. All factory-installed wiring shall be routed through plastic wiring trays, manufactured by Thomas & Betts, Panduit or approved equal.
2. All internal panel wires shall be identified at each end by machine-printed number tags, identified on shop drawings for identification on point-to-point wiring diagram.
3. Where possible, all internal panel components shall be din-rail mounted.
4. The completed panel(s) shall have a minimum of 30% available unused physical space for future expansion/modification, as well as a minimum of 30% available spare power from the panel power supply.
5. Control wiring shall be done with stranded copper wire, with 600 (six hundred) volt, 90 (ninety) degree C, flame-retardent, type MTW thermoplastic insulation, NEMA Class II-S.
6. Terminal boards and strips shall be bottom or side mounted, and clearly labelled prior to installing on site.

**END OF SECTION**

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**16910-9  
ELECTRICAL CONTROLS**

Revised: 3/5/96







FORTUNATO SONS, INC.  
630 Johnson Avenue  
Bohemia, New York 11716

**EXTRACTION WELLS BIDSHEET**

All persons wishing to submit a competitive bid proposal must use these bidsheets. In addition to providing an amount in figures, you must write out each per unit bid where indicated. Additional information, if necessary, can be attached to this bidsheet. This bidsheet consists of seven pages in total, partial bidsheets will not be accepted.

1. Mobilization/Demobilization

A. The Contractor will mobilize/demobilize one mud-rotary rig (including all necessary tools) and a full crew to the Grumman Aerospace Corporation, Bethpage, New York site.

Mud Rotary Rig (for pilot boreholes) 11,100<sup>00</sup>  
\$ \_\_\_\_\_ /Lump Sum (unit price)  
1 unit

Written Subtotal Amount \_\_\_\_\_ \$ 11,100<sup>00</sup>  
*Eleven thousand one hundred dollars* Subtotal

B. The Contractor will mobilize/demobilize one reverse rotary rig and full crew to the Grumman Aerospace Corporation, Bethpage, New York site.

Reverse Rotary Rig (for extraction wells) 25,786<sup>00</sup>  
\$ \_\_\_\_\_ /Lump Sum (unit price)  
1 unit

Written Subtotal Amount \_\_\_\_\_ \$ 25,786<sup>00</sup>  
*Twenty five thousand seven hundred eighty six dollars* Subtotal

C. The Contractor will mobilize/demobilize all necessary tools, equipment and manpower to perform the final development of the extraction wells at the Grumman Aerospace Corporation, Bethpage, New York site.

5700<sup>00</sup>  
\$ \_\_\_\_\_ /Well  
3 Wells

Written Subtotal Amount \_\_\_\_\_ \$ 17,100<sup>00</sup>  
*Seventeen thousand one hundred dollars* Subtotal

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DATE CONTROL

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FORTUNATO SONS, INC.  
630 Johnson Avenue  
Bohemia, New York 11716

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2. Drilling

The Contractor will provide all labor, tools, and materials required to perform and complete the drilling in a safe and efficient manner.

A. Pilot borehole by mud-rotary method (estimated footage is 1,695 feet).

40<sup>00</sup>  
\$ /ft.  
1,695 feet

Written Subtotal Amount

\$67,800<sup>00</sup>  
Subtotal

*Sixty seven thousand eight hundred dollars*

B. 24-inch diameter borehole by mud rotary/reverse method for the extraction wells (estimated footage 1,695 feet).

74<sup>00</sup>  
\$ /ft.  
1,695 feet

Written Subtotal Amount

\$130,575<sup>00</sup>  
Subtotal

*One hundred thirty thousand five hundred fifteen dollars*

C. Laying water lines to supply pilot borehole and extraction well drilling and installation (estimated 5000 feet).

100  
\$ /ft.  
5,000 feet

Written Subtotal Amount

\$5,000<sup>00</sup>  
Subtotal

*Five thousand dollars*

3. Formation Sampling

For collecting split-spoon core samples.

A. Estimated total quantity is 130, 2-inch diameter core samples for boreholes drilled with mud rotary/reverse rotary rig for the extraction wells.

85<sup>00</sup>  
\$ /sample  
130 samples

Written Subtotal Amount

\$11,050<sup>00</sup>  
Subtotal

*Eleven thousand fifty dollars*

CLOSED & RETURNED  
SITE CONTROL

FORTUNATO SONS, INC.  
630 Johnson Avenue  
Bohemia, New York 11716

4. Sieve Analysis

A. Estimated total quantity is 130 soil samples for the purpose of sieve analyses (includes providing curves and recommending gravel pack and well screen sizes).

