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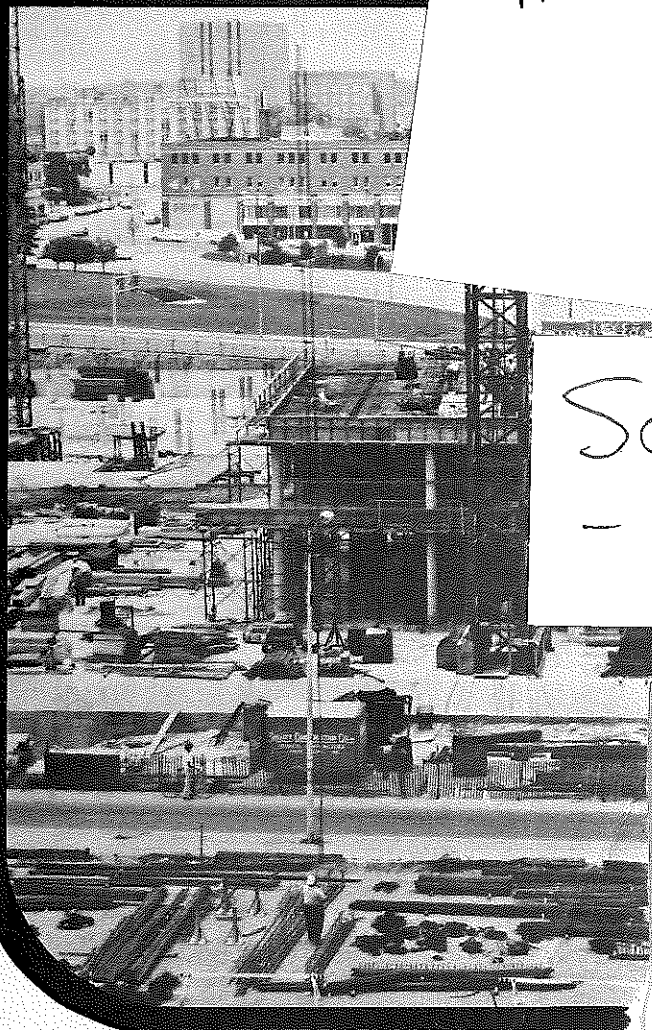
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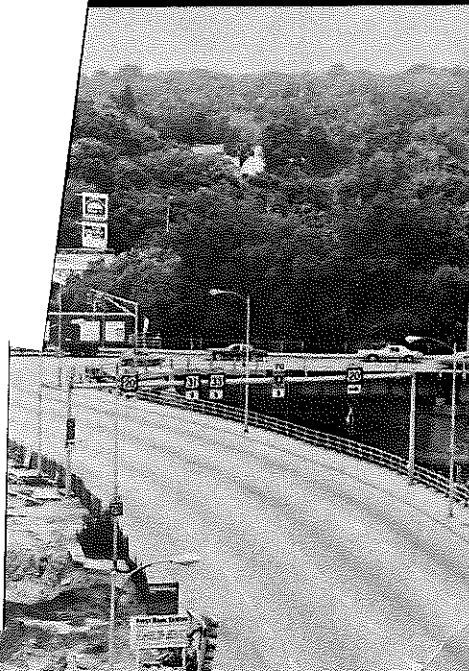
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Contract No. _____

SPECIFICATIONS
FOR
VILLAGE OF GROVER HILL
SEWAGE WORKS IMPROVEMENTS

October, 1989

Prepared For:
VILLAGE OF GROVER HILL
VILLAGE COUNCIL
BOARD OF PUBLIC AFFAIRS

Prepared By:
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Ohio #E-52085
DEL Job #86065D

VILLAGE OF GROVER HILL
SEWAGE WORKS IMPROVEMENTS
BOOK 2 - DIVISION II
TREATMENT FACILITY/LAB BUILDING
REBID
OCT. 4 1989

BOOK 2 - DIVISION II

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SECTION 01005

ADMINISTRATIVE PROVISIONS

PART 1 - GENERAL

1.01 Form of Specifications:

- A. Abbreviated or outlined type, includes incomplete sentences.
- B. Omission of words or phrases, such as: "the Contractor shall", "in conformance with", "shall be", "as noted on the plans", "according to the plans", "a", "an", "the" and "all" are intentional.
- C. Supply omitted words or phrases by inference.
- D. Part numbers are not intended to be consecutive, but represent standard specification titles.

1.02 Work Covered by Contract Documents:

- A. Work covers construction of improvements generally described in the Notice to Bidders and shown on the detailed project plans.
- B. Contractor's Duties:
 - 1. Pay all legally required sales, consumer and use taxes and adhere to the following:
 - a. Contractor shall obtain sales tax information from all subcontractors and suppliers.
 - b. Submit sales tax information on proper forms to Owner prior to final acceptance.
 - c. Contractor shall be allowed an exemption of Ohio sales tax.

1.03 Contracts:

- A. Construct work under Unit Price Contract as indicated.

1.04 Project Contacts:

- | | |
|---|--|
| A. Engineer: Stephen C. McPherson
Design Enterprise, Ltd.
901 East 86th Street
Indianapolis, Indiana 46240
(317) 255-7088 | Mayor: John Moon
Village of Grover Hill
Village Hall
1 Main Street
Grover Hill, Ohio 45849
(419) 587-3225 |
|---|--|

1.05 Contracts:

- A. Two Lump Sum Contracts will be let on this project and are as follows:**
 - 1. Electrical Contract (E.C.): Electrical Contractor shall provide and install MCC, generators, instrumentation and controls, all electrical fixtures, and make electrical connects to all equipment or fixtures supplied by other Contractors.**
 - 2. General Contract (G.C.): General Contractor shall be primary coordinator of all contracts within this Division II and shall provide and install all equipment, connections and work required which is not specifically provided under the other contracts.**
 - 3. General Contractor shall also provide and install an EPA project sign and all items within Section 01500 and Section 01580.**

1.06 Summary of Work:

- A. Furnish and install equipment and materials and perform construction associated with project, as outlined in Specifications and shown on Drawings.**
- B. The Contractor shall purchase all required patent rights for the Biolac process by Parkson Corp. for the Wastewater Treatment Plant installation and operation.**
- C. The following is a description of equipment and services to be procured from Parkson.**
 - 1. Lagoon Baffles per Section 11115**
 - 2. Clarifier/Flocculation Equipment per Section 11221**
 - a. All integral clarifier equipment required including flocculating rake mechanism, partition wall and overflow weir.**
 - 3. Wastewater Aeration Equipment per Section 11230**
 - a. Float assemblies with required flexible hose and stainless steel hardware to form complete aeration chains.**
 - b. Diffuser assemblies, including Wyss diffusers with diffuser frame, sheath, retainer pad, check valve, stainless steel clamps and screws.**
 - c. Hardware for attaching the aeration chain to the piping and restraining chains and hooks. The imbedded posts and anchors to which the restraining chains attach are provided by the Contractor.**

- d. Ductile iron air piping manifold with mechanical joints, tee pieces and butterfly valves.
 - e. Quantity 3, positive displacement blower assemblies, complete with blower, mounting base V-belt drive and guard, TEFC motor, inlet filter/silencer, pressure relief valve, flexible discharge connector, check valve, discharge pressure gauge, isolation butterfly valve and discharge silencer.
 - f. One remote mount electrical control panel, Nema 4 enclosure, to operate the aeration system and clarifier.
 - g. Three (3) man-days and one (1) trip of installation supervision and three (3) man-days and one (1) trip of start-up supervision.
- 4. Air Lifts per Section 11304
 - a. Sludge removal system including sludge suction piping; sludge gate for directing WAS/RAS flow; quantity 1, positive displacement blower, with air piping and accessories.
 - 5. Fiberglass Weirs per Section 11350
 - 6. Contractor shall include \$102,180 in his bid for the equipment and services procured from Parkson. (See Bid Document B-10)
- D. Work includes the completion of systems listed below: Two (2) wastewater cells, sludge pond double liner system with leak detection system, lab building and equipment, yard piping, plant lift station, fencing, 4" force main, access road and main pump station. Contractor shall install all equipment furnished by Parkson Corp. Contractor shall include \$18,000 in his bid for the power transmission cost for Ohio Power Company at the treatment plant site. (See Bid Document B-10)
 - E. Work includes all laboratory equipment, furnishings, supplies, casework and fixtures as specified in Sections 11450 and 12345 of the Specifications.

1.07 Sequence of Work:

- A. The general sequence of installation for the main components of work to be installed within this Contract is as follows:
 - 1. The road to the sewage treatment plant shall be installed first along with required power lines and electrical substation.

2. The components of work in this Contract which convey and treat sewage shall be installed next. The order of these components shall be at the Contractor's option to achieve optimal expediency, efficiency and protection of installed work.
3. Install and secure area with the specified fence after major earthwork operations but prior to equipment delivery, storage, installation and testing.
4. The domestic water well shall be installed next.
5. The office building, laboratory, equipment, and seeding/ planting shall be last.

1.08 Supervision by Contractor:

- A. The Contractor will supervise and direct his work. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction for his work unless specified otherwise. The Contractor will employ and maintain on the work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The supervisor shall have full authority to act on behalf of the Contractor and all communications given to the supervisor shall be as binding as if given to the Contractor. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the work. The Contractor shall strictly adhere to any direction given by Engineer in regards to installation of Biolac equipment and/or related processes to maintain the Parkson Process Guarantee.

1.09 Work and Workmanship:

- A. Provide all required labor, materials, equipment and Contractor's services necessary for the complete installation of systems required in full conformity with requirements of authorities having jurisdiction; all as indicated on drawings and herein specified.
- B. Finished job shall be functional and complete in every detail including any and all such items required for complete system whether or not these items be specified or shown on drawings.
- C. Special attention shall be given to accessibility of working parts and controlling parts. Adjustable parts shall be within easy reach. Removable parts shall have space for removal.
- D. Each Contractor and Subcontractor shall study the drawings and specifications and acquaint himself with details of all work to be performed by other trades. Necessary steps shall be taken to integrate and coordinate his work with the other trades.

- E. It is assumed that the Contractor is familiar with standard first class installation procedures. Therefore, these specifications do not attempt to include every detail or operation necessary for a complete installation.
- F. It is the responsibility of each Contractor and Subcontractor to leave necessary room for other trades. No extra compensation will be allowed to cover the cost of removing piping, conduit, or equipment found encroaching on space required by others.

1.10 Historical or Archaeological Discovery:

- A. If during the course of construction, evidence of deposits of historical or archaeological interest is found, cease operations affecting the find and notify the Owner, who shall notify the State Historical Department. No further disturbance of the deposits shall ensue until the Contractor has been notified by the Owner that he may proceed. The Owner will issue a Notice to Proceed only after the State official has surveyed the find and made a determination of value and effect and submitted such determination to the Owner.
- B. Compensation to the Contractor, if any, for loss of time or changes in construction to avoid the find, shall be determined in accordance with changed conditions or change order provisions of the specifications.

1.11 Engineering Services:

- A. Owner will furnish boundary surveys, establish base lines for principal components for work, and provide bench marks as shown on drawings. Contractor shall develop and make detail surveys as required to execute the construction.
- B. Preserve all monuments, bench marks, reference points and stakes established by the Engineer. In case of willful or careless destruction of same, the Contractor will be charged with the resulting expense of replacement and shall be responsible for any mistakes or loss of time that may result from their unnecessary loss or disturbance.
- C. It shall be the duty of the Contractor to call to the attention of the Engineer any reference lines, points or bench marks which may have been disturbed or which seem to be off line or grade.
- D. Contractor shall reimburse Owner for extra engineering cost necessitated by continuance of work beyond the completion date recognizing time extensions granted by Owner. This cost will be a part of the assessed liquidated damages, per the General Conditions.

- E. Contractor shall reimburse Owner for engineering, design and inspection cost necessitated by use of equipment other than that detailed in plans and specifications.
- F. It should be particularly noted that the terms "furnish" and "provide" are interchangeable and that each of these terms means to provide, install and connect, unless otherwise stated.
- G. When tables or schedules show quantities of materials, they shall not be used as a final count. These figures serve only as a guide for furnishing all the materials on drawings or as specified.

1.12 Drawings and Minor Deviations:

- A. Construction drawings show general arrangement of all piping, equipment and appurtenances. They shall be followed as closely as actual building construction and work of other trades will permit. Mechanical work shall conform to requirements shown on all drawings. General and structural drawings shall take precedence over mechanical drawings. It is not possible to indicate all offsets, fittings and accessories as may be required to meet such conditions. Do not scale from drawings.
- B. In event of conflict of requirements detailed in the drawings, General Conditions, Administrative Provisions and any subsequent sections of these specifications, the Bidder shall inform the Engineer of such conflict in writing not later than ten (10) days before the bids are due. If such notification is not provided, the Contractor shall accept the Engineer's decision in resolution of such conflict without any further compensation.
- C. For purpose of clarity and legibility, distribution systems are essentially diagrammatic, although size and location of equipment and piping are drawn to scale where possible. Verify Contract Documents information at the site.

1.13 Guarantee:

- A. In the event of a conflict between the following and the General Conditions at the front of the specifications, the latter shall prevail.
- B. Except as otherwise specified, under individual equipment sections, all workmanship, materials and equipment shall be guaranteed for a period of one year after final acceptance of project by Owner.
- C. Contractor agrees to make good all damage to construction of building or site, or equipment which in the opinion of Engineer, is result of, or incidental to the use of materials, equipment or workmanship which are inferior, defective or not in accordance with specifications.

- D. Contractor shall keep works in good repair during guarantee period. In case such repairs become necessary, Owner shall give written notice to Contractor to commence such repairs within thirty (30) days after such notice is given. Owner may make such repairs either by its own employees or by independent contract and may thereupon recover from the Contractor and his sureties cost of repairs so made together with cost of supervision and inspection thereof. Owner shall have sixty (60) days after expiration of said guarantee period in which to notify Contractor of any such repairs necessary on date of such expiration.
- E. Determination of the necessity for repairs shall rest entirely with Engineer whose decision upon the matter shall be final and obligatory upon the Contractor. Guarantee herein stipulated shall extend to the whole body of improvement and all its appurtenances.
- F. Please refer to Process Guarantee Section 01006.

1.14 Electrical Connections to Equipment:

- A. In event that supplier of equipment requires larger starter or disconnect than those indicated on documents, he shall reimburse the Electrical Work Contractor supplying these items for the difference.
- B. Connections and wiring diagrams shown on drawings or described in specifications are typical and are for bidding purposes only. Detailed diagrams and instructions shall be provided by Contractor supplying equipment.
- C. Additional relays, switches, contractors, conduit, wire, connections, etc., which may be required for control purposes in addition to those specified for and indicated on drawings shall be provided by the Electrical Work Contractor at the General Contractor's expense. These devices shall be installed by the supplier.
- D. Wiring diagrams shall be specially drawn so they will apply specifically to this project. "Typical" wiring diagrams will not be acceptable for installation purposes. In event that several pieces of equipment from different suppliers are combined in one system, Contractor shall furnish complete wiring and control diagram to enable Electrical Work Contractor to make proper connection. Diagrams shall be submitted to Engineer for approval prior to actual wiring.
- E. Contractor shall furnish to Electrical Work Contractor written notice of approval and acceptance of all control wiring installed for mechanical systems by Electrical Work Contractor. Such approval shall be given within thirty (30) days of completion of all such control wiring. Two (2) copies of letter shall be sent to Engineer.

1.15 Requirements of Regulatory Agencies:

- A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations.
- B. In case of difference between building codes, specifications, state laws, local ordinances, industry standards and utility company regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Engineer in writing of any such difference.
- C. Non-Compliance: Should Contractor perform any work that does not comply with the requirements of applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.
- D. Permits: Each Contractor shall obtain and pay for all building permits required by his work.
- E. All work shall comply with the current requirements of the U.S. Department of Labor - Occupational Safety and Health Administration, entitled Occupational Safety and Health Standards; National Consensus Standards and Established Federal Standards.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

SECTION 01006

PARKSON SUBCONTRACT PROVISIONS

PART 1 - GENERAL

1.01 Work Included:

- A. The Contractor shall purchase all required patent rights for the Biolac process by Parkson Corp. for the Wastewater Treatment Plant installation and operation.
- B. The following is a description of equipment and services to be procured from Parkson.
 - 1. Float assemblies with required flexible hose and stainless steel hardware to form complete aeration chains, per Section 11230 of the Specifications.
 - 2. Diffuser assemblies, including Wyss diffusers with diffuser frame, sheath, retainer pad, check valve, stainless steel clamps and screws, per Section 11230 of the Specifications.
 - 3. Hardware for attaching the aeration chain to the piping and restraining chains and hooks per Section 11230 of the Specifications. The imbedded posts and anchors to which the restraining chains attach are provided by the Contractor.
 - 4. Ductile iron air piping manifold with mechanical joints, tee pieces and butterfly valves, per Section 11230 of the Specifications.
 - 5. Quantity 3, positive displacement blower assemblies, complete with blower, mounting base V-belt drive and guard, TEFC motor, inlet filter/silencer, pressure relief valve, flexible discharge connector, check valve, discharge pressure gauge, isolation butterfly valve and discharge silencer, per Section 11230 of the Specifications.
 - 6. One remote mount electrical control panel, Nema 4 enclosure, to operate the aeration system and clarifier, per Division 16 of the Specifications and as shown on Drawings.
 - 7. All integral clarifier equipment required including flocculating rake mechanism, partition wall and overflow weir, per Section 11221 of the Specifications.
 - 8. Sludge removal system including sludge suction piping; sludge gate for directing WAS/RAS flow; Quantity 1, positive displacement blower, with air piping and accessories per Section 11304 of the Specifications.

9. Three (3) man-days and one (1) trip of installation supervision and three (3) man-days and one (1) trip of start-up supervision, per Section 11230 of the Specifications.
10. Contractor shall include the dollar amount stated in the Bid Forms in his bid for the equipment and services procured from Parkson.

C. Contractor shall install all equipment furnished by Parkson Corp.

PART 2 - PRODUCTS

2.01 Parkson Corporation Quotation, Conditions of Sale and Process Guarantee:

- A. The Parkson Corporation Process Guarantee shall be extended directly to the Village of Grover Hill, Ohio.
- B. Parkson control panel shall be as described in Section 11230 hereinafter.
- C. The following are copies of original pages which will be forwarded to the Contactor awarded the Contract for the General Construction ("GC"):



BIOLACTM TREATMENT SYSTEM

BIOLAC-R TREATMENT SYSTEM SPECIFICATION

FOR GROVER HILL, OH WWTP

1.0 General

The Biolac-R Treatment System is a biological treatment system equipment package including aeration system, integral clarifier, sludge removal system and controls for operation of the above. To insure the integrity of the system, all of the components listed above must be supplied by the same manufacturer. The Biolac System equipment shall be as manufactured by Parkson Corporation.

All concrete required for support or installation of any equipment supplied as part of the Biolac System shall be provided as shown on the plans. All concrete will be provided by the contractor.

2.0 Floating Aeration Chain System

2.1 General

The floating aeration chain system shall be as manufactured by Parkson Corporation. It is the intent of this specification that the manufacturer provides a complete aeration chain system including all equipment and hardware required for the in-basin components.

2.2 Float Assembly

The float assembly shall be composed of an outer polyethylene shell filled with closed-cell polyurethane foam. The ends of the float assembly shall be sealed.

The float shell shall contain inhibitors to resist ultraviolet deterioration. The float shall be designed such that even with the entire aeration chain filled with water, it will remain afloat.

Through the center of the float and extending out each end of the float, will be an air pipe with one hose connection on each side of the float.

Air will travel through the air pipe and hose connections, to the downcoming air tubes. Two downcoming air tubes will be provided per float. They will attach to the hose connections in the air pipe by stainless steel clamps. The downcoming air tubes will be made of EPDM (ethylene-propylene diene material) or equal and have an inside diameter of 3/4". They will connect to a diffuser assembly and be cut to a length so that the diffuser assembly is positioned with the fine bubble diffusers approximately 1 foot off the basin bottom (from the horizontal centerline of the diffusers) at the minimum liquid level. The downcoming air tubes will connect to the diffuser assembly with stainless steel clamps.

2.3 Flexible Hose

Flexible hose will be used to connect the air pipes from adjacent float assemblies together to form the aeration chains. The flexible hose shall be of multi-layered construction. The outer and inner layer will be made of PVC, with the outer layer impregnated with plasticizers and U.V. inhibitors. The hose will be reinforced in the middle with 2 spiral plies and one longitudinal ply of Vytacord® fiber for strength. All layers shall be fused together to form one continuous hose material. The hose shall have an inside diameter of 4". It shall be provided in 300 ft. rolls and cut to suit at the jobsite at time of installation.

2.4 Fine Bubble Diffusers - General

Connected to the air pipe through the float assembly by EPDM flexible downcoming air tubing, is a fine bubble diffuser/counterweight assembly for introducing the air into the wastewater. The diffuser/counterweight assembly will have PVC or LDPE wetted parts. Each diffuser/counterweight assembly will support either two or four diffusers.

Diffusers shall be Wyss® Flex-A-Tube® as manufactured by Parkson Corporation. The diffuser shall be of hollow cylindrical shape when the air is being diffused through it and shall be able to collapse into the frame when air is not being diffused. Rigid, microporous ceramic or plastic diffusers are not acceptable.

The minimum outside diameter shall be approximately 2.4 inches (6.1 cm) and the overall length approximately 24.5 inches (62.2cm).

2.5 Diffuser Sheath

The diffuser sheath shall be composed of a modified, PVC, special soft plastic material. This soft plastic sheath shall be held in place by stainless steel clamps.

2.6 Diffuser Frame

The diffuser frame shall be one piece construction, acetal or other suitable plastic material. The frame shall have a 3/4 inch NPT inlet. Thread quality shall be such that the diffuser can be installed without pipe sealents.

2.7 Backflow Check Valve

The diffuser shall have a separate check valve to eliminate backflow into the aeration system. The check valve shall consist of a soft plastic flap, retainer pad and two (2) stainless steel screws. The check valve shall not impede air flow and keep headloss to a minimum.

2.8 Diffuser Components

Each diffuser consists of:

- One (1) - Frame
- One (1) - Sheath.
- One (1) - Retainer Pad.
- One (1) - Check Valve
- Two (2) - 304 Stainless Steel Screws.
- Two (2) - Stainless Steel Clamps.

Additional hardware and piping required to complete the diffuser/counterweight assemblies shall be provided and made of PVC or LDPE wetted parts.

2.9 Aeration Chain Attachment

The aeration chain will be fed air from one/both sides and connect to the air manifold piping by a stainless steel clamp. A butterfly valve will be present at one/both ends of each aeration chain for individual control of the air flow to each chain.

An adjustable tension line consisting of plated steel chain will be present at each end of the aeration chain. The tension line will connect to the last float assembly at each end and also to a hook anchored on the basin bank. (Hook and anchor post by contractor).

3.0 Air Piping Manifold

3.1 General

A ductile iron air piping manifold with mechanical joints and other required hardware shall be provided by Parkson, located along one/both side of the aeration basin and one side of the aerated polishing section. This air piping manifold will be continuous for both aerated basins, to feed air to the aeration chain system. The air manifold will be buried. All air piping and piping accessories between the air piping manifold and the blowers will be provided by Parkson. Required concrete thrust blocks will be provided by the contractor as shown on their plans.

3.2 Aeration Chain Tee

A tee will be located at the point of attachment of each aeration chain and shall be the same diameter as the aeration chain flexible hose. Between this tee and the aeration chain a butterfly valve will be located for control of the air flow to the chain. The butterfly valve and all hardware between the valve and the aeration chain will be provided by Parkson. Each tee shall be supported by a concrete thrust block, as shown on the plans.

3.3 Air Quality

The air provided to the aeration chains shall be of a quality equal to or better than air that has been filtered through a 10 micron air filter.

3.4 Connection To Air Blowers

The air piping header which will be located along one/~~both~~ side of the aeration basin and will connect to Qty. 3, 3 hp. positive displacement blowers. These blowers will be centrally located near the aeration basin. They will be mounted and located as shown on the plans.

Expansion joints, flexible connectors and other piping hardware and accessories shall be used in accordance with good air piping practices and as directed by Parkson Corporation.

4.0 Biolac Aeration Blowers

4.1 General

Parkson Corporation shall furnish Qty. 3, 3 HP positive displacement air blowers, complete with electric motors, and all accessories which are called for on the drawings and specifications. One blower shall be for standby operation. The blowers shall be located as shown on the plans.

4.2 Performance Requirements

Each blower shall be capable of delivering 70 standard cubic feet per minute of air at inlet conditions of 100° F maximum and 14.5 psia against the discharge pressure of 5 psig.

Each blower unit shall be of the positive displacement rotary type, designed for continuous service and shall be of the manufacturer's standard design and all parts of duplicate machines shall be interchangeable without modification.

4.3 Construction

- a. Impellers shall be machined from high strength grey iron to an exact involute shape and permanently fastened to steel shafts. Impellers and shafts shall be statically and dynamically balanced to operate without vibration.

- b. Head Plates shall be machined from grey iron and ground on the interior surface to exact operating tolerances. The grey iron headplates shall be heavily ribbed for rigidity and all mating surfaces shall be precision machined. Bearing fits shall be machined into the head plates to assure exact bearing positioning. Impeller cases shall be machined from cast iron conformed to prevent distortion.
- c. Bearings shall be anti-friction bearings designed to handle V-belt pull. They should be self-centering on an axial plane to allow impellers to accurately position themselves between head plates.
- d. Cylinder shall be a one piece precision-machined cast grey iron casing.
- f. Lubrication of timing gears and gear-end bearing shall be oil-splashed lubricated from an oil-tight housing surrounding the timing gears. Drive-end bearings to be lubricated through fittings. Blowers shall be provided with lip-type seals to prevent oil and grease from entering the impeller chamber.
- g. Drive Shaft - The motor shaft shall be operated at 1800 R.P.M. and extended for V-belt drive.
- h. Electric Motors - Each blower shall be provided with a constant speed, squirrel cage induction motor designed in accordance with NEMA and AIEE standards. Motors shall be TEFC, foot mounted, 3 horsepower, 230/460 volt, 3 phase, 60 cycle, motors with 1.15 service factor.
- i. Bases - Each blower unit shall be mounted on a single heavy, full length, fabricated steel frame, properly braced to form a rigid support for the entire unit.
- j. Accessories
 - 1. Inlet filter/silencer - shall be cannister type and mounted outside.
 - 2. Flexible connector on discharge.
 - 3. Check valve on discharge of blower to prevent backflow of air into the blower when it is not operating.
 - 4. One discharge, isolation butterfly valve.
 - 5. Weighted type pressure relief valve.
 - 6. One, 4-1/2" diameter discharge pressure gauge (0-15 psi).
 - 7. Discharge Silencer

5.0. Biolac System Control System

5.1 General

Parkson shall furnish a remote mounted electrical control panel as required to safely and efficiently operate the aeration system and the clarifier system according to the details on the drawings and the specifications and as required by Parkson Corporation.

5.2 Control Panel

A single control panel shall be designed and furnished by Parkson Corporation to control all positive displacement aeration blowers and the integral clarifier. The control panel shall have the following features or provisions for controlling the aeration system:

1. 24 hour timers, Qty (2) Total.
2. H.O.A. switches, one (1) per blower.
3. Run lights for each blower.
4. Starters, circuit breakers, and control power transformer.
5. Hour Totalizer for each blower.
6. Selector Switch for Selecting Timer Sequence.
7. A wall mounted control panel with each item labeled on panel cover - Nema 4 Enclosure.
8. All external wiring by others.

The control panel shall also control the integral clarifier. This includes controls for the 2-HP blower for the sludge return airlift(s) and the 3/4 HP flocculating rake mechanism drive motor(s). This custom panel as shown on the drawings shall include the necessary controls to operate motor starters, circuit breakers, relays, and timers. The custom panel shall include controls for the R.A.S. and W.A.S. flows using a timer schedule. A submersible pump, provided by Parkson, will be used to waste sludge as required.

6.0 Biolac System Integral Clarifier

6.1 General

An integral clarifying zone with a hopper bottom, shall be provided at the end of the extended aeration basin opposite the influent. The clarifying zone is formed by three concrete walls and a concrete bottom as shown on the plans. Location of the clarifier is as shown on the plans.

6.2 Clarifier Design

The clarifier shall be designed with an overflow rate of 200 GPD/ft² at minimum water level, based on the design flow rate of 0.08 ~~XXX~~ MGD.

6.3 Partition Wall

A one-piece, partition wall will be provided by Parkson Corporation to separate the clarifying zone from the aeration basin. Flow will enter the clarifier underneath the partition wall. It shall be designed such that flow does not short circuit around the partition wall. The partition wall shall be removable without draining the basin. All hardware for attachment of the partition wall shall be provided by Parkson.

6.4 Flocculating Rake Mechanism

A flocculating rake mechanism will be designed and furnished by Parkson Corporation for each of the integral clarifiers. Each unit shall be furnished complete with all mechanical equipment required for proper operation, including complete drive units, complete rake mechanism and all hardware required for installation.

The flocculating rake mechanism shall consist of a drive assembly and a non-drive/pulley assembly. Each assembly shall be located approximately six inches (6") above the clarifiers maximum water level and mounted flush against the clarifier's side walls as located on the plans. The rake mechanism shall be suspended from a 1/4" diameter stainless steel cable stretching across the width of the integral clarifier. The rake mechanism consists of a vertically hung galvanized pipe assembly clamped to the stainless steel drive cable with 304 stainless steel U-bolts, as shown on the drawing. The rake shall be supported by a polyethylene float so that it has approximately neutral buoyancy. From the rake assembly shall be hung steel chains which extend down into the sludge blanket to be used to aid in distribution and concentration of the sludge in the hopper bottom sludge removal zone. The rake mechanism shall run at approximately 9 feet per minute, and only run when the sludge removal system is operating.

Each drive unit shall be anchored to the metal support frame located approximately 6" above the clarifiers high water level. The drive unit shall consist of a 3/4 hp worm gear reduction unit with a C flanged T.E.F.C. motor. Both the drive and driven pulleys of this assembly shall be covered for safety.

7.0 Sludge Removal System

7.1. General

A sludge removal system will be designed and furnished by Parkson Corporation to provide a positive and controllable method for removing sludge from the integral clarifier. This system shall be furnished complete with all the mechanical equipment required for proper operation, including air lift and sludge suction piping, submersible pump for sludge wasting. Return sludge will flow by gravity to the front end of the aeration basin.

7.2 Airlift Blower

The sludge removal system shall utilize one 2 hp, positive displacement blower with the required accessories. The blower shall be capable of delivering 30 cubic feet per minute of air at inlet conditions of 100°F and 14.5 psia against the discharge pressure of 5.3 p.s.i.g.

7.3 Air Piping

A 2" diameter air header for supplying air to the air lift, will be buried along the back edge of the integral clarifier running from the air lift blower to the air lift piping as shown on the plans. The airlift piping shall be removable to allow for cleaning if required. All inserts required for passage of the air piping through the clarifier concrete will be provided by others.

7.4 Sludge Suction Piping

Sludge suction piping for removing the settled solids from the clarifier shall be located along the length of the clarifier hopper bottom. Holes shall be spaced along the length of this piping for even removal of sludge.

The sludge suction piping shall be of PVC construction, and shall be as shown on the plans. All hardware for installing and supporting the piping shall be provided by Parkson..

8.0 Overflow Weir

8.1 General

An overflow weir shall be provided by Parkson Corporation for each integral clarifier. It will control the liquid level in the clarifier/aeration basin and control the flow out of the clarifier to the effluent pipe, provided by others.

8.2 Weir Design

The overflow weir shall be designed such that the weir loading is less than 10,000 GPD/lineal foot of weir length at design flow.

9.0 Performance

9.1 Mechanical Guarantee

All equipment manufactured by the supplier shall be guaranteed to be free from defective material and workmanship, under normal use and service, for a period of 12 months from the date the purchaser is notified that the order is ready for shipment.

Any equipment supplied by the supplier, but not of their manufacture, shall be provided with all guarantees and warranties provided by the original equipment manufacturer passed on to the end user.

9.2 Experience

Equipment of design similar to that proposed, shall have been in use at least five (5) years in similar applications.

A reference list of at least 20 installations of equipment similar to that proposed for this project shall be provided upon the engineer's request.

10.0 Execution (by Contractor)

10.1 Installation

Install all aeration equipment in accordance with the manufacturer's instructions.

Manufacturer shall supply personnel to supervise installation for maximum of 3 man-days.

10.2 Acceptance and Start-Up

Notify the Owner, Engineer and Manufacturer in writing when the installation is ready for

inspection. Notification must be given a minimum of 10 days prior to inspection date.

Manufacturer shall supply personnel to be present at inspection and supervise start-up for a maximum of 5 man-days.

After inspection, any adjustments or corrections deemed necessary for the correct operation of the Biolac System shall be detailed by the supplier and performed by the contractor.

CRM
R-4/6/87

PARKSON CORPORATION

BIOLAC® TREATMENT SYSTEM

QUOTATION NO: BL-199

SHEET 1 OF 3

DATE: 4/21/89

TO: All Bidding Contractors
(Hereinafter called the purchaser)

ATTENTION: Bidding Contractors

PROJECT: Grover Hill, OH
PURCHASER'S REF: Biolac-R
Treatment System

SCOPE OF SUPPLY:

Parkson Corporation offers the product(s) as described below:

1. A total of 8 float assemblies with required flexible hose, and stainless steel hardware to form complete aeration chains.
2. A total of 8 diffuser assemblies, including 44 Wyss® diffusers with diffuser frame, sheath, retainer pad, check valve, stainless steel clamps and screws.
3. Hardware for attaching the aeration chain to the piping and restraining chains and hooks. The imbedded posts and anchors to which the restraining chains attach are provided by the contractor.
4. (1) Lot ductile iron air piping manifold with mechanical joints, tee pieces, and butterfly valves. Note all piping will be shipped in standard lengths and must be cut in the field.
5. Qty. 3, 3 HP positive displacement blower assemblies, complete with blower, mounting base V-belt drive and guard, TEFC motor, inlet filter/silencer, pressure relief valve, flexible discharge connector, check valve, discharge pressure gauge, isolation butterfly valve, and discharge silencer.



6. One remote mount electrical control panel, Nema 4 enclosure, to operate the aeration system and clarifier. Motor starters and elapsed time meters to be provided by others.
7. All integral clarifier equipment required including flocculating rake mechanism, partition wall and overflow weir.
8. Sludge removal system including sludge suction piping; Qty. 1, 2 HP positive displacement blower, with air piping and accessories.
9. 4 man-days and 2 trips of start-up supervision.

TOTAL PRICE: F.O.B. Point of Manufacture, Freight allowed..
.....US.\$ 102,180
Prices valid for 60 days for delivery within 6 months.

PAYMENT TERMS:

90% net 30 upon shipment or notice that equipment is ready for shipment;

10% upon acceptance of equipment no later than 120 days after shipment of equipment.

SHIPMENT: 6-8 weeks from receipt of written purchase order for approval drawings and

10-12 weeks after receipt of drawing approval for buried air piping

16-20 weeks after receipt of drawing approval for balance of shipment.

All deliveries to be confirmed at time of order placement.



PATENTS:

The Biolac System/Equipment is protected by U.S. Patents and additional Patents may be pending.

START-UP ASSISTANCE: 4 DAYS TOTAL, 2 TRIPS

Parkson will furnish Purchaser one Field Service Engineer to advise in instruction and start-up. The services of this engineer will be provided without charge for the period specified above. However, the Purchaser assumes all responsibility for the readiness of the System when he requests start-up service. Should Parkson's Field Service Engineer arrive at the job site and determine that the system cannot be started up within a reasonable time, Parkson shall have the option to bring him home and bill the Purchaser for time, travel and living expenses.

Additional field service is also available from Parkson and will be quoted at prevailing per diem rates at time of service, plus all travel and living expenses.

Current per diem rate for field service :\$ 550.00 per day plus travel and living expenses.

STANDARD CONDITIONS OF SALE:

Our STANDARD CONDITIONS OF SALE, as stated on the attached sheet, shall apply.

Please return one signed copy of this quotation, or your purchase order to Parkson Corporation, referring to this quotation number, date and related correspondence.)

ACCEPTED:

BY: _____
TITLE: _____
DATE: _____

PARKSON CORPORATION
P.O. Box 408399
Ft. Lauderdale, FL
33340-8399

BY: Bruce E. Cohen
Bruce E. Cohen
TITLE: Sales Manager
DATE: 4/21/89

PARKSON CORPORATION



STANDARD CONDITIONS OF SALE

- I. ACCEPTANCE:** All prices are F.O.B. Point of Manufacture and are firm for acceptance within thirty (30) days from the date of this quotation, unless otherwise stated in the quotation. All orders are subject to written acceptance and credit approval by Parkson Corporation.
- II. SALES TAXES:** Prices quoted do not include any applicable city, county, state or federal excise, sales, use or any other taxes now in force or to be enacted, unless otherwise stated in the quotation. All such taxes are to be paid and borne by the Purchaser.
- III. PAYMENT POLICY:** Payment terms shall be as stated in the quotation. If shipment is delayed by Purchaser, date of readiness for shipment shall be deemed to be the date of shipment for payment purposes. If manufacture is delayed by Purchaser, a payment shall be made based on purchase price and percentage of completion, balance payable in accordance with the terms as stated.

If payments are not made in conformance with the terms stated herein, the contract price shall, without prejudice to Parkson's right to immediate payment, be increased by 1½% per month on the unpaid balance, but not to exceed the maximum amount permitted by law.

If at any time in Parkson's judgement Purchaser may be or may become unable or unwilling to meet the terms specified, Parkson may require satisfactory assurance or full or partial payment as a condition to commencing, or continuing manufacture, or in advance of shipment.

- IV. SHIPMENT:** Parkson will use all reasonable care in shipping the equipment or parts and will endeavor to make shipment within the time estimated in the quotation subject to confirmation by Parkson at time of placing order.