35<sup>00</sup>  
\$ /sample  
130 samples

Written Subtotal Amount \_\_\_\_\_

\$ 4550<sup>00</sup>

*Four thousand five hundred fifty dollars*

Subtotal

5. Well Casing

A. For supplying and installing 18-inch low carbon steel casing for the extraction wells (estimated total footage 1,500 feet).

65<sup>50</sup>  
\$ /ft.  
1,500 feet

Written Subtotal Amount \_\_\_\_\_

\$ 98,250<sup>00</sup>

*Ninety eight thousand two hundred fifty dollars*

Subtotal

6. Well Screen

A. For supplying and installing 8-inch or 10-inch diameter, flush-joint, internally-threaded, stainless-steel (316), continuously wire wrapped well screen for the extraction wells (estimated total footage 195 feet). Slot size to be determined.

82<sup>50</sup>  
\$ /ft.  
195 feet

Written Subtotal Amount \_\_\_\_\_

\$ 16,084<sup>50</sup> (A)

*Sixteen thousand eighty four and 50/100*

Subtotal for 8-inch

97<sup>00</sup>  
\$ /ft.  
195 feet

Written Subtotal Amount \_\_\_\_\_

\$ 18,915<sup>00</sup>

*Eighteen thousand nine hundred fifteen dollars*

Subtotal for 10-inch

(A) Amount not included in total on page 7. Included amount for 10" screen

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QUOTE CONTROL

FORTUNATO SONS, INC.  
630 Johnson Avenue  
Bohemia, New York 11713

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7. Gravel Pack

A. For supplying and installing gravel pack in the extraction well boreholes around the well screens to an elevation 30 feet above the top of the screen (estimated quantity 285 linear feet).

30<sup>00</sup>  
\$ /ft.  
285 feet

Written Subtotal Amount \_\_\_\_\_

\$550<sup>00</sup>

*Eight thousand five hundred fifty dollars*

8. Well Seal

A. For supplying and installing a fine sand (finer than gravel pack) in extraction well borehole to an elevation of 15 feet above the top of the gravel pack (estimated quantity 45 linear feet).

25<sup>00</sup>  
\$ /ft.  
45 feet

Written Subtotal Amount \_\_\_\_\_

\$1125<sup>00</sup>

*One thousand one hundred twenty five dollars*

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G.D.S. QUOTE CONTROL

B. For supplying and installing 100 percent polymer-free bentonite slurry seal to an elevation of 5 feet above the top of the fine sand (estimated quantity of 15 linear feet), and for supplying and installing polymer-free 95 percent bentonite/5 percent cement grout to a depth of 2 feet below land surface (estimated quantity 1,350 linear feet).

Bentonite Seal

40<sup>00</sup>  
\$ /ft.  
1,350 feet 15 feet

Written Subtotal Amount \_\_\_\_\_

\$600<sup>00</sup>

*Six hundred dollars*

Bentonite Cement/Grout

25<sup>00</sup>  
\$ /ft.  
1350 feet

Written Subtotal Amount \_\_\_\_\_

\$33,750<sup>00</sup>

*Thirty three thousand seven hundred fifty dollars*

FORT NATO SONS, INC.  
530 Johnson Avenue  
Bergen, New York 11715

5

- C. For supplying and installing polymer-free 95 percent bentonite/5 percent cement grout to land surface for the purpose of abandoning the extraction well pilot boreholes (estimated quantity 1,695 linear feet).

Bentonite/Cement Grout

12<sup>00</sup>  
\$ /ft.  
1,695 feet

Written Subtotal Amount \_\_\_\_\_

\$ 20,340<sup>00</sup>  
Subtotal

*Twenty thousand three hundred forty dollars*

- 9. Well Completion

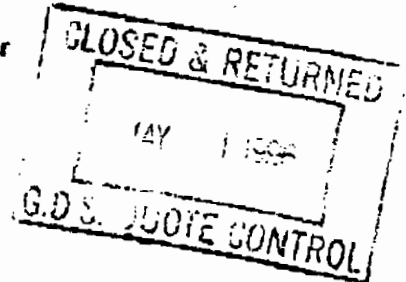
- A. For supplying and installing one 2-foot cement seal above the grout and installing a hinged locking cover over the extraction wells (estimated quantity 3).

300<sup>00</sup>  
\$ /cover  
3 covers

Written Subtotal Amount \_\_\_\_\_

\$ 900<sup>00</sup>  
Subtotal

*Nine hundred dollars*



- 10. Well Development (for all three wells combined)

- A. Preliminary development by mechanical surging and air-lift (estimated 120 hours).

150<sup>00</sup>  
\$ /hour  
120 hours

Written Subtotal Amount \_\_\_\_\_

\$ 18,000<sup>00</sup>  
Subtotal

*Eighteen thousand dollars*

- B. Final development (includes mobilization and setting and removing a pump capable of 1,600 gpm) by pumping (estimated 24 hours).

150<sup>00</sup>  
\$ /each  
24 hours

Written Subtotal Amount \_\_\_\_\_

\$ 3600<sup>00</sup>  
Subtotal

*Three thousand six hundred dollars*

FORTINATO SONS, INC.  
630 Johnson Avenue  
Bohemia, New York 11715

11. Health and Safety Equipment for Personnel

For supplying, monitoring, and fitting all contractor and sub-contractor personnel with Level "C" or "B" Health and Safety equipment to be used at the work site if conditions require higher than Level "D" protection. In accordance with the Health and Safety Plan (HASP) prepared for the site, it is anticipated that a Level "D" or a modified Level "D" protection will be required as minimum protection while working on-site, and the Contractor will include the cost of supplying Level "D"/modified Level "D" protection in his operating costs used to calculate his bid. Upon request, a copy of the HASP will be available from Geraghty & Miller to all interested bidders.

A. Level "C" Protection

Written Amount Six hundred dollars  $600^{00}$   
(do not include in total bid price) \$ \_\_\_/day

B. Level "B" Protection

Written Amount \_\_\_\_\_  $1200^{00}$   
(do not include in total bid price) \$ \_\_\_/day  
One thousand two hundred dollars

12. Stand-By Rate

Compensation for services when work is stopped by Grumman, or Consultant (estimated 10 hours).

$120^{00}$   
\$ \_\_\_/hour  
10 hours

Written Subtotal Amount \_\_\_\_\_  $1200^{00}$   
One thousand two hundred dollars Subtotal

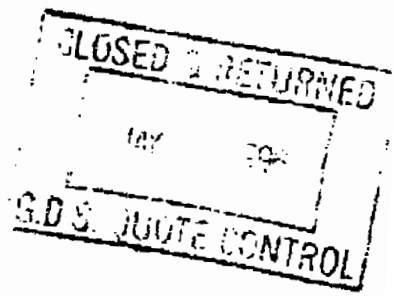
13. Disposal/Holding Truck

A disposal/holding truck (minimum 6,000 gallon tank) will be supplied by the driller to contain, settle and transport preliminary development water, drilling fluids or any other material to an on-site plant or other location designated by Grumman. During preliminary development, two disposal/holding tank trucks will be needed on-site.

$800^{00}$   
\$ \_\_\_/day  
21 days

Written Subtotal Amount \_\_\_\_\_  $16800^{00}$   
Subtotal

Sixteen thousand eight hundred dollars



FORTINATO SONE, INC.  
630 Johnson Avenue  
Bohemia, New York 11716

7

14. Decontamination

All downhole equipment must be steam cleaned prior to drilling, between each well, and before leaving the site (estimated quantity 24 hours).

140<sup>02</sup>  
\$ \_\_\_\_\_/hour  
24 hours

Written Subtotal Amount \_\_\_\_\_

\$ 3360<sup>02</sup>  
Subtotal

*Three thousand three hundred sixty dollars*

Grand Total : \$ 498,291<sup>02</sup> (1)