The shipping date is to be considered as approximate only for the reason that Parkson's ability to complete and ship equipment or parts ordered within this period may depend upon conditions beyond Parkson's control.

Equipment or parts will be crated for domestic truck shipment at Parkson's expense; however, Parkson assumes no responsibility for loss of, or damage to the equipment after delivery to the carrier, who shall be deemed to be acting for the Purchaser, and the equipment shall thereafter be at the Purchaser's risk.

It is Parkson's policy to ship its equipment "Bill-Collect" with the motor freight company mailing their invoice(s) directly to the purchaser's billing address, unless otherwise stated.

If shipment is not accepted within seven days after the Purchaser is notified that the order is ready for shipment, the equipment will be stored at the Purchaser's risk and expense.

- V. TITLE & INSURANCE:** Title to the product(s) and risk of loss or damage shall pass to the Purchaser upon shipment, or seven (7) days after the Purchaser is notified that the order is ready for shipment, whichever event shall first occur, except that a security interest in the product(s) or any replacement shall remain in Parkson's name, regardless of mode of attachment to realty or other property, until the full price has been paid in cash. Purchaser agrees to do all acts necessary to perfect and maintain said security interest, and to protect Parkson's interest by adequately insuring the product(s) against loss or damage from any external cause with Parkson named as insured or co-insured.
- VI. ERECTION:** Unless otherwise stated in writing, the equipment shall be assembled and erected by and at the expense of the Purchaser.
- VII. CANCELLATION & BREACH:** Orders placed cannot be cancelled, nor shipments of goods made up, or in process, be deferred beyond the original shipment dates specified, except with Parkson's written consent and upon terms which shall indemnify Parkson against all loss.

In the event of cancellation or the substantial breach of this purchase agreement by Purchaser, as by failing to make any of the payments when due, the parties agree that Parkson will suffer a serious and substantial damage which will be difficult, if not impossible, to measure, both as of the time of entering into this purchase agreement and as of the time of such cancellation or breach; and therefore, the parties agree that upon such cancellation or breach the Purchaser shall pay to Parkson the sums set forth herein below which the parties do hereby agree shall constitute agreed and liquidated damages in such event:

If cancellation or breach shall occur after the acceptance of the purchase order but prior to mailing of general arrangement drawings by Parkson to Purchaser, liquidated damages shall be 10% of the selling price.

If cancellation or breach shall occur within thirty (30) days from the mailing of general arrangement drawings by Parkson to Purchaser, the liquidated damages shall be 30% of the selling price.

If the cancellation or breach occurs after thirty (30) days from the mailing of general arrangement drawings by Parkson to Purchaser, but prior to notification that the order is ready for shipment, the liquidated damages shall be the total of 30% of the selling price plus the expenses incurred, cost of material, and reasonable value of the work expended to fill the order involved herein by Parkson's engineers.

and other employees, agents and representatives after the mailing of general arrangement drawings by Parkson to Purchaser, said sums to be determined in the sole reasonable discretion of Parkson; provided, however, that the total liquidated damages under this provision shall not exceed the total selling price.

If cancellation or breach shall occur after Parkson has notified purchaser that the order is ready for shipment, then the liquidated damages shall be the total selling price.

VIII. DRAWINGS & SPECIFICATIONS: In the event that drawings are sent to the Purchaser for approval after the order is placed, the drawings must be returned marked "Approved" or "Approved as Noted" within ten (10) working days after receipt unless otherwise noted. In the event that Purchaser's written comments are not given within the ten (10) day period, the items are deemed adequate by Parkson.

IX. MATERIALS OF CONSTRUCTION, PAINTS AND COATINGS: The Purchaser is responsible for determining the suitability and giving final approval of materials of construction, paints, coatings, etc. to be used by Parkson.

X. CONFIDENTIAL INFORMATION & IMPROVEMENTS: Purchaser will keep confidential and will not use or reproduce any information received from Parkson in connection with this quotation for the use, operation, or maintenance of the product(s), except with the written consent of Parkson. Purchaser will not copy or otherwise reproduce any written or printed material or drawings furnished to Purchaser by Parkson in connection with the product(s) or this proposal. Purchaser will return all such material to Parkson if this quotation is not accepted. Purchaser will not copy the product(s) or make any design drawings of the product(s) and will not permit others to copy or make any design drawings of the product(s). Parkson shall have a royalty-free license to make, use and sell, any changes or improvements in the product(s) invented or suggested by Purchaser or its employees.

XI. GUARANTEE: All equipment or parts covered by this quotation are guaranteed to be free from defective material and workmanship, under normal use and service, for a period of twelve (12) months from date the Purchaser is notified that the order is ready for shipment. This guarantee does not cover failure of normal wearing parts unless failure of such part has resulted from defective material and workmanship. In the event of any defects developing within the stated period, under normal and proper use, Parkson is to be notified promptly in writing, and upon receipt of our written consent, the parts are to be returned promptly to Parkson, F.O.B. Parkson's factory. If Parkson's inspection indicates defective material or workmanship, the parts will, at Parkson's option, either be repaired or replaced without charge, F.O.B. Parkson's factory. In the case of components purchased by Parkson and incorporated in the equipment, Parkson's guarantee is limited to the component manufacturer's guarantee. **NOTE:** Parkson Corporation does not accept liability for any corrective or other work, or expenditures of any kind that have not been authorized by it in writing prior to the commencement of such work or prior to committing to such expenditures, without exception. Service calls, when requested and where no evidence of defective material or workmanship is found, will be at the expense of the Purchaser.

Parkson shall not be held liable for any further cost, expense, or labor to replace equipment or replaceable parts, or indirect or consequential damages.

THE FOREGOING GUARANTEE IS EXCLUSIVE AND IN LIEU OF ALL OTHER GUARANTEES AND WARRANTIES OF QUALITY, WRITTEN, ORAL OR IMPLIED; ALL OTHER WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE, ARE HEREBY DISCLAIMED.

XII. CONSEQUENTIAL DAMAGES: In no event shall Parkson be liable for special, indirect, incidental or consequential damages, including, but not limited to, loss of profits or revenue, loss of use of the equipment or any associated equipment, cost of capital, cost of substitute equipment, facilities or services, down time cost, or claims of customers of the Purchaser for such other damages.

XIII. LIABILITY: Parkson Corporation will only be responsible for damages from proven negligent acts of its direct employees only.

XIV. GOVERNMENTAL LAWS AND REGULATIONS:

1. Parkson Corporation believes its equipment design complies with most Governmental Laws and Regulations and Industrial Practices; however, it cannot accept responsibility for any State, City or other local laws not specifically brought to our attention and with copies attached.

2. Regarding OSHA Compliance:

a. Parkson will only be held liable for those OSHA standards which are in effect as of this date and to the extent they are applicable to the performance by Parkson Corporation of its obligations under this contract.

b. That Parkson can only be held liable for the physical characteristics of the product(s) and not for the circumstances of the use of the product(s).

c. That Parkson's liability through any noncompliance to OSHA shall be limited to the cost of modifying the product(s) or replacing the noncomplying product(s) or component(s) after receipt of prompt written notice of the noncompliance.

XV. ATTORNEY'S FEES: In the event of Purchaser's breach of the terms of this purchase agreement, Purchaser shall pay all costs and expenses, including a reasonable attorney's fee incurred by Parkson for the enforcement or prosecution of its rights thereunder. This shall include, without limitation, all such attorney's fees reasonably incurred prior to litigation as well as appellate attorney's fees.

XVI. LITIGATION: The parties agree that in the event of any litigation between the parties related to, based upon or in any way involving this purchase order or the goods and services involved herein, that the jurisdiction and venue for such action shall solely and exclusively be in Broward County, FL.

XVII. ENTIRE AGREEMENT: The parties agree that the foregoing constitutes the entire agreement between the parties and that there are no other agreements, terms or conditions, expressed or implied, which are not included within the foregoing purchase agreement, including the standard conditions of sale set forth herein, unless otherwise agreed to in writing.



PARKSON CORPORATION

May 3, 1989

Mr. Steve McPherson
Design Enterprises, Inc.
901 East 86th Street
Indianapolis, IN 46240

Subject: Parkson Biolac System for Grover Hill, Ohio
BL-199

Dear Mr. McPherson:

Enclosed please find the completed process guarantee statement for the subject project, as per your request.

Please feel free to contact me if you have any additional questions.

Very truly yours,
PARKSON CORPORATION

Bruce E. Cohen
Bruce E. Cohen
Sales Manager

BEC/bsr
sunr.

Encl - As noted.

cc: B. Cantwell - Henry P. Thompson - IN



PARKSON CORPORATION

BL-902.A

PROCESS GUARANTEE STATEMENT

for Grover Hill, OH

This treatment system has been designed based on the following Influent Parameters:

Daily Flow	=	60,000	gpd max.
BOD5	=	160	mg/l max.
TSS	=	100	mg/l max
NH3	=	25	mg/l max.
TKN	=	40	mg/l max
Daily BOD5 Load	=	80	lbs/day max.
Daily NH3 Load	=	13	lbs/day max.
Daily TKN Load	=	20	lbs/day max.
Influent Temperature	=	20	'C
Basin Wastewater Temp	=	20	'C
pH	=	6-9	
Nutrients	=	100:5:1	(BOD: N:P)
Alkalinity	=	240	mg/l min. as CaCO3

Based on these maximum influent values (with the minimum BOD load to the plant being one half the maximum), the treatment system proposed will, in the absence of toxicity, and when operated by a certified operator according to the supplier's instructions and generally accepted operational procedures, produce an effluent of the following quality (monthly average values):

BOD5	10	mg/l
TSS	12	mg/l
NH3	1.5	mg/l

If the owner believes the system not to be meeting the above guaranteed effluent limits he shall:

1. Notify the supplier in writing, of the suspected problem and provide all facts and data and information necessary to verify the problem.
2. Provide other information on processing plant and treatment plant operation that may be required by the supplier to identify the cause of the problem.
3. Provide manpower as required to assist the supplier in determining the cause of the problem.



The supplier shall:

1. Review all facts, data and information provided by the owner to determine the cause of the problem.
2. Recommend and perform any additional test work that may be required to determine the cause of the problem.
3. Make any changes in the system process or equipment design necessary to correct the problem until the system is meeting the guaranteed effluent values.
4. All charges incurred by the supplier in correcting the system process or equipment, including the suppliers engineering time and travel expenses, any recommended test work, modifications to existing equipment or addition of new equipment, freight expense, and installation cost, up to the value of the original purchase order for equipment shall be for the supplier's account.
5. If after determining the cause of the problem, and spending substantial effort to correct the problem, it is not feasible to do so with the system the purchase price of the equipment will be refunded upon return of the equipment.

If, after review of existing data or performance of additional recommended test work, the results indicate the treatment system is meeting the guaranteed effluent values, then the cost of reviewing this data and performing any additional test work, including engineering time, travel expenses and test costs, shall be for the owner's account.

This guarantee is valid for 1 year after plant start-up.

SECTION 01090

REFERENCE STANDARDS

PART 1 - GENERAL

1.01 Requirements Included:

- A. Applicability of Reference Standards.
- B. Provision of Reference Standards at site.
- C. Acronyms used in Contract Documents for Reference Standards.
Source of Reference Standards.

1.02 Quality Assurance:

- A. Products or workmanship specified shall comply with requirements of all applicable codes and standards. They shall include all state laws, local ordinances, utility company regulations and applicable requirements of nationally accepted codes and standards. These requirements are to be considered minimum and are to be exceeded when so indicated on the drawings or herein specified.
- B. The date of the standard is that in effect as of the bid date, except when a specific date is specified.
- C. When required by individual specification section, obtain copy of standard. Maintain copy at job site during planning and progress of the specific work, until Substantial Completion.
- D. Except as otherwise specified herein, all piping work and materials shall conform to American Standards Association Code for Pressure Piping.

1.03 Schedule of References:

A. Standards:

- 1. Recommended Standards for Water Works
- 2. Recommended Standards for Sewage Works
- 3. Building Officials and Code Administrators (BOCA); adopted by the State of Ohio and amended by the following:
 - a. Ohio Basic Building Code
 - b. Ohio Basic Building Code (Mechanical)
 - c. B.O.C.A. Basic Pump Code
 - d. Ohio Fire Code
- 4. State Board of Health Division
- 5. Ohio State Fire Prevention Commission

6. AASHO: American Association of State Highway Officials
7. ACI: American Concrete Institute
8. AISC: American Institute of Steel Construction
9. AMCA: Air Moving and Conditioning Association
10. ANSI: American National Standards Institute
11. API: American Petroleum Institute
12. ASA: American Standards Association
13. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers
14. ASME: American Society of Mechanical Engineers
15. ASTM: American Society of Testing Materials
16. AWS: American Welding Society
17. AWWA: American Water Works Association
18. FIA: Factory Insurance Association
19. FM: Factory Mutual
20. IEEE: Institute of Electrical Electronic Engineers
21. MSS: Manufacturing Standards Society
22. NBS: National Bureau of Standards
23. NEC: National Electric Code
24. NECA: National Electrical Contractor's Association
25. NEMA: National Electrical Manufacturer's Association
26. NFPA: National Fire Protection Association
27. OSHA: Occupational Safety and Health Act
28. SMACNA: Sheet Metal and Air Conditioning Contractors
29. UL: Underwriters Laboratories

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall schedule and administer progress meetings.
- B. Engineer will attend meetings to ascertain that work is expedited consistent with construction schedule and with Contract Documents.

1.02 Pre-Construction Meeting:

- A. Schedule within 5 days after date of Notice to Proceed.
- B. Attendance:
 - 1. Owner
 - 2. Engineer and his inspector/representative
 - 3. Other prime contractors
 - 4. Major subcontractors of all prime contractors
 - 5. Safety representative
 - 6. Representatives of governmental or other regulatory agencies
- C. Minimum Agenda:
 - 1. Distribute and discuss list of major subcontractors, tentative time and payment schedule and construction schedule approved by Engineer prior to construction.
 - 2. Critical work sequencing
 - 3. Relation and coordination of prime contractors
 - 4. Designation of responsible personnel
 - 5. Processing of field decisions and change orders
 - 6. Adequacy of distribution of Contract Documents
 - 7. Submittal of shop drawings, project data and samples
 - 8. Procedures for maintaining Record Documents
 - 9. Use of premises for office and storage areas and Owner's requirements
 - 10. Major equipment deliveries and priorities
 - 11. Safety and first-aid procedures
 - 12. Security procedures
 - 13. Housekeeping procedures

1.03 Progress Meetings:

- A. Schedule regular meetings as determined at Pre-Construction Conference.

- B. Set location of meetings as determined at Pre-Construction Conference.
- C. Attendance:
 - 1. Engineer and his consultants
 - 2. Other prime contractors
 - 3. Subcontractors as pertinent to agenda
 - 4. Safety representative
 - 5. Representatives of governmental or other regulatory agencies
- D. Minimum Agenda:
 - 1. Review work progress since last meeting
 - 2. Note field observations, problems and decisions
 - 3. Identify problems which impede planned progress
 - 4. Review off-site fabrication problems
 - 5. Develop corrective measures and procedures to regain planned schedule
 - 6. Revise construction schedule as indicated
 - 7. Plan progress during next work period
 - 8. Coordinate projected progress with other prime contractors
 - 9. Review submittal schedules and expedite as required to maintain schedule
 - 10. Review changes proposed by Owner for effect on construction schedule and effect on completion date

SECTION 01300

SUBMITTALS AND SUBSTITUTIONS

PART 1 - GENERAL

1.01 General:

- A. Submit Shop Drawings, project data and samples required by Specification Sections.
- B. Designate in construction schedule proposed submittal dates.

1.02 Shop Drawings:

- A. Submit Drawings prepared by Contractor, Subcontractor, supplier or distributor which illustrate some portion of the Work.
- B. Show fabrication, layout, setting or erection details.
- C. Identify details by reference to sheet and detail numbers shown on contract drawings.
- D. Minimum sheet size: 8-1/2" x 11".

1.03 Product Data:

- A. Manufacturer's standard schematic drawings:
 - 1. Modify Drawings to delete information which is not applicable to project.
 - 2. Supplement standard information to provide additional information applicable to project.
- B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.
 - 1. Clearly mark each copy to identify pertinent materials, products or models.
 - 2. Show dimensions and clearances required.
 - 3. Show performance characteristics and capacities.
 - 4. Show wiring diagrams and controls.

1.04 Submission Requirements:

- A. Schedule submissions at least ten (10) days before reviewed submittals will be needed.
- B. Submit number of copies of Shop Drawings, project data and samples which Contractor requires for distribution plus three (3) copies which will be retained by Engineer.

C. Accompany submittals with transmittal letter containing:

1. Date
2. Project title and number
3. Contractor's name and address
4. The number of each Shop Drawing, product data and sample submitted
5. Notification of deviations from Contract Documents
6. Other pertinent data

D. Submittals shall include:

1. Date and revision dates
2. Project title and number
3. The names of Engineer, Contractor, Subcontractor, Supplier, Manufacturer, and separate detailer when pertinent
4. Identification of product or material
5. Relation to adjacent structure or materials
6. Field dimensions clearly identified as such
7. Specification Section number
8. Applicable standards, such as ASTM number or Federal Specification
9. A blank space 4" x 5" for the Engineer's stamp
10. Identification of deviations from Contract Documents

1.05 Resubmission Requirements:

A. Shop Drawings:

1. Revise initial Drawings as required and resubmit as specified for initial submittal.
2. Indicate on Drawings any changes which have been made other than those requested by Engineer.

B. Product Data and Samples: Submit new data and samples as required for initial submittal.

1.06 Distribution of Submittals After Review:

A. Distribute copies of Shop Drawings and product data which carry Engineer's stamp as needed.

B. Distribute samples as directed by the Engineer.

1.07 Substitutions:

A. Approval Required:

1. The Contract is based on the standards of quality established in the Contract Documents.
2. All products proposed for use, including those specified by required attributes and performance, shall require approval by the Engineer before being incorporated into the Work.

3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this Work by the Engineer.

B. "Or Equal":

1. Where the phrase "or equal" or "or equal as approved by Engineer" occurs in the Contract Documents, means any material which, in the opinion of the Engineer, is equal in quality, durability, appearance, strength, design and performance to the material specified, and will function adequately in accordance with the general design.
2. Where in these Specifications, one or more certain materials, trade names, or articles of certain manufacture are mentioned, it is done for the express purpose of establishing a basis of durability, efficiency, quality, performance, function and meeting the design intent and not for the purpose of limiting competition.
3. The Engineer shall evaluate proposed substitutions and the decision of the Engineer shall be final.
4. Exception: The "or equal" clause shall not be used to substitute different equipment for the Biolac process equipment listed in Section 01005 Par. 1.06C 1 thru 5.

1.08 Operating and Maintenance Data:

- A. The Contractor shall furnish to the Engineer, prior to the completion of the work under this contract, six (6) copies of all manufacturer's drawings, parts catalogs, wiring diagrams, installation and operating instructions, guarantees and other data or information which may be needed or useful in the operation, maintenance, repair, for ordering replacements, for all items of mechanical and electrical equipment furnished under this contract. Such data shall be complete in every detail, including index, and each set shall be assembled under a suitable cover. The above noted requirements shall be furnished in addition to any specified wall-mounted instructions required under the Technical Provisions of the Specifications. The cost of furnishing the above data shall be included in the applicable contract unit price or lump sum prices for the equipment furnished.

PART 2 - PRODUCTS

2.01 Product and Material Approval:

- A. A specification followed by one or more manufacturer's and "or equal" is open to all equal products or materials.

2.02 Shop Drawings:

- A. Review of Shop Drawings does not relieve Contractor of responsibility for correct ordering of materials and equipment. Contractor review shall insure that equipment will fit in available space.
- B. Information to be included in the submittal:

1. Manufacturer's model number or catalog number, size and performance curves and data. Indicate operating point on curves and tabular data for each piece of equipment that curves or data represent.
 2. Indication of all performance data, construction materials, finishes and modifications to manufacturer's standard design called for in the specifications.
 3. Location of connections for all piping required.
 4. Roughing-in, foundation and support point dimensions.
 5. Indicate all electrical characteristics.
 6. Wiring diagrams or connection diagrams conforming to NEMA Standard 101-1.293.
 7. Data shall be coordinated and included in single submittal.
 8. For submissions, such as catalogs, mark information that is to be provided, including all accessories and modifications, so there is no confusion.
- C. Submit Shop Drawings in brochure form and include all related equipment in one brochure.
- D. Submit Shop Drawings of all equipment in this specification and as specifically stated in the individual sections.
- E. Contractor is to affix his company name, in the form of a stamp, to all Shop Drawings and Submittals before submitting. Contractor shall stamp or mark Shop Drawings for submittals "Approved", date and initial (or sign) prior to issuing.
- F. Contractor shall submit minimum 3/8" scale drawings (such as sheet metal fabrication or pump suction and discharge piping and valves) on reproducible material. Engineer will comment on reproducibles and will return prints with action marked.

2.03 Record Drawings (As-Builts):

- A. During construction, maintain complete and legible set of drawings, showing changes and deviations between actual construction and Engineer's drawings. Submit marked-up set to Engineer for review before "As-Builts" are made.
- B. Upon completion of project, this Contractor shall revise working drawings to "As-Built" condition, using reproducible mylar.
- C. Mylars shall be obtained from Engineer at the Contractor's expense.
- D. Submit two (2) copies of "As-Built" drawings to Engineer for review. One (1) set of reviewed drawings shall be transmitted to Owner by Engineer for their permanent record and other set will be retained by Engineer for their permanent record.

2.04 Maintenance Manual:

- A. Contractor shall submit at 75% of job completion, four (4) Maintenance Manuals.
- B. Maintenance Manuals are to include one approved copy of each submittal and shall show all information relative to maintenance and operating instructions for all new mechanical equipment.
- C. Maintenance Manual shall be in following chronological order and form:
 - 1. Index of complete contents.
 - 2. Title of job, Owner, address, dates of submittal, name, address and phone number of Contractor and Engineer.
 - 3. Include description of operation and each mechanical system.
 - 4. Material finish schedules and recommended maintenance procedures.
 - 5. Each piece of equipment which is submitted for approval shall be bound into this manual as follows:
 - a. Name of equipment
 - b. Manufacturer's model and serial number (if one exists)
 - c. Vendor
 - d. Shop Drawings
 - e. Installation, operation and maintenance instructions which are to be supplied by vendors
 - 6. Any special emergency instructions or list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of system.
 - 7. Copy of valve tag list
- D. Information for each piece of equipment shall be separated by pasteboard tabbed divider, identifying equipment by same number as listed in Index.
- E. All information shall be arranged in as many standard 3-ring vinyl coated notebooks as necessary.
- F. General Contractor shall prepare Maintenance Manual. Electrical Contractor shall coordinate with General Contractor the assemblage order and submit to him his data with tabbed dividers for inclusion.

2.05 Inspection:

- A. Provide in triplicate, a Certificate of Inspection at completion of the work. Inspection to be performed by local authority having jurisdiction (i.e., City Inspector, County Inspector, etc.).

2.06 Reports:

- A. Submit for attachment to Substantial Completion Certificate the following:
1. Letter certifying that all mechanical installation comply with applicable codes.
 2. All other test reports.

PART 3 - EXECUTION

Not Used

SECTION 01310

CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 Work Included:

- A. Coordinate schedules of other contractors.

1.02 Form of Schedules:

- A. Prepare in form of horizontal bar chart.
- B. Show chronological order of beginning of each item of work.

1.03 Content of Schedules:

- A. Provide complete sequence of construction by activity.
 - 1. Shop drawings, product data and samples with submittal dates and dates reviewed for which copies shall be required.
 - 2. Decision dates for products specified by allowances and selection finishes.
 - 3. Product procurement and delivery dates.
 - 4. Dates for beginning and completion of each element of construction, specifically concrete placement, subcontractor work, equipment installation, equipment tests and start up.
- B. Identify work of separate phases, or other logically grouped activities.
- C. Show projected percentage of completion for each item of work as of first day of each month.
- D. Provide separate subschedule showing submittals, review times, procurement schedules and delivery dates.
- E. Provide subschedules to define critical portions of entire schedule.

1.04 Updating:

- A. Show all changes occurring since previous submission of updated schedule.
- B. Indicate progress of each activity and show completion dates.
- C. Include:
 - 1. Major changes in scope.
 - 2. Activities modified since previous updating.

3. Revised projections due to changes.
4. Other identifiable changes.

D. Provide narrative report, including:

1. Discussion of problem areas, including current and anticipated delay factors and their impact.
2. Corrective action taken or proposed and its effect.
3. Effect of change in schedules of other prime contractors.
4. Description of narratives shall include effect on schedule due to change of scope, revisions in duration of activities and other changes that may affect schedule.

1.05 Submittals:

- A. Submit initial schedules within twenty (20) days after date of Notice to Proceed.
 1. Engineer will review schedules and return review copy within ten (10) days after receipt.
 2. If required, re-submit within seven (7) days after return of review copy.
- B. Submit biweekly updated schedules accurately depicting progress to first day of each month.
- C. Submit the number of copies required by Contractor, plus four (4) copies to be retained by Engineer.

1.05 Distribution:

- A. Distribute copies of reviewed schedules to:
 1. Job site file.
 2. Other prime contractors.
 3. Subcontractors.
 4. Other concerned parties.
- B. Instruct recipients to report any inability to comply and provide detailed explanation with suggested remedies.

PART 2 - PRODUCTS

2.01 Equipment Delivery Schedule:

- A. Submit at pre-construction meeting a schedule listing equipment and materials required for complete installation, quantity required and delivery dates required to meet schedule. Any and all delivery delays shall be identified at the pre-construction meeting.

PART 3 - EXECUTION

Not Used

SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 Work Included:

- A. Submit to the Engineer a schedule of values at least ten (10) days prior to submitting first application for payment.
- B. Upon request by Engineer, support values given with data that will substantiate their correctness.
- C. Submit quantities of designated materials.

1.02 Schedule Use:

- A. Payment for materials stored on site will be limited to those materials listed in schedule of unit material values.
- B. Use schedule of values only as basis for Contractor's requests for payments on lump sum type contracts.

PART 2 - PRODUCTS

2.01 Form of Schedule:

- A. Submit typewritten schedule of values on 8-1/2" x 11" white paper.
- B. Use Table of Contents of this specification as basis for format for listing costs of work for Sections under Divisions 2 thru 16.
- C. Identify each line item with number and title as listed in Table of Contents of this specification.

PART 3 - EXECUTION

3.01 Preparing Schedule of Values:

- A. Itemize separate line item cost for each of the following general cost items:
 - 1. Insurance and Performance and Payment Bonds.
 - 2. Field supervision and layout.
 - 3. Temporary facilities and controls.
 - 4. Mobilization and demobilization of construction equipment.
- B. Itemize separate line item cost for work required by each section of this specification.

- C. Break down installed costs into:
 - 1. Delivered cost of product with taxes paid.
 - 2. Total installed cost with overhead and profit.
- D. For each line item which has installed value of more than \$10,000, break down costs to list major products or operation under each item.
- E. Round off figures to nearest one hundred dollars.
- F. Make sum of total costs of all items listed in schedule equal to total contract sum.

3.02 Preparing Schedule of Unit Material Values:

- A. Submit separate schedule of unit prices for materials to be stored on which progress payments will be made for unit price type and lump sum type contracts.
- B. Make form of submittal parallel to schedule of values with each line item identified same as line item in schedule of values.
- C. Include in unit prices only:
 - 1. Cost of material.
 - 2. Delivery and unloading on site.
 - 3. Legally applicable taxes.

3.03 Review and Resubmittal:

- A. After review by Engineer, revise and resubmit schedule (and schedule of material values) as required.
- B. Resubmit revised schedule in same manner as initial submission.

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all necessary equipment, labor and materials for temporary construction facilities and controls as follows:

1. Barriers
2. Field Office
3. Protection of Installed Work
4. Security
5. Storage of Materials
6. Services
7. Sanitary Facilities
8. Removal

1.02 Barricades and Lights:

- A. Erect and maintain barricades and lights or watchmen for protection and warning of pedestrians and vehicles, prevent access of unauthorized persons to portions of site where work is in progress.
- B. Location and Arrangement: Conform to ordinances and laws. Meet approval of Engineer and Owner.

1.03 Field Office:

- A. Provide at an Engineer and Owner approved location a Contractor's field office. Field office shall contain an in-service telephone with access to such provided for the Owner and Engineer.

1.04 Protection of Installed Work:

- A. Provide temporary protection for installed products. Control traffic in immediate area to minimize the possibility of damage.

1.05 Security:

- A. Protect Work, existing facilities and newly installed items from unauthorized use, vandalism and theft.

1.06 Storage of Materials:

- A. Arrange for storage space to suit needs.

- B. Provide suitable protection from weather and vandalism for all materials and equipment to be installed. Storage shall be dry, clean and safe. Any materials or equipment damaged, deteriorated, rusted, or defaced due to improper storage shall be fully repaired, refinished or replaced, as directed by the Engineer.
- C. Store materials and equipment in manner which will preserve their quality and fitness; provide temporary storage buildings as required.
- D. Location of construction facilities, including construction office and yard on site, shall be subject to approval by Engineer; remove upon completion of work.

1.07 Services:

- A. Arrange for water, electrical energy, compressed air and other services to meet own requirements.

1.08 Sanitary Facilities:

- A. Provide suitable non-segregated sanitary facilities for construction personnel. Maintain in sanitary condition.

1.09 Removal:

- A. Remove temporary materials, equipment, services and construction prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities. Restore existing facilities used during construction to specified, or to original, condition.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

SECTION 01580

TEMPORARY PROJECT IDENTIFICATION

PART 1 - GENERAL

1.01 Description:

- A. Furnish, install and maintain project identification signs.
- B. Content required on project identification sign: (One required)
 - 1. Title of project as listed on Contract Documents.
 - 2. Name of Owner as listed on Contract Documents.
 - 3. Names of the Engineers, Prime Contractors and the Funding Agency, where appropriate.

1.02 Quality Assurance:

- A. Design Criteria: Support, framing, surfaces; design to resist 50 mph wind velocity.
- B. Material Standards: Those specified in respective specification sections for products used.
- C. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction time.
- D. Sign Painter Qualifications: Engaged as professional sign painter for type of work specified, for period of not less than three (3) years.
- E. Requirements of Regulatory Agencies:
 - 1. Comply with requirements of authorities having jurisdiction.
 - 2. Obtain and pay for required permits.

1.03 Submittals:

- A. Submit drawings showing:
 - 1. Structure and framing
 - 2. Sizes, grades of members
 - 3. Foundation
 - 4. Surface material for sign
 - 5. Layout of sign, showing sizes and styles of letters
 - 6. Colors

PART 2 - PRODUCTS

2.01 Structural Materials:

- A. Supports: May be new or used, but must be sound and structurally adequate.
- B. Preservative Treatment: For wood supports in contact with ground, as required to prevent deterioration during specified period of use.

2.02 Framing Materials:

- A. Wood or steel.
- B. May be new or used, in sound condition.
- C. Grade: As required to meet structural requirements.
- D. Suitable for specified finish.

2.03 Surface Material for Signs:

- A. Plywood: A-C DFPA, with High Density Overlay.
- B. Thickness: As required to provide even, level surface.
- C. Sizes: Maximum standards locally available.

2.04 Rough Hardware:

- A. Galvanized, aluminum or brass.

2.05 Paint:

- A. Nationally recognized manufacturer.

PART 3 - EXECUTION

3.01 Installation of Supports:

- A. Set pole-type supports into excavations:
 - 1. Depths equal to 25% of height from ground to top of sign, minimum 3 feet (914 mm).
 - 2. Plumb holes, backfill, tamp earth around poles.

3.02 Framing:

- A. Frame Members, Secure to Supports: To code requirements and applicable trade standards.
- B. Space members to widths of surfacing material, maximum 24 inches on centers.

3.03 Surfacing:

- A. Install sheets vertical, in one piece for height of sign.
- B. Butt joints, nail securely.
- C. Install trim:
 - 1. Maximum lengths of standard material
 - 2. Miter corners
 - 3. Splice and joints
 - 4. Nail securely

3.04 Painting:

- A. Paint all exposed surfaces, except creosoted poles.
 - 1. Maximum lengths of standard material
 - 2. Minimum one coat of exterior enamel
- B. Paint lettering in styles, sizes, colors as indicated on Project Sign, page PS-1, Part IV - Supplemental General Conditions hereinbefore.
- C. Paint logotypes to conform with Project Sign Details.

3.05 Maintenance:

- A. Repair damages to structure, framing or sign.
- B. Repaint surfaces, lettering or logotypes which show severe weathering.
- C. Maintain sign and supports in neat, clean condition.

3.06 Removal:

- A. Remove sign, framing, supports and foundations at completion of project or when directed by Engineer.

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 Substantial Completion:

- A. Contractor:
 - 1. Submit written certification to Engineer that project, or designated portion of project, is substantially complete.
 - 2. Submit list of major items to be completed or corrected.
- B. Engineer will make an inspection within fourteen days after receipt of certification together with Owner's representative.
- C. Should Engineer consider that work is substantially complete:
 - 1. Engineer shall prepare an amended list of items to be completed or corrected as determined by the inspection.
 - 2. Engineer will prepare and issue a Certificate of Substantial Completion containing the date of substantial completion, an amended list of items to be completed or corrected, a time schedule to complete or correct work, time and date Owner will assume possession of work or designated portion thereof, and signatures of the Engineer, Contractor and Owner.
- D. Should Engineer consider that work is not substantially complete:
 - 1. Engineer shall notify Contractor in writing stating reasons.
 - 2. Contractor shall complete work and send second written notice to Engineer certifying that project, or designated portion of project is substantially complete.
 - 3. Engineer will reinspect work.
- E. The Parkson representative shall certify in writing that the Biolac portion of the project is substantially complete and operational.

1.02 Final Inspection:

- A. Contractor shall submit written certification that:
 - 1. Contract Documents have been reviewed.
 - 2. Project has been inspected for compliance with Contract Documents.
 - 3. Work has been completed in accordance with Contract Documents.
 - 4. Equipment and systems have been tested in the presence of Owner's representative and are operational.
 - 5. Project is completed and ready for final inspection.
- B. Engineer will make final inspection within fourteen days after receipt of certification.

C. Should Engineer consider that work is not finally complete:

1. Engineer shall notify Contractor in writing stating reasons.
2. Contractor shall take immediate steps to remedy the stated deficiencies and send second written notice to Engineer certifying that work is complete.
3. Engineer will reinspect work.

1.03 Reinspection Cost:

- A. Should Engineer be required to perform second inspection because of failure of work to comply with original certifications of Contractor, Owner will compensate Engineer for additional services and deduct amount paid from final payment to Contractor.

1.04 Closeout Submittals:

- A. Project record documents: As required by Section 01720.
- B. Guarantees and Bonds specified in General Conditions.

1.05 Instruction:

- A. Instruct Owner's personnel in operation of all systems, mechanical, electrical and other equipment.

1.06 Evidence of Payments and Release of Liens:

- A. Submit the following documents before final payment is made:
1. Contractor's release or Waiver of Liens.
 2. Separate releases of waivers of liens for subcontractors, suppliers and others with lien rights against property of Owner together with list of those parties.
- B. All submittals shall be duly executed before delivery to Engineer.

1.07 Final Application for Payment:

- A. Contractor shall submit final application in accordance with requirements of General and Supplementary Conditions.
- B. Engineer will issue final certificate in accordance with provisions of General Conditions.
- C. Should final completion be materially delayed through no fault of Contractor, Engineer may issue a Semi-Final Certificate for Payment, in accordance with provisions of General Conditions.

1.08 Post-Construction Inspection:

- A. Prior to expiration of one year from date of substantial completion, Engineer will make visual inspection of project in company with Owner and Contractor to determine whether correction of work is required in accordance with provisions of General Conditions.
- B. For guarantees beyond one year, Engineer will make inspection at request of Owner after notification to Contractor.
- C. Engineer will promptly notify Contractor in writing of any observed deficiencies.

SECTION 01710

FINAL CLEANING

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to finally clean and maintain throughout the construction period structures, buildings and all sites of work in a standard cleanliness as described in this Section.

1.02 Related Work Described Elsewhere:

- A. Comply with requirements for cleaning as described in various other Sections within this specification.

1.03 Quality Assurance:

- A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

PART 2 - PRODUCTS

2.01 Cleaning Materials and Equipment:

- A. Provide personnel, equipment and materials needed to maintain specified standards of cleanliness.

2.02 Compatibility:

- A. Use cleaning materials and equipment which are compatible with surface being cleaned.

PART 3 - EXECUTION

3.01 Progress Cleaning:

A. General:

1. Retain stored items in orderly arrangement allowing maximum access. Do not impede drainage or traffic. Provide required protection of materials.
2. Remove scrap, debris, and waste material promptly from job site.
3. Store items awaiting removal in good order. Observe fire protection requirements. Control dust and fugitive air emissions. No burning will be permitted.

B. Site:

1. Inspect site and pick up scrap, debris, and waste material daily. Remove items to place designated for storage.
2. Inspect arrangement of materials stored on site; restack, tidy, or otherwise service storage arrangements.
3. Maintain site in neat and orderly condition at all times.

3.02 Final Cleaning:

- A. Definition: "Clean" shall be level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.
- B. General: Prior to completion of Work, remove from job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning.
- C. Site: Broom clean paved areas on site and public paved areas adjacent to site. Remove resultant debris.

3.03 Cleaning During Owner's Occupancy:

- A. Should Owner occupy Work or any portion thereof prior to its completion and acceptance, responsibilities for interim and final cleaning of occupied spaces shall be as determined by Engineer in accordance with Contract General Conditions.

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 Maintenance of Documents:

- A. Maintain at job site one (1) copy of:
 - 1. Contract Drawings
 - 2. Specifications
 - 3. Addenda
 - 4. Reviewed shop drawings
 - 5. Change Orders
 - 6. Other modifications to Contract
 - 7. Field test records
- B. Store documents in temporary field facilities apart from documents used for construction.
- C. Provide files and racks for storage of documents.
- D. Maintain documents in clean, dry and legible conditions.
- E. Do not use record documents for construction purposes.
- F. Make documents available at all times for inspection by Engineer and Owner.

1.02 Recording:

- A. Label "PROJECT RECORD" in 2" high printed letters on each document.
- B. Keep record documents current.
- C. Do not permanently conceal any work until required information has been recorded.
- D. Record drawings: Legibly mark in red pencil to record actual construction.
 - 1. Depths of various elements of foundation in relation to survey datum.
 - 2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 - 3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

4. Field changes of dimension and detail.
5. Changes made by Change Order or field order.
6. Details not on original contract drawings.

E. Specification Addenda: Legibly mark up each Section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
2. Changes made by Change Order or field order.
3. Other matters not originally specified.

F. Shop Drawings: Maintain as record documents; legibly annotate drawings to record changes made after review.

1.03 Submittal:

A. Deliver record documents to Engineer at completion of project.

B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each record document.
5. Certification that each document as submitted is complete and accurate.
6. Signature of Contractor or his authorized representative.

SECTION 01900

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 Scope of Work:

- A. Bid items to include all foreseeable work associated with the completion of the project.
- B. Measurement:
 - 1. Generally, the work actually performed or items actually installed.
 - 2. Conducted by the Contractor and observed by the Owner's Representative.
- C. Payment:
 - 1. Include all associated materials and work.
 - 2. Additional payments shall not be made for any "item" of work not in the "Bid", except work considered to be unforeseen and unusual. Engineer's decision of additional payment shall be final.

1.02 Changes in Scope:

- A. Additional payment may be made for unforeseen or unusual work conducted by order of the Engineer, and for major additions to the work.
- B. Dewatering shall not be considered unforeseen or unusual work.
- C. Major subtractions from the work shall constitute a lessening of the item bid payment.
- D. Adjustments in payment shall be made at a negotiated price as per contract conditions.
- E. Items of work not specifically ordered by the Engineer shall not be additional pay items.
- F. Additional pay items shall be allowed only when work is executed pursuant to the Engineer's prior written instruction. A Change Order shall be issued in accordance with the General Conditions.
- G. Measurement for payment of additional pay items shall be agreed upon daily between the Contractor and Engineer. Payments shall include provision of granular material, disposal of excavated material, and all other needed features of the work performed.

- H. Planting of vegetation indicated on the Plans shall be included in the lump sum bids for a particular item of work. The Contractor shall not be paid the entire bid amount until the vegetation has been planted and accepted.

PART 2 - PRODUCTS

Reserved

PART 3 - EXECUTION

3.01 Contract "GC" and Contract "EC" - Lump Sum Price:

A. Measurement:

1. Generally, the percentage of the total required work actually performed or items actually installed per the approved Schedule of Values.
2. Conducted by the Contractor and observed by the Owner's Representative.

B. Payment:

1. Include all associated materials and work.
2. Additional payments shall not be made for any "item" of work not in the "Bid", except work considered to be unforeseen and unusual, or for change in scope when ordered by Engineer in form of written instructions.

3.02 Biolac Equipment:

- A. Measurement and payment for the Biolac supplied equipment shall be in accordance with Paragraph 19.1 of the General Conditions as related to materials and equipment not incorporated in the work but delivered and suitably stored at the site.

SECTION 02060

ENVIRONMENTAL PROTECTION PROVISIONS

PART 1 - GENERAL

1.01 Work Included:

A. Contractor shall provide all work necessary to incorporate adequate environmental protection measures to minimize or to preclude adverse environmental construction impacts of the following:

1. Air Pollution by Dust
2. Air Pollution by Smoke, Fumes and Sprays
3. Water Pollution by Spillage and Waste
4. Structural Impacts of Erosion on Water Areas
5. Construction Operation in Water Areas
6. Land Despoilment by Destruction of Land Forms and Vegetation
7. Environmental Damage of the Land by Spillage and Waste
8. Noise Pollution, particularly in Residential Areas
9. Improper Use of Pesticides
10. Visual Light
11. Health and Safety Hazards

1.02 Permits:

- A. Execute work in compliance with permits provided by Owner.
- B. Where required, obtain environmental permits and execute work in compliance with permits.

PART 2 - PRODUCTS

2.01 Equipment:

- A. Equipment shall comply with OSHA Regulations, EPA Regulations, and good construction maintenance practice.
1. Periodically check equipment and machinery for proper tuning to minimize exhaust emissions and noise.
 2. Use machinery and equipment incorporating proper muffler design and installation to reduce noise levels.

2.02 Sanitary Facilities:

- A. Furnish chemical sanitary facilities at construction site.

2.03 Temporary Vegetative Plantings (Less than 6 Months):

A. Temporary seedings require fertilizer, lime, seedbed preparation, seed coverage, mulch, and irrigation for quick plant growth.

B. Temporary Herbaceous Species:

1.	<u>March 1 to June 15</u>	<u>Per 1000 Sq. Ft.</u>	<u>Per Acre</u>
(a)	Oats	3 lbs.	4 bu.
	or		
(b)	Perennial Ryegrass	1 lb.	40 lbs.
2.	<u>June 16 to August 15</u>		
(a)	Oats and	2 lbs.	2 bu.
	Sudangrass	2 lbs.	2 bu.
	or		
(b)	Perennial Ryegrass	1 lb.	40 lbs.
3.	<u>August 16 to November 1</u>		
(a)	Rye	3 lbs.	2 bu.
	or		
(b)	Wheat	3 lbs.	2 bu.
	or		
(c)	Perennial Ryegrass	1 lb.	40 lbs.

2.04 Temporary Structures:

- A. Temporary ditch checks shall consist of straw or hay bales or coarse aggregate.
- B. Temporary inlet filters and filter dikes shall consist of straw or hay bales or filter fabric adequately supported on fence.
- C. Temporary dikes shall consist of suitable compacted embankment material.
- D. Temporary slope drains shall consist of pipe, coarse aggregate, riprap, rock channel protection, mats, plastic sheets, or other materials. Such materials shall be approved by the Engineer before being incorporated into work. Sediment pits shall be included as part of slope drain construction.
- E. Temporary sediment basins and dams shall be constructed by methods approved by Engineer. Sand or fabric filters may be required.
- F. Temporary diversion channels are to be constructed around the WWTP facilities to collect runoff and prevent silt and other erodible materials from entering local drainage courses. Diversion channels will flow to temporary silt basins. At the WWTP site, straw will be placed on disturbed areas to control runoff, and hay bales will be placed at swale points to confine runoff to the site.

- G. All disturbed areas are to be restored to their original contours (except for the WWTP itself) and mulched and reseeded. If due to weather, final grading can not be accomplished within two weeks, temporary seeding is to be used until long-term restoration can occur.

PART 3 - EXECUTION

3.01 Erosion Control:

- A. Limit surface area of erodible earth material exposed by clearing and grubbing surface area of erodible earth material exposed by excavation, borrow, and fill operations and provide immediate permanent or temporary control measures to prevent contamination of adjacent streams or other water courses, ales, ponds, or other areas of water impoundment.
- B. Construct temporary ditch checks, filters, benches, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, seeding or other control devices or methods necessary to control erosion and sedimentation.
- C. Incorporate permanent erosion control features into project at earliest practicable time. Except where future construction operations will damage slopes, perform permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Establish final grades and application of Liming, Commercial Fertilizer, and Seeding and Mulching.
- D. Temporary control measures will be used to correct conditions that develop during construction; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.
- E. When erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter; otherwise temporary erosion control measures will be required between successive construction stages.
- F. Limit area of excavation, borrow and embankment operations in progress commensurate with capability and progress in keeping the finished grading, mulching, seeding, and other such permanent control measures current in accordance with the accepted schedule. Mulching, seeding, and other such permanent control measures shall be applied after completion of 8-feet (vertical) of embankment or cut, unless otherwise directed by the Engineer. Should seasonal limitations or embankment make such coordination unrealistic, temporary erosion control measures shall be taken immediately.

- G. Mulch, lime, fertilize and temporarily seed each construction area as rough grading is completed, where finish grading and further construction operations will not proceed for one (1) month.

3.02 Dust Control:

- A. Dust control measures using watering equipment shall be used in all areas during construction and in all areas where seeding or other final surface restoration practices are not to be immediately implemented. Water, not oil, will be used for dust control during construction of all facilities.

3.03 Disposal of Debris:

- A. All debris (including excavation material in excess of project requirements) shall be completely removed from project site and disposed of.
- B. Litter shall be policed daily.
- C. Store, maintain, and dispose of materials to preclude harborage or rodents and insects.

3.04 Maintenance of Traffic:

- A. Contractor shall be responsible for control, directions, and safety of vehicular and pedestrian traffic in work areas. Provide all necessary equipment and personnel for this work. Traffic control arrangements shall be subject to Owner's approval. Access for emergency vehicles will be maintained at all times.

3.05 Working Hours:

- A. Work in Residential and Commercial Areas: Plan and coordinate work for completion during normal working hours.
- B. Work on Sundays and Holidays: No work will be permitted on Sundays or Federal, legal holidays except to save property or life in case of emergency, unless authorized or directed by Owner's Representative.
- C. Night Work:
 - 1. Unless otherwise permitted by Owner, work shall be limited to daylight hours.
 - 2. Work carried on after dark shall be adequately illuminated.
 - 3. Furnish buffers to shield lighting and noise from adjacent residential areas.

3.06 Work Within 100-Year Stream Floodway:

- A. Remove all excavated materials.
- B. Backfill areas subject to flooding with clean, granular material: sand, river run pea gravel or equal.
- C. Riprap areas subject to erosion.
- D. Execute work per Corps of Engineer Permit.
- E. Elevation of the 100-year stream floodway is 722.0 \pm .

3.07 Open Excavation:

- A. Minimize open excavation where practical.
- B. Fence open excavation with properly supported snow fencing when work is not in progress.
- C. No trench will be left open at the close of the work day, where practical.

* * * END OF SECTION * * *

02060-5

SECTION 02221

EARTHWORK FOR STRUCTURES

PART 1 - GENERAL

1.01 Work Included:

- A. The Contractor shall perform all excavation, grading, disposal of debris and spoils, preparation of subgrade and foundations, borrow, embankment, structural backfill, restoration and cleanup necessary or required for the construction of structures covered by the Contract Documents. The excavation shall include the removal and disposal of all materials of whatever nature encountered, including water, and all obstructions that would interfere with the proper construction and completion of the required work. Excavations shall be adequately shored and braced so that the earth will not slide or settle, and so that all existing improvements of any kind will be fully protected from damage. Any damage resulting from lack of adequate shoring and bracing shall be the responsibility of the Contractor. The Contractor shall make all necessary repairs or reconstruction at his own expense, and shall bear all other expense resulting from such damage.

1.02 Related Work Specified Elsewhere:

- A. Section 01900 - Measurement and Payment
- B. Section 02222 - Earthwork for Utilities
- C. Section 02502 - Pavement Restoration
- D. Section 02980 - Landscaping for Utilities

1.03 Quality Assurance:

- A. Standards: Ohio Department of Transportation - Construction and Material Specifications, 1987 Edition (ODOT) is referred to hereafter by basic designation only for a part of this specifications to the extent indicated by the references thereto. Contractor shall have a copy on the job during this phase of the work.

1.04 Definitions:

- A. Excavation: Removal of earth and rock to form a hole or trench for the installation of structure.

2.03 Granular Structure Bedding Materials:

- A. Granular fill material for structure bedding or support shall consist of clean, natural, unwashed gravel or crushed stone free from cementitious substances and flat or flaky particles in an amount sufficient to cause the material to cake or pack, thereby forming an unyielding or uneven support for the pipe. All granular fill material used for structure bedding or support shall be of such sizes that 100% will pass a 1 inch screen, 95% (minimum) will pass 3/4 inch, and 5% (maximum) will pass a No. 4 sieve. Percentages passing shall be measured by weight.

2.04 Granular Backfill Material:

- A. Granular material for excavation backfill above structure bedding shall be clean, natural, unwashed gravel, sand, or crushed stone, ranging in size from medium gravel to medium sand. Granular backfill material shall conform to the following gradations: (ODOT Table 703-1, #57)

<u>Sieve Sizes</u>	<u>Percentages Passing by Weight</u>
1-1/2 inch	100%
1 inch	95% to 100%
1/2 inch	25% to 60%
No. 4	0% to 10%
No. 8	0% to 5%

The presence of 5% to 10% of fine clay or loam particles is desirable, but materials containing clay or loam in the form of lumps shall not be acceptable.

2.05 Job-Excavated Materials for Compacted Earth Backfill:

- A. All job-excavated materials which are used for excavation backfill above structure bedding and which are to be compacted by any method except settlement by water, shall be "clean backfill" as specified above and shall be of such composition that said materials can be compacted to 90% relative compaction by the compaction method used and with water added, if needed, to bring them to optimum moisture content.

PART 3 - EXECUTION

3.01 Site Preparation:

- A. Remove existing topsoil, vegetation, roots, grass or other perishable material from areas which are to be excavated or filled.
- B. Strip materials to full depth of topsoil unless directed otherwise by Engineer.

- C. Stockpile topsoil on site where directed.
- D. Stripping and stockpiling operations shall be completed before starting excavation operations.
- E. Approved topsoil removed from areas will be used for finish grading.

3.02 Rough Grade:

- A. Do all rough cutting, filling and grading necessary to bring following areas to planned subgrades:
 - 1. Slabs-On-Grade: To 6" below bottom of such slabs.
 - 2. Outside Lawn Areas: 6" below finish grades. Slope grading uniformly away from buildings.
 - 3. Sidewalks: 6" below finish elevation.
 - 4. Drives or Parking Areas: 8" below finish grades.
- B. Cooperate with other Subcontractors or Owner for installation of sidewalks, paving, finish grading, seeding, sodding or other site work indicated or specified.
- C. Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given and existing grades.
- D. Finish surfaces shall be reasonably smooth, compacted and free from irregular surface changes.
- E. Regrade interior and exterior work where shrinkage and settlement has occurred.

3.03 Excavation:

- A. Excavate to depths shown and as required for fittings, foundation walls, grade beams, floor slabs, and under floor fills. Excavate subsoil deposits of deleterious material, such as brick, stone, wood, vegetation, silt, etc., where same interferes with new construction.
- B. Excavate outside of walls as required to permit placing and removal of forms, inspection of work and installation of dampproofing drain tile, and other below grade work.
- C. Excavate to exact size of footings, trenches and other work where forms are not used. Trim and level excavations to proper elevations and clear them of debris and rubbish.
- D. Neatly step footings where indicated or required at a slope not exceeding 1:2.

- E. If satisfactory soil conditions are not found at depth indicated, cease work and notify Owner's Representative.
- F. Backfill unauthorized excavation to foundation levels shown with concrete at no expense to Owner.

3.04 Backfill:

- A. Provide minimum of 6" (compacted depth) of Granular Structure Bedding Material under all interior slabs on grade.
- B. Provide minimum of 6" (compacted depth) of Granular Structure Bedding Material under all sidewalks and exterior slabs on grade.
- C. Do not place frozen backfill material. Do not place material on frozen or wet ground or in standing water.
- D. Place materials in compacted layers not exceeding 8" under slabs and 18" elsewhere.
- E. Place backfill on each side of piers, walls and structures simultaneously to avoid displacement.
- F. Use Granular Backfill Material against walls to 12" from surface where shown.
- G. Protect below grade waterproofing, dampproofing and insulation with single thickness of 1/2" fiberboard, 1/8" asphalt impregnated board or other approved means.
- H. Do not operate heavy equipment closer to any wall than a distance equal to height of backfill above top footings.

3.05 Embankments:

- A. Construct all embankment or fill sections with excavated on-site material where possible.
- B. Scarify existing grade minimum 6" deep before commencing fill.
- C. Provide water as needed to obtain optimum moisture content for compaction.
- D. Provide additional off-site material needed to complete embankment.

3.06 Compaction:

- A. Backfill adjacent to walls to same density as adjacent fill with small vibratory or hand tamping equipment.

- B. Compact backfill and embankment fill within building outlines, drives and parking areas to density of at least 95% of standard proctor density.

3.07 Dewatering:

- A. Furnish, install, operate and remove dewatering equipment necessary to drain and keep excavations free of water.
- B. Obtain Engineer's approval of proposed method of dewatering.
- C. Prevent surface water from flowing into excavation; promptly remove any accumulated water.

3.08 Finish Grading:

- A. Place minimum 6" topsoil on all rough graded areas unless shown otherwise.
- B. Grade areas disturbed by construction operations.
- C. Grade to smooth, uniformly sloping surfaces to elevations indicated.
- D. Slope finish ground surfaces from elevations indicated to existing grade with slope not to exceed 2" per foot unless indicated otherwise.
- E. Fill depressions and provide for positive drainage away from building area or structure.

3.09 Underground Obstructions:

- A. Do not commence excavation prior to site inspection by representative of local utilities.
- B. Known underground piping, foundations and other underground obstructions in vicinity of construction are shown on plans in an appropriate way only. The Contractor shall verify actual locations.
- C. Protect and log for submittal all underground facilities encountered during excavation. Repair without compensation existing facilities damaged during excavation whether or not shown.
- D. Contractor must determine exact location of underground utilities to avoid damage and conflicts.

SECTION 02222

EARTHWORK FOR UTILITIES

PART 1 - GENERAL

1.01 Work Included:

- A. The Contractor shall perform all excavation, backfilling, and compaction necessary or required for the construction of the pipe lines and appurtenances covered by the Contract Documents. The excavation shall include the removal and disposal of all materials of whatever nature encountered, including water, and all obstructions that would interfere with the proper construction and completion of the required work. Excavations shall be adequately shored and braced so that the earth will not slide or settle, and so that all existing improvements of any kind will be fully protected from damage. Any damage resulting from lack of adequate shoring and bracing shall be the responsibility of the Contractor. The Contractor shall make all necessary repairs or reconstruction at his own expense, and shall bear all other expense resulting from such damage.

1.02 Related Work Specified Elsewhere:

- A. Section 01900 - Measurement and Payment
- B. Section 02221 - Earthwork for Structures
- C. Section 02502 - Pavement Restoration
- D. Section 02980 - Landscaping for Utilities

1.03 Definitions:

- A. **Excavation:** Removal of earth and rock to form a trench for the installation of a water main, gravity sanitary sewer, storm sewer, or force main.
- B. **Earth:** Unconsolidated material in the crust of the earth derived by weathering and erosion. Earth includes: materials of both inorganic and organic origin; boulders less than 1/3 cubic yard in volume, gravel, sand, silt and clay; materials which can be excavated with a backhoe, trenching machine, drag line, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.
- C. **Undercutting:** Excavation of rock and unsuitable earth below the bottom of the pipe or conduit to be installed in the trench.

- D. Subgrade: Undisturbed bottom of a trench.
- E. Bedding: Granular specified material placed in trench to support pipe and conduit.
- F. Rock: Stone or hard shale in original formation, boulders over 1/3 cubic yard in volume, masonry or concrete that cannot be broken and removed by normal job equipment (power shovel 1/3 yard capacity, scoops, bulldozers), without the use of explosives or drills. This does not include material such as loose rock, concrete or other materials that can be removed by means other than drilling and wedging, but which for reasons of economy in excavating, the Contractor prefers to remove by drilling and wedging.
- G. Backfill and Fill: Specified material placed in trench from the top of bedding to finished grade, or to subbase of pavement.
- H. Topsoil: Earth containing sufficient organic materials to support the growth of grass.

1.04 Unstable Material

- A. It is the intent of these specifications that all pipe shall have a stable foundation. Any material encountered on subgrade which is not stable and can not be made adequate, shall be removed and replaced with stable material. Such work shall be done at the Contractor's expense.
- B. Under no condition will the Contractor be paid extra for not having determined beforehand the nature and character of materials that will be encountered in excavation.

1.05 Submittals:

- A. Submit at time of Substantial Completion, the record log as herein specified.
- B. Submit the materials test reports.
- C. Submit a utility line damage and repair method report for each occurrence.

1.06 Job Conditions:

- A. All information given in the Contract Documents relating to test borings, materials encountered, and rock elevations, is from surveys performed by other consultants. Such information is furnished only for the information and convenience of the Contractor. The Engineer does not warrant or guarantee that the materials and conditions encountered during construction will be the same as indicated by the soil boring data or by information shown on the drawings.

- B. Existing storm sewers, sanitary sewers, water mains, gas mains, electric ducts, telephone ducts, steam mains and other underground structures, lines, and their house connections have been shown on the plans according to the best available information. The exact location and protection of these facilities and structures, their support and maintenance in operation during construction (in cooperation with the proper authorities), is the responsibility of the Contractor in the performance of his contract.
- C. The Contractor shall be responsible for keeping the area in and around his work free from excessive dust caused by the construction and related activities. The Contractor shall be required to spread water as often as necessary to keep the dust down. The use of oil shall not be allowed.

PART 2 - PRODUCTS

2.01 Clean Backfill:

- A. When used in these specifications, the term "clean backfill" shall mean any backfill material of whatever nature that is free of roots, brush, sticks, debris, junk, cinders, broken concrete or brick, large lumps of clay, frozen material or stones greater than 8 inches in their largest dimensions.

2.02 Replacement Materials for Unsuitable Foundations:

- A. Material to be used for replacement of unstable or unsuitable materials in trench bottoms shall be crushed rock or crushed gravel of the following sizes:

<u>Pipe Size</u>	<u>100% Passing</u>	<u>100% Retained</u>
4" to 12"	3/4"	No. 4 Sieve

2.03 Granular Pipe Embedment Material:

- A. Granular fill material for pipe embedment or support shall consist of clean, natural, unwashed gravel or crushed stone free from cementitious substances and flat or flaky particles in an amount sufficient to cause the material to cake or pack, thereby forming an unyielding or uneven support for the pipe. All granular fill material used for pipe embedment or support shall be of such sizes that 100% will pass a 1/2 inch screen and 95% will be retained on a No. 4 sieve. The presence of approximately 5% of fine clay or loam particles is desirable.

2.04 Granular Pipe Cover Material:

- A. Bedding material shall be used for cover material.

2.05 Granular Backfill Material:

- A. Granular material for trench backfill above pipe embedment shall be clean, natural, unwashed gravel, sand, or crushed stone, ranging in size from medium gravel to medium sand. Granular backfill material shall conform to the following gradations: (ODOT Table 703-1, #57)

<u>Sieve Sizes</u>	<u>Percentage Passing by Weight</u>
1-1/2 inch	100%
1 inch	95% to 100%
1/2 inch	25% to 60%
No. 4	0% to 10%
No. 8	0% to 5%

The presence of 5% to 10% of fine clay or loam particles is desirable, but materials containing clay or loam in the form of lumps shall not be acceptable.

2.06 Job-Excavated Materials for Compacted Earth Backfill:

- A. All job-excavated materials which are used for trench backfill above pipe embedment and which are to be compacted by any method except settlement by water, shall be "clean backfill" as specified above and shall be of such composition that said materials can be compacted to 90% relative compaction by the compaction method used and with water added, if needed, to bring them to optimum moisture content.

2.07 Concrete Backfill:

- A. Concrete used for backfill around sewers, water mains, or other utility piping shall be 2000 psi strength at 28 days.
- B. Light weight cellular concrete may be used for filling of abandoned sewers as a grouting mixture for filling voids and as a substitute for backfill concrete in tunnels or casing pipes. The cellular concrete shall be produced by blending preformed foam with cement-sand grout slurry to produce a concrete having a fresh weight per cubic foot of not less than 75 pounds.

PART 3 - EXECUTION

3.01 Existing Utilities, Structures and Property:

- A. All poles, fences, sewer, gas, water or other pipes, wires, conduits and manholes, buildings, structures and property along the routes of force mains and sewers shall be supported and protected from damage by the Contractor.
- B. Movable items such as mail boxes may be temporarily relocated during construction. Place movable items in their original location immediately after backfilling is completed, unless otherwise shown on the drawings. Replace movable items which are damaged during construction.
- C. The Contractor shall proceed with caution in the excavation and preparation of trenches so that the exact location of underground utilities and structures, both known and unknown, may be determined. The Contractor shall be responsible for the repair of utilities and structures when broken or otherwise damaged. Contractor shall immediately notify the utility involved and the Engineer when damage occurs. Submit a written detailed report to the Engineer for each occurrence of the damage sustained and the proposed method of repair. Should the utility involved require damaged pipe lines or conduit be repaired by their own forces, the Contractor shall abide by the utility requirements and bear all repair charges with no additional expense to the Owner.
- D. Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of underground structures, the Contractor shall make explorations and excavations for such purpose at no additional cost and shall not be eligible for a Change Order in the Contract amount.
- E. Wherever sewer, gas, water, or other pipes or conduits cross the trench, the Contractor shall support said pipes and conduits without damage to them and without interrupting work of this Contract. The manner of supporting such pipes, etc. shall be subject to the approval of the utility involved.
- F. When utility lines that have to be removed or relocated are encountered within the areas of operations, the Contractor shall notify the Engineer in ample time for the necessary measure to be taken to prevent interruption of the service.
- G. The Contractor shall so conduct the work that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the work unless he shall have first obtained the property owner's written consent thereto and shall have provided a copy of said written consent to the Engineer.

- H. All excavated material shall be piled in a manner that will avoid obstructing sidewalks and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural watercourses shall not be obstructed.

3.02 Clearing:

- A. Clear, remove and legally dispose of logs, stumps, brush, vegetation, rubbish, and other perishable matter from the project site as required to perform work.
- B. Do not remove or damage trees that do not interfere with the work. Completely remove trees required to be removed, including stumps and roots. Properly treat damaged trees which can be saved.
- C. Debris from the tree removal, including trunk, branches, leaves, roots and stumps, shall not be buried or burned on the job site, but must be completely hauled away and disposed of at the Contractor's expense.

3.03 Stripping and Stockpiling of Topsoil:

- A. Strip topsoil and vegetation from the excavated areas. Clean topsoil shall be stockpiled for reuse as the upper 6 inches of the areas to be seeded.
- B. Do not intermix grass, weeds, roots, root mat, brush and stones larger than 3 inches with stockpiled topsoil. Dispose of root contaminated topsoil.
- C. Stockpiled topsoil and fill materials are to be protected from soil erosion by temporary seeding, and are not to be stored within 200 feet of a stream bank or a lake shore.

3.04 Pavement and Walk Removal:

- A. Remove excavated asphaltic and concrete materials from existing pavement and walks removed from over the excavated areas. These materials shall be legally disposed of off the job site as these materials are excavated.
- B. The width of pavement removed along the normal trench for the installation of pipe and structures shall not exceed the width of the trench by more than one foot on each side of the trench when the amount of pavement removed is less than 75% of the total existing pavement width. Remove all existing pavement when the excavation requires the removal of 75% or more of the total existing pavement width.

- C. Remove walks completely when excavation is along the length of a walk and requires the removal of part of the walk. Remove walks to existing joints in the walks when excavation crosses walks. If there are no joints in an existing walk, the width of walk removed shall not exceed the width of the trench by more than 12 inches on each side of the trench.
- D. Saw cut to full depth to remove pavement and walks so that pavement and walks are cut along straight lines. The face of the remaining pavement and walk surfaces shall be approximately vertical.

3.05 Excavating:

A. General:

- 1. After stripping to topsoil and vegetation, perform excavations of every description regardless of material encountered within the grading limits of the project to lines and grades as indicated on the drawings or as otherwise specified.
- 2. Materials removed below the depths indicated without specific direction of the Engineer shall be replaced at no additional cost to the Owner, to the indicated excavation grade with satisfactory bedding materials placed and compacted.

B. Dewatering:

- 1. If dewatering becomes necessary, all dewatering flows are to be settled in siltation basins or directed through straw filters before being discharged to stabilized sites such as streams, or lake, or storm sewers, not onto exposed soils, stream banks or any other site where flows could cause erosion.
- 2. Keep excavations free from water until the force mains, sewers, structures, and appurtenances to be constructed in the excavations are completed and will safely withstand forces from water. Provide sufficient dewatering equipment and make satisfactory arrangements for the disposal of the water without undue interference with other work, damage to property, or damage to the environment.
- 3. Operate dewatering equipment ahead of pipe laying and keep the water level below the pipe invert until the pipe is secured by backfill.

C. Trenching:

1. Trees, boulders, and other surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operations, shall be removed or made safe before excavating is begun.
2. Do not open more than 100 feet of trench in advance of the installed pipe, unless otherwise directed or permitted by the Engineer. Excavate the trench within 6 inches of full depth for a distance of at least 30 feet in advance of the pipe laying, unless otherwise directed or permitted.
3. Contractor shall be responsible for the determination of the angle of repose of the soil in which the trenching is to be done. Excavate all slopes to at least the angle of repose except for areas where solid rock allows for line drilling or presplitting, or where shoring or trench box is to be used.
4. Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Give special attention to slopes which may be adversely affected by weather or moisture content.
5. Flatten the trench sides when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action, and slide planes appear.
6. Shoring, sheeting, trench box, or other means shall be used to support sides of trenches in hard or compact soil when the trench is more than 5 feet in depth and 8 feet or more in length. Sides of trenches shall include embankments adjacent to trenches. In lieu of shoring, the sides of the trench above the 5-foot level may be sloped to preclude collapse, but shall not be steeper than a 1-foot rise to each 1/2 foot horizontal. Provide a bench of 4 feet minimum at the toe of the sloped portion of the trench wall when the outside diameter of the pipe to be installed is greater than 6 feet.
7. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow water to accumulate in an excavation. If possible, the grade should be away from the excavation.

8. Excavations shall be inspected by a competent Contractor's representative after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins shall be increased if necessary.
9. Do not store excavated or other material nearer than 4 feet from the edge of any excavation. Store and retain materials as to prevent materials from falling or sliding back into the excavation. Install substantial stop log or barricades when mobile equipment is utilized or allowed adjacent to excavations.
10. The width of trenches in earth for sewer pipes, force main pipes, building connections, and other drain lines up to and including 15 inches in internal diameter shall provide a clearance of not less than 8 inches or more than 10 inches on each side of the pipe.
11. The maximum clear width of trenches in earth for manholes shall be the greatest external width of the structure plus the space necessary for the construction and removal of the forms and construction of masonry work.
12. The design of the force main, sewer pipe and structures is predicated upon the width of trench specified in this Section. The Contractor shall be responsible for the provision and installation, at his own expense, of such remedial measures as may be directed by the Engineer, should the trench width limits as specified in this Section be exceeded.
13. Test the air in excavations in locations where oxygen deficiency or gaseous conditions are possible. Establish controls to assure acceptable atmospheric conditions. Provide adequate ventilation and eliminate sources of ignition when flammable gases are present. Attended emergency rescue equipment, such as breathing apparatus, a safety harness and line, and basket stretcher, shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.
14. Provide walkways or bridges with guardrails where employees, public or equipment are required or permitted to cross over excavations.
15. Provide ladders where employees are required to be in trenches 4 feet deep or more. Ladders shall extend from the floor of the trench to at least 3 feet above the top of the excavation. Locate ladders to provide means of exit without more than 25 feet of lateral travel.

16. Provide adequate barriers and physically protect all remotely located excavations. Barricade or cover all wells, pits, shafts, and similar excavations. Backfill temporary wells, pits, shafts, and similar excavations upon completion of exploration and similar operations.

D. Quicksand: Carry on the work with utmost vigor and proceed with the work expeditiously when running sand, quicksand, or other bad or treacherous ground is encountered. Install bedding to support the pipe as directed by the Engineer.

3.06 Sheeting:

- A. The Contractor shall be responsible for construction means, methods, techniques, and procedures, and for providing a safe place for the performance of the work by the Contractor, Sub-Contractors, suppliers and their employees, and for access use, work, or occupancy by all authorized persons.
- B. The Contractor shall be solely responsible for all obligations prescribed as employer obligations under Chapter XVII of Title 29, Code of Federal Regulations, Part 1926, otherwise known as "Safety and Health Regulations for Construction".
- C. Adequate supporting systems, such as sheeting, shoring, piling, cribbing, and bracing shall be furnished and installed by the Contractor as required to protect existing buildings, utilities, and property from damage during the progress of the work.

3.07 Storage and Removal of Excavated Material:

- A. Suitable excavated material required for filling and backfilling operations may be stockpiled in on-site locations as approved by the Engineer, until the material is ready to be placed.
- B. Remove unsuitable materials from the job site as unsuitable materials are excavated. Remove surplus suitable materials from the job site as trenches are backfilled.

3.08 Temporary Plugs:

- A. Prevent foreign matter from entering pipe while it is being installed. Do not place debris, tools, clothing, or other material in the pipe. Close the open ends of pipe by watertight plugs when pipe laying is not in progress. Remove any earth or other material that enters pipe, lateral pipe, or appurtenances through any open pipe end. Remove earth and other materials at no additional cost to the Owner.

3.09 Backfilling Force Main and Sanitary Sewer Trenches:

A. General:

1. Backfilling of force main trenches shall meet the requirements of ANSI/AWWA C600, unless otherwise specified in this Section.
2. Do not backfill trenches and excavations until all utilities have been inspected by the Engineer or his representative and until all underground utilities and piping systems are installed in accordance with the requirements of the specifications and the drawings. Required hydrostatic tests may be applied to the line either before or after the trench is backfilled, subject to the approval of the Engineer.
3. Place and tamp bedding and backfill in a manner which will not damage pipe, pipe coating, wrapping, or encasement.

B. Pipe Bedding:

1. Material from the trench subgrade to the centerline of the pipe shall be Granular Pipe Embedment Material. Place bedding by hand or approved mechanical methods in layers of 8 inches loose depth. Compact bedding by hand tamping or with a power operated hand vibrating compactor. Deposit bedding in the trench for its full width on each side of the pipe simultaneously.

C. Pipe Cover:

1. Material from the centerline of the pipe to 12 inches over the pipe top shall be Granular Pipe Embedment Material. Placement and compaction shall be the same as that for pipe bedding.

D. Excavated Material Backfill:

1. Material excavated from an open trench may be used for backfilling from pipe cover material to 6" below finished grade providing it meets the requirements of Clean Backfill; and providing a different type of backfill material has not been specified or shown on the plans. Where excavated material is used for backfilling and there is a deficiency due to the rejection of a part thereof, the Contractor, upon written order of the Engineer, shall remove the rejected material from the site of the work and shall furnish an additional quantity of clean backfill at his own expense.

2. Excavated material shall be placed immediately after the hand backfill. Such backfilling may be done from the top of the trench by mechanical means, or directly from trucks by depositing the backfill on a slope equal to the angle of repose of the material and allowing it to flow progressively forward in such a manner as to prevent the formation of voids. The earth backfill shall be compacted to at least 80% of maximum.
3. The backfill in no case shall be dropped from such height or in such volume that its impact upon the sewer or structure will cause damage. The Engineer reserves the right to regulate and control the manner of depositing such backfill, but in any case, the Contractor will be held liable for damage to the sewer or structures.
4. Settling of backfill by flooding or puddling will not be permitted on this project.
5. Excess trench material shall be roughly graded over the sewer trench in a timely manner soon after the pipe is installed. This material shall be mounded over the trench with a crown height of no more than 6 inches, feathered to existing grade, until complete settlement has occurred and the trench is ready for final grading and cleanup. An exception to this would be trenches in traveled pathways. Any excess greater than needed thusly shall be hauled off and disposed of or stored by the Contractor.
6. After settlement of backfill and immediately before restoration of vegetated areas, grade and remove excess earth in unpaved area to be restored. Remove to 6 inches below finish grade. Place 6 inches of topsoil over entire area to be restored.

E. Granular Material Backfill:

1. Where excavation occurs within five feet of the edge of existing or proposed roadway pavement or within twelve feet of a state highway pavement edge and within its right-of-way, the backfill from the pipe cover material to six inches below finish grade shall be Granular Backfill Material followed by topsoil or granular material to match existing surrounding material.
2. Where trenches cut into or across roadways, driveways, utility crossings, walks, and in areas to be paved or subject to traffic, the backfill from the pipe cover material to within 8 inches of the existing pavement surface shall be Granular Backfill Material. Material shall be under these traffic areas and extend out two feet beyond their edges, from there it shall slope down on a 2:1 slope. The top eight inches of backfilling shall then be ODOT item

304 aggregate compacted in place, prior to opening the street to traffic. With the exception that all alleys, driveways, parking areas or roadways which have a temporary surfacing of crushed stone, limestone chips, graded aggregate, etc., shall be surfaced with materials and depth to correspond with the existing surfacing.

3. Place Granular Backfill Material in 6-inch lifts. Compact each lift of backfill to not less than 95% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling, unless permitted in writing by the Engineer.
4. Where sand or gravel backfilling is indicated on the plans or is required by the specifications, and sand or gravel is encountered in excavation which in the judgement of the Engineer is satisfactory for backfilling, the Contractor, upon written order of the Engineer, shall use such excavated sand or gravel for backfilling the trench.

3.10 Maintenance During Guarantee Period:

- A. As trenches are backfilled, the Contractor shall remove all surplus material and regrade and leave free, clear, and in good order all roadways affected by the construction of the work. The Contractor shall maintain the trenches, adding crushed stone and grading as necessary, until sufficient settlement has taken place and final restoration is made. During the progress of, and until the expiration of the guarantee period, he shall maintain in good and safe condition the surface of the pavements over the trenches, and promptly fill all depressions over and adjacent to trenches caused by settlement of backfilling.