(1) Total includes Item 64 10 inch screen pricing

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CONTROL





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TRANSACTION REPORT

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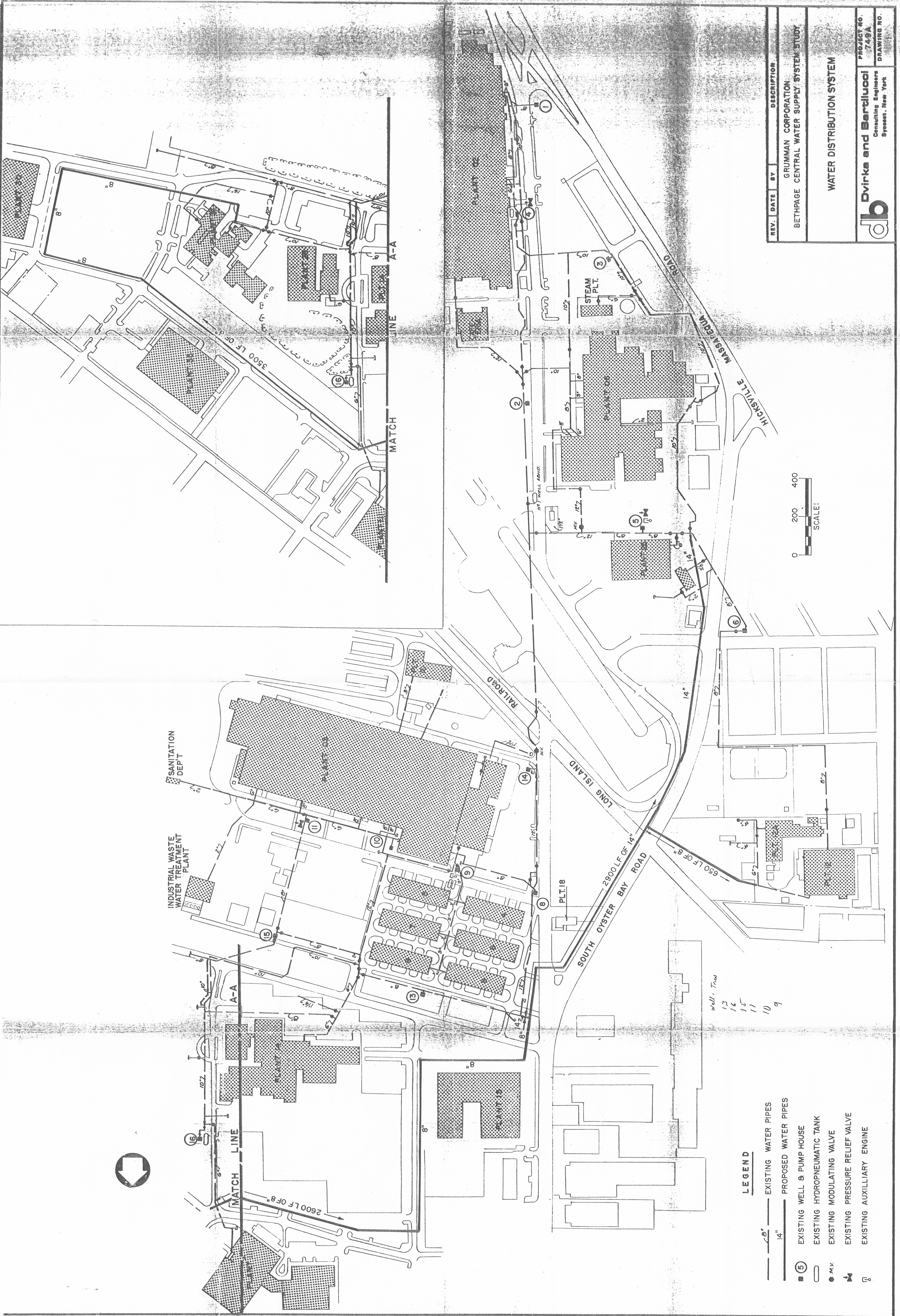
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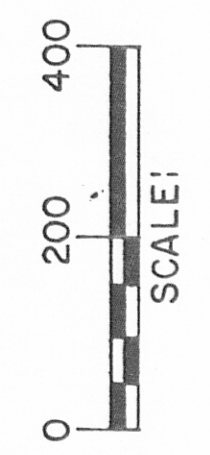
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REV.	DATE	BY	DESCRIPTION
			GRUMAN CORPORATION BETHPAGE CENTRAL WATER SUPPLY SYSTEM STUDY
			WATER DISTRIBUTION SYSTEM
			PROJECT NO. 74-9A DRAWING NO.

**Dvirka and Barilucci**  
 Consulting Engineers  
 Syosset, New York



**LEGEND**

- 8" — EXISTING WATER PIPES
- 14" — PROPOSED WATER PIPES
- ⑤ EXISTING WELL & PUMP HOUSE
- EXISTING HYDROPNEUMATIC TANK
- M.V. EXISTING MODULATING VALVE
- ⚡ EXISTING PRESSURE RELIEF VALVE
- ⊞ EXISTING AUXILIARY ENGINE

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