3.11 Maintaining Traffic:

- A. Before closing any thoroughfare, the Contractor shall notify and, if necessary, obtain a permit or permits from the duly constituted public authority having jurisdiction, state, county, or city, which notice shall be given not less than 72 hours in advance of the time when it may be necessary in the process of construction to close such thoroughfare.
- B. The Contractor shall conduct his work in such manner as not to unduly or unnecessarily restrict or impede normal traffic through the streets of the community. Insofar as it is practicable, excavated material and spoil banks shall not be located in such manner as to obstruct traffic; and the traveled way of all streets, roads, and alleys shall be kept clear and unobstructed insofar as is possible and shall not be used for the storage of construction materials, equipment, supplies, or excavated earth, except when and where necessary. If required by duly constituted

public authority, the Contractor shall, at his own expense, construct bridges or other temporary crossing structures over trenches so as not to unduly restrict traffic. Such structures shall be of adequate strength and proper construction and shall be maintained by the Contractor in such manner as not to constitute an undue traffic hazard. Should temporary obstruction of one or both lanes of existing roadways become necessary during construction, the Contractor shall provide a minimum of two flagmen, lighted barricades at night and traffic cones. All arrangements shall be subject to Engineer's and Owner's approval. Private driveways shall not be closed except when and where necessary, and then only upon due advance notice to the Engineer and for the shortest practicable period of time consistent with efficient and expeditious construction. The Contractor shall be liable for any damages to persons or property resulting from his work.

3.12 Walks and Passageways:

- A. The Contractor, when required, shall make provisions at cross streets for the free passage of vehicles and foot passengers, either by bridging or otherwise, and shall not obstruct the sidewalks, gutters, or streets, nor prevent in any manner the flow of water in the latter, but shall use all proper and necessary means to permit the free passage of surface water along the gutters. The Contractor shall immediately cart away all offensive matter, exercising such precaution as may be directed by the Engineer. All material excavated must be so disposed of as to inconvenience the public and adjacent tenants as little as possible and to prevent injury to trees, sidewalks, fences, and adjacent property of all kinds. The Contractor may be required to erect suitable barriers to prevent such inconvenience or injury.

3.13 Warning Lights:

- A. The Contractor shall place sufficient warning lights on or near the work and keep them illuminated during periods of reduced visibility (from twilight in the evening until sunrise) and will be held responsible for any damages that any party or the Owner may sustain in consequences of neglecting the necessary precaution in prosecuting this work.

3.14 Rock Excavation:

- A. Where rock is encountered in the trench, the Contractor shall open the trench to full depth for at least fifty feet (50') in advance of the pipe. When it is required to place structures in rock, the excavation shall be no larger than is necessary to facilitate the placing of forms. The rock shall be excavated to 6 inches below the outside surface of the pipe or bell. Rock shall be stripped in sections of not less than fifty feet (50')

in length, and the Engineer or his representative shall be notified in order that all measurements and inspections may be made before pipe is laid.

- B. A minimum 4" deep bed of well-compacted Granular Pipe Embedment Material shall be placed under and to centerline of the pipe. The pipe shall be laid in this bed so that the entire length of each pipe shall be uniformly supported by the 4 inch bed. Engineer may adjust grades should excessive rock be encountered.
- C. The pay width (when allowed) for rock excavation shall be the maximum shown in the standard trench details and vertically to the top of the rock layer. The pay lines for cast-in-place manholes and other sewer structures shall be as close to the outside neat lines of the manhole or sewer structure as possible, and the face of the rock shall be used for the backform. The pay lines for precast manholes and other sewer structures shall be a maximum of 18 inches beyond the outside neat lines of the manhole or other sewer structure. Rock measurements shall begin at a place which is at the specified depth below the pipe or other structure and shall be based on the actual volume of the excavated material in its original and undisturbed condition.
- D. Rock excavation shall be defined to include all hard, solid rock in ledges, bedded deposits and unstratified masses and all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock, concrete or solid masonry structure, or any other material that in the opinion of the Engineer requires continual drilling and wedging to be removed, and shall include boulders of more than one-third cubic yard in volume.
- E. Thin rock layers, separated by clay or silt seams, or shale which can be removed with a power shovel of not less than three-quarters yards capacity without drilling and wedging shall not be considered rock excavation. The Engineer's decision as to what does or does not constitute rock excavation shall be final.
- F. Blasting will not be allowed.
- G. Rock removed from the trench shall be disposed of as directed by the Engineer and suitable backfill material be substituted therefore.
- H. Boulders shall be removed from excavation and stockpiled or disposed of at the direction of the Engineer.

3.15 Cleanup and Maintenance:

- A. Clean up the job site as backfilling is completed. Remove excess earth, rock, bedding, materials, and backfill materials. Remove unused piping materials, structure components, and appurtenances. Restore items moved, damaged, or destroyed during construction. Grade area to be restored. Leave backfill mounded over trenches which are not backfilled with Granular Backfill Material. Cleanup and restoration specified in this paragraph shall be completed within 1,000 feet of excavation.
- B. Restoration of grass, bushes, trees, and other plants shall be as specified in Section 02980, Landscaping for Utilities.
- C. Restoration of pavement and walks shall be specified in Section 02502, Pavement Restoration. A temporary driving surface, such as crushed stone, shall be compacted in place in the trench area as backfilling is complete. Cold-mix asphalt patching material may be used as a temporary driving surface at the Contractor's option or when specifically called for in the plans or specifications. Temporary pavement shall not be more than 1,000 feet behind the excavation. When no existing pavement remains after excavation, a temporary compacted aggregate surfacing may be provided instead of the permanent pavement or a temporary cold-mix asphalt pavement. When the pavement is asphaltic concrete, placement of the asphaltic concrete surface course may be delayed until all other heavy construction is completed.
- D. Maintain the job site until the work has been completed and accepted. Fill trenches which settle when settlement is visible. Restore items damaged by construction or improper restoration. Keep dust conditions to minimum by the use of water.

3.16 Log:

- A. The Contractor shall maintain a continuous log showing the following:
 - 1. Size, type, depth, and station-distance of all fittings installed.
 - 2. Size, type, depth, and station of all utilities encountered in any trenching.
- B. This log shall be open for inspection at all times by the Engineer and shall be turned over to the Engineer at the end of construction.

SECTION 02546

AGGREGATE SURFACING

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall place compacted course or courses of crushed aggregate in conformity with the plans and details as shown on the drawings and as herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 02980 - Landscaping for Utilities

1.03 Quality Assurance:

- A. Standards: Ohio Department of Transportation - Construction and Material Specifications, 1987 Edition (ODOT) is referred to hereafter by basic designation only for a part of this specification to the extent indicated by the references thereto. Contractor shall have a copy on the job during this phase of the work.
- B. Qualifications of Manufacturers: The Manufacturers of the products specified under this Section shall certify they are in compliance with these specifications and that their product has been prequalified by the State Highway DOT or the local municipality where the work is being performed.
- C. Regulating Authorities: All work shall comply with the appropriate authorities.

1.04 Submittals:

- A. Submit written certifications of compliance as hereinbefore specified.

PART 2 - PRODUCTS

2.01 Aggregate: Per ODOT 411.02

- A. Furnish sound, crushed limestone, crushed slag, crushed gravel or slacker aggregate. Shale shall not exceed 5 percent. Where major portion of material in coarse aggregate has shown characteristics of acquiring mudlike condition when tested for soundness, it shall be tested for soundness and the maximum loss shall be 5 percent. If gravel is used, that portion retained on No. 4 sieve shall contain not less than 40 percent fractured pieces. Crushed limestone, crushed slag and crushed gravel shall meet the following grading requirements:

<u>Sieve Size</u>	<u>Total Passing, Percent</u>
1-1/2 Inch	100
1 Inch	75-100
3/4 Inch	50-95
3/8 Inch	35-75
No. 4	30-60
No. 40	7-30
No. 200	3-13

Fraction of these materials passing No. 40 sieve shall have plasticity index of not more than six. Graduation and physical characteristics of material shall be such that it will compact to provide stable, structurally sound roadway surface.

PART 3 - EXECUTION

3.01 Subgrade:

- A. Roll and compact subgrade for stabilized crushed aggregate to depth of 6 inches to 100 percent of maximum dry density as determined by AASHTO T 99, Method C.

3.02 Placement:

- A. Spread aggregate over prepared subgrade in uniform lifts not to exceed 6 inches compacted. Blade and shape to specified grade and cross-section. Compact each lift as it is placed.

3.03 Compaction:

- A. Obtain initial compaction of material by use of crawler type tractors, tamping rollers, trench rollers, or suitable pneumatic tire equipment. Use pneumatic tire equipment for final compaction. Compaction shall follow the spreading operation closely to prevent loss of contained moisture and displacement of material.
- B. When surface stability of the crushed aggregate cannot be obtained due to lack of fines, add additional fines to upper portion of course to secure surface stability. Maximum fines passing No. 200 sieve shall not exceed 15 percent in upper portion.
- C. Water may be applied to aid in compaction and prevent segregation material in manner that will not soften the subgrade. Compact aggregate surface in manner to maintain roadway grade and cross-section.

SECTION 02670

WATER WELL SYSTEM

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install a water well system consisting of a well pump, well with casing, water line from well to building, hydropneumatic tank system, specialties and accessories as shown on the drawings and herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15060 - Piping and Valves
- C. Section 15061 - Piping Schedules
- D. Section 15130 - Gauges
- E. Section 15170 - Motors
- F. Division 16 - Electrical

1.03 Quality Assurance:

- A. Standards:
 - 1. Standards referred to hereafter by basic designation only, form a part of this specification to the extent indicated by references thereto. Latest revisions shall apply, unless otherwise specified.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
 - 2. Certified copies of reports of factory tests specified in this section and required by the referenced standards.
 - 3. Shop drawings with performance data and physical characteristics.
 - 4. Manufacturer's installation instructions.
 - 5. Manufacturer's operation and maintenance material and manuals.

6. Wiring diagrams for automatic controls.
7. Form of warranty.

1.05 Product Delivery, Storage and Handling:

- A. The Contractor shall be responsible for the delivery, storage and handling of products.
- B. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.01 Well Pump:

- A. Pump housing or case shall contain bowls and impellers and support weight of entire pumping unit. High quality seamless material capable of containing shut-in pressure of pump with adequate safety factor: stainless steel, monel or carbon steel. If carbon steel, protected with tough and corrosion-resistant coating.
- B. Diffuser or bowls shall be one-piece casting expertly designed and machine to have high efficiency. Bushing surfaces shall provide proper alignment for impellers. Material shall be high grade Ni-Resist or bronze. Suction screen or strainer shall be provided over pump intake to prevent large particles entering pump. Screen shall be grid type with large screen area and efficient hydraulic design.
- C. Impellers shall be bronze and cast in one piece, accurately machined and inspected. Radial or mixed flow type and non-overloading. Head characteristic shall be steep as possible so that increase or decrease of operating head above design point will not cause excessive variation in pump capacity. Impellers shall have axial thrust pads of fibrous material to prevent metal to metal contact with diffusers. Impeller shall be designed to run at 3450 RPM to provide high heads with small diameters. Impeller thrust shall be taken on diffuser or bowl wearing pads and not transmitted to motor thrust bearing.
- D. Pump shaft shall be made of corrosion-resistant material of adequate strength to perform work required. Thrust from pump shaft shall be only transmitted to motor thrust bearing.
- E. Submersible electric motor (3450 RPM) shall be a type used successfully on underwater service for minimum of 20 years. Sealed in oil to insure corrosion-free and wear-free service. Unit shall have mechanical seal to insure no water will enter and corrode operating parts. Motor rotor shall be mounted in ball or marine type bearings and end play kept to minimum. Motor shall

be capable of operating in ambient temperatures up to 175°F without harm. Motor shall have adequate capacity to operate pump at all heads and capacities.

- F. Power cable shall be the highest quality specifically made for underwater service and type used in this service for not less than five years. Cable splices shall be made in accordance with manufacturer's specifications, according to NEC. Cable shall be not less than size shown on drawings where applicable.
- G. Pump motor control panel provided by pump supplier shall incorporate a magnetic starter with "thermal type" heater for overload protection and a fusible disconnect switch. Panel shall be capable of being locked in the open position. Contacts shall be provided for pressure switch.
- H. Suction pipe shall be of required length, of proper diameter and same material as pump column provided. Slotted strainer shall have net inlet opening area not less than four times area of suction pipe provided.
- I. Discharge pipe shall be threaded and coupled in random sections 21 feet long. Pipe shall be of sufficient size to handle water pumped without excessive friction losses and of tensile strength great enough to hold its weight plus pump, motor, shaft, cable, water and safety factor of 200%. All shall be suspended from sanitary well seal which caps well casing.
- J. Pump and motor shall have standard nameplate showing manufacturer, serial number, capacity, RPM, head in feet. Motor nameplate shall show HP, speed, rated current, voltage and rated frequency.
- K. Pump manufacturer shall be Red Jacket, Gould or equal.
- L. Pump shall be 460V/60 hz/3 phase.

2.02 Pneumatic Tank - Above Ground:

- A. Capacity, arrangement, shell length, diameter and openings as shown on the drawings.
- B. Tank shall be vertical.
- C. Material: Galvanized steel, designed for 125 psi working pressure with ASME label, with replaceable diaphragm.
- D. Mount as shown on drawing.
- E. Operating range: 20 psi to 60 psi.
- F. Manufactured by Amtrol No. 251 or equal.

2.03 Pressure Switch:

- A. Mechanical contact.
- B. 30 psi to 50 psi operating range (0 psi to 90 psi adjustable).
- C. Manufactured by Allen Bradley, Square D, or equal.

PART 3 - EXECUTION

3.01 General:

- A. Well to be completed in gravel to rock formation. The exact design depth of well is not known. Base Bid shall be submitted upon a basis of well driven, cased and developed, including 10 feet of stainless steel well screen to a depth of 40 feet. Yield shall be no less than 10 GPM. Pump selected hereinafter shall be used for size and type of pump for basis of bid. Well drilling contractor shall make final determination as to size of pump required. Obtain written approval from Engineer of pump to be used prior to installation.

3.02 Installation:

- A. Well shall be cased with black Sch. 40 steel pipe or PVC pipe, standard weight, size as indicated on drawings.
- B. Should well be completed in water bearing gravel formation, the Contractor shall furnish and install wire wound type Everdur or equal, well strainer set opposite water bearing gravel formation. Strainer shall be of largest possible diameter to enter well pipe and shall be a product of a recognized manufacturer. Strainer shall be a wire wound type with continuous V-shaped slots of suitable length for gravel formation encountered. Base Bid shall be strainer with ten lineal feet slotted opening of correct size or sizes for gravel formation encountered and not less than four times area of suction pipe; with suitable top and bottom fittings. Joint shall be tight to prevent entrance of sand at top and bottom. After strainer is set in place, well shall be thoroughly surged, plungered and developed to remove fine sand and silt and obtain maximum yield. Casing shall be extended not less than 12" above exterior grade.
- C. Well shall be drilled true and plumb to permit installation of well pump specified without binding or interference of proper operation.
- D. The annular space between the well casing and the drill hole shall be sealed as follows: Cable tool; the casing must be surrounded with a slurry of drilling clay during the complete drilling process. Rotary bit; the space filled with cement grout from the bottom of the drill hole to the surface.

- E. After completion of well, the well drilling subcontractor shall provide suitable and necessary equipment to test well for the capacity or volume of not less than the required minimum. Equipment for test and developing, etc., shall be provided by the Contractor. Well shall be pumped until the well water is clean and free from sediment and ready for installation of permanent pump. Well shall be tested not less than five hours after cleaning. Detailed written report shall be submitted to the Engineer with complete log of well as completed showing static water level, drawdown and pumping levels at various capacity, etc. Contractor shall provide own power for test pump.
- F. A sample from the water supply system shall be submitted to the Laboratory of the Ohio State Board of Health for bacteriological analysis. Disinfect well as necessary for satisfactory results. Repeat sample test as necessary.
- G. Pump shall be Red Jacket Model 1/2 HP-9BC 230/1/60 at 121 psi discharge pressure or equal. Pump selection is based on forty foot well depth. If actual depth is different, subcontractor shall make different selection of pump size to fit well depth.
- H. Terminate well with pitless well adapter at 24" above finished grade. Well and water supply shall comply with the Ohio Department of Health Private Water System Rules, Chapter 3701-28.

3.03 System Calibration:

- A. Entire system including accessories shall be checked and calibrated after installation by a qualified representative of equipment manufacturer for correct and satisfactory operation. Well system shall be left in first-class condition ready for continuous and satisfactory operation. Equipment manufacturer's representative shall instruct Owner's maintenance personnel on care of equipment.

3.04 Warranty and Service:

- A. Equipment furnished as specified shall have a 12 month warranty against defective materials and workmanship. Manufacturer shall provide free starting service and one year's free service.

3.05 Instruction Manual:

- A. Unit shall be provided with a full set of installation instructions. Instructions shall give pre-installation checks necessary before unit is placed into well.

SECTION 02731

SEWAGE COLLECTION LINES

PART 1 - GENERAL

1.01 Work Included:

- A. Provide all sewer pipe, fittings, structures and accessories required for gravity sanitary sewer construction as indicated on the drawings.

1.02 Related Work Specified Elsewhere:

- A. Section 02221 - Earthwork for Structures
- B. Section 02222 - Earthwork for Utilities
- C. Section 02502 - Pavement Restoration
- D. Section 02980 - Landscaping for Utilities

1.03 Quality Assurance:

- A. Comply with the latest published editions of the American Society of Testing and Materials (ASTM) Standards:
 - 1. ASTM C478 Concrete Pipe Manholes
 - 2. ASTM D3034
 - 3. ASTM D1784
 - 4. ASTM D2321 Underground Installation of Flexible Thermoplastic Sewer Pipe
- B. Comply with the latest published editions of American Water Works Association (AWWA) Standards:
 - 1. AWWA C151 Ductile-Iron Pipe
 - 2. AWWA C110 Cast/Ductile-Iron Fittings
 - 3. AWWA C111 Rubber Gasket Joints for Cast/Ductile-Iron Pipe
- C. Performance Tests: The Contractor shall test all gravity sewers and manholes constructed under the Contract. The Contractor shall constantly check horizontal and vertical alignment. Testing for vertical deflection and sewer watertightness testing in the case of all gravity sewers and hydrostatic testing of ductile iron pipe shall be as specified in this section.

D. Line and Grade Requirements:

1. The Contractor shall provide assurance to the Engineer or the Engineer's representative that the sewer is laid accurately to the required line and grade as shown on the drawings. The Contractor shall utilize a laser beam instrument to lay and check the alignment and grade between manholes. Before proceeding with the next section of sewer, the section shall be checked for proper line and grade. Variations from a uniform line and grade as shown on the drawings and described below shall be cause for the line to be rejected.
2. Conventional Gravity Sewer: Variance from established line and grade shall not be greater than $1/32$ of an inch per inch of pipe diameter and not to exceed $1/2$ inch, provided that such variation does not result in a level or reverse sloping invert; provided also that the variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed $1/64$ inch per inch of pipe diameter or $1/2$ inch maximum.
3. Small Diameter Gravity Sewer: Variance from established line and grade shall not be greater than $1/8$ of an inch per inch of pipe diameter and not to exceed 1 inch, provided that such variation does not result in a level or reverse sloping invert; provided also that the variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed $1/16$ inch per inch of pipe diameter or $1/2$ inch maximum.

E. Test Sections:

1. Initial Performance Test: An initial performance and leakage test will be performed on the first sections of sanitary sewer constructed of approximately 600 feet in length of each size and type sewer material installed. No additional sewer pipe shall be installed until the first section of sewer of each size and type of sewer material has satisfactorily passed the test for line and grade and the leakage test.
2. Subsequent Performance Testing: After the initial performance test and leakage test and as work progresses, the Engineer may designate additional sections for testing as conditions in his opinion warrant. If a review of the Contractor's workmanship leads the Engineer to question whether or not the tolerances and standards specified are being met, the Engineer reserves the right to select other locations and lengths to be tested. The Engineer shall notify the Contractor of the location where a test is to be

required not later than 15 days after the sewer installation has been completed. Unless otherwise authorized, the Contractor shall arrange to commence the test within 15 days after the sewer has been installed or 15 days after receiving notification by the Engineer, whichever date is later.

3. Final Performance Testing for Acceptance: Before acceptance and final payment for all new sanitary sewers, the Contractor and the Engineer or the Engineer's representative shall check all sewers, even if previously checked, for accurate alignment and grade. Also, all sanitary sewers shall be tested as specified herein for watertightness. The program of testing whether by infiltration, exfiltration, or air-testing shall be determined by the Engineer.

F. Pipe Marking: Each length of pipe shall bear the name or trademark of the manufacturer, the location of the plant, and the date of manufacture. Each length shall likewise be marked to designate the class or strength of the pipe. The marking shall be made on the exterior or interior of the pipe barrel near the bell or groove end and shall be plainly visible.

1.04 Submittals:

- A. Contractor is required to submit the following in accordance with Section 01300 hereinbefore.
 1. Manufacturer's Certificate of Compliance certifying that products meet the requirements of the applicable specifications and standards.
 2. Product data, plans and details on all materials and methods of installation specified in this Section.

1.05 Product Delivery, Storage and Handling:

- A. Deliver materials on manufacturer's original skids or in original unopened protective packaging.
- B. Store materials to prevent physical damage.
- C. Protect materials during transportation and installation to avoid physical damage.

PART 2 - PRODUCTS

2.01 Ductile Iron (DI):

- A. Joints on ductile iron pipe shall be push-on type conforming to AWWA C151, latest revision. Fittings shall be ductile iron and shall comply with AWWA Specification C110 and C111, latest revision, with push-on or mechanical joints for 150 psi working pressure.

- B. Coat pipe inside and out with coal tar pitch varnish.
- C. Use where shown on plans or where required by conflicts with wells and water mains.

2.02 Polyvinyl Chloride Plastic Pipe (PVC):

- A. Comply with ASTM D3034 for pipe using material conforming to ASTM D1784 for pipe and fittings, or
- B. Comply with ASTM F-794 for PVC ribbed pipe.
- C. Joints for PVC Sewer Pipe:
 - 1. Joints on PVC sewer pipe shall be the integral bell type gasketed joint designed so that when assembled the elastomeric gasket inside the bell is compressed radially on the pipe spigot to form a positive seal. The joint shall be so designed to avoid displacement of the gasket when installed in accordance with manufacturer's recommendations. The joint shall comply with the physical requirements of ASTM D3212, and the gasket shall be the only element depended upon to make the joint flexible and watertight. Gasket material shall meet ASTM F477.
 - 2. All PVC pipe entering a manhole shall have a manhole waterstop gasket as supplied by the manufacturer firmly clamped around the pipe at the manhole. If flexible entry type manhole system is used, the waterstop gasket is not required.
- D. Provide pipe and fittings with minimum SDR-35 dimension ratio, (this only applies to non-ribbed PVC pipe).
- E. Mark all pipe and fittings.

2.03 Structures and Pipe Accessories:

- A. Manholes:
 - 1. Construct eccentric or concentric top manholes as indicated of precast pipe in conformance with ASTM C478 using Type III Portland Cement.
 - 2. Construction details as indicated on the drawings.
 - 3. Provide factory fabricated block-outs at base or cast-in-place rubber gasket for connection of required sewer lines.
 - 4. Furnish 5" minimum wall thickness.
- B. Manhole Accessories:
 - 1. Manhole Steps - Cast-Iron Neenah R1980-E or equal.
 - 2. Manhole lid and cover:
 - a. Gray cast-iron, with minimum clear opening of 22 inches.

- b. Use Neenah R-1916-F or equal for bolted covers.
- c. Provide anchor bolt holes and bolts for manhole frame and top.

PART 3 - EXECUTION

3.01 Pipe Installation:

A. Handling:

1. Handle in a manner to insure installation in sound and undamaged condition.
 - a. Do not drop or bump.
 - b. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements, and coatings.
2. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.
3. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

B. Installation:

1. All pipe shall be reinspected for soundness and damage due to handling immediately before being lowered into the trench. Any pipe found to be unsound or damaged will be rejected and shall be removed immediately from the site of the work. Utilize equipment, methods and materials insuring installation to lines and grades as indicated.
 - a. Do not lay on blocks unless approved by Engineer.
 - b. Obtain approval from Engineer of method proposed for transfer of line and grade from control to the work.
2. Install pipe of size, material, strength class, and joint type with embedment shown for plan location.
3. Insofar as possible, commence laying at downstream end of line and install pipe with bell ends in direction of laying. Sewer pipe shall have spigot ends in direction of flow. Obtain approval for deviations therefrom.
4. Clean interior of all pipe, fittings and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.
 - a. Close open ends of pipe with snug fitting closures.
 - b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.
 - c. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.
5. Brace or anchor as required to prevent displacement after establishing final position.

6. Perform only when weather and trench conditions are suitable. Do not lay in water.
7. Observe extra precaution when hazardous atmospheres might be encountered.
8. Sanitary sewer relation to water mains:
 - a. Maintain 10 feet horizontal separation whenever possible.
 - b. When conditions prevent a lateral separation of 10 feet, sewer may be installed closer to a water main if:
 - (1) Installed in separate trench.
 - (2) Installed in same trench with water main located to one side on bench of undisturbed earth with minimum horizontal separation of 3 feet.
 - (3) Elevation of crown of sewer must be at least 18-inches below invert of water main and a minimum horizontal separation distance of 3 feet.
 - c. When above conditions cannot be obtained, sewers must be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water tightness.
 - d. Vertical separation of sanitary sewers crossing under any water main should be at least 18 inches when measured from top of sewer to bottom of water main. If physical conditions prohibit separation, sewer may be placed not closer than 6 inches below a water main or 18 inches above a water main. Separation distance shall be maximum feasible in all cases. Where sewer crosses above or less than 18 inches below a water main, one full length of sewer pipe of water main material shall be located so both joints are as far as possible from water main. Sewer and water pipes must be adequately supported and have watertight joints. A low permeability soil shall be used for backfill material within 10 feet of point of crossing.
9. Auger or jack steel casing pipe in place where shown on plans.
10. PVC (polyvinyl chloride) gravity sewer pipe and fittings, ASTM Designation D3034 SDR 35 and ribbed PVC pipe ASTM F794, shall be installed in accordance with the directions contained in ASTM Designation D2321. Only **Granular Pipe Embedment Materials** as specified in Section 02222 Earthwork for Utilities will be acceptable for bedding and haunching of the pipe placed and compacted in accordance with ASTM D2321.
11. All PVC pipe entering a manhole shall have manhole waterstop gasket as supplied by the manufacturer firmly clamped around the pipe. If flexible entry type manhole system is used, the waterstop gasket is not required.

12. All PVC pipe shall have a deflection test performed by the Contractor in the presence of the Engineer or his representative.
13. All pipe shall be bedded as specified herein. Bell holes shall be excavated in advance of pipe laying so the entire pipe barrel will bear uniformly on the prepared Granular Pipe Embedment Material.
14. Each length of pipe shall be mechanically pulled "home" with a winch or come-along against the section previously laid and held in place until the trench and bedding are prepared for the next pipe section. Care shall be taken in laying the pipe so not to damage the bell end of the pipe. Mechanical means consisting of a cable placed inside the pipe with a winch, jack, or come-along shall be considered to pull the pipe home where pushing the pipe will not result in a joint going completely home and staying in place. Pushing the pipe home shall be done by means of a block and push bar. Use of hydraulic excavating equipment as the means of pushing or moving the pipe to grade will not be permitted.
15. The Contractor shall use laser beam equipment to maintain accurate alignment and grade. A qualified operator shall handle the equipment during the course of construction. Survey instruments may be used for checking alignment and grade if questions arise about the accuracy of the work.
16. Open excavation shall be satisfactorily protected at all times. At the end of each day's work, the open ends of all pipes shall be protected against the entrance of animals, children, earth, or debris by bulkheads or stoppers. The bulkheads or stoppers shall be solid and not allow passage of water into the installed pipe line. Any earth or other material that may find entrance into the main sewer or into any lateral sewer through any open end or unplugged branch must be removed at the Contractor's expense. The cost of all such plugs, and the labor connected therewith, must be included in the Contractor's bid and at no additional cost to the Owner.
17. The Contractor shall conduct a leakage test as described hereinafter on the first section of sewer of each size and type sewer material installed. No additional sewer pipe shall be installed until the first reach of sewer of each size and each type sewer material has satisfactorily passed the leakage test.

C. Jointing:

1. General Requirements:

- a. Locate joint to provide for differential movement at structures.
 - (1) Locate joint not more than at least 18 inches out from a structure wall.
 - (2) Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing of structure when joint is within 18 inches of structure wall.
- b. Perform in accordance with manufacturer's recommendations.
- c. Clean and lubricate all joint and gasket surfaces with lubricant recommended.
- d. Utilize methods and equipment capable of fully homing or making up joints without damage.
- e. Check joint opening and deflection for specification limits.

D. Cutting:

1. Cut in neat workmanlike manner without damage to pipe.
2. Cut ductile iron with Carborundum saw or other approved method.
 - a. Smooth cut by power grinding to remove burrs and sharp edges.

E. Closure Pieces:

1. Connect two segments of pipelines or pipeline segment and existing structure with short sections of pipe fabricated for the purpose.
2. Observe specifications regarding location of joints, type of joints, and pipe materials and strength classifications.

F. Temporary Plugs:

1. Furnish and install temporary plugs at each end of work for later removal by others where indicated on the drawings.
2. Plugs: Use test plugs as manufactured by pipe supplier, or fabricated by the Contractor. Plug must be watertight against heads of up to 20 feet of water. Secure in place in a manner that will facilitate removal when required to connect pipe.

3.02 Pipe Bedding and Haunching:

- A. Each pipe section shall be laid in a firm foundation of bedding material and haunched and backfilled with care.

- B. Prior to pipe installation, carefully bring bedding material to grade along the entire length of pipe to be installed. To provide adequate support for the pipe, the following bedding procedures are required.
- C. Granular Pipe Bedding Material shall have a minimum thickness beneath the pipe of 4 inches. The bedding material shall extend up the sides of the pipe to the centerline of the pipe.
- D. The pipe backfill between the bedding material and a plane 12 inches over the top of the pipe shall be hand-placed Granular Pipe Embedment Material.
- E. In yielding subsoils, the trench bottom shall be undercut to the depth necessary and backfilled with Replacement Material for Unstable Foundations to form a firm foundation. No additional payment shall be made for stabilizing yielding subsoils.
- F. Where excavation occurs in rock or hard shale, the trench bottom shall be undercut and a minimum of 6 inches of Granular Pipe Embedment Material placed prior to pipe installation.
- G. The manufacturer of the pipe material and fittings shall provide installation advice and bedding, haunching, and backfill instructions to the Contractor's work force when first installing the pipe and fittings. The service of an experienced installation representative shall be provided for a minimum of two days at no additional cost to the Owner.

3.03 Length of Open Trench:

- A. Except by permission of the Engineer, not more than 100 feet of trench shall be opened at any one time. Not more than 100 feet of trench may be opened in advance of the completed pipe laying operation, and not more than one street crossing may be obstructed by the same trench at any one time. Trench shall be backfilled immediately after pipe has been installed and alignment verified.

3.04 Manhole Installation:

- A. Construct manhole foundation and channel inverts integrally. Precast manhole foundations may be used at the Contractor's option with the channel inverts constructed in place.
- B. Install precast manhole sections after foundation concrete has attained 75% of design strength.
- C. Manhole foundation and manhole may be installed simultaneously if manhole section is supported on concrete blocks and foundation concrete placed under and around bottom section.
- D. Completely fill joints with preformed plastic gasket.

- E. Heat materials in freezing weather and protect work from cold; maintain temperature of work at 40°F for at least 24 hours after placing.
- F. Invert Channels:
 - 1. From invert channel as indicated.
 - 2. Make changes in direction of flow with smooth curves of as large a radius as size of manhole permits.
 - 3. Make changes in size and grade smoothly and uniformly.
 - 4. Slope floor of manhole adjacent to channels to drain thereto.
 - 5. Finish channel bottom smoothly without roughness, irregularity, or pockets.
- G. Pipe Connection:
 - 1. Make watertight.
 - 2. Use rubber gasket.
- H.. Manholes shall be vacuum tested as described in Paragraph 3.09 before coating with epoxy.
- I. Completely coat interior and exterior of manholes with 30 mils of coal tar high-build epoxy.

3.05 Service Connection Laterals:

- A. Install a service connection lateral stub off main sewer line at each dwelling or business place as indicated on the drawing or as directed by the Engineer. The building service shall extend from a "wye" or "tee" fitting in the main sewer line to the new septic tank location as indicated on the drawing or as directed by the Engineer.
- B. Service Wyes: Install wyes, 4" branch diameter unless shown otherwise on the drawings. See Standard Detail, "Service Connection Detail".
- C. Risers: Use in lieu of wyes for service connections where invert of sewer is 10' or more below ground surface or where shown on plans. See Standard Detail, "Service Connection Detail".
- D. Make no connections to existing house lateral sewers or extend service connections beyond this contract without permission of Engineer.
- E. Backfill trench only after entire wye and service line connection lateral and wye connection has been inspected and approved by Engineer. Compact as specified in Section 02222.
- F. No payment for service lines will be made until all specified requirements have been met.

- G. Fittings for building service connections on a main line sewer shall be tees or 45-degree wyes and shall be of the same material as the main line sewer, unless otherwise approved by the Engineer.
- H. The service connection lateral pipe shall connect to the main line sewer at the spring line (3 or 9 o'clock position) and shall include the necessary bends and straight pipe sections to reach the property line at the elevations specified. A pipe stopper or a bell cap shall be placed on/in the last bell. This stopper or bell cap should be compatible with the type of infiltration/exfiltration test performed on the sewer.
- I. At the discretion of the Engineer, when and where he feels that improper installation practices are suspected, or questionable bedding materials and methods are employed, or where the installations are severe, the Contractor will have to perform deflection testing on the service connection lateral as specified in Paragraph 3.08.
- J. Backfill around fittings and service connection lateral pipe shall be carefully placed and compacted to prevent damage from backfill settlement.
- K. The Contractor shall mark the end of each unconnected building service lateral with a 5/8-inch steel rod 5 feet long placed vertically over the end of the lateral. The rod shall be painted yellow and left sticking above the existing ground not more than 1 inch.
- L. The Contractor shall keep accurate horizontal and vertical location measurements of each building service connection lateral installed. Copies of these measurements shall be furnished to the Engineer as the work progresses. The accuracy of the measurements shall be the Contractor's responsibility.

3.06 Stubs, Connections, Bulkheads and Miscellaneous Items of Work:

- A. Where special junction chambers are to be constructed or where existing sewers carrying sanitary sewage are encountered, the Contractor shall provide and maintain temporary connection to prevent a nuisance. All such temporary connections, pumping, and diversion shall be included in the price bid for this work.
- B. Where called for on the drawings, shop connections and stubs for future sewer connections shall be provided. The cost of this work shall be included in the price for manholes.
- C. New sewer connections to existing manholes shall be neatly made by cutting a hole in the existing structure, concreting the sewer in place, and providing a watertight connection. Such connections shall be included in the bid price for this Contract.

- D. The Contractor shall not connect any existing sewers or house services prior to the completion of the infiltration/exfiltration tests, air tests, and acceptance of the sewer without the written permission of the Engineer.

3.07 Acceptance Tests for Sewer Pipelines:

- A. Deflection Testing: For PVC pipe, the entire length of installed main-line pipe shall be tested for acceptance with an approved go-no-go mandrel under the observation of the Engineer. The testing shall be conducted after the final backfill has been in place for at least 30 days. No pipe shall exceed a deflection of 5%. The deflection test shall be run using a mandrel having a diameter equal to 95% of the inside diameter of the pipe. The test shall be performed without a mechanical pulling device. All pipe exceeding the allowable deflection shall be replaced, repaired, and retested at no additional cost to the Owner.
- B. Infiltration Testing:
1. General:
 - a. Maximum infiltration for each section of sewer pipe shall not exceed 50 gal/day/inch-mile of pipe diameter.
 - b. Infiltration, exfiltration or air test may be used to provide compliance with infiltration requirement.
 - c. Acceptance of air test or exfiltration results will not preclude rejection of work if infiltration is measured and exceeds limitation.
 2. Air Test:
 - a. Furnish all facilities required including:
 - (1) Necessary piping connections
 - (2) Test pumping equipment
 - (3) Pressure gauges or manholes
 - (4) Bulkheads
 - (5) All miscellaneous items required
 - b. Obtain approval from Engineer of equipment and methods proposed for use.
 - c. Conduct initial test on first section of pipe, not exceeding 600 lineal feet, which is laid by each crew.
 - (1) Perform initial test on first section of pipe laid by each crew.
 - (2) Perform test before backfilling of initial section.
 - (3) Satisfactorily complete test before crew is permitted to continue pipe installation.
 - d. Test remaining pipe in sections determined by Contractor and approved by Engineer.
 - e. The ends of the sewer section being tested shall be sealed and properly blocked. The seal at one end shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice

at one end of the section. The air supply line will contain an off-on gas valve and a pressure gauge having a range from 0 to 25 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of the nearest \pm 0.1 psi. The seals at each manhole shall be properly blocked to prevent displacement while the line is under pressure.

- f. Plug all pipe outlets with pneumatic plugs having a sealing length equal to or greater than the diameter of the pipe to be tested. The pneumatic plug shall be able to resist internal testing pressures without requiring external bracing.
- g. Once the pipe outlet plugs are securely in place, pressurized air is introduced to the system. The air shall be fed through a single control panel with three individual hose connections as follows:
 - (1) From control panel to pneumatic plugs for inflation in sewer pipe;
 - (2) From control panel to sealed line for introducing the pressurized air;
 - (3) From sealed line to control panel. This line will enable continuous monitoring of the air pressure rise in the sealed line.
- h. Introduce low pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe.
- i. A minimum of two minutes shall be provided for the air pressure to stabilize to conditions within the pipe. Air may be added slowly to maintain a pressure of 3.5 to 4.0 psig for at least two minutes.
- j. Time required for pressure to decrease from 3.5 to 2.5 psi greater than average back pressure of any ground-water above pipe shall not be less than time in following table for given diameters.

<u>Pipe Diameter (Inches)</u>	<u>Minutes</u>
3 to 6	3.0
8	4.0
10	5.0

In areas where the groundwater is above the top of the pipe, the test pressures shall be increased by 0.433 per foot of groundwater (e.g., if the groundwater is 11-1/2 feet, the 3.5 to 2.5 pressure drop will be increased by 5 psi; the time then will be measured for a pressure drop from 8.5 psi to 7.5 psi).

- k. Repeat test as necessary after all leaks and defects have been repaired.

1. Safety Precautions During Air Test:
 - (1) The air test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.
 - (2) As a safety precaution, pressurizing equipment should include a regulator set at perhaps 10 psi to avoid overpressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.
3. Exfiltration Test:
 - a. Furnish all water and facilities required to plug pipe sections and fill with water to attain a minimum elevation of water in upstream manhole two feet higher than top of pipe in line being tested, or two feet above existing groundwater level along the pipe section under test, whichever is the higher elevation.
 - b. Maintain water level in manhole at start of test period for one hour.
 - c. Water added to maintain level (water lost) shall not exceed the following amounts:
 - (1) 3" to 6" pipe - .95 gallon per 100 feet
 - (2) 8" pipe - 1.26 gallon per 100 feet
 - (3) 10" pipe - 1.58 gallon per 100 feet
 - d. Allowable leakage may be increased by 5% for each foot of head above water elevation indicated above.
 - d. Dewater pipe upon completion of testing.
4. Infiltration Test:
 - a. May be used in lieu of air test or exfiltration test if Contractor can prove that groundwater conditions are such that crown of pipe is covered with not less than two feet of water at highest point in section being tested. The test head shall be maintained for not less than 24 hours before a weir measurement is made.
 - b. The groundwater level at each manhole on the section being tested shall be determined by the Contractor providing a 3/8-inch I.D. pipe through each manhole at an elevation near the invert. Aggregate shall be placed on the outside of the pipe to prevent clogging. The end of the pipe on the inside of the manhole shall

contain fittings, together with a vertical transparent pipe to determine the groundwater level. The pipe through the manhole shall be permanently sealed after the tests have been completed.

- c. The test shall be conducted by plugging off the upper end of the pipe section being tested and placing a weir or other approved measuring device in the pipe at the lower end of the section. Sufficient time shall be allowed for the water level over the weir to stabilize before reading the flow. The groundwater table shall be checked at the manholes on the section being tested to determine if a minimum of 2 feet of head exists over the top of pipe at the time of the test.
- d. Infiltration shall be measured with weir at manhole and shall not exceed amounts stated in Paragraph 3, Exfiltration Test.
- e. Engineer will require exfiltration or air test if Contractor cannot prove to satisfaction of Engineer that groundwater conditions are satisfactory.

3.08 Hydrostatic Testing:

- A. A hydrostatic test on ductile iron pipe with push-on type joints has two purposes: one is to set the gaskets in place, and the other is to provide a leakage test.
- B. Said test shall include all ductile iron sewer pipe with push-on type joints installed by the Contractor in this Contract. The Contractor shall make arrangements with the Engineer for scheduling the test after the sewer pipe has been accepted as being ready for testing. The test shall be performed in the presence of the Engineer, or his representative, on the day mutually agreed upon.
- C. Water for testing shall be obtained by the Contractor. The Contractor shall furnish all necessary equipment, piping, pumps, fittings, gauges, and operating personnel to properly conduct the test.
- D. Hydrostatic test on ductile iron pipe with push-on joints installed as gravity sewers and siphons shall be in accordance with the following provisions:
 - 1. The ends of the sewer section being tested shall have test plugs or caps adapted with a tap of adequate diameter to fill and pressurize the system with water.
 - 2. When a section is terminated at a manhole with a plain end (spigot), the pipe must extend into the manhole of sufficient length to accommodate a restraining cap. The benchwall shall be formed in the manhole after the test section has been approved.

3. Water shall be introduced into the section to be tested at the lower end. The upper end shall have an orifice at the top of the plug or cap to expel air when filling the system with water. All air shall be expelled from the pipe.
4. The test plugs or caps shall be capable of withstanding an internal pressure of 175 psi.
5. The system shall be tested in conformance with Section 13 of AWWA Specification 600, at 50 pounds per square inch over a period of not less than one hour. The system will not be acceptable until all leaks have been repaired.
6. Hydrostatic test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed in such a way as to prevent blowouts. Inasmuch as a force of 2500 pounds is exerted on an 8-inch plug by an internal pipe pressure of 50 psi, it should be realized that sudden expulsion of a poorly installed plug or cap can be dangerous. As a safety precaution, no one shall be allowed in the manholes when the pipe is pressurized.

3.09 Manhole Testing:

- A. All manholes shall be vacuum tested after installation and before coating with epoxy and before backfilling.
- B. Manhole-to-pipe connections shall be a flexible connector, such as the Kor-N-Seal or equal.
- C. All lift holes shall be plugged with a non-shrinking mortar, as approved by the Engineer.
- D. The seal between the manhole sections shall be in accordance with ASTM C923.
- E. Stubouts, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn.
- F. Installation and operation of vacuum equipment and indicating devices shall be in accordance with equipment specifications for which performance information has been provided by the manufacturer and approved by the Engineer.
- G. With the vacuum tester set in place:
 1. Inflate the compression band to 40 psi to effect a seal between the vacuum base and the structure.
 2. Connect the vacuum pump to the outlet port with the valve open.
 3. Draw a vacuum to 10" of Hg. and close the valve.

- H. Acceptance standards for leakage shall be established from the elapsed time for a negative pressure change from 10 inches to nine inches of mercury. The maximum allowable leakage rate for a four-foot diameter manhole shall be in accordance with the following:

<u>Manhole Depth</u>	<u>Minimum Elapsed Time for a Pressure Change of 1 Inch Hg</u>
10 ft. or less	60 seconds
>10 ft. but <15 ft.	75 seconds
>15 ft. but <25 ft.	90 seconds

For manholes five feet in diameter, add an additional 15 seconds and for manholes six feet in diameter, add an additional 30 seconds to the time requirements for four-foot diameter manholes.

- I. If the manhole fails the test, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test or the manhole shall be tested in accordance with the standard exfiltration test and rated accordingly.
- J. If a manhole joint mastic is completely pulled out during the vacuum test, the manhole shall be disassembled and the mastic replaced.

3.10 Closed Circuit Television Inspection:

- A. The sections of sewers which do not pass the watertightness tests as specified in Paragraph 3.08 shall be inspected by closed circuit television and shall be repaired as directed by the Engineer.
- B. The Contractor shall furnish a qualified television technician, a trained supervisor, and sufficient personnel to perform all the work required in the inspection operation.
- C. The Contractor shall furnish spare cameras and related equipment to prevent delays due to equipment breakdowns. Cameras shall be equipped with remote-control focusing devices, remote-control devices to adjust the light intensity, and enough cable shall be furnished to inspect 1,000 linear feet of sewer in a continuous operation. One camera shall be small enough to pass through a 6-inch opening.
- D. The Contractor shall clean the sewer, where required, one section at a time. After the sewer is cleaned, the television camera shall be attached to end of a rod or line so that it can be pulled through the pipe line. The camera shall trail a line of steel cable which will be attached to a winch of sufficient size to be able to pull back or retrieve the camera whenever necessary.

- E. The camera shall transmit a continuous image to the television monitor. This image shall be clear and sharp enough to enable those viewing the monitor to be able to easily see the interior condition of the pipe line being inspected.
- F. For each television inspection unit being used, the Contractor shall provide a mobile air-conditioned viewing room large enough to accommodate at least three people for the purpose of viewing the monitor while the inspection is in progress. Minimum size of the monitors shall be 17 inches, measured diagonally across the viewing screen. Electrical power to operate the equipment shall be provided by the Contractor.
- G. The Contractor shall furnish all equipment required for making a continuous video tape of the view which appears on the monitor.
- H. The Engineer or his representative shall be present at all times during television inspection of the sewers and will indicate to the Contractor whatever data may be required to be logged and prepared for record purposes. The Contractor shall prepare and furnish to the Owner not less than two copies of the complete record, video tape, and report of all inspection work done.
- I. The cost of this work (should it become necessary) shall be included as part of the bid, and no additional compensation will be made to the Contractor.

SECTION 02732

SEWAGE FORCE MAINS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary for the installation of all sewage force main pipes, fittings, valves, and appurtenances in conformity with the plans and details of the drawings and herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 01900 - Measurement and Payment
- B. Section 02222 - Earthwork for Utilities
- C. Section 02502 - Pavement Restoration
- D. Section 02731 - Sewage Collection Lines
- E. Section 02980 - Landscaping for Utilities

1.03 Quality Assurance:

- A. Comply with the latest published edition of American Water Works Association (AWWA) Standards:
 - 1. AWWA C110 and C110a - Gray Iron and Ductile-Iron Fittings, 2" through 48" for water and other liquids.
 - 2. AWWA C111 - Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings.
 - 3. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4" through 12" diameter.
 - 4. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
 - 5. AWWA C151 - Ductile-Iron Pipe, centrifugally cast in metal mold or sand lined molds, for water or other liquids.
- B. Comply with the latest published editions of the American Society for Testing and Materials (ASTM) Standards:
 - 1. D-1784 - Polyvinyl Chloride (PVC) Compounds.
 - 2. D-2241 - Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).
 - 3. D-3139 - Joints for PVC Pressure Pipes and Flexible Elastomeric Seals.
- C. Comply with the latest published editions of the American National Standards Institute (ANSI) Standards:

1. ANSI A21.51
2. ANSI A21.10
3. ANSI A21.11

- D. All pipe, fittings, valves and appurtenances shall be new and unused.
- E. All pipe, fitting and valve size, and all reference to pipe diameter on the drawings or in the specifications are intended to be nominal size or diameter and shall be interpreted as such.

1.04 Submittals:

- A. Contractor is required to submit the following in accordance with Section 01300 hereinbefore.
1. Manufacturer's Certificate of Compliance certifying that products meet the requirements of the applicable specifications and standards.
 2. Certified copies of test reports of factory tests required by the applicable standards.
 3. Shop drawings with performance data and physical characteristics for valves.
 4. Product data, plans and details on all materials and methods of installation specified in this Section.

1.05 Product Delivery, Storage and Handling:

- A. The Contractor shall be responsible for the delivery, storage and handling of products.
- B. Load and unload all pipe, fittings, valves and appurtenances by hoists or skidding. Do not drop products. Do not skid or roll products on or against other products. Slings, hooks, and pipe tongs shall be padded. Use sling, hooks and pipe tongs in such a manner to prevent damage to products.
- C. Keep stored products safe from damage or deterioration. Keep the interior of pipe, fittings, valves and appurtenances free from dirt or foreign matter. Drain and store valves in a manner that will protect valves from damage by freezing. Store gaskets and other products which will be deteriorated by sunlight in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Use gaskets on a first-in, first-out basis.
- D. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.01 General Requirements:

- A. Pipe furnished may be any one of the materials specified herein for sewage force mains as indicated on the drawings.
- B. Use ductile-iron pipe for all aboveground or exposed pressure sewer lines unless shown otherwise on the drawings.
- C. All pipe shall be marked in accordance with the applicable standard specification under which the pipe is manufactured unless otherwise specified.

2.02 Ductile-Iron Pipe (DIP):

- A. Use pipe complying with AWWA C151 except as otherwise specified.
- B. Provide thickness class based on AWWA C151 and as follows:
 - 1. 3" to 4" Diameter - Class 51, minimum
 - 2. 6" to 18" Diameter - Class 50, minimum
 - 3. Increase thickness class as required by AWWA C151 for depths of cover over 5 feet or working pressure in excess of 100 psi.
- C. Provide mechanical or push-on joints for all buried pipe in accordance with AWWA C111.
- D. Provide flange joints for all interior and exterior exposed pipe.
- E. Provide mechanical sleeve type couplings where specified or indicated.
- F. Provide anchored couplings where indicated and where restraint is required to withstand specified operating or hydrostatic test pressure.
- G. Provide fittings:
 - 1. In accordance with AWWA C110 with pressure rating of not less than that specified for adjacent pipe.
 - 2. Compatible with joint type of adjacent pipe.
 - 3. With all specials, taps, plugs, flanges and wall fittings as required.
 - 4. Coated with manufacturer's standard coating.

2.03 Polyvinyl Chloride Pipe (PVC):

- A. Provide pipe meeting AWWA C900, PVC compounds, ASTM D-1784 Standards. Design and manufacture of pipe shall meet minimum requirements of a working pressure of 150 psi plus 100 psi surge

and a safety factor of 2 at the depth of cover indicated on the drawings and specified in this Section. Wall thickness of pipe and integral bell shall be have a dimension ratio of 18 (DR-18).

- B. Provide push-on joints with bell integrally cast into pipe.
- C. Use elastomeric gaskets, as provided in AWWA C900 or ASTM D3139.
- D. Provide ductile iron fittings meeting AWWA C110 requirements. Use long radius fittings where possible.
 - 1. Design and manufacture fittings for a pressure rating of 150 psi.
 - 2. Fitting joints shall be push-on joints. Joints shall meet the requirements of AWWA C111. Thrust block joints as indicated on the drawings and specified in this Section.
 - 3. Mark each fitting. Marking shall meet the requirements of AWWA C110.
 - 4. Outside surfaces of the fittings shall be bituminous coated complying with AWWA C104.
 - 5. The inside surface of the pipe for pipe 3 inches and larger shall be mechanically shot blasted to white metal and then lined with a virgin polyethylene material having a minimum thickness of 20 mils. Polyethylene material shall comply with ASTM D-1248.
 - 6. Polyethylene encasement for ductile iron fittings, when specifically called for on the drawings, shall meet the requirements of AWWA Standard C105.
- E. Provide pipe marked to indicate the following:
 - 1. Nominal Pipe Size
 - 2. Material Code Designation
 - 3. Standard Dimension Ratio
 - 4. Pressure Rating
 - 5. Manufacturer's Name or Trademark
 - 6. National Sanitation Foundation Seal
 - 7. Appropriate ASTM Designation Number
- F. Nuts and bolts for anchored mechanical joints shall be high strength, heat treated, cast iron. Nuts shall be hexagon nuts. Bolts shall be tee head bolts. Nuts and bolts shall meet the requirements of ANSI/AWWA A21.11/C111.

2.04 Valves and Valve Boxes:

- A. Eccentric Plug:
 - 1. Plug: 100% full opening.
 - 2. Material: Iron body, cast iron plug with rubber covering.
 - 3. Rating: 175 psi working pressure.
 - 4. Stem: NRS

5. Seats: Bronze, adjusted to appropriate pressure and for reverse flows.
 6. Operators: Open counterclockwise with 2" square operating nut.
 7. Ends: Burled to be mechanical or push-on joint, accessible to be flanged.
 8. Valves shall be Clow Corporation Model No. F-5413, F-5412 or equal.
- B. Valve Boxes: Valve boxes for plug valves shall be cast iron. Valve boxes shall be two piece or three piece type. Each two piece box shall be complete with bottom section, top section, and cover. Each three piece box shall be complete with base, center section, top section and cover. Valve boxes shall be extension type with slide or screw type adjustment. Each base and bottom section shall be the proper size for the valve served. Each valve box assembly shall be the proper length for the valve served. The minimum thickness of metal shall be 3/16 inch. Valve box cover shall be blank with no wording.

2.05 Sewage Air and Vacuum Valves:

- A. Sewage combination air and vacuum valves shall be as follows:

<u>Size</u>	<u>Specification</u>
2" x 1"	Apco No. 401 SC, Val-Matic Co. No. 301 BWA, or equal
2" x 2"	Apco No. 402 SC, Val-Matic Co. No. 302 BWA, or equal
3" x 3"	Apco No. 403 SC, Val-Matic Co. No. 303 BWA, or equal
4" x 4"	Apco No. 404 SC

2.06 Air and Vacuum Valve Chambers:

- A. Air and vacuum valve chambers shall be 4-foot diameter precast concrete manhole barrels with precast concrete flat slab tops. Precast manhole barrels shall meet the requirements of ASTM C478.
- B. Air and vacuum valve chamber access frames and cover shall be Neenah R-1915-G, or equal. Cast the word "SEWER" in each cover.

PART 3 - EXECUTION

3.01 Handling and Cutting Pipe:

- A. Pipe and fittings shall be handled carefully to avoid cracking or abrasion of the fitting coating. Handle in a manner to insure installation in sound and undamaged condition. Do not drop or bump. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements and coatings. Ship, move and store with provisions to prevent movement or shock contact with adjacent units. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

- B. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- C. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack.
- D. All cutting shall be done with a machine having steel cutters or knives adapted to the purpose. All cut ends shall be examined for possible cracks caused by cutting.

3.02 Installation of Piping:

- A. All piping shall be installed utilizing equipment, methods and materials insuring installation to accurate lines and grades and shall be supported, guided, or anchored as shown, as specified, or as necessary. Accomplish horizontal and vertical curve alignments of pipe with bends, bevels and deflected joints.
- B. All piping installations shall be done in accordance with manufacturer's instructions and in a neat and workmanlike manner. Maximum total deflection in all directions at each joint shall be 4°. Limit of joint deflection for ductile-iron pipe shall conform to AWWA C600. Use short specials preceding curves as required.
- C. Do not lay on blocks unless pipe is to receive total concrete encasement.
- D. Pipe shall be inspected prior to installation to determine if any pipe defects are present. No defective pipe or fittings shall be placed in the work, and any piece found to be defective after having been placed shall be removed and replaced by a second piece and at the expense of the Contractor.
- E. Install pipe of size, material, strength class, and joint type with embedment as shown on plans or specified herein.
- F. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.
 - 1. Close open ends of pipe with snug fitting closures.
 - 2. Do not let water fill trench. Do not lay pipe in water. Include provisions to prevent flotation should water control measures prove inadequate.

3. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.
- G. When bell and spigot pipe is laid, the bell of the pipe shall be cleaned of mud, sand or other obstruction and wiped out before the clean spigot of the next pipe is inserted into it. The new pipe shall then be shoved home firmly against the back of the bell and securely held until the joint has been completed. Conform to AWWA C600 and ASTM D2321 for PVC pipe.
- H. Brace or anchor as required to prevent displacement after establishing final position.
- I. Perform only when weather and trench conditions are suitable. Do not lay in water. Allow pipe to reach trench soil temperature prior to installation in ditch.
- J. Temporary Plugs: Install whenever installed pipe is left unattended. Use water tight plug.
- K. Observe extra precaution when hazardous atmospheres might be encountered.
- L. Jointing: Locate joint to provide for differential movement at changes in type of pipe embedment, at changes from rock soil trench bottom and structures. Do not locate joint within 18 inches of structure wall. Clean and lubricate all joint and gasket surfaces with lubricant recommended. Utilize methods and equipment capable of fully homing or making up joints without damage. Check joint deflection for specified limits. Perform joint make up in accordance with manufacturer's recommendations for type of pipe used.
- M. Obtain approval of Engineer of method proposed for transfer of line and grade from control to the work.
- N. Wrap fittings and tie rods with polyethylene where shown on plans in accordance with AWWA C105.
- O. Thrust Blocks and Restrained Joints:
 1. Provide concrete thrust blocks at all horizontal turns utilizing fittings.
 2. Use on all dead-end and tee fittings.
 3. Install as indicated in details on drawings.
 4. Construct to undisturbed edge of trench for bearing.
 5. Provide minimum bearing area in S.F. as follows based on 150 psi test pressure and 2000 psf soil bearing:

<u>Pipe Size</u>	<u>Tee Deadends</u>	<u>11-1/4° Bend</u>	<u>22-1/2° Bend</u>	<u>45° Bend</u>	<u>90° Bend</u>
4"	1.0	0.5	0.5	0.5	1.3
6"	2.2	0.5	0.9	1.6	3.0
8"	3.8	0.8	1.5	2.9	5.3
10"	6.0	1.2	2.3	4.5	8.4

6. Restrained joints shall be installed on all vertical turns utilizing fittings as per manufacturer's recommendations or as required by Engineer at no additional cost to the Owner.

3.03 Provisions for Cutting and Jointing Ductile-Iron Pipe:

- A. Conform to AWWA C600.
- B. Visually examine while suspended and before lowering into trench.
 - 1. Paint bell, spigot, or other suspended portions with turpentine and dust with cement to check for cracks invisible to the eye.
 - 2. Remove turpentine and cement by washing when test is satisfactorily completed.
 - 3. Reject all defective pipe.
- C. Cut ductile-iron in a neat workmanlike manner without damage to pipe with Carborundum saw or other method approved by Engineer.
 - 1. Smooth cut by power grinding to remove burrs and sharp edges.
 - 2. Repair lining as required and approved by Engineer.

3.04 Relation of Sewage Force Main to Water Mains:

- A. Sanitary force mains must be laid at least 10 feet horizontally from any existing or proposed water main. The distance to be measured edge to edge. Should specific conditions prevent this separation, the Contractor shall notify the Engineer for specific instructions regarding the treatment of the separation.
- B. Whenever the force main crosses a water main, it should be laid to provide a minimum vertical distance of 18 inches between the outside of the force main and the outside of the water main. The force main shall be below the water main. When the above conditions cannot be obtained, sewers must be constructed of ductile cast iron and with mechanical joints. Sewage force main shall be of this material and joint for a minimum of 20 feet out away from the cross point.

3.05 Valve and Appurtenance Installation:

- A. Valves: Install with stems vertical when installation is horizontal. Tighten all valve glands as work is installed; add additional gland packing, if required; and retighten glands after valves are placed in operation and brought up to operating pressure. Replace any gland packing which is deteriorated or in unsatisfactory condition.

3.06 Accepting Tests for Sewage Force Mains:

- A. Perform hydrostatic pressure and leakage test.
1. Conform to AWWA C600 procedures, Section 13 as modified herein and shall apply to all pipe material specified.
 2. Perform after backfilling.
 3. Said test shall include all force main in this Contract as shown on the drawings. The Contractor shall make arrangements with the Engineer for scheduling the test after the piping has been accepted as being ready for testing. All concrete thrust blocks shall have been in place for a period of at least ten days prior to the test. The test shall be performed on the day mutually agreed upon and in the presence of the Engineer.
 4. The Contractor shall furnish all necessary equipment, piping, pumps, fittings, gauges and operating personnel to properly conduct the test. The system will not be acceptable until all leaks have been repaired to the satisfaction of the Engineer.
 5. At the option of the Contractor, the force main may be tested in sections approximately 500 feet in length (subject to the approval of the Engineer).
 6. During the filling of the pipe and before the application of the specified test pressure, all air shall be expelled from the pipe line, if necessary, by means of taps at points of highest elevation; and after completion of the test, the taps shall be tightly plugged, unless otherwise specified.
 7. When push-on type joints are used, the Contractor shall completely fill the pipe with water and apply sufficient pressure to set the joint gaskets before commencing the leakage test outlined above.
 8. Water for testing will be obtained by the Contractor at his cost.
- B. Test separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs.
1. Contractor to furnish and install test plugs, including all anchors, braces and other temporary or permanent devices to withstand hydrostatic pressure on plugs, at no additional cost to the Owner.

2. Contractor responsible for any damage to public or private property caused by failure of plugs.
- C. Limit fill rate of line to available venting capacity. Fill rate shall be regulated to limit velocity in lines when flowing full to not more than 1 fps.
- D. Pressure Test:
 1. Conduct test at pressure of at least 100 psi.
 2. Maintain pressure for a minimum of eight (8) consecutive hours.
 3. Test pressure shall not vary by more than ± 5 psi.
- E. Leakage Test:
 1. Conduct concurrently with the pressure test.
 2. Maintain pressure for a minimum of eight (8) consecutive hours.
 3. Acceptable when leakage does not exceed that determined by the following formula:
$$L = \frac{ND}{7400} P$$

L = Maximum permissible leakage in gallons per hour.
N = Number of pipe joints in segment under test.
D = Nominal internal diameter of pipe being tested in inches
P = Average actual leakage test pressure, psig.
4. Repeat leakage test as necessary.
 - a. After location of leaks and repair or replacements of defective joints, pipe or fittings.
 - b. Until satisfactory performance of test.
 - c. At no increase in cost to the Owner.
- G. Refit and replace all pipe not meeting the leakage or pressure requirements.
- H. Repair all visible leaks regardless of the amount of leakage.
- I. Engineer or his Inspector will observe all tests.

SECTION 02745

SEPTIC TANK

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to perform and install the following:
 - 1. At each residence, verify existing disposal facility, building outfall and lot outfall line.
 - 2. Install new septic tank and appurtenances.
 - 3. Disposal of existing facilities, if required, to install new septic tank.

1.02 Related Work Specified Elsewhere:

- A. Section 02221 - Earthwork for Structures
- B. Section 02222 - Earthwork for Utilities
- C. Section 02731 - Sewage Collection Lines
- D. Section 02980 - Landscaping for Utilities

1.03 Submittals:

- A. Shop Drawings: Submit drawings on septic tanks, piping, covers and appurtenances.
- B. Field Drawings: Upon completion at each residence or building, furnish 8-1/2" x 11" sketch locating septic tank, gravity pipe and SDG pipe, horizontally and vertically, relative to fixed surface structure, such as a building corner, etc.

PART 2 - PRODUCTS

2.01 Septic Tank Container:

- A. Septic tank shall be approved tank by local and state requirements.
- B. Tank retention capacity shall be 1000 gallon or 2000 gallon effective volume in locations as shown on drawings or as directed by the Engineer.

- C. Each tank shall include an inlet and outlet PVC tees for baffles, access manway, access port at outlet and inlet, and watertight inlet and discharge ports.
- D. Concrete Tanks - Comply with ASTM C913:
1. Wall Penetrations: Where plastic pipe penetrates concrete wall, either:
 - a. Cast groove integrally in opening for installation of O-ring to provide watertight connection; or
 - b. Cast galvanized steel pipe sleeve in wall for installation of gasket to provide watertight connection.
 2. Plastic pipe to concrete will not be permitted for watertight closure.
- E. Polyethylene Tank - Comply with the following:
1. Septic tanks shall be made from a high density cross-linked, or linear low density polyethylene material, and shall be rotationally molded.
 2. Raw material formulations shall meet or exceed the minimum physical properties described herein as follows:
 - a. Values Table:

<u>Property</u>	<u>ASTM</u>	<u>Cross-Linked High Density PE</u>	<u>Linear-Low Density PE</u>	<u>Units</u>
Density (base resin)	D1525	0.935	0.935	g/cc
Melt Index	D1238	N/A	2.0	g/10 min.
ESCR F50, hrs.	D1693	1000	1000	hrs.
Condition A; 10% Igepal				
Tensile Strength	D638	2300	2300	PSI
Ultimate 2"/min.				
Elongation @ Break 2"/min.	D638	650	650	%
Vicat Softening Temp.	D1525	230	230	°F
Brittleness Temp.	D746	-50	-50	°C
Flexural Modulus	D790	110,000	110,000	PSI
Izod Impact 73°F	D256	9	3	ft.-lb./in.

Note: The formulation shall contain sufficient U.V. stabilization material for up to two years above-ground storage.

b. Raw Material Testing:

- (1) All raw materials shall be sampled at the minimum frequency of at least one sample for every 10,000 lbs. of material in a 40,000 lb. lot, or every 22,500 lbs. of material in a 180,000 lb. lot. Each sample shall be tested for melt index, flexural modulus and/or density, and Izod impact. The raw material minimum performance requirements outlined in the Values Table shall be met or exceeded.
- (2) Test results will be recorded by the manufacturer for each sample of raw material tested. The test results from each lot of material used in manufacturing the tanks shall be submitted to the Engineer.

2.02 Septic Tank Cleanouts:

- A. Location: Above baffles in influent and effluent pipe. Manway may be used for cleanout.
- B. Riser Pipe:
 1. Diameter: 18-inches
 2. Material: Rigid pipe manufactured of concrete, extra strength Vitreous Clay or ABS Truss Pipe.
 3. Collar: Galvanized Steel band with 3-inch collar perforated for bolting to septic tank cover.
- C. Cover: Bell cap with O-ring gasket to provide watertight seal.

2.03 Septic Tank Baffling:

- A. Furnish and install baffles at influent and effluent pipe.
 1. Tanks: 6-inch x 4-inch tee, ABS, PVC, or equal.

2.04 Waterproofing Materials:

- A. Description:
 1. Portland cement and chemical additives, mixed with water to form creamy paste.
 2. Paste shall form hard, dense, watertight plaster on manhole surface.

3. Mixture, when brushed into precast manhole sections or brick masonry, shall penetrate surface and react chemically with soluble salts to form insoluble crystals, thereby sealing inner structure.
4. Waterproofing materials shall be Drycon manufactured by IPA Systems, Inc.; Vandex Super as manufactured by Vandex, Inc.; Coma-Kote M by Sika Chemical Corporation; or equal.

2.05 Bituminous Sealing Materials:

- A. Bituminous Joint Sealer: Mixed asphalt and mineral filler complying with AASHTO M-89, penetration grade 40 to 50.
- B. Bituminous Coat: FS TT-C-494, or Mil-C18480, or SSPC-Paint 12, cold-applied solvent-type bituminous mastic coating for application in dry film thickness of 15 mils per coat.

PART 3 - EXECUTION

3.01 Site Work:

- A. Locate existing septic tank.
- B. Septic tank location shown on plans are approximate and will be located in field under the direction of the Engineer or his representative, the Owner and the property Owner.
- C. New approved lateral from house to existing septic tank will require the new septic tank location such that it will not impact the existing tank.
- D. If new tank impacts existing tank:
 1. Excavate tank; expose top of septic tank, inlet and outlet ports.
 2. Pump tank contents: Contractor shall be responsible for disposal at State approved site or as approved by Owner.
 3. Contractor shall remove entire tank and shall be responsible for disposal at State approved site or as approved by Owner.

3.02 Septic Tank Installation:

- A. Excavation: Overexcavate septic tank pit 6-inches below floor and provide 6" granular base. Set tank inlet elevation to provide one percent (1%) slope from building outfall.
- B. System Set Up: Ballast to prevent flotation. Install unit true and plumb. Furnish and install adapter fitting to provide watertight connections at inlet and discharge pipe. Seal interior and exterior of tank with high build coal tar epoxy sealing materials, two coats 15 mil each for a total minimum dry film thickness of 30 mil.

- C. Testing: Contractor shall fill septic tank to top of riser with water. If water level has not dropped more than 1/2" in the first 24-hour period, the tank has passed. Should a tank fail the initial test, all joints, including the airtight plugs, of the failing tank shall be checked with an acceptable leak detection device to locate the leak. Should the leaks be due to the airtight plugs, these plugs shall be resealed and the test repeated. Should the leaks be found to be coming from one or more integral parts of the tank, the offending sections can be repaired and retested, but repairs must be approved by the tank manufacturer and the Engineer and must be capable of maintaining long-term watertight integrity for the offending section. Any tank failing the exfiltration test more than two times is subject to rejection.
- D. Contractor shall make final connection to new lateral or tested and approved existing building lateral.
- E. Backfill: Backfill and compact soils in 1-foot lifts to 6-inches above original grade. Comply with backfill procedures specified in Section 02221, Earthwork for Structures. Support pipes during backfill.

3.03 Continuity of Service:

- A. Maintain continuous service of existing utilities to residences and other buildings. If existing leach bed or septic tank overflow drain pipe is destroyed, restore leach bed or drain pipe, or pump septic tank as required until sewer main is ready for connections. Repair damage to surface water drainage courses or pipes, water services, gas services, cablevision, electrical services, or telephone lines.

3.04 Restoration:

- A. Maintain site during construction to minimize area disruption. Mound soils over excavation as required for settlement and dispose of excess materials.
- B. Clean up Site: Grade site to drain away from tank. Restore area to original condition as per Section 02980, Landscaping for Utilities.

SECTION 02774

BASIN EXCAVATION AND COMPACTION

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall perform all work necessary to strip topsoil, excavate, construct embankment, provide sealing and erosion control, restore and clean-up as necessary to complete required lagoon and sludge pond construction as herein specified and shown on drawings.
- B. Waste and borrow sites are indicated on drawings.

1.02 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Soil sample test results.

PART 2 - PRODUCTS

2.01 Embankment Materials:

- A. Material shall be soil which is free of roots, vegetation, frozen material, material with high organic content, or other deleterious materials.
- B. Materials which can be properly consolidated, excavated from within limits of proposed site.
- C. Material determined unsuitable by the Engineer shall be disposed of in waste area.

2.02 Lagoon Liner Material:

- A. 3/4" maximum particle, rock or clod size.
- B. Native materials may be used if approved by engineer. Material shall be suitable such that a permeability of 10^{-7} cm/sec at a head of 12 feet of water or less is achieved after compaction to 95% standard or 90% modified Proctor. This condition shall be met with the material less than or equal to 4% wet of optimum.

2.03 Erosion Control Material:

- A. Material required for erosion and sediment control throughout contract period.
- B. Riprap shall be broken limestone, dolomite, quartzite, or concrete. 80% of material shall be greater than three inches (3") diameter and less than six inches (6") diameter.

2.04 Project Signs:

- A. Warning Signs shall be provided as shown on drawings.

PART 3 - EXECUTION

3.01 Stripping and Storage of Topsoil:

- A. Remove existing topsoil, vegetation, roots, grass or other perishable materials from areas which are to be excavated or receive fill.
- B. Stockpile topsoil for use later in embankments.
- C. Stripping and stockpiling operations shall be completed before starting excavation operations.

3.02 Foundation Preparation for Liner:

- A. Compact foundation to 95% of standard Proctor density.
- B. Scarify top 1" to 2" prior to placement of overlaying lifts to ensure bonding (only if sheepfoot roller is not used).

3.03 Bottom and Dike Construction:

- A. Construct embankment from suitable material excavated from within limits of lagoon and approved bottom areas.
- B. Material encountered during embankment construction determined unsuitable by the Engineer shall be disposed of in waste area to be designated by the Engineer.
- C. Compact embankment fill to 90% of standard proctor density with tamping or rubber-tired rollers.
- D. Moisture content of compacted material shall be at optimum water content or up to 4% above optimum. Drying or wetting by approved methods may be necessary for proper moisture.
- E. Embankment fill shall be placed in horizontal layers not exceeding 6-inches compacted thickness.

F. Work shall be performed to comply with the following:

1. The bottom of the lagoon shall be kept at a uniform level at all times except as required for drainage during construction. The bottom of cell 1 shall be sloped at 1/8" per foot towards the clarifier.
2. Finished elevations of lagoon bottom shall not be more than 3-inches, plus or minus, from the average elevation of the bottom.
3. The entire section of a dike shall be brought to the same elevation at the same time, except that portion to be used as a drainage outlet and intersecting sections of adjacent dikes which may vary by two feet.
4. No areas within the lagoon shall be over-excavated except as directed by the Engineer.

G. Installation of pipelines through embankments and backfill around structures shall be as specified herein.

H. Do not place snow, ice, or frozen earth in fill, and do not place fill on a frozen surface.

3.04 Lagoon and Sludge Pond Clay Liner:

- A. Over-excavate lagoon floor and side walls to thickness of 1 foot.
- B. Perform "Foundation Preparation" as specified in Paragraph 3.02 above.
- C. Core or trench borrow area to be used as source for liner. Deliver soil samples to soil testing laboratory for analysis of placement and compaction requirements to meet permeability requirements specified below.
- D. To ensure that the lining permeability meets all applicable Ohio EPA requirements, a compaction/permeability relationship shall be established in the laboratory. A remolded permeability test shall be performed on a representative sample of the proposed liner material molded at various densities between 90% and 100% of standard Proctor density (ASTM D-698), slightly (<1%) wet of optimum. This procedure establishes a minimum "control" density, which yields an acceptable permeability. (See Article 2.02 Par. B for acceptable permeability.)
- E. No soil material shall be placed or compacted during weather conditions which would interfere with adequate compaction or moisture content control, such as freezing temperatures or rainy conditions.
- F. Soil material shall be placed in 8-inch loose lifts at a moisture content between 0 to 4% above optimum moisture content. (Compacted to a permeability of 1×10^{-7} CM/Sec.)

- G. Soil material shall be compacted using standard engineering compaction methods unless otherwise specified in the plans to a minimum compaction rate of 95% of standard or 90% modified maximum dry density.
- H. Compacted soil material shall be tested for density and moisture content at a rate of one test per lagoon for each lift, with a minimum of one test for any day that soil material is compacted. The sample location shall be approved by the Engineer for each lift sampled. Each core hole shall be individually filled and recompactd before placing the next lift. An independent soil testing lab (approved by Engineer) hired by the Contractor shall conduct density and moisture tests on these samples and compare their values to those of the representative samples (test as described in Par. D).
- I. If any of the core samples do not meet or exceed the specified density/permeability relationship the entire lift shall be recompactd and a new sample taken. The samples shall be tested and the results certified by the soil testing lab. Do not place the next lift until receiving approval from the Engineer.
- J. Results of density and moisture content testing shall be submitted to the Ohio EPA Northwest District Office.
- K. Only soil materials specifically approved for use, in the detailed plans, may be used.

3.05 Percolation Test:

- A. A percolation test shall be performed by the Contractor under the supervision of the Engineer on each cell of the lagoon system including the sludge pond.
- B. Test shall be in accordance with the following method
 - 1. Prefill cell to 12-foot level. (9 feet for the sludge pond)
 - 2. Beginning not less than seven (7) days after filling, monitor the water loss from the cell daily for a minimum of five (5) days.
 - 3. Calculations of the water loss must consider the influences of evaporation and precipitation during the test.
- C. Percolation rate shall not exceed 10^{-7} cm/sec in strict accordance with OEPA requirements.
- D. If unsatisfactory test results are obtained by either method above, the pond shall be drained, if necessary, and reworked with additional testing until the OEPA requirements are met. This shall be done at the Contractor's expense.

3.06 Erosion Control:

- A. Temporary terraces, contour furrows, bale checks, channel linings, and waterways shall be installed and maintained as required to prevent erosion and sedimentation.
- B. Subsurface Drainage:
 - 1. Install drainage tubing to relieve hydraulic pressure and permit construction of lagoon seal.
 - 2. Install collars 3-foot inside interior and exterior toe of dikes extending 6-inches beyond limits of trench.
 - 3. Seal tubing prior to percolation testing.

SECTION 02776

DOUBLE HDPE BASIN LINERS

PART 1 - GENERAL

1.01 Work Included:

- A. The Contractor shall furnish all labor, material and equipment to install the double basin lining material as indicated on the drawings and as herein specified.
- B. The basin lining material shall be High Density Polyethylene (HDPE), 30 mil thickness for the secondary liner and 40 mil thickness for the primary liner. The primary and secondary liner shall be separated by drainage net (HDPE or PE).
- C. The basin lining material shall be Gundline HD, 30/40 mil as manufactured by Gundline Lining Systems, Inc., Houston, Texas; Schlegel 30/40 mil as manufactured by Schlegel Lining Technology, Inc. or equal.

1.02 Related Work:

- A. Submittals and Substitutions: Section 01300
- B. Basin Excavation and Compaction: Section 02774

1.03 Manufacturer's Experience:

- A. The manufacturer of the lining material described hereunder shall have previously demonstrated his ability to produce this membrane by having successfully manufactured a minimum of five million square feet of similar liner material for hydraulic lining installations. The manufacturer must be listed by the NSF (National Sanitation Foundation) Standard 54 as meeting all the requirements for manufacturing HDPE.
- B. The manufacturer shall submit with the shop drawings a list of ten (10) similar installations which have been in service at least two (2) years. The list shall include the Owner's name, phone number, location of project, square feet of project installed, and the completion date. Shop drawings not including this required information will not be accepted.

1.04 Submittals:

- A. The manufacturer shall submit for approval samples of the liner material for Owner review and testing. Testing shall include compatibility analysis by material supplier or Owner.

- B. The manufacturer shall submit for approval as soon as practical after award of the contract, six (6) sets of full and complete shop and installation drawings showing a minimum of:
 - 1. Details showing the sheet layout of the liner system indicating the location and direction of seams and panel sizes.
 - 2. Details of jointing, liner system, liner anchorages to concrete structures, details of sealing the liner material to concrete structures, details of sealing the liner material to pipe conduits, and other openings into the structure.
- C. Certificates of compliance with the requirements of standards and testing methods specified herein shall be submitted prior to delivery. The liner material manufacturer must satisfy by affidavit to the Owner, Engineer and Contractor, jointly, that the material he offers to furnish will meet in every aspect the requirements set forth in the specifications. The contractor shall transmit to the Owner and Engineer the affidavit given him by the manufacturer or supplier prior to approval for the furnishing and installing of any such material.
- D. The Contractor shall submit a schedule detailing the liner fabrication and installation.

1.05 Delivery, Storage and Handling of Materials:

- A. The liner material and other material shall be delivered to the site after the required submittals have been approved.
- B. Storage and handling of the materials shall conform to the manufacturer's recommendations.

1.06 Quality Assurance:

- A. The manufacturer of the liner material shall perform quality control tests of the raw material and final product to ensure a maximum consistency of the liner material.

PART 2 - PRODUCTS

2.01 Liner Material:

- A. The membrane liner shall comprise HDPE, material manufactured of new, first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures.
- B. The Contractor shall, at the time of bidding, submit a certification from the manufacturer of the liner he intends to use stating that the sheeting meets physical property requirements for the intended application.

- C. The liner material shall be so produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. Any such defect shall be repaired in accordance with the manufacturer's recommendations.
- D. The liner material shall meet the specification values according to the following table.

TABLE 1

TYPICAL PHYSICAL PROPERTIES FOR HDPE LINER

<u>Property</u>	<u>Test Method</u>	<u>Value</u>
Density	ASTM D-792, Method B	0.949/cm ³
Thickness (Nominal)	ASTM D-374	30/40 mils
Tensile Properties	ASTM D-638, Type IV, Speed C	
a. Tensile Strength @ Break		>3500 psi
b. Tensile Strength @ Yield		>2500 psi
c. Elongation @ Break		>500%
d. Elongation @ Yield		>15%
Tear Resistance	ASTM D-1004, Die C	45 lbs. (minimum)
Low Temperature	ASTM D-746, Procedure B	-40°F
Puncture Resistance	FTMS 101B, Method 2031	270 lbs.
Volatile Loss	ASTM D-1203, Method A	0.1% (maximum)
Dimensional Stability (% Change in Each Direction)	ASTM D-1204 212°F, 60 minutes	±2% (maximum)
Seam Strength	ASTM D-1623	100% Visual Pass in in Tensile and Peel
Color		Black

2.02 Factory Quality Control:

- A. All compound ingredients of the liner materials shall be randomly sampled on delivery to the manufacturing plant to ensure compliance with specifications.
- B. Samples of the production run shall be taken and tested according to the appropriate ASTM specification to ensure that tensile strength, breaking strength and tear strength meet the minimum specifications. A quality control certificate shall be issued with the material.
- C. All welding material and adhesives shall be of a type recommended and supplied by the manufacturer and shall be delivered in the original sealed containers - each with an indelible label bearing the brand name, manufacturer's mark number, and complete directions as to proper storage.

2.03 Accessory Material:

- A. The sponge rubber sheeting shall be type SC-42, neoprene, closed cell medium, 1/4 inch thick.
- B. A neoprene adhesive shall be used for gluing the sponge rubber sheeting to the concrete and liner surfaces.
- C. The metal battens shall be 1/4" stainless steel, width of the strips shall be two (2) inches minimum.
- D. The metal fastenings shall be alloy steel fasteners as manufactured by Ramset, Inc., Kwik Bolt by Hilti Corp., Molly Parabolts by USM Corp., or equal.
- E. Asphaltic cement shall be wet or dry elastic roof sealer and have no deteriorating effect on the liner material.

2.04 Geotextile Material:

- A. Geotextile material shall completely surround all HDPE perforated drainage pipe.
- B. Geotextile material shall be Trevira #1120 Spunbond by ARMCO or Gundle or equal.

2.05 Drainage Net:

- A. Drainage net shall completely separate primary and secondary HDPE liners.
- B. Drainage net shall be Tensar 1/4" drainage net by ARMCO or Gundle or equal.

PART 3 - EXECUTION


3.01 Inspection:

- A. The Contractor shall be responsible for inspection of the liner material upon arrival at the job site. Should the material show damage from transit, the material will be so identified by the Contractor and set aside.
- B. During unrolling of the liner material, the Contractor will carry out visual inspection of the sheet surface. Any faulty areas shall be repaired in an approved manner by the Contractor.

3.02 Area Subgrade Preparation:

- A. Surfaces to be lined shall be smooth and free of all rocks, stones, sticks, roots, sharp objects, or debris of any kind within 8 inches of the surface. The surface should provide a firm, unyielding foundation for the membrane with no sudden sharp or abrupt changes or break in grade. No standing water or excessive moisture shall be allowed. The Contractor shall certify in writing that the surface on which the membrane is to be installed is acceptable before commencing work.
- B. The prepared subgrade shall be cleaned and smoothed prior to the anchoring of the liner. The subgrade shall be 12 inches of recompacted clay, compacted to 95% modified proctor density. Recompacted clay subbase shall be installed to a permeability of 10^{-7} cm/sec.

3.03 Lining Installation:

- A. The liner shall be placed over the prepared surface in such a manner as to assure minimum handling. Anchor trench excavation and any structure seal preparation should be completed before lining installation begins. The sheets shall be of such lengths and widths and shall be placed in such a manner as to minimize field seaming. Only those sheets of lining material which can be anchored and sealed together that same day shall be unpackaged and placed in position.
- B. In areas where wind is prevalent, lining installation should be started at the upwind side of the project and proceed downwind. The leading edge of the liner shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.
-  C. Materials, equipment or other items shall not be dragged across the surface of the liner or be allowed to slide down slopes on the lining. All parties walking or working upon the lining material shall wear soft-sole shoes. Equipment shall have rubber tires.
- D. Lining sheets shall be closely fit and sealed around inlets, outlets and other projections through the lining. Lining to concrete seals shall be made with a mechanical anchor or as shown on the drawings. All piping, structures and other projections through the lining shall be sealed with approved sealing methods.

3.04 Field Seams:

- A. Individual panels of liner material shall be laid out and overlapped by a minimum of 6 inches prior to field seaming. Extreme care shall be taken by the installer in the preparation of the areas to be seamed. The area to be seamed shall be cleaned and prepared according to the procedures laid down by the material manufacturer.

- B. The sheets shall be placed in the basin to permit termination at the top of the side slopes and adjacent to concrete structures and pipe conduits. The layout shall be designed to minimize the number and length of field seams and consistent with proper methods of installation.
- C. The welding equipment used for the HDPE liner shall be capable of continuously monitoring and controlling the temperature in the zone of contact where the machine is actually fusing the lining material so as to ensure changes in environmental conditions will not affect the integrity of the weld. Only welding systems which utilize the extrusion fusion process shall be used for bonding the HDPE lining materials.
- D. No "fish mouths" shall be allowed within the seam area. Where "fish mouths" occur, the material shall be cut, overlapped, and repaired. All seams on completion of the work shall be tightly bonded. Any membrane area showing injury due to excessive scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of liner membrane.

3.05 Penetrations of Liner Material:

- A. Penetrations through the liner for pipe conduits, patches, etc. shall be field seamed and in accordance with the lining manufacturer's recommendations.
- B. All pipe penetrations shall be sleeved or wrapped with material of same type as the liner. Each pipe sleeve shall be sealed to the liquid carrying pipe to prevent leakage. The basin liner shall be anchored to a concrete collar surrounding the penetration. An apron shall be seamed to the pipe sleeve and to the base sheet outside of the area where the base sheet is anchored to the concrete collar.

3.06 Repairs and Patching:

- A. Repairs to the liner material shall be made with the parent material and with the same liner to liner seam construction. The patch material shall extend a minimum of 6 inches, in each direction from the damaged area. The patch shall be sealed to the parent liner in the same manner as for field seams.
- B. All joints or seams shall be tightly bonded upon completion of the work. Any lining surface showing injury due to scuffing, penetration by foreign objects, or distress from rough subgrade shall, as directed by the Engineer, be replaced or covered and sealed with an additional layer of liner material.

3.07 Safety Ladders:

- A. Each cell shall have a minimum of two (2) HDPE T-section safety ladders heat welded to each of the four cell sides.
- B. These ladders shall extend from the basin floor to two feet above the water line.

3.08 Field Seam Testing and Quality Control:

- A. The manufacturer shall provide a factory trained representative to supervise the installation, field seaming and field testing of the liner material.
- B. The Contractor shall employ on-site physical non-destructive testing on all seams to ensure watertight homogeneous seams. A quality control technician shall inspect each seam. Any area showing a defect shall be marked and repaired in accordance with the manufacturer's repair procedures.
- C. The Engineer reserves the right to require the Contractor to perform destructive material test of seam samples (spot check) whenever the quality of particular welded joints or seams are questionable.

3.09 Warranty:

- A. The manufacturer shall warrant his product to be free from defects in workmanship for a period of one (1) year from the date of acceptance of the completed installation.
- B. In the event of a failure in the liner or if the liner is proven defective in service during the warranty period, the manufacturer shall provide, replace or repair the liner without any additional cost to the Owner.

SECTION 02830

CHAIN LINK FENCES

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary for the installation of chain link fences with gates and accessories as required and as indicated on the drawings.

1.02 Related Work Specified Elsewhere:

- A. Section 02222 - Earthwork for Utilities
- B. Section 02980 - Landscaping for Utilities

1.03 Quality Assurance:

- A. Comply with the latest published editions of the American Society of Testing and Materials (ASTM) Standards and is referred to hereafter by basic designation only for a part of this specification to the extent indicated by references thereto.

1.04 Submittals:

- A. Contractor is required to submit the following in accordance with Section 01300 hereinbefore.
 - 1. Shop Drawings: Details of fabrication and installation.
 - 2. Manufacturer's Literature: Description data of installation methods and procedures, and standard drawings of fence and gate installation.
 - 3. Certificates: Manufacturer's certification that materials meet specification requirements.

1.05 Product Delivery, Storage and Handling:

- A. Deliver materials with manufacturer's tags and labels intact.
- B. Handle and store so as to avoid damage.

PART 2 - PRODUCTS

2.01 Steel Fabric:

- A. Conform to ASTM-4392 for galvanized steel fabric.
- B. No. 9 gauge wire woven in 2-inch mesh.
- C. Top and bottom selvages shall be knuckled top and bottom.

- D. Fabric: Galvanized coating shall be done after weaving and shall be Class II, 2.0 oz./sq. ft., minimum.

2.02 Top Rail, Mid-Rail:

- A. Where shown, fence shall have continuous top rail and mid-rail for its full length of 1-5/8-inch galvanized tubing, Allied SS40, or equal.
- B. Top rail shall pass through openings provided in post tops.
- C. Each length shall be coupled with sleeve coupling or one end of rail swaged for distance of 3-inches.

2.03 End, Corner and Pull Posts:

- A. Roll form sections, Allied SS40, or equal, with integral fabric loops.
- B. Pipe posts have tops to exclude moisture.

2.04 Line Posts:

- A. Roll form sections, Allied SS40, or equal.
- B. Pipe-posts shall have tops to exclude moisture.
- C. Terminal posts shall be braced to adjacent line post.

PART 3 - EXECUTION

3.01 Inspection:

- A. Verify that final grading in fence location is completed without irregularities which would interfere with fence installation.
- B. Do not commence work until unsatisfactory conditions have been corrected.

3.02 Preparation:

- A. Measure and lay out complete fence line.
- B. Measure parallel to surface of ground.
- C. Locate and mark position of posts.
- D. Locate line posts at equal distance spacing, not exceeding ten foot (10-foot) centers for woven wire fence.
- E. Locate corner posts at positions where fence changes direction more than ten (10) degrees.

3.03 Fence Installation:

A. Posts:

1. Set posts in concrete footings, mix to provide 3,000 psi, 28-day compressive strength.

B. Fabric: Connect as follows:

1. To line posts with #9 gauge wire clips every 12-inches.
2. To top rail with #9 gauge wires every 24-inches.
3. To terminal and corner posts as indicated on the drawings, tied to fabric every 14-inches with 11 gauge, 1-inch steel bands.
4. Fabric shall be installed on side of posts facing away from public property.

- C. Existing Fence Connections: When new fence joins an old fence at any point, a corner or brace post shall be set at the junction and be braced and anchored the same as herein required for corner posts.

3.04 Adjust and Clean:

- A. Adjust brace rails and wires for rigid installation.
- B. Tighten hardware, fasteners, and accessories.
- C. Remove excess and waste materials from project site.

SECTION 02980

LANDSCAPING FOR UTILITIES

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary for the restoration of the landscape damaged or destroyed during construction of the work included in this Contract and planting required for new treatment plant site.
- B. Contractor shall repair or replace lawn areas, trees, ornamental plants, bushes, fencing, mailboxes, planters and related items.
- C. Provide topsoil, fertilizer, agricultural ground limestone, seed, mulch and sod as required to promote healthy vegetation and a lasting restoration.
- D. Lawn areas are defined as grassed areas which are cut and maintained on a routine basis and include lawns at homes and businesses, and grass shoulders of streets, roads and highways.
- E. Replacement of underbrush in fields and woods, along farm fences and roads, and in similar areas is not required, unless otherwise shown on the drawings. However, those disturbed areas shall be seeded.

1.02 Related Work Specified Elsewhere:

- A. Section 02222 - Earthwork for Utilities
- B. Section 02502 - Pavement Restoration

1.03 Quality Assurance:

- A. Qualification of Workmen: Execute work under supervision of experienced, knowledgeable planting foreman.
- B. Standards:
 - 1. Disease and Insect Control: Comply with specifications of Federal, State and County laws.
 - 2. Quality and Size: Conform with "Horticultural Standards" for number one grade nurserymen.
 - 3. All plants shall be true to name.

4. Tagging:

- a. One of each bundle or lot shall be tagged with name and size of plant in accordance with standard practice of American Association of Nurserymen.
 - b. Botanical names shall take precedence over common names.
- C. Source Quality Control: Provide producer's tests for purity and germination of seed, dated within nine months of sowing.

1.04 Submittals:

- A. General: Comply with the provisions of Section 01300.
- B. Materials List: Submit list of materials proposed to be furnished and installed, demonstrating conformance with specification.
- C. Submit seed and fertilizer -- bag labels as evidence of materials supplied.
- D. Submit manufacturer's certification that material meets specification requirements.

1.05 Job Conditions:

- A. Existing Conditions: Perform seeding or other planting only after preceding work affecting ground surface is completed.
- B. Environmental Requirements:
 - 1. Plant seed or other plantings in unfrozen soil within 5% to 10% moisture content.
 - 2. Do not seed when wind exceeds 15 mph.
 - 3. Seed between calendar dates: February 15 to June 1 and August 15 to November 1.
 - 4. Do not sow seed when the moisture content of the soil is too low or too high for seed germination.
 - 5. Plant trees and ornamental plants during the proper time and under the proper conditions for the particular tree or plant.
- C. Protection: Restrict foot and vehicular traffic from seeded areas after planting to end of the established period.

1.06 Delivery, Storage and Handling:

- A. Delivery and Storage: Deliver products, plantings and seed to job site in original containers or bundles with labels intact and legible. Remove from site plants not to name, and materials which do not comply with specification. Protect plant materials before, during and after installation.
- B. Store seed, fertilizer and agricultural limestone in cool, dry area protected from exposure to elements, ground moisture, rodents and insects.
- C. Handle seed and fertilizer materials to prevent contamination or spillage.
- D. In event of damage or rejection by Engineer of spoiled or unhealthy plantings, Contractor shall make replacements immediately at no additional cost to Owner.

PART 2 - PRODUCTS

2.01 Fertilizer:

- A. Provide commercial inorganic pre-mixed balanced 11-8-4 fertilizer for trees, brush and other plants. Seeding fertilizer shall be 12-12-12.
- B. Deliver to site in bags labeled with manufacturer's guaranteed analysis.
- C. Protect fertilizer from elements during storage.

2.02 Soil Amendment: (Restoration Only)

- A. Provide when directed by Engineer for restoration of planting areas, Redwood sawdust fortified with organic nitrogen, or a commercial soil amendment such as "Tillo", "Silver Spade", or equal.

2.03 Mulch: (Restoration Only)

- A. Provide when directed by Engineer for restoration, standard size ground bark chips 1/4 inch to one inch in size, being mill-run chips of Douglas Fir bark, "Silverbark" distributed by Weyerhaeuser Company, or equal.

2.04 Mulch: (Seed Cover)

- A. Mulch shall be clean straw, grass, hay, pine needles, jute netting or wood fiber. Straw shall be threshed straw of cereal grain such as oats, wheat, barley, rye and rice. Mulch shall not contain objectional weed seeds or other material that might be detrimental to the planting being established.

2.05 Asphalt Adhesive:

- A. Asphalt adhesive for seed cover mulch shall be emulsified asphalt. Adhesive shall meet the requirements of ASTM D977 for Grade SS-1.

2.06 Agricultural Ground Limestone:

- A. Limestone shall be agricultural grade with a minimum total neutralizing power of 90. At least 40% of the limestone shall pass a No. 100 sieve, and at least 90% shall pass a No. 8 sieve.

2.07 Grass Seed:

A. General:

- 1. Grass seed shall be free from noxious weeds, grade A recent crop, recleaned, and treated with appropriate fungicide at time of mixing. Use clean, dry, new crop seed.
- 2. Deliver to site in sealed containers with dealer's guaranteed analysis.

B. Proportions by Weight:

Kentucky Blue Grass	-	65%
Red Fescue	-	15%
Annual Rye	-	20%

Seed shall not contain more than 5% inert matter.

2.08 Fence and Other Products:

- A. Replacement fence, mail boxes, planters, and other items shall be new and unused. Fence, mail boxes, planters and other items shall be the same type as the items removed. Fence mail boxes, planters and other items shall be of equal quality to the items removed when the items removed were new.

2.09 Tree Stakes:

- A. Provide tree stakes, rough-sawn, two inches by two inches by eight feet long.

2.10 Plant Materials:

- A. Provide plant materials in kind and size as required to replace those destroyed, or new as indicated on the drawings.

2.11 Water:

- A. Free of matter harmful to plant growth.

2.12 Other Materials:

- A. All other materials, not specifically described but required for a complete and proper installation or restoration, shall be as selected by the Contractor subject to the approval of Engineer.

PART 3 - EXECUTION

3.01 Inspection Prior to Seeding and Planting:

- A. Check that preceding work affecting ground surface is completed.
- B. Verify that soil is unfrozen and within allowable range of moisture content.
- C. Correct conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.
- D. Begin work only when conditions are satisfactory.

3.02 Seeding:

A. Preparation:

1. Fine grade area using hand raking, harrowing or other method to form seed bed.
2. Till fertilizer into top 2 inches of soil at rate of 25 lbs./1000 square feet.
3. Water dry topsoil and moisten to a 4" depth for at least 48 hours prior to seeding to obtain a loose friable seed bed.

B. Application:

1. Broadcast half of seed with mechanical seeder.
2. Broadcast remaining half of seed at right angles to first seeding pattern, using same broadcast method.
3. Apply seed at 3.20 lbs./1000 square feet.
4. Cover seed to depth of 1/4" by raking, harrowing or cultipacking.
5. Roll seeded area with roller weighing maximum of 150 lbs./ft. of width.
6. Spread mulch uniformly at 50 lbs./1000 square feet.
7. Place jute netting over seeded area with slopes 1 and 2 and steeper.

8. Anchor mulching fabric with stakes 4 feet o.c. and at edges.
9. Water seeded areas if rainfall is not imminent.
10. Apply additional annual rye at rate of 0.75 lbs./1000 square feet on slopes in excess of 20%.
11. Lower soil ph as necessary with an appropriate rate of mechanical application of agricultural ground limestone.

C. Protection:

1. Immediately after seeding, erect barricades and warning signs to protect seeded areas from traffic until grass is established.

D. Lawn Maintenance:

1. Watering: Keep soil moist during seed germination period and supplement rainfall if necessary during germination.
2. Reseed and mulch spots larger than 1 square foot not having uniform stand of grass.
3. Repair and reseed eroded areas.
4. Establishment period to extend sixty (60) days.

E. Cleanup:

1. Remove trash and excess materials from project site.
2. Maintain paved areas in clean condition.
3. Remove barriers and signs from project site at termination of establishment period.

3.03 Spreading of Topsoil:

- A. Finish Grading: Depth of topsoil shall conform to Section 02222 hereinbefore.
- B. Fine Grading: Upon completion of finish grading, perform all fine grading required in planting areas, using topsoil obtained from the site.
- C. Raised Planter Beds: (Restoration Only)
 1. Backfill with a mixture consisting of two parts topsoil and one part specified soil amendment, by volume.
 2. Place the backfill mixture in layers not exceeding eight inches in uncompacted thickness.

3. Compact each layer by thorough saturation with water to prevent future settlement.

3.04 Removal of Plants for Relocation:

- A. In lieu of plant replacement, the existing plants in construction path may be relocated at the option of the Contractor.
- B. Plants to be relocated shall be packaged, maintained and replant in conformance with requirements of specifications for Commercial Nursery Stock.

3.05 Planting Trees and Shrubs:

A. General:

1. Plant nursery stock upon delivery to site and approval by Engineer.
2. Where site conditions will permit, heel-in all bare root and balled material with damp soil to protect from sun and wind.
3. Regularly water all nursery stock in container.
4. Place stock in cool area protected from sun and drying winds.

B. Excavation:

1. At all holes more than twelve inches deep, probe by hand to determine if mechanical auger will hit in-place utilities.
2. Provide planting holes for shrubs in one gallon containers of a size twelve inches in diameter and twelve inches deep.
3. Provide planting holes for shrubs and trees in five gallon containers of a size 20 inches in diameter and 18 inches deep.
4. Provide planting holes for trees in 15 gallon containers of a size 30 inches in diameter and 30 inches deep.

C. Planting:

1. Fill holes with backfill mixture consisting of three parts soil taken from the hole and one part soil amendment, by volume.
2. Fill to proper height to receive plant, and thoroughly tamp before setting plant.
3. Set plant in upright position in center of hole, and compact the backfill mixture around the ball or roots.

4. Thoroughly water each plant when the hole is 2/3 full.
5. After watering, tamp soil in place until the surface of backfill is level with surrounding area and crown of plant is at finished grade of the surrounding area.
6. Build up temporary watering basin around base of each tree and shrub, except no basins in turf areas or in raised planter areas.

3.06 Planting Ground Cover: (Restoration Only)

- A. Preparation: Rake existing soil smooth and free from all soil lumps, rocks, sticks, and other deleterious materials.
- B. Planting:
 1. Space the ground cover plants evenly as directed by the Engineer, staggering spaces around trees and shrubs and in open areas.
 2. Plant only in soil that is moist but friable, never wet or soggy.
 3. In the case of planting in open on hot days, shorten time between planting and watering.
- C. Mulch Planting Area:
 1. Straw mulch 50 lbs. per 1000 square feet.
 2. Jute netting on slopes 1:2 or greater.

3.07 Staking:

- A. Stake trees, one stake per tree minimum with two tree ties per stake.
- B. Drive stakes into ground at two feet minimum.

3.08 Progress and Final Inspection:

- A. In addition to normal progress inspections, schedule and conduct formal inspections, giving Engineer at least 24 hours prior notice of readiness for inspection:
 1. Inspect plants in containers prior to planting.
 2. Inspect plant locations to clarify compliance with restoration.
 3. Final inspection at the end of the maintenance period.

3.09 Maintenance:

- A. Maintain planting, starting with planting operations and continuing for thirty (30) days after all planting is complete and approved by Engineer. Maintenance work during this period shall be as follows:
 - 1. Watering, weeding, cultivating, spraying, and pruning necessary to keep the plant materials in healthy growing condition, and to keep planted areas neat and attractive during maintenance period.
 - 2. Provide equipment and means for proper application of water during maintenance period.
 - 3. Protect planted areas against damage, including erosion and trespassing.
- B. Replacements:
 - 1. At maintenance period end, all plant material shall be in healthy growing condition.
 - 2. During the maintenance period, should appearance of any plant indicate weakness and probability of dying, replace plant with new and healthy plant of same type and size.
 - 3. Replacements required because of vandalism, flooding or other causes beyond control of Contractor are not part of the Contract.
 - 4. Relocated Plants: Warranty conditions shall not be applied to relocated plants. Remove failing relocated plants, grade area, seed and mulch.
- C. Extension of Maintenance Period: Continue maintenance period until all previously noted deficiencies have been corrected, at which time the final inspection will be made.

3.10 Fencing and Other Restoration:

- A. Locate fences, mailboxes, planters and other items in the same location that the item had been prior to construction. Erect wire and board fences plumb and on straight lines. Set mailboxes, posts, poles and similar items plumb. Restore planters and similar items to the same shape the items had been prior to construction.
- B. Wire fences shall have the proper tension for the type of wire fence restored. Other fences and items shall be properly erected or constructed.

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 General Description of Work Covered:

- A. Mixing, placing, finishing and providing all related services necessary to construct all cast-in-place concrete work indicated within these Construction Documents.

1.02 Quality Assurance:

- A. Comply with the latest published edition of the American Concrete Institute (ACI) and American Society of Testing and Materials (ASTM) standards and codes:
1. ACI 315 Manual of Standard Practice for Detailing
 2. ACI 318 Building Code Requirements for Reinforced Concrete
 3. ACI 347 Recommended Practice of Concrete Formwork
 4. ASTM A36 Structural Steel
 5. ASTM A615 Deformed Billet Steel Bars for Concrete Reinforcement
 6. ASTM C33 Concrete Aggregates
 7. ASTM C39 Concrete Strength of Molded Concrete Cylinders
 8. ASTM C94 Ready-Mixed Concrete
 9. ASTM C143 Slump of Portland Cement Concrete
 10. ASTM C150 Portland Cement
 11. ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete
 12. ASTM C260 Air-Entraining Admixtures
 13. ACI 304 Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
 14. ACI 301 Specification for Structural Concrete for Building

- ## PART 2 - PRODUCTS

A. Normal Portland Cement	ASTM C150, Type I
B. High Early Strength Portland Cement	ASTM C150, Type III
C. Air-Entrained Portland Cement	ASTM C150, Type IA
D. May be either bagged or bulk. Partially set or caked cement will be rejected.	

A. Clear, fresh, free from injurious amounts of oil, alkaline, acid or organic matter.

B. Water of known potable quality requires no testing. Other sources shall meet the requirements of AASHTO T-26.

A. Clean, hard, durable particles of natural sand, free from injurious amounts of silt, shale, coal, organic matter or other deleterious substances.

B. Gradation, percent of weight passing:

C. Fineness Modulus: 2.3 Minimum
3.1 Maximum

- 03300-2

2.04

Coarse Aggregate:

A. Clean, hard, durable particles of gravel or crushed stone free from injurious amounts of objectionable materials.

B. Gradation, percent of weight passing:

<u>Sieve Size</u>	<u>% Passing</u>
1"	100
3/4"	90-100
3/8"	20-55
No. 4	0-10
No. 200	0-15

C. Objectionable materials, percent by weight:

Clay Lumps	0.5% Maximum
Coal and Shale	0.5% Maximum
Total of All Shale, Coal and Clay Combined	1.0% Maximum
Unsound Chert Particles Retained on 3/8" Sieve	3.0% Maximum

2.05

Admixtures:

A. Air-Entraining Agent:

1. Conform to ASTM C260.
2. Add at the mixer, vary amount to produce specified air content.

B. Other Admixtures:

1. Water Reducing: ASTM C494
2. Cement Disbursing: Pozzoloth No. 8
3. Use only with prior approval by the Engineer.

2.06

Reinforcing Steel:

A. Deformed Bars: ASTM 615, Grade 60.

B. Plain Bars: ASTM 615, Grade 60.

C. Wire Mesh Reinforcement: ASTM A187.

2.07

Curing Materials:

- A. Liquid Membrane: White pigmented chlorinated rubber, ASTM C309.
- B. Liquid Membrane: Resin base, clear compound, permitting application of paint, Serviced Products Corp. - Code 2802 or equal.
- C. Plastic Film: White pigmented, 0.00085" (minimum) thick.
- D. Burlap: Jute fabric, clean, free of impurities.
- E. Surface Hardener: Grain crystal, acidic fluorosilicate base, slightly hygroscopic chemical surface hardener, SIKKA Hardener, SIKKA Chemical Corp., or equal.

2.08

Joint Materials:

- A. Joint Sealer: Hot poured, non-extruding, elastic, ASTM D1190.
- B. Performed Expansion Joint Filer: Non-extruding, bituminous fiber, ASTM D1751.

2.09

Waterstop:

- A. Polyvinyl chloride, centerbulb.
- B. Size to suit joints; minimum 6-inches.

2.10

Form Materials:

- A. Use plywood, metal, metal-framed plywood faced or other acceptable panel-type material.
- B. Coat forms with non-bonding, non-staining commercial compounds.

2.11

Moisture Barrier:

- A. Polyethylene sheet, minimum 6 mil., ASTM E154.

2.12

Proportions and Mix Criteria:

- A. Water/Cement Ratio: 0.466 pounds per pound (maximum)
- B. Slump: 3-1/2", plus or minus 1-inch.
- C. Air Content: 6.0% plus or minus 1.0%/

D. Required Flexural Strength:

1. 7-Day 500 psi
2. 28-Day 650 psi --or--

Required Compressive Strength:

1. 7-Day 2800 psi
2. 28-Day 4000 psi

E. Assumptions for Mix Design:

1. Specific Gravity of Cement: 3.14 lbs/C.F.
2. Specific Gravity of Aggregate: 2.65 lbs/C.F.
3. Weight of Water: 62.4 lbs./cubic foot.
4. Air Void: 6%.

F. Submit mix design including proportions of cement, fine aggregate and coarse aggregate along with test results one week prior to anticipated placement.

2.13 Grout:

A. Non-Shrink:

1. Use pre-mixed, non-shrink, Embeco Pre-Mixed Grout or Embeco Pre-Mixed Mortar by Master Builders Company, or equal.
2. Keep water to a minimum for placing by the dry packing method.

B. Grout for Bonding:

1. One part cement to 1-1/2 parts sand by weight.
2. Keep water to a minimum.

PART 3 - EXECUTION

3.01 Subgrade:

- A. Insure subgrade is true to line and grade and compacted as specified.
- B. Fill and recompact any ruts or depressions.

- C. Check cross section with template.
- D. Place moisture barrier or moisten subgrade prior to placing of concrete. Method to be approved by the Engineer.

3.02

Forms:

- A. Provide forms for all concrete work including footings and base slabs.
- B. Construct forms so that completed concrete will conform to shapes, lines, grade and dimensions indicated and required.
- C. Forms shall be true, plumb and level with reasonable tight joints. Adequately support and brace forms.
- D. Place anchors, inserts, bolts, sleeves and other devices indicated or required for the various portions of all the work.
- E. Oil temporary forms with non-staining form oil before reinforcing steel is placed.
- F. Rough form finish as defined by ACI 301 permitted for concealed concrete.
- G. Smooth form finish as defined by ACI 301 required for all exposed concrete.
- H. Provide 3/4" chamfer on exposed corners and edges.

3.03

Removal of Forms:

- A. Do not remove forms or supports until concrete has acquired sufficient strength to safely support its own weight and the superimposed loads.
- B. Remove formwork for columns, walls, beam sides and other parts not supporting the weights of the concrete as soon as the concrete has hardened sufficiently to resist damage from removal operations.
- C. Formwork for slabs, beam soffits and other parts supporting the weight of the concrete shall remain in place until the concrete has reached its specified 28-day strength.
- D. Protect concrete from damage prior to acceptance.
- E. Prohibit traffic until concrete is at least ten (10) days old.

3.04

Placing Reinforcing:

- A. Support and tie all reinforcing, including temperature steel.
- B. Place reinforcing steel in accordance with the approved Shop Drawings.
- C. Position and support wire together and securely fasten in place to insure against displacement during the placing of concrete. Support reinforcing steel for slabs on grade on concrete brick or reinforcing bar supports. Wall and column dowels to footings or base slabs shall be tied in position prior to concrete pour. In no case shall these dowels be placed after placement of concrete.
- D. Unless otherwise indicated, the minimum concrete coverage shall be as follows:
 - 1. Concrete Against Ground - 3" for bars.
 - 2. Concrete Exposed to Weather - 2" for bar larger than #5 and 1-1/2" for #5 bars or smaller.
 - 3. Slabs and Walls Not Exposed to Weather: 3/4"
- E. Place temperature reinforcing for slabs on grade at the center of the slab.
- F. Promptly notify Engineer when all reinforcing steel for each pour has been placed. Obtain Engineer's approval before commencing pour.

3.05

Placing Concrete:

- A. Clean transporting equipment, reinforcing and embedded items before placing concrete.
- B. Batch trucks or paving equipment not permitted on prepared subgrade unless authorized by the Engineer based on actual job conditions.
- C. Place no concrete until after inspection of forms by Engineer.
- D. Prevent segregation during placing.
- E. Consolidate flat work with one pass of mechanical vibrator moving parallel to centerline. Unusual sections and widths may be hand puddled and finished.
- F. Place concrete continuously so that each pour unit will be monolithic in construction or construction joint. Permit not more than 30 minutes between depositing adjacent batches.

- G. Place slab concrete over membrane waterproofing before waterproofing has become damaged or dirty.
- H. Slope horizontal surfaces of exterior concrete for drainage.
- I. Deposit concrete in forms in horizontal layers not deeper than 24". Avoid inclined construction joints. Place each layer while preceding layer is still plastic to avoid cold joints.
- J. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
- K. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to penetrate placed layer of concrete and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. Limit vibration time to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

3.06 Joints:

A. Contraction:

- 1. Extend entirely across flat slabs at locations shown.
- 2. Locations where not shown, maximum spacing is:
 - a. Driveways: 10 ft.
 - b. Sidewalks: 4 ft.
 - c. Other Flat Slabs: 20 times slab thickness.

B. Expansion:

- 1. Install where shown on plans.
- 2. Location where not shown: All structures and features which project through, into or against slab.
- 3. Install according to manufacturer's recommendations, set material securely before placing concrete.
- 4. Install 1/2" x 4" unless shown otherwise.

C. Filling Joints:

1. Fill not later than 14 days after sawing.
2. Fill immediately following cleaning.
3. Fill to 1/8" of surface.
4. Remove excess while material is still pliable.
5. Remove low areas where necessary.
6. Omit filling sidewalk joints.

3.07 Finishing Exterior Flat Work:

- A. Strike off and float as required.
- B. Check surface with ten foot straight edge, maximum variance allowed - 1/4".
- C. Drag concrete surface longitudinally with double thickness burlap drag after completion of straight edging unless noted otherwise.
- D. Use edger on edges of slab.
- E. Use hand finishing only when approved by Engineer.

3.08 Finishing Other Concrete:

- A. Interior Floors: Smooth, steel-troweled machine finish; use edger on exposed edges. Grind smooth defects which would reflect through applied finish flooring.
- B. Exterior walks and steps lightly broomed finish transverse to traffic flow: use edger on exposed edges.
- C. Other Surfaces:
 1. Remove fins, projections and loose material.
 2. Clean surfaces of form oil.
 3. Patch honeycomb, aggregate pockets, voids and holes as follows:
 - a. Chip out until sound concrete is exposed to minimum depth of 1".

- b. Prepare patching mortar with approximately two parts of normal Portland Cement, one part white cement, nine parts fine aggregate; vary proportions of aggregate as necessary to match color of adjacent concrete.
 - 4. Fill holes left by form ties to within 1-inch of surface with non-shrink grout. Fill remainder with patching mortar specified hereinbefore.
 - 5. Apply grout-cleaned finish to all exposed vertical surfaces. Wet surface and rub grout on surfaces with rubber or cork float. Scrape off excess grout and finish with burlap rub.
- D. Coordinate required finish with Engineer.

3.09

Curing:

A. Pavements and Exterior Slabs:

- 1. Method: Use impervious membrane with curing compound consisting of finely ground white pigment and vehicle ready-mixed for use without alteration.
- 2. Rate of Application: Not less than one gallon per 15 square yards of surface.
- 3. Application: Apply as soon as surface water sheen disappears.
- 4. Limitations: When weather is extremely hot or windy, apply immediately after burlap dragging or cover fresh concrete with wetted burlap. Maintain wet until followed by curing with curing compound.

- B. Other Concrete Work: Cure with resin base clear membrane curing compound, follow with double impregnation of chemical hardening in accordance with manufacturer's recommendation on interior slab surfaces.

3.10

Pavement Protection:

- A. Protect pavement from all damage prior to final acceptance.
- B. Exclude traffic until concrete is at least ten (10) days old.
- C. Permit construction equipment only as directed by Engineer.
- D. Protect against weather; Contractor to have on site enough burlap or canvas to protect surface of fresh concrete in case of rain.

3.11

Testing:

- A. Furnish at least three 6" diameter x 12" cylinders from each major pour for test purposes. Test cylinders will be cast by Engineer. Test one cylinder at 7 days, test second cylinder at 28 days and test third cylinder only if needed for confirmation of compression strength.
- B. Protect and transport cylinders from time and place made to the lab.
- C. Provide tests by testing laboratory designated and approved by Engineer. 85% of cylinders tested at 28 days shall show strength higher than specified.
- D. Provide core sample if test results indicate less than 85% passing specified strength as required by Engineer.
- E. Pay cost of all testing including necessary core samples and tests.
- F. Provide one copy of all test reports to Engineer.
- G. Define major pour as 150 cubic feet or more.

3.12

Weather Limitations:

- A. Begin mixing with minimum air temperature at 35°F and rising.
- B. Stop mixing and placing when air temperature is 40°F and falling
- C. Place no concrete on frozen subgrade.
- D. Place no concrete when stormy or inclement weather is imminent or will prevent good workmanship.
- E. Do not permit aggregates containing frozen lumps.
- F. During cold weather, protect as follows:

Predicted Low
Temperature

Protection

32°F Minimum

One (1) layer plastic on burlap.

25°F Minimum

One (1) layer plastic and one (1) layer burlap or two (2) layers of burlap.

Below 25°F

Two (2) layers plastic or burlap and 6" of straw.

Coverings for temperatures over 25°F to remain in place 48 hours. For temperatures under 25°F, leave in place for 5 days, minimum.

G. Complete all finishing operation prior to darkness.

3.13 Miscellaneous Concrete Items:

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Use non-shrink grout as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing machines and equipment. Use non-shrink grout as shown on plans.

SECTION 04100

MORTAR

PART 1 - GENERAL:

1.01 Work Included:

- A. Contractor shall provide all work necessary to perform mortaring of masonry units and other items indicated on the drawings or specified in other sections of these specifications.

1.02 Requirements of Regulatory Agencies:

- A. Mortar materials and mixing thereof shall meet or exceed requirements of applicable state and local building codes.

1.03 Environmental Conditions:

- A. Do not mix mortar when ambient temperature is less than 40°F unless cold weather requirements as described hereinafter are met.

PART 2 - PRODUCTS

2.01 Materials:

- A. Masonry Cement: ASTM C-91, Type II, one of the following or equal:
 - 1. "Kosmortar" (Kosmos Portland Cement Co.)
 - 2. "Brixment" (Louisville Cement Co.)
 - 3. "Richmortar" (Miami Cement Co.)
 - 4. "Masonry Mortar" (Lone Star Cement Co.)
- B. Portland Cement: ASTM C150, Type I, II or III or ASTM C175 Type IA, or IIIA; standard grey in color unless otherwise indicated.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Quicklime: ASTM C5.
- E. Aggregate: Clean, washed, sharp mason's sand conforming to ASTM C144; for joints 1/4" wide and less, sand shall pass #16 sieve.
- F. Water: Clean, free from deleterious amounts of acids, alkalis, oil, salts or organic materials and potable.

- G. Anti-Freeze Liquid, Salts and Similar Substances: Do not use in mortar to lower freezing point.

2.02 Mixes:

- A. Mortar: Mixed in accordance with ASTM C270 and proportioned within limits given in following table. Water retention of mortar shall be determined in accordance with ASTM C91 and shall have flow after suction of not less than 70% of that immediately after mixing.

<u>Mortar Type</u>	<u>Parts Portland Cement</u>	<u>Parts Masonry Cement</u>	<u>Parts Hydrated Lime</u>	<u>Aggregate Damp & Loose Conditions</u>
S	1/2	1	---	Not less than 2-1/4
	1	---	1/4 to 1/2	and not more than 3
	---	1	---	times the sum of the
	1	---	1/2 to 1-1/4	volumes of the cements and lime used.

- B. Portland Cement: Used in exterior wall construction shall be waterproof type.

PART 3 - EXECUTION

3.01 Cold Weather Requirements:

- A. When air temperature is 40°F and below, heat aggregate (but do not scorch it) or mixing water to produce board mortar temperature of 40 to 120 degrees F. If water is boiled, place part of aggregate into water in mixer "flash" in cement when it is added.

SECTION 04220

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install concrete masonry units in conformity with the drawings and as herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 04100 - Mortar

1.03 Environmental Conditions:

- A. Do not lay concrete masonry when ambient temperature is less than 40°F unless cold-weather requirements as described hereinafter are met.

1.04 Product Handling:

- A. Storage: Store concrete masonry units off ground. Cover stockpiles with waterproof membranes so that units will be dry when used. Temporarily anchor membranes in place so that they are not pulled or blown off. Do not allow membranes or anchorage thereof to restrict air circulation around stockpiles.

PART 2 - PRODUCTS

2.01 Concrete Masonry Description:

- A. General: Manufactured from sand, gravel, crushed gravel, crushed stone or a combination thereof, conforming to ASTM C33.
- B. Units: Light weight concrete units conforming to ASTM C90, Grade N, Type II, below grade and Type I, above grade.
- C. Curing: Units cured by same method and stored under cover at plant.
- D. Sizes:
 - 1. Block "Line" Units: 7-5/8" x 15-5/8" x thicknesses as indicated on Drawings (nominal 8" x 16").
 - 2. Non-load Bearing Units: 3-5/8" x 15-5/8" (nominal 4" x 16") or 5-5/8" x 15-5/8" (nominal 6" x 16").

PART 3 - EXECUTION

3.01 Conditions of Surfaces:

- A. Clean surfaces with which masonry units will be in contact free from dirt, grease, water, snow, frost and other foreign matter that might affect bonding of masonry work.

3.02 Cold-Weather Requirements:

A. During Erection

1. Air Temperature Below 40°F: Refer to Section 04100 for mortar preparation requirements.
2. Air Temperature 25 to 20 degrees F: Provide auxiliary heat on both sides of walls to keep temperatures above 32°F. Keep board mortar temperature above 40°F.
3. Air Temperature 20°F and Below: Enclose working area and provide auxiliary heat to keep temperature above 32°F. Keep board mortar temperature above 40°F.

B. After Erection and At Work Stops

1. Mean Daily Air Temperature 40 to 32 Degrees F: Protect work from rain, sleet and snow for 24 hours by covering tops with weather-resistant membranes that overhang work at least 2' on both sides.
2. Mean Daily Air Temperature 32 to 25 Degrees F: Completely cover work for 24 hours with weather-resistant membranes.
3. Mean Daily Temperature 25 to 20 Degrees F: Completely cover work for 24 hours with insulating blankets or other equal protection.
4. Mean Daily Temperature 20°F and Below: Maintain work above 32°F for 24 hours by enclosing surrounding area and heating work with electric heating blankets, infrared heat lamps or other approved method.

3.03 Erecting Concrete Masonry:

- A. Do not lay units with or on frozen materials or surfaces; do not lay units having frost or snow on their surfaces. Do not wet units. Use only units that are dry and free from cracks, chips, spalls, or other defects. Lay first course in full mortar beds; lay subsequent courses in face-shell mortar beds. Place mortar so that all joints are full and so that mortar will ooze out of joints on both sides of face-shells as next course above is positioned. Do not reuse mortar that has fallen on ground, floor or scaffolds. Avoid over-plumbing and pounding of corners and jambs to fit stretcher units after they have been set in position. Where adjustment is necessary after mortar has started to harden, rake off such mortar and replace with fresh mortar. Where fresh masonry adjoins masonry that is partially or totally set, clean and lightly wet exposed surfaces of such set masonry. Should it be necessary to "stop off" horizontal run, set back 1/2 unit length in each course; toothing will not be permitted unless approved. Remove loose units and mortar. Cut units when dry, using power-driven masonry saw.
- B. Mortar type shall be type S in walls below grade.
- C. Bond shall be stagger bond pattern with horizontal joints level and vertical joints plumb.
- D. Exposed heights of bed joints and exposed widths of head joints shall be 3/8" but in no case less than 5/16" nor more than 7/16".
- E. Grout door frames in masonry walls full width mortar; grout full in other conditions indicated on the Drawings.

3.04 Tooling Joints:

- A. Unexposed Joints: Strike flush with faces of units. Also, strike flush joints in other surfaces so indicated on the Drawings.
- B. Exposed Joints: When joints have become "thumb-print" hard, tool with approved rounded jointer. Such jointer shall be larger than widths and heights of joints so that complete contact is made along edges of masonry units. Depress joints not more than 1/16" and not less than 1/32"; tool slick and neat.

3.05 Cleaning:

- A. Cleaning: Rub surfaces of walls free of mortar daubs and fins. Remove foreign materials from faces of units and mortar joints so that finishing materials to be applied thereto will not be affected by such foreign materials.

3.06 Clean Up:

- A. Remove mortar droppings and residues from adjacent materials and surfaces. Leave all such materials and surfaces and faces of masonry walls, where applicable, smooth, clean and free from defects ready in all respects for application of finishes.
- B. Clean up all excess material, trash and debris resulting from work of this section.

SECTION 05500

MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 Work Included:

- A. Furnish and install carbon steel shapes not directly integral with structural systems of buildings, as well as those not specifically indicated to be by others, including but not limited to the following:
 - 1. Bearing angles, curb angles, edge angles and their related anchor bolts and clips.
 - 2. "In wall" and "in ceiling" framing for support of equipment.
 - 3. Plates
 - 4. Steel Lintels
 - 5. Pipe supports, hangers and anchors
 - 6. Other items fabricated from steel but not specifically indicated to be by others.

1.02 Shop Drawings:

- A. Submit Shop Drawings of miscellaneous metals work to the Engineer for approval.

1.03 Coordination:

- A. Where miscellaneous metal items will be used for attachment or support of manufactured equipment, consult with the appropriate manufacturer and verify that metal items as detailed on drawings will properly receive and support their equipment.

1.04 Product Handling and Storage:

- A. Handle and store miscellaneous metals work in manners to protect from physical damage, scratching or marring of shop coats and from corrosion due to moisture.

1.05 Industry Standards:

- A. Where detailing is not specifically indicated on Drawings, conform to recommendations of the National Association of Architectural Metal Manufacturers' Architectural Metal Handbook, latest edition.

PART 2 - PRODUCTS

2.01 Materials:

- A. Carbon Steel (including plate, angle, bar, wide flange, channel, tee, beam and other shapes): ASTM A36.
- B. Steel Pipe: ASTM A53.
- C. Bolts and Nuts (for use with carbon steel shapes, steel pipe and miscellaneous uses): ASTM A307.
- D. Galvanized Steel: hot dipped, minimum coating 2 oz. per sq. ft.
- E. Miscellaneous Parts and Materials: as approved.
- F. Paint: miscellaneous metal fabricator's standard "shop coat".

2.02 Fabrication:

- A. Verifying Conditions: take all necessary field measurements to make miscellaneous metal items fit neatly and accurately into adjacent work and properly receive supported items.
- B. Painting: thoroughly clean all carbon steel surfaces free from rust, scale, dirt, grease and other foreign matter, so paint will bond properly to the surfaces. Cover all surfaces, including bolts, nuts, washers, rivets and welds. Apply paint by brushing, rolling spraying, flow coating or dipping. Omit paint on fraying surfaces of members and parts to be field bolted and along margins of members and parts to be field welded. Shop applied paint coats shall be complete and smooth, free from runs, sags and other defects.

PART 3 - EXECUTION

3.01 Installation:

- A. General: Erect items as indicated or required, or both, to adequately serve each intended purpose. Fit neatly and accurately into adjacent work. Use sufficient quantities of anchors to fasteners to securely and rigidly install each item. Keep vertical, horizontal and sloped members true-to-line with all fitting neatly together and accurate. Provide all necessary temporary bracing, especially during any demolition phase of work, and remove such bracing at completion of work. Field bolting, riveting, welding and other joining shall conform to requirements set forth hereinbefore for general shop fabrication techniques.

3.02 Completion of Work:

- A. Cleaning: remove all shop and field identification marks from those surfaces which will be finish painted and exposed in completed work.

SECTION 06100

CARPENTRY

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to erect a wood framework structure consisting of loose wood members, doors, frames, trusses, windows and miscellaneous blocking and bracing. Includes rough hardware to join the members and anchor the framework to other construction.

1.02 Related Work Specified Elsewhere:

- A. Section 06190 - Wood Trusses
- B. Section 07300 - Roof Shingles
- C. Section 07460 - Exterior Siding
- D. Section 08110 - Hollow Metal Frames
- E. Section 08120 - Hollow Metal Doors
- F. Section 08250 - Wood Doors
- G. Section 08300 - Glass and Glazing
- H. Section 12100 - Casework and Fixtures

1.03 Product Handling:

- A. Storage: Store all materials to be used during the construction off ground and protect from moisture with original packaging, canvas, or plastic covers, but do not restrict ventilation. Cover all stock piles with waterproof materials so that materials will be dry when used. Temporarily anchor membranes or coverings so they are not pulled or blown off.

1.04 Special Coordination:

- A. Ascertain where all necessary bracing, all wood blocking within walls, ceilings, and roof areas, and any bulkheads are required for the installation, support, or attachment of any work of others. Provide all such blocking and bracing accordingly.

- B. Provide all necessary temporary bracing and blocking as required for the erection and completion of the structures. Remove any and all temporary bracing after the completion of this portion of the Contract Documents.

PART 2 - PRODUCTS

2.01 Materials:

- A. Lumber: All structural lumber to be a Standard Construction Grade #2 or better Douglas Fir or Southern Yellow Pine (WWPA Section 40.12) of sizes and structural integrity conforming to the new National Dimension Rule and having a moisture content of 19% or less.
- B. Plywood: Standard and C-C of thickness as designated or required on drawings for each specific use shown within these documents. Use "Exterior" grade products in any exterior walls, roof, or fascias' as shown.
- C. Windows: Check drawings for the specific sizes and styles. Approved manufacturer's products to be "Anderson", Kolbe and Koebe", or equal.
- D. Rough Hardware: Nails, screws, bolts and nuts, toggle bolts, expansion anchors, powder actuated anchors, and all other types and sizes best suited for each particular condition; non-corrosive where they may be exposed to moisture or humidity, and where in contact with concrete or masonry. All types and sizes of fasteners and particular method of installation to be as recommended by the different product line manufacturers as well as standard construction techniques.
- E. Exterior Trim: All exterior trim work, gutter boards, gable trim, soffit and overhang framing, and all other exterior exposed wood finish to be in sizes and type as designated to be smooth-planed finish in #2 grade cedar or redwood.

2.02 Wood Treatment:

- A. Preservation Treatment: Wood blocking and plywood occurring in conjunction with roofing, exterior walls, and in areas where humidity may exceed 50% R.H., shall be preservative pressure treated in conformance with applicable AWPA standards and shall bear AWPI LP-2 Quality Mark designation.

PART 3 - EXECUTION

3.01 Installation:

- A. Utilize materials and workmanship techniques in accordance with best acceptable practices of trade. Make cuts and joints neat and accurate so that adjoining ends and edges of members are in full contact with each other. Use wood members of sizes indicated on the drawings or of adequate sizes to provide secure anchorage or support for each particular condition. Use sufficient quantities of rough hardware items to secure each wood member in place, maintaining proper lines and elevations. Use expansion anchors in solid masonry and concrete. Take care not to split or otherwise damage materials or weaken anchorage.

SECTION 06190

WOOD TRUSSES

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to erect all wood roof trusses shown on the drawings and specified herein.

1.02 Standards:

- A. All design and fabrication shall meet or exceed the latest editions of the following:
 - 1. National Design Specifications for Stress Grade Lumber and Its Fastening (NFPA)
 - 2. Timber Construction Standards (AITC)
 - 3. Design Specifications for Light Metal Plate Connected Wood Truss (TPI)
 - 4. All applicable State and local codes

1.03 Shop Drawings:

- A. Submit fully detailed shop drawings for approval by the Engineer.
- B. Shop drawings shall include certified truss designs with the following data included:
 - 1. Pitch, span and spacing of trusses with sizes and location of truss bearing.
 - 2. Design loads for truss and axial forces in all members.
 - 3. Size, specie and stress grade for all truss members, and size and location of connection plates.
 - 4. Permanent lateral bracing as required by design to reduce buckling length of individual truss members.
 - 5. Drawings shall be certified by a Professional Engineer registered in the State of Ohio.

PART 2 - PRODUCTS

2.01 Material:

- A. All lumber used for truss members shall conform to the published stress ratings for the species and grades as set out in the official grading rules of the appropriate lumber associations, or as noted on the drawings.
- B. All lumber shall conform to the species and sizes indicated on the approved truss design drawings.
- C. Material used shall have a moisture content of not more than 19% nor less than 7% at time of fabrication.
- D. Connector plates shall be not less than 20 ga., galvanized, with a minimum yield of 33,000 psi and tensile strength of 45,000 psi.

2.02 Design Loads:

- A. All roof trusses shall be designed for the following loads:
 - 1. 10 psf dead load plus 25 psf live load at the top chord, and
 - 2. 10 psf dead load plus 10 psf live load at the bottom chord.

2.03 Fabrication:

- A. Trusses shall be fabricated by skilled craftsmen in a properly equipped shop and supervised by qualified foreman.
- B. Manufacturing of trusses shall be open to inspection of materials, workmanship and equipment at all times by the Engineer.
- C. Truss members shall be accurately cut to length, angle and be true to line to assure tight joints for finished truss.
- D. Provide jigs and clamps to hold the truss members in place until the connector plates have been installed on both sides of the joints.
- E. Camber shall be designed and built into trusses so that straight and level top and bottom chords exist after truss is set and has dead load applied.
- F. Each truss shall be permanently marked with manufacturer's name.

PART 3 - EXECUTION

3.01 Handling and Erection:

- A. Fabrication trusses and sub-components shall be so handled and stored that they are not subject to damage. If the trusses are to be stockpiled prior to erection, sufficient bearing points and/or bracing shall be provided to prevent excessive lateral bending, racking, or tipping over.
- B. Field erection of the trusses, including items such as proper handling, safety precautions, temporary bracing to prevent toppling of the trusses during erection, and any other safeguards or procedures consistent with good workmanship and good building erection practices, shall be the responsibility of this Contractor.
- C. At each end of each truss provide hurricane anchor, such as Simpson H2.5 or equal.
- D. Proper erection bracing shall be installed to hold the trusses true and plumb and in safe condition until permanent truss bracing and bridging can be solidly nailed in place to form a structurally sound roof framing system. All erection and permanent bracing shall be installed and all components permanently fastened before the application of any loads.

SECTION 07190

VAPOR RETARDERS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall perform all work necessary to install vapor retarders on the walls and under the concrete floor slab.

1.02 Related Work Specified Elsewhere:

- A. Section 02221 - Earthwork for Structures
- B. Section 03300 - Cast-In-Place Concrete

PART 2 - PRODUCTS

2.01 Materials:

- A. Polyethylene Film: 6 mil thick under slab, 4 mil thick on walls, clear, widths available.
- B. Mastic: as recommended by film manufacturer, compatible with adjacent materials.

PART 3 - EXECUTION

3.01 Conditions of Surfaces:

- A. Bedding over which vapor retarder film will be placed shall be adequately compacted, relatively smooth, and free from large stones, glass, and other objects and materials that might puncture film. Rake fill as required to maintain it in a smooth, consistent-depth condition as film is placed thereon. Where vapor barrier occurs over exterior wall, take care to extend behind intersecting walls.

3.02 Installation:

- A. Place film in continuous sections over entire areas to receive it. Lap individual sections in direction of concrete placement at least 6 inches and seal with mastic. Seal film around all projections through it. Should film be cut, torn, or punctured, cover cut, tear, or puncture with additional section of film of size to extend at least 12 inches in all directions from damaged area, mastic in place. Extend up wall minimum of 12" from under slab. Exterior wall vapor retarder to lap over to floor from interior side of wall studs.

SECTION 07210

BUILDING INSULATION

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install the insulation work indicated on the drawings and specified herein.

1.02 Delivery & Storage:

- A. Deliver materials to the job site in original unopened packages. Store under cover and protect from weather conditions.

1.03 Quality Assurance:

- A. Manufacturers: Owens-Corning Fiberglass, Celotex, Certainteed, or equal.

PART 2 - PRODUCTS

2.01 Materials:

- A. Rigid Insulation: Perimeter rigid polystyrene board closed cell polyisocyanurate, 2" thickness, minimum R-5 per inch of thickness (below grade).
- B. Batt Insulation: Unfaced batts of insulation for R-value of 19 in exterior walls and R-value of 30 for roof/attic installation. Conforming to ASTM C665-84 type I non-combustible.

PART 3 - EXECUTION

3.01 Installation:

- A. Install insulation blankets in accordance with manufacturers instructions.
- B. Fit insulation between framing members and anchor in place. Install behind electrical receptacles and piping.
- C. Seal batts and blankets around items protruding through insulation.
- D. Add supplementary support for insulation over 8'-0" high until interior finish is applied.

3.02 Completion of Work:

- A. Remove all trash and debris as result of work of this section.

* * * END OF SECTION * * *
07210-1

SECTION 07300

ROOF SHINGLES

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install shingles and flashings shown on the drawings and specified herein.

PART 2 - PRODUCTS

2.01 Materials:

- A. Underlayment shall be a lapped and nailed 15 lb. asphalt felt.
- B. Shingles shall be U.L. Class "A" Roofing with 20 year warranty.

2.02 Manufacturers:

- A. Certainteed "Glassguard"; GAF "Sentinel"; Manville "Fireglass"; or approved equal

PART 3 - EXECUTION

3.01 Installation:

- A. Install underlayment, shingles, flashings, roof vents, etc., in accordance with shingle manufacturer's recommendations.
- B. Fasteners to be galvanized nails 12 gauge 1-1/4" long to penetrate 3/4" through roof decking.

3.02 Color:

- A. Color shall be selected by the Owner or the Engineer from manufacturers standard colors.

3.03 Guarantee:

- A. Warranty - 20 years

SECTION 07460

EXTERIOR SIDING

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install all exterior siding, flashings, and exterior trim applicable to complete this section as shown on the drawings or specified herein.

1.02 Related Work Specified Elsewhere:

- A. Section 06100 - Carpentry

1.03 Product Delivery and Handling:

- A. Deliver materials to project site in original unopened manufacturer's packaging. Store under cover and in a manner as to protect from damage and marring of finishes.

1.04 Special Coordination:

- A. Ascertain where all necessary starter strips, base flashings and all other flashings that are required for the installation and attachment of the exterior siding.

PART 2 - PRODUCTS

2.01 Materials:

- A. Exterior horizontal siding to be a preformed panel having a double 5" lap configuration with a full 10" exposure. Panels to be a solid polyvinyl chloride compound as defined within the ASTM-D3679-81a standard specification. All siding panels and accessories to be produced from PVC compound containing quality color pigments with color throughout the entire thickness of the panel. All panels to have an evenly textured embossed finish.
- B. All panels to be a uniform .044 inch thickness and to be shipped and installed in standard 12'-0" lengths where possible.
- C. All accessories, flashings, and trim to be produced from the same quality PVC compound with the same textured embossed finish.

2.02 Manufacturers:

- A. Alcoa; Georgia Pacific; Allside; or equal.

PART 3 - EXECUTION

3.01 Installation:

- A. Install all preformed panels, trim, flashings and accessories, etc., including application fasteners in accordance with specific manufacturer's specifications and recommendations.

3.02 Color:

- A. Color shall be selected by the Engineer from manufacturers standard color selections.

3.03 Guarantee/Warranty:

- A. Warranty - 20 year pro-rated.

SECTION 07600

FLASHING & SHEET METAL

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install flashing and sheet metal work as specified herein at locations indicated on drawings except where such work is specifically indicated to be by others. Excepted work shall include exposed caulking, Section 07900 and flashing in conjunction with Mechanical and Electrical Work, Division 15 and 16.

1.02 Related Work Specified Elsewhere:

- A. Section 04220 - Concrete Unit Masonry

1.03 Coordination:

- A. Closely coordinate work of this section with related work of others such that no delay is caused as a result of improper scheduling. Install all roof flashing and materials in manners to maintain guarantee required under that section.

1.04 Product Handling and Storage:

- A. Handle and store flashing and sheetmetal items in manners to protect them from damage and marring of finishes. Any item so damaged may be ordered replaced at the option of the Engineer at no additional cost.

PART 2 - PRODUCTS

2.01 Materials:

- A. Copper: 3 oz. per square foot bonded with asphalt to heavy waterproofed kraft paper.
- B. Aluminum: sheet aluminum alloy type 4S.
- C. Solder: type best suited for applicable metal.
- D. Flux: type best suited for applicable solder and metal.
- E. Nails, Screws, Rivets and Other Fasteners: AISI copper of sizes and types suited for each particular condition.
- F. Mastic: ASTN D491, asphaltic, trowel consistency.

2.02 Uses and Gages:

- A. Thru-Wall Flashing, Pitch Pockets and Miscellaneous Flashings: 3 oz. copper.

2.03 Fabrication:

- A. Standards: where detailing is not specifically indicated on the Drawings, conform to recommendations of the Specifications of the Copper and Brass Research Association.
- B. Sections: form to profile and designs indicated on drawings; sections may be factory-products or shop-fabrications. Make in longest lengths practical so that joints will be held to minimums. Form sections with true lines, accurate corners and breaks and uniform surfaces. Fully weld or solder joints and wash-off excess flux and other soldering residues. Relieve edges. Insofar as practicable, permanently assemble flashings and sheetmetal items in shop; where impractical to accommodate shipment, coordinate and check parts to assure proper field-fit before shipment. Form two piece flashings such that inserts snap securely into receivers.
- C. Corner Pieces: provide for external and internal corners. Form to complete profile of section, extending 12" away from corner.

PART 3 - EXECUTION

3.01 Installing In-Wall Flashings:

- A. Isolate dissimilar materials so that electrolysis will not occur. Lay sections in full mortar beds so that each section is mechanically bonded in place on both sides. Lap adjacent sections at least 3"; interlock herringbone deformations from one section to another. Place so that natural drainage is toward exterior. Fill joints between sections with 1/8" thick caulk type or rubber-based contact adhesive cement. Where flashings extend through walls, turn-down extensions on 45° angle. Close-off all terminations so that complete flashing system provides positive method of directing moisture out of walls. Seal around protrusions, interruptions and the like with mastic so that such are watertight.

3.02 Performance Requirements:

- A. Completed flashing and sheetmetal installations shall be true-to-line, uniform, firmly in contact with adjacent materials, free from waves, buckles, bends, creases, tool marks and punctures and shall be completely watertight.

3.03 Completion:

- A. Touch: neatly touch up all mars and abrasions to shop-applied finishes using materials to match original coating.
- B. Cleaning: clean all excess mastic and other residues from exposed surfaces of flashing and sheetmetal items to leave an even consistent appearance.
- C. Cleanup of work areas: remove all trash, debris, excess material and equipment resulting from work of this section and dispose of properly.

SECTION 07900

CAULKING AND SEALANTS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install caulking and sealants as required to provide neat, finished appearing, watertight joints at junctures of all materials, items and surfaces except where such are specifically indicated to be caulked or sealed by others. Prepare and caulk or seal joints between items and adjacent surfaces including, but not limited to the following:
 - 1. Control joints and expansion joints in concrete and masonry walls.
 - 2. Miscellaneous metal items.
 - 3. Open joints in sheet metal work.
 - 4. Hollow metal frames.
 - 5. Access panels.
 - 6. Mechanical and electrical items penetrating walls, floors and ceilings.
 - 7. Others as required, doors - windows, dissimilar materials.
- B. Sealants - Exterior exposed to the weather
- C. Caulking - Interior

PART 2 - PRODUCTS

2.01 Materials:

- A. Sealant & Caulking:
 - 1. Caulk: Acrylic Latex - One-part, gun-grade; nearly 100% recovery from 100% elongation, excellent paintability. Tremco Acrylic Latex 834 (interior)
 - 2. Sealant: Acrylic Terpolymer - One-part, gun-grade; conforming to Fed. Spec TT-S-00230, 300% to 400% elongation at 20°F, excellent recovery, average hardness (Shore A) of 40 after 5 years; "Mono" as manufactured by Tremco Manufacturing Co., or approved equal. (Exterior)

- B. Primers: Quick drying, clear and approved by sealant manufacturers.
- C. Backer Rods: Closed cell polyethylene or urethane foam, polyvinyl chloride or closed cell neoprene; circular in cross section and of sizes to assure that they will stay in place under pressure of applying sealants.

PART 3 - EXECUTION

3.01 Conditions of Surfaces:

- A. Joints shall be clean, dry and free from oil, grease loose material and foreign matter.

3.02 Preparation:

- A. Primers: Where recommended or required by sealant manufacturer, prime joints with brushes that will reach all surfaces of joint. Mask adjacent surfaces that will not be covered with sealant and that are subject to staining or other damage by primers.
- B. Backer Rods: Install firmly and evenly in place where indicated or required to depths and contours recommended by sealant manufacturer. Use backer rods for all exterior caulking and sealant work.

3.03 Sealant Locations:

- A. Acrylic Latex: Interior work except where silicone rubber is specified.
- B. Silicone Rubber: Joints between sinks, equipment and cabinets.
- C. Acrylic Terpolymer: Exterior work.

3.04 Application:

- A. Apply sealants with guns or other devices having nozzles of size to allow joints to be completely filled with single bead of material. Use sufficient pressure to drive materials completely and fully into joints so that joints are weather and water tight. Install foam tape in one piece section where indicated on drawings.
- B. Tooling Joints: Point joints at flush vertical surfaces slightly concave; point joints at flush horizontal surfaces flush or slightly raised so that such joints will not retain or "pond" moisture. Point joints in internal corners with approved coving tool.

C. Finishing Joints: Finish exposed joints uniformly smooth and straight, free from wrinkles and sags.

3.05 Completion of Work:

A. Remove excess sealants from joints. Remove sealant deposits from surfaces not intended to be caulked and restore such surfaces to their original condition.

SECTION 08110

HOLLOW METAL FRAMES

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install hollow metal door frames.

1.02 Quality Assurance:

- A. Requirements of Regulatory Agencies: Fabricate those hollow metal frames indicated on the Drawings to be fire-rated in accordance with applicable Underwriters' Laboratories, Inc., (UL) specifications. Each required frame shall bear the authorized UL label showing the rating index and its conformance to the applicable specification. Should provisions of this section conflict with an applicable UL specification, notify the Owner and the Engineer immediately and do not fabricate the frames in conflict until instructed to do so by the Owner and Engineer.

- B. Manufacturers: Ceco Corporation; Steel Craft Mfg. Corporation; Mesker Brothers Industries, Inc.; or equal.

1.03 Submittals:

- A. Shop Drawings: Submit Shop Drawings to the Engineer for approval. Show fabrication techniques, details, contours, elevations, dimensions, and schedules of frame sizes, locations and types.
- B. Samples: Submit samples of frame sections and frame components to the Engineer for approval if so requested.

1.04 Coordination:

- A. Obtain templates for hardware in order to accurately prepare mortises and to reinforce frames to receive hardware.

1.05 Product Storage:

- A. Store frames off floors in manners that will prevent undue deflections and in locations that will prevent damage caused by construction operations. Keep stockpiles covered and protected from the weather.

PART 2 - PRODUCTS

2.01 Materials:

- A. Steel: U.S. standard gauges of hot rolled prime quality sheet carbon steel; free from scale, pits, rust and other surface and internal defects; galvanized at exterior locations.
- B. Primers and Coatings: Manufacturer's standards, as approved.

2.02 Gauges and Sizes:

- A. Frame Sections
 - 1. Exterior frames: 14 gauge steel
 - 2. Other frames: 16 gauge steel
- B. Floor Clips: 14 gauge steel, minimum 1-1/2" x minimum 1-1/4" x approximately width of frame throat opening.
- C. Frame Anchors
 - 1. Adjustable Masonry Anchors: 16 gauge steel, UL approved.
 - 2. "Tee" Anchors: 16 gauge steel.
 - 3. Stud Anchors: 18 gauge steel, UL approved where applicable.
- D. Spreaders: 16 gauge steel, 1" x 1" angle or equivalent.
- E. Plaster Guards: 24 gauge steel.
- F. Hardware Reinforcement: 8 gauge steel, 12 gauge steel for surface mount hardware.
- G. Glazing Moldings: 20 gauge steel channels.
- H. Silencers: Glynn-Johnson GJ-64 or equal.
- I. Miscellaneous Parts: Gauges required to best execute each particular condition as approved.

2.03 Fabrication:

- A. Frames: Fabricate frames to designs, profiles and sizes indicated on Drawings. Construct frames from combinations of head, jamb and stop members, each formed from single sheets of steel. Frames shall be welded corners. Miter Joints; fit members tightly together, keeping them straight, true-to-plane and in proper alignment. Provide sinkages and mortises as required so that hardware will, in completed work, be flush with

frame surfaces. Finished frames shall be smooth and free from warps, waves, buckles, pits, burrs, sharp edges and other defects.

- B. Floor Clips: Provide at jambs. Weld longer legs to inside of frame rabbets. Provide two 3/8" diameter holes in shorter legs for anchorage to structural floor slabs.
- C. Frame Anchors: Provide at least 3 anchors per jamb for frames up to 60" high and at least one additional anchor per jamb for each additional 30" of frame height or fraction thereof.
- D. Spreaders: Tack weld to jambs in manner that they may be removed after frames are installed with minimum of damage to finished surfaces.
- E. Plaster Guards: Weld behind hardware cutouts.
- F. Hardware Reinforcement: Form to receive hardware in such manner that it will, in completed work, be flush with frame surfaces. Weld to inside surfaces of frames. Where hardware will be surface mounted, provide reinforcement plates. Drill and tap holes for attachment of hardware.
- G. Head Stiffener Channels: Provide at all frames over 36" in width, except do not provide for UL labeled frames; weld channel webs to inside rabbet faces of frame head sections.
- H. Silencers: Drill frames, except those bearing UL labels, to receive silencers. Provide 3 silencers per lock jamb for single doors and 2 per head for double doors. Space evenly along jambs and approximately 1" to either side of meeting point on head. Ship loose for field installation.

2.04 Finishing:

- A. After fabrication, dress, fill and sand surfaces to remove tool marks, surface imperfections and evidence of welding so that surfaces are smooth, true-to-plane and free of irregularities. Chemically treat to insure maximum paint adhesion and spray-on complete and uniform coat of rust inhibitive metal primer. Do not paint over UL labels. Prime coat shall be smooth, free from runs, sags, voids and other defects and fully cured before frames are shipped. In addition, paint insides of exterior frames with asphaltic paint. Exterior frames shall be galvanized.

PART 3 - EXECUTION

3.01 Installation:

- A. Secure frames in place, keeping them plumb, true-to-line, and ready for doors. Provide bracing to assure that frames will remain in correct final position until completely secured by walls. Keep spreaders intact.
- B. Floor Clips: Fasten securely to structural floor slabs by means of expansion bolts or lead drive pins.

3.02 Completion of Work:

- A. Inspection: Periodically inspect frames to assure that they are in their correct final positions. If misaligned, realign them and provide additional bracing or other provisions to maintain frames in their exact final positions.
- B. Touch Up: When frames are secured in place, remove spreaders and evidence thereof. Neatly repair and touch up mars, scratches, dents and defects in shop applied prime coats with same material as used for shop coats and clean surfaces free of foreign matter.
- C. Installing Silencers: Install silencers only after finish painting has been applied and approved.

SECTION 08120

HOLLOW METAL DOORS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install hollow metal doors.

1.02 Related Work Specified Elsewhere:

- A. Section 08110 - Hollow Metal Frames
- B. Section 08700 - Finish Hardware

1.03 Quality Assurance:

- A. Requirements of Regulatory Agencies: Fabricate those hollow metal doors indicated on the Drawings to be fire rated in accordance with applicable UL specifications. Each required door shall bear the authorized UL label showing the rating index and its conformance to the applicable specification.
- B. Manufacturers: Ceco Corporation; Steel Craft Mfg. Corp.; Mesker Brothers Industries, Inc.; or equal.

1.04 Submittals:

- A. Shop Drawings: Shop Drawings to the Engineer for approval. Show fabrication techniques, details, elevations, dimensions and schedules of door sizes, locations and types.

1.05 Coordination:

- A. Templates: Obtain templates for hardware in order to accurately prepare mortises and to reinforce doors to receive hardware.
- B. Finish Hardware Items: Receive finish hardware items supplied by others for installation under this section.

1.06 Product Storage:

- A. Doors: Store doors off floors in manners that will prevent undue deflections and in locations that will minimize chances of damage caused by construction operations. Keep stockpiles covered and protected from weather.

PART 2 - PRODUCTS

2.01 Materials:

- A. Steel: U.S. standard gauges of cold rolled stretcher leveled steel, free from scales, pits, rust and other surface and internal defects; galvanized at exterior locations.
- B. Glazing Frames: Steel, factory products, UL approved, finished with baked on rust inhibitive enamel prime coat, of sizes indicated on the Drawings.

2.02 Gauges:

- A. Door Face Sheets: 16 gauge steel, seamless doors, with 10 year performance warranty.
- B. Edge Channels: 11 gauge steel at hinge sides and 14 gauge steel at lock sides.
- C. Head Caps: 14 gauge steel, galvanized at all out swinging doors.
- D. Closure Channels: 16 gauge steel.
- E. Hardware Reinforcement: 9 gauge steel, 12 gauge steel for surface mount hardware.

2.03 Fabrication:

- A. Fabricate doors to designs and sizes indicated on the Drawings, allowing for clearances of 1/8" at tops and jambs and 3/8" from finished floors at bottoms; allow clearances to accommodate thresholds, where required.
- B. Cores: Construct continuous edge channel at vertical edges and continuous closure channels at tops and bottoms; turn flanges of top closure channel inward. Stiffen and sound insulate so that face sheets are smooth and free from waves, buckles, dents, "oil canning" and evidence of welding; so that metallic ringing does not occur; and, in case of UL labeled doors, so that applicable UL specifications are met.
- C. Face Sheets: Form over open ends of edge channels to provide solid flush edges, thus concealing channel flanges. Miter joints; fit members tightly together, keeping them straight, true-to-plane, and in proper alignment. Continuously weld connections and joints; dress welds in exposed surfaces to produce invisible joint lines. Provide sinkages and mortises as required to receive hardware and so that hardware will, in completed work, be properly installed. Bevel lock stiles 1/8" in 2".

- D. Hardware Reinforcement: Form to receive hardware in such manner that it will, in completed work be flush with door surfaces. Weld to inside surfaces of doors. Where hardware will be surface mounted, provide reinforcement plates. Drill and tap holes for attachment of hardware.
- E. Glazing Frames: Secure with frames in full contact with face sheets all around. Keep straight and square. Use frames for double pane insulated glass for exterior doors.
- F. Plastic, liquid or putty filling of seams shall not be allowed.

2.04 Finishing:

- A. After fabrication, dress, fill and sand surfaces to remove tool marks, surface imperfections and evidence of welding so that surfaces are smooth, true-to-plane and free of irregularities. Chemically treat to insure maximum paint adhesion and bake on complete and uniform coat of rust inhibitive enamel primer. Do not paint over UL labels. Prime coats shall be smooth, free from runs, sags, voids and other defects, fully cured before doors are shipped.

PART 3 - EXECUTION

3.01 Installation of Doors:

- A. Hang doors squarely in appropriate frames, maintaining clearances of 1/8" at tops and jambs and 3/8" from finished floors at bottoms; maintain clearances as required to accommodate thresholds so that both doors and frames will be tight. Doors shall operate freely and smoothly without binding or rubbing frames and floors.

3.02 Installation of Finish Hardware Items:

- A. Install finish hardware items neatly and accurately in place according to manufacturer's instructions, the approved Finish Hardware Schedule and the pre-installation meeting. Drive screws, bolts and nuts "home" without stripping threads, marring slots or damaging finishes. After installation, test, adjust, ease and lubricate finish hardware items so that all operate freely, smoothly and functionally.

3.03 Completion of Work:

- A. After doors have been hung and finish hardware items have been installed, neatly repair and touchup mars, scratches, dents and defects in shop applied prime coats with same material as used for shop coats and clean surfaces free of foreign matter.

SECTION 08250

WOOD DOORS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install all interior wood door and frame assemblies.

1.02 Quality Assurance:

- A. Furnish doors in sizes shown on the drawings to meet, or exceed National Wood Manufacturers Association standard and conforming to U.L. requirements and bearing the appropriate label.

PART 2 - PRODUCTS

2.01 Materials:

- A. Face doors with premium grade birch hardwood
- B. Thickness: 1-3/8" unless specifically noted on plans
- C. Side Edges: 1-1/4" hardwood
- D. Top and Bottom Edges: 1-1/8" softwood
- E. Core: Staved wood core average density 30 lbs. per cubic foot
- F. Frames and trim to be Western White Pine and precut-assembled and prehung with door units installed in each designated preassembled cased frame unit.
- G. Finish: Stain

PART 3 - EXECUTION

3.01 Warranty:

- A. Life of installation for interior use.

3.02 Installation:

- A. Set frame plumb and square and prepare for finish hardware.

SECTION 08700

FINISH HARDWARE

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install finish hardware on all doors.

1.02 Related Work Specified Elsewhere:

- A. Section 06100 - Carpentry
- B. Section 08110 - Hollow Metal Frames
- C. Section 08120 - Hollow Metal Doors
- D. Section 08200 - Wood Doors

1.03 Quality Assurance:

- A. Hardware supplier shall be an established firm dealing in contract builder's hardware, with a sample room and an adequate inventory.
 - 1. Suppliers shall be prepared to provide a competent representative to service hardware on the job as may be required.
 - 2. Supplier shall be regular franchised distributor for all materials required for this project and only domestic manufacturers will be used.

1.04 Submittals:

A. Schedules:

- 1. Submit a complete typewritten schedule showing all factory serial numbers and sizes, etc., for approval by the Engineer.
- 2. Furnish copies of the approved schedule as requested to the Engineer and to such door and frame manufacturers as may require them.
- 3. Catalog cuts, drawings, other descriptive data on hardware shall be furnished as requested by the Engineer.
- 4. After final approval of the hardware schedule by Engineer, hardware supplier shall furnish copies of the approved schedule as requested by the Contractor to such other subcontractors and supplies necessary to complete their portion of this project.

1.05 Responsibility:

- A. It shall be supplier's responsibility to examine the door and frame drawings and elevations to determine the suitability of hardware specified.
- B. Particular attention is directed to threshold and kickplate heights and push plate widths. It will be this supplier's responsibility to furnish the correct hardware to fit the door and frame conditions.
- C. No considerations will be granted for any alleged misunderstanding of the material to be furnished for the work to be done, in agreement to all items and conditions referred to herein or indicated on the drawings.

1.06 Product Handling:

- A. Finishing hardware shall be receipted for upon delivery. Delivery shall be made so that all work shall progress without delay or interruption.
- B. The Contractor shall provide adequate locked storage space for materials and be responsible for the scheduled quantities of hardware when delivered to the job.

PART 2 - PRODUCTS

2.01 Location and Description:

- A. It is not the intent of this specification to list all doors; typical requirements only are indicated for use as a guide for preparing the detailed schedule. Refer to drawings, details and other specifications for further information as the extent of hardware required.

2.02 Attachments:

- A. Surface-type door pulls, door closures, surface door holders shall be furnished and installed with hex bolts and machine screws. Length to door thickness.
- B. No exceptions will be made in method of attachments.

2.03 Keying and Keys:

- A. All locks and cylinders shall be keyed and masterkeyed per Owner's requirements.
 - 1. Furnish two (2) keys for each lock, six (6) keys for each masterkeyed set.

2. A construction key system of type approved by the Engineer shall be utilized during construction.

2.04 Locks and Latches:

- A. Knob and latch sets shall be Schlage Plymouth Design standard duty cylindrical type. US26D finish, lever or push-pull type for spaces to be occupied, or equal.

2.05 Thresholds and Weatherstripping:

- A. Exterior doors opening out shall have thresholds as listed by National Guard or equal. Weatherstripping shall be type #190.

2.06 Hinges:

- A. Hinges shall be manufactured by Stanley Hardware, Hager Hinge Co., McKinney Mfg. Co., Lawrence Brothers Inc., or equal unless specified otherwise. Each hinge shall be full portise, ball bearing, template type with flush barrel.
- B. Except where label provisions require larger or heavier hinges, or where specified otherwise herein, provide 1-1/2" pairs of hinges for each door 91" or under in height and 2 pairs of hinges for each door over 91" in height.

2.07 Plates, Kick and Mop:

- A. Plates shall be laminated plastic unless shown or specified otherwise. Beveling, drilling and countersinking shall be equivalent to standards of Brookline.
- B. Kick and mop plates shall be 2" less than width of door to single acting doors, 2" less than width for each leaf or pair. Kick plates shall be 8" high.

2.08 Surface Overhead Closers:

- A. Surface overhead closers shall be LCN or equal. Except where specified otherwise, provide LCN 4010 Series and LCN 1460 Series, or equal where parallel arm type is scheduled. Closers shall be of proper sizes as recommended by the manufacturer. Finish shall be AL.
 1. Surface closers shall be fastened to door using through bolts.
 2. Furnish special overhead closers where shown or specified.

2.09 Door Bumpers (Stops):

- A. Bumpers or stops shall be provided wherever an opened door strikes any part of building construction. Door bumper shall in general, be wall type; such as Ives 401 Series. Material shall be brass or bronze, dull chrome plated.
- B. Furnish floor dome type where wall type cannot be used. Bumper or stops may be omitted where overhead stop and holder prevents door from striking building construction.

2.10 Silencers:

- A. Furnish three (3) GJ #64 door silencers for each single interior door and two (2) for each pair of doors. Locate bottom silencer above kickplate.

2.11 Finishes:

- A. Unless specified otherwise, finishes shall be US26D or US28 where indicated.

PART 3 - EXECUTION

3.01 Installation:

- A. Finishing Hardware shall be installed as recommended by the National Builder's Hardware Assoc.
- B. Fastenings of suitable size, quantity, type and finish shall be provided to secure hardware in position for heavy use and long life.

3.02 Schedule:

- A. The following schedule is furnished for whatever assistance it may afford the Contractor and shall not be considered as entirely inclusive. In preparing his bid the Hardware Supplier shall check the suitability and adaptability of all items specified in relation to all details and surrounding conditions. The Engineer's attention shall be called to any items not suitable or adaptable and to any manifest errors, typographical or otherwise so that corrections may be made before any hardware is furnished.

MANUFACTURER'S ITEMS LISTED

Butts.	Hager; or equal
Locksets	Schlage; or equal
Stops, Wall Bumpers.	Ives; or equal
Metal Astragals.	National Guard; or equal

SET #1

Single Exterior Doors - Chlorine Room

To have:

1-1/2	Pr. Butts	BB1191 NRP 4-1/ x 4-1/2	26D
1	Lockset	A53PD PLY	26D
1	Door Closer	4114 CUSH	AL
1	Threshold	525 - 36" zero type (1/2" or less in height)	AL
1	Set Weatherstrip	190	AL
1	Locks & Latches	Interior & Exterior Level or push/pull operated	

NOTE: All Hardware shall be corrosion resistant

SET #2

Single Exterior Doors

To have:

1-1/2	Pr. Butts	BB1191 NRP 4-1/ x 4-1/2	26D
1	Lockset	A53PD PLY	26D
1	Door Closer	4114 CUSH	AL
1	Threshold	525 - 36" zero type (1/2" or less in height)	AL
1	Set Weatherstrip	190	AL
1	Locks & Latches	Interior & Exterior Level or push/pull operated	

SET #3

Single Equipment Room Doors

Each to have:

1-1/2	Pr. Butts	BB1279	4-1/2 x 4-1/2	26D
1	Lockset	A80PD	PLY	26D
1	Closer	1460		AL
1	Set Weatherstrip	190		
1	Stop	407-1/2B26D		
1	Door Bottom Sweep	102AV		AL

SET #4

Single Door Laboratory - Interior

Each to have:

1-1/2	Pr. Butts	BB1279	4-1/2 x 4-1/2	26D
1	Lockset	A53PD	PLY	26D
1	Closer	1460		AL
1	Stop	407-1/2B26D		
1	Kickplate	8 x 34 x 16		US28
1	Threshold	525 - 36" Zero Type (1/2" or less in height)		AL

SET #5

Sgl. Toilet Room Door

Each to have:

1-1/2	Pr. Butts	BB1279	4-1/2 x 4-1/2	US26D
1	Privacy Lockset			US28
1	Kickplate	8 x 34 x 16		US28
1	Closer	1460		AL
1	Stop	407-1/2B26D		
1	Name Sign	Restroom		

SET #6

Pair Exterior Doors - Work Room

3	Pr. Butts	BB1191 NRP	4-1/ x 4-1/2	26D
1	Lockset	A53PD PLY		26D
1	Door Lockset	Blank Knob		26D
2	Door Closer	4114 CUSH		AL
2	Threshold	525 - 36" zero type (1/2" or less in height)		AL
2	Set Weatherstrip	190		AL
2	Door Bottom Sweep	102AV		AL
2	Flush Bolts	458-12		US26D

NOTE: Sgl. Doors to have 3 door silencers.

Pairs of doors to have 2 door silencers.

SECTION 08800

GLASS AND GLAZING

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install glass in windows and doors as indicated on the drawings and so specified herein.

1.02 Related Work Elsewhere:

- A. Section 06100 - Carpentry
- B. Section 08110 - Hollow Metal Frames
- C. Section 08120 - Hollow Metal Doors

1.03 Quality Assurance:

- A. Manufacturers: L.O.F.; PPG; American Sait Gobain, or equal.

PART 2 - PRODUCTS

2.01 Materials:

- A. Safety Glass - 1/4" thick laminated at entry units
- B. Plate Glass - 1/4" thick clear
- C. Glazing Accessories - shims, spacers, setting blocks shall be neoprene
- D. Blocks 40-50 durometer, 1/2" deep, 1/2" wide, 3/4" length.
- E. Glazing Compound - Federal Specification TT-P-781A Type 1 color to match adjoining surface
- F. Tape sealant, synthetic butyl rubber based tape, reinforced with nylon fiber.

PART 3 - EXECUTION

3.01 Installation:

- A. Clean all metal sash of foreign material.
- B. Install glass with experienced glazer in accordance with Flat Glass Jobbers Association Glazing Manual.

C. Glass for Exterior Surfaces:

1. Exterior Doors: 1" insulated safety glass. Interior light 1/4" clear plate; exterior light 1/4" clear safety glass.
2. Exterior Windows: Windows are to be a size as shown on drawings and to be supplied as primed pre-assembled units with both sash of each unit being operable. Acceptable manufacturers to be "Andersen", "Kolbe and Kolbe", "Marvin" or equal. Installation to be as recommended by specific manufacture.

3.02 Completion of Work:

- A. At completion of this work, inspect glazing work and replace all broken, chipped, scratched, improperly set, cracked glass. Repair all defects in workmanship.
- B. After inspection and approval, thoroughly clean all glass exposed to view. Remove all labels.

SECTION 09250

GYPSUM DRYWALL

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary for the installation of gypsum drywall and appurtenances in conformity with the drawings and as specified herein.

1.02 Related Work Specified Elsewhere:

- A. Section 09900 - Painting

1.03 Manufacturers:

- A. Gypsum Board: U.S. Gypsum; National Gypsum - Gold Bond; Georgia Pacific; or equal.

1.04 Environmental Conditions:

- A. Temperature: Maintain temperature uniformly within the range of 55° to 70°F. for 24 hours before, during and after wall application and joint finishing.
- B. Ventilation: Provide adequate ventilation to eliminate moisture and build-up.

1.05 Product Delivery, Storage and Handling:

A. Delivery and Handling:

1. Deliver materials to the product site with manufacturer's labels intact and legible.
2. Provide materials for use on project free from damage.
3. Delay material delivery until project is ready for installation.

B. Storage:

1. Store materials inside under cover and stacked flat on clean floor.
2. Do not stack wallboard so that long lengths are over short lengths.

3. Distribute material storage areas to provide working area for other trades.
4. Store adhesives at approximately 70°F. for 24 hours before using.

PART 2 - PRODUCTS

2.01 Materials:

- A. All gypsum board rated 1 hour fire code.
 1. Fire shield wallboard 5/8" thick tapered edges
 2. MR Board (fire shield) 5/8" thick tapered edges
- B. Fasteners:
 1. Bugle head screws Type S
 2. Self drilling - self tapping screws
- C. Joint Treatment:
 1. ASTM C 475
 2. Joint tape perforated
 3. Joint compound - ready mixed

2.02 Drywall Panel Components:

- A. Materials:
 1. Regular gypsum wallboard shall be 5/8" thick. Long edges shall be tapered Sta-Smooth.
 2. 5/8" fire-shield, long edges shall tapered Sta-Smooth. Wallboard shall be delivered to job bearing identification as to the correct design number.
 3. Gypsum sheathing - 5/8" thick.
- B. Fasteners: Type "S" bugle wall and ceiling.
- C. Joint Treatment Materials:
 1. Joint tape
 2. Joint compound shall be ready-mixed
 3. Lite ready-mixed
 4. Fast-hardening joint compound shall be Sta-Smooth.
 5. Topping compound shall be ready-mixed
- D. Adhesives:
 1. Board-to-Board: Sta-Smooth joint compound joint compound.

E. Accessories:

1. Corner beads shall be galvanized steel 1-1/8" x 1-1/8"
2. Casing beads and trim shall be galvanized steel
3. E-Z strip expansion joint centerline of room
4. Acoustical sealant, Tremco or equal

PART 3 - EXECUTION

3.01 Preparation for Work:

- A. Examine and inspect materials to which gypsum board is to be applied. Remedy all defects prior to installation of drywall. Any defects in the finished installation due to misaligned framing or other cause will be the responsibility of the work performed under that section of the specifications and such defects shall be remedied under that section of the specification.
- B. During cold weather maintain a room temperature of not less than 40°F during application of gypsum wallboard. For laminating, joint treatment, texturing and decoration the room temperatures, during cold weather, should be maintained between 50° and 70°F for 48 hours before application and continuously thereafter until completely dry. Provide adequate ventilation.

3.02 Inspection:

- A. Check framing for accurate spacing and alignment.
- B. Verify that spacing of installed framing does not exceed maximum allowable for thickness of gypsum wallboard to be used.
- C. Do not proceed with installation of wallboard until deficiencies are corrected and surfaces to receive wallboard are acceptable.

3.03 General Wallboard Application:

- A. **Cutting Wallboard:** Gypsum wallboards shall be cut by scoring and breaking, or by sawing, working from the face side. Where board meets projecting surfaces, it shall be scribed neatly.
- B. Use wallboard of maximum practical lengths to minimize end joints.
- C. Use single panel to span entire length or width or surface where possible.
- D. Stagger end joints.

3.04 Application:

A. Attachment:

1. Minimum edge clearance for mechanical fasteners: 3/8".
2. Position mechanical fasteners opposite each other on adjacent ends or edges.
3. Attach single layer wallboard to wood framing with Type S screw:
 - a. Center abutting ends or edges over support surface.
 - b. Space screws 12" on center along supports in ceilings of single layer.
 - c. Attach starting from center of wallboard and proceed toward outer ends and edges.
 - d. Set screws perpendicular to wallboard surface.
 - e. Drive screws with positive clutch electric screw driver.
 - f. Do not fracture wallboard face paper.
 - g. Provide floating angle by fastening only overlapping edge of base layers at inside corners.

3.05 Joint System:

A. Prefill:

1. Fill "V" joint flush.
2. Remove excess compound beyond the "V" groove.
3. Leave clear depression to receive tape.
4. Permit pre-fill compound to harden prior to application of tape.

B. Taping and finishing joints:

1. Taping or embedding joints:
 - a. Apply compound in thin uniform layer to all joints and angles to be reinforced.
 - b. Apply reinforcing tape immediately, centered tape over joint.
 - c. Seat tape into compound.
 - d. Leave approximately 1/64" to 1/32" under tape to provide proper bond.
 - e. Apply skim coat immediately following tape embedment but not to function as fill or second coat.
 - f. Fold tape and embed in angles to provide true angle.
 - g. Dry embedding coat prior to application of fill coat.

2. Filling:

- a. Apply joint compound over embedding coat.
- b. Fill taper flush with surface.
- c. Apply fill coat to cover tape.
- d. Feather out fill coat beyond tape.
- e. Do not apply fill coat on interior angles.
- f. Dry fill coat prior to application on finish coat.

3. Finishing:

- a. Spread joint compound evenly over and beyond fill coat on all joints.
- b. Feather to smooth uniform finish.
- c. Over tapered edges, do not protrude finished joint beyond plane of surface.
- d. Apply finish coat of taped angles to cover tape and taping compound.
- e. Sand final application of compound to provide surface ready for decoration.

C. Filling and finishing depressions:

1. Apply joint compound as first coat to fastener depressions.
2. Apply at least 2 additional coats of compound.
3. Leave filled and finished depressions level with plane or surface.

D. Finishing beads and trim:

1. First fill coat:

- a. Apply joint compound to bead and trim.
- b. Feather out from ground to plane of the surface.
- c. Dry compound prior to application of second fill coat.

2. Second fill coat:

- a. Apply joint compound in same manner as first fill coat.
- b. Extend beyond first coat onto face of wallboard.
- c. Dry compound prior to application of finish coat.

3. Finish coat:

- a. Apply joint compound to bead and trim.
- b. Extend beyond second fill coat.
- c. Feather finish coat from ground to plane of surface.
- d. Sand finish coat to provide flat surface ready for decoration.

3.06 Ceiling:

A. Back block ends and edges of wallboard.

3.07 Cleaning:

A. Restore to original condition, or replace, work or materials of other trades damaged or permanently stained during erection of drywall systems.

SECTION 09501

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install acoustical ceilings and appurtenances required to complete work shown on the drawings or as herein specified.
- B. Acoustical ceiling shall include acoustical tiles, suspension system, and appurtenances.
- C. Lighting fixtures shall be as specified in Section 16510 and air diffusers and grilles as specified in Section 15870 and shall be coordinated with the ceiling system for compatibility of design and appearance.

1.02 Quality Assurance:

- A. Standards:
 - 1. Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.
- B. All items shall be fabricated, delivered, stored, and installed in accordance with the Acoustical Materials Association Standards.

1.03 Definitions:

- A. ASTM - American Society for Testing and Materials
- B. U.L. - Underwriter's Laboratory

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Manufacturer's Certificate of Compliance certifying compliance with the applicable specifications and standards.
 - 2. Certified copies of test reports of factory tests required by the applicable standards as specified in this section.
 - 3. Shop drawings with physical characteristics.
 - 4. Samples of acoustic ceiling panels and components of suspension system.

1.05 Product Delivery, Storage and Handling:

- A. The Contractor shall be responsible for the delivery, storage, and handling of products.
- B. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.01 Acoustical Ceilings:

- A. Furnish acoustical ceilings as specified in this section and as shown on the drawings.
- B. Wood Fiber Tiles:
 - 1. Wood fiber tiles shall be high impact non-combustible tile, fabricated with inorganic binders, and resistant to fungus, dry rot, and termites.
 - 2. Tiles shall comply with Federal Specification SS-S-118A, Class 25, Type 1X. Material shall bear the U.L. label and meet fire hazard classification criteria based on ASTM-E-84 tunnel test procedure for a flame spread rating of less than 25 and a smoke development rating of less than 50.
 - 3. Material shall have a noise reduction coefficient of .40 to .50 on number 7 mountings.
- C. Mineral Fiber Tiles:
 - 1. Mineral fiber tiles shall be bonded by organic and inorganic materials, molded or cast to produce a textured appearance. Colors, where specified, shall integral throughout the tile.
 - 2. Tiles shall comply with Federal Specification SS-S-118A, Class 25. Material shall bear the U.L. label and meet fire hazard classification criteria based on ASTM E-84 tunnel test procedure for a flame spread rating of less than 25 and a smoke development rating of less than 50.
 - 3. Material shall have a noise reduction coefficient of .50 to .60 and a sound attenuation range of .35 to .39 on number 7 mounting.
- D. Suspension System:
 - 1. Suspension system shall be an exposed "tee" grid. Components shall be formed from commercial quality cold rolled steel, zinc coated, and pre-painted. The system shall support the ceiling assembly with a maximum deflection of 1/360 of the span.
 - 2. Main tees shall be of double web design and with a bulb, with exposed flange with a rolled cap and cross tee holes at 6-inch o.c., hanger wire holes at 2-inch o.c., and integral reversible splice.

3. Cross tees shall be of double web design and with a bulb, with web extending to form a positive interlock between cross tee webs. The bottom flange shall be extended and offset.
4. Wall moldings shall have a channel or angle shape securely fastened to walls and columns, and with a 1-inch exposed face.
5. Hangers shall be 10 gauge galvanized hanger wire.
6. Tie wire shall be 16 gauge galvanized.
7. Furring members, where required, shall be 1-1/2" cold rolled steel channels.
8. Hold down clips, where required, shall be manufacturer's standard clips.

PART 3 - EXECUTION

3.01 Preparation of Work:

- A. Building shall be properly enclosed and the structure in proper condition to receive acoustical materials and suspension systems. Conditions outlined in the current bulletin of the Acoustical Materials Association shall apply. Area shall be broom cleaned and uninterrupted for free movement of rolling scaffold.

3.02 Installation:

- A. Install the acoustical ceiling in accordance with the drawings and manufacturer's written instructions.
- B. Hangers shall be installed from structure and hanger wrapped three turns around downstanding leg.
- C. Main runner joints shall be connected with appropriate splicers.
- D. Hanger wires shall be installed at 48-inch centers and at all four corners of light fixtures and other concentrated loads.
- E. Install main runner tees at 48-inch or 24-inch on center as shown. Install cross tees and end angles as required. Lay out in rectangular pattern, parallel to building walls, and suitably fitted to building dimensions. Refer to reflected ceiling drawings and mechanical and electrical drawings for ceiling layouts and details.
- F. Carefully fit ceiling material in suspension system and rest on flange of inverted tees or wall angles. Complete system shall include tight grid joints, straight, true with all faces in same plane, with all boards neatly fitted in place.
- G. Where required, hold ceiling panels in place with required clip.

3.03 Cleaning:

- A. Following installation, clean soiled or discolored surfaces of units.
- B. Remove and replace units which are damaged or improperly installed.

3.04 Protection:

- A. Protect installed ceiling against damage during subsequent construction activities.

ACOUSTICAL CEILING DATA SHEET

1. Acoustical Tiles:

- a. Size: 24" x 48"
- b. Thickness: 5/8"
- c. Style: Fissured
- d. Manufacturer: Tonico, Tectum Inc., Armstrong, or equal

2. Suspension System:

- a. Grid Spacing: 24" x 48"
- b. Hold Down Clips: Not required
- c. Manufacturer: 250 Snap-Grid System, Chicago Metallic Corp., or equal

SECTION 09660

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary for the installation of tile within confines of walls, under cabinets and built-in equipment which occur within such confines.

1.02 Submittals:

- A. Submit complete set of color samples of tile, edge strips and feature strips to the Owner for selection. Once colors have been selected, submit two samples of each selected color showing extreme range of color and pattern variation.

1.03 Extra Stock:

- A. Provide a minimum of one full box of tile of each tile color selected for Owner's maintenance use.

1.04 Environmental Conditions:

- A. Store tile materials for a period of at least 24 hours in area the ambient temperature of which is at least 70°F., but not more than 90°F. During installation and at least 48 hours thereafter, maintain same temperature with areas of installation.

PART 2 - PRODUCTS

2.01 Materials:

- A. Standard of Manufacture: Resilient tile materials and accessories shall be as manufactured by Armstrong Cork Co., Floor Division, or equal.
- B. Resilient Tile: Armstrong "Imperial Modern" Excelon: 12" x 12" x 3/32" thick, marbleized full thickness, factory waxed; conforming to Fed. Spec. SS-T-312, Type IV, colors as selected by Owner.
- C. Edge Strips: 1/8" thick x 1" or 1-1/2" wide vinyl asbestos, lengths as required, factory-waxed, conforming to Fed. Spec. SS-T-312, Type IV; one long edge square and other long edge beveled; colors to match adjacent tile.

- D. Adhesive: as recommended by tile manufacturer, highly resistant to frequent washing and scrubbing.
- E. Base: 4" high base coved - minimum 48" lengths. Color as selected from standards.
- F. A maximum of two colors may be selected.

PART 3 - EXECUTION

3.01 Conditions of Surfaces:

- A. Adjacent Work: Walls, subfloors, ceilings and other similar work occurring within areas to receive tile shall be completely installed and finished before tile work is started, unless specifically directed to be otherwise.
- B. Subfloors: inspect subfloors to receive tile to ascertain that such subfloors have been installed in manners that will not detrimentally affect tile work. Commencement of tile work shall mean acceptance of subfloor conditions.

3.02 Preparation:

- A. Floors: Neatly patch, fill or otherwise repair cracks, trowel marks, irregularities and other conditions in floors that may reflect through tile installation. Use approved patching materials. Apply patching materials so that they too, will not reflect through tile installation and so that they will properly bond with the floors.

3.03 Installation:

- A. Layout: layout work symmetrically from center point of areas so that border tiles will be not less than half original width.
- B. Adhesive: apply to floors, tiles or both as recommended or required by manufacturer, in sufficient thickness to assure proper and secure bond to floors. Do not exceed maximum working area recommended by manufacturer. Remove filmed-over or dried adhesive and recoat.
- C. Tile: Lay tiles, in standard square pattern. Keep longitudinal and lateral joints even and "hairline" tight with tiles making full contact along edges. Lay tiles one direction of face pattern. Cut, fit and scribe tiles to walls, door frames and other similar work and fit tiles neatly into breaks and recesses around drains, pipe openings and similar items protruding through floors. Fit border tiles tight to vertical surfaces so that base toe cannot be pushed behind such tiles. Intermix tiles from different cartons to minimize shade and pattern variation within an area.

- D. Edge Strips: install continuously across termination of tile at exposed concrete floors. Where termination occurs at door opening, install so that strip will be concealed when door is closed.

3.04 Completion of Work:

- A. Cleaning: After tile work has been completed and defects in materials and workmanship have been corrected, clean materials free from excess adhesive, dirt, grease, oil and other foreign matter. Remove excess adhesive from adjacent surfaces.

SECTION 09800

SPECIAL COATINGS

PART 1 - GENERAL

1.01 Description:

- A. Scope: Furnish and apply coatings and do related work necessary to complete work shown or specified.
- B. Codes, Specifications and Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise shown or specified.
- C. Definitions:
 - 1. Abbreviations: OSHA - Occupational Safety & Health Administration; SSPC - Steel Structures Painting Council
 - 2. Coating: The term coating includes emulsions, enamels, paints, stains, varnishes, sealers, emulsion filler, and other coating materials whether used as prime, intermediate, or finish coats.
 - 3. Spatter: Drops and droplets of coating and spilled or splashed coatings on surfaces not specified to be coated or surfaces previously finish coated.

1.02 Quality Assurance:

- A. Minimum requirements for materials are included in this Section. These requirements are intended to establish standards of quality. Products of manufacturers which meet all minimum requirements as herein established shall be acceptable. Written acceptance of the materials to be used shall be obtained prior to surface preparation or application.
- B. No request for substitution will be considered which decreases the film thickness designated, or which offers a change from the generic type of coating specified. Requests for substitution shall contain the full name of each product, descriptive literature, directions for use, generic type, nonvolatile content by volume.
- C. All materials shall be brought to the job site in the original sealed and labeled containers of the manufacturer and shall be subject to inspection by the resident representative of the job.

- D. All materials shall be the product of or recommended by the coating manufacturer.
- E. All materials shall be compatible with the service intended. No products shall be used that may have ingredients which might react detrimentally with adjacent fluids or gases.

1.03 Submittals:

- A. Submittals shall be as specified in the General Conditions.
- B. Submit the following:
 - 1. Shop drawings with performance data and physical characteristics.
 - 2. Color charts.
 - 3. List of surfaces indicating coating system and colors.
 - 4. Manufacturer's Certificate specified in Article 3.06.
 - 5. Manufacturer's application instructions.

1.04 Product Delivery, Storage and Handling:

- A. The Contractor shall be responsible for the delivery, storage and handling of products.
- B. Promptly remove damaged or deteriorated products from the job site. Replace damaged products with undamaged and undeteriorated products.

1.05 Job Conditions:

- A. Environmental Requirements:
 - 1. Perform coating work in strict conformance with manufacturer's printed recommendations as to environmental conditions under which coating and coating systems can be applied.
 - 2. Do not apply finish in areas where dust is being generated.
 - 3. During the course of the coating work, adequately ventilate the coated spaces to ensure there will be no concentration of noxious odors, hazardous fumes, or flammable vapors.
 - 4. Do not apply coatings in damp weather or when the temperature is below 50°F or above 95°F.
- B. Protection:
 - 1. Protect all finish work of other trades and surfaces not being coated. Furnish suitable coverings as required. Remove coating spatter from all finished surfaces and restore finishes of affected items to their original conditions at no additional cost to the Owner.

2. Post "Wet Paint" notices, as required, to protect newly coated surfaces.
 3. Keep oily rags and waste in Underwriters' Laboratories labeled metal containers. Do not allow oily rags and waste to accumulate in buildings.
- C. Job Site Conference: The Contractor shall arrange and conduct a job site conference between the coating manufacturer's representative, the Engineer's representative, and the personnel assigned this work prior to any field surface preparation or coating application.

PART 2 - PRODUCTS

2.01 Manufacturers:

- A. Except as otherwise specified, materials shall be the products of the following manufacturers or equal: Tnemec Company, Inc.; Porter Paint Company.
- B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer, unless otherwise acceptable to the Engineer.

2.02 Materials:

- A. All field applied primers and undercoats shall be provided to ensure compatibility of total coating systems and of the same manufacturer as the finish coats for each system as specified hereafter. Provide barrier coats over incompatible primers or remove and reprime as required. No thinner or solvents other than those approved by the Coating Manufacturer shall be used.
- B. All materials shall herein be assigned a designation number for ease of reference. The minimum material requirements shall be as listed.

Designation	Generic Composition	No. of Coats	Dry Mil Thickness		Manufacturer's Name
			Per Coat		
Primer P-1	Titanium-Pigmented Alcohol-Soluble Resin	2	2.0-3.0		Tnemec 707 Tar Bar Porter #64 Primer Sealer
		2	1.0-2.0		
Primer P-2	Universal Primer (Special Resin)	1	2.5-3.5		Tnemec #77 Chem-Primer Porter #284 U-Prime
		1	2.5-3.5		
Primer P-3	Polyamide Cured Epoxy	1	3.0-4.0		Tnemec 66-1211 Porter #43
		1	3.0-4.0		
Primer P-4	High Build Epoxy Primer	*	*		Tnemec Series 83 Porter #895 Unifill
		*	*		
Primer P-5	Synthetic Resin or Modified Polyester	*	*		Tnemec #561 Masonry Surface Filler Porter #895 Unifill
		*	*		
Primer P-6	PVA Sealer	1	1.5-2.5		Tnemec 51-792 Porter 767
		1	1.5-2.5		
Primer P-7	Nonpenetrating Oil Based Primer	1	1.0-2.0		Tnemec 36-603 Porter #565 Primer
		1	1.0-2.0		
Finish F-1	Polyamide Epoxy	2 or 3	3.0-6.0		Tnemec 66 HB Porter 43 HB Gloss Epoxy
		2 or 3	3.0-6.0		
Finish F-2	Medium to Long Oil Alkyd Resin	2	1.5-2.5		Tnemec Series 2 Porter IA-24 Series
		2	1.5-2.5		
Finish F-3	High Build Epoxy	1	10.0-12.0		Tnemec Series 83 Porter Tile 8
		2	10.0-12.0		
Finish F-4	Modified Epoxy	1	-		Tnemec Series 52 Porter Series 4361/ 4351
		2	-		
Finish F-5	Medium to Long Oil Alkyd	2	1.5-2.5		Tnemec 23 Porter IA-24 Series
		2	1.5-2.5		
Finish F-6	Coal Tar Epoxy	2	8.0-10.0		Tnemec 413 Tnemec Tar Porter Tar Set C-200
		2	8.0-10.0		

* Masonry porosity shall be completely filled to seal all surface voids (possibly a minimum of two coats).

2.03 Coating Systems:

A. Surfaces shall be coated with the following systems:

<u>Type of Surface</u>	<u>Prime Coats</u>	<u>Finish Coats</u>	<u>Minimum Number of Coats</u>	<u>Min. Total Finished Dry Mil Thickness (Note 1)</u>
Exposed Pipe with Bituminous Coating	-	F-1	2	6.0
Exposed Pipe without Bituminous Coating	P-2 & P-3 (Note 2)	F-1	3	8.0
Manhole Frames & Covers	P-2 & P-3 (Note 2)	F-1	4	10.5
Non-submerged Interior Metals & Machinery	P-2 & P-3 (Note 2)	F-1	3	8.0
Submerged Metals & Machinery (Note 3)	P-2 & P-3 (Note 2)	F-1	4	10.5
Non-submerged Exterior Metals & Machinery	P-2	F-2	3	5.0
Concrete Walls & Ceilings	-	F-1	2	8.0
Concrete Submerged Walls (Note 3)	-	F-1	3	10.0
Interior Masonry	P-4	F-3	3	20.0-23.0
Exterior Masonry	P-5	F-4	3	8.0-10.0 (Note 4)
Interior Walls (Drywall)	P-6	F-1	3	9.5
Wood	P-7	F-5	3	4.0

Notes:

1. The total finished dry mil thickness shall be in accordance with the manufacturer's coating system's requirements.
2. Use P-2 for shop primer and P-3 for field touch-up primer.
3. The term submerged applies to water and wastewater. Special consideration shall be given to applications where acids or other highly corrosive materials will be present.
4. Total dry film thickness of 8.0-10.0 mils excludes the primer.

2.04 Colors:

- A. Comply with OSHA requirements concerning color coding and safety marking.
- B. Color code exposed piping. Color code equipment associated with piping, unless otherwise shown or specified.
- C. Color coding shall be as follows, unless otherwise specified or directed by Engineer.

<u>Application</u>	<u>Color</u>	
	<u>Tnemec</u>	<u>Porter</u>
Dangerous Machine Parts & Energized Equipment	OSHA Safety Orange	OSHA Safety Orange
Traffic Operations & House-keeping Marking	OSHA White	OSHA White
Fire Protection Equipment & Flammable Materials	OSHA Safety Red	OSHA Safety Red
Radiation Hazards	OSHA Purple	OSHA Purple
Water Lines		
Raw	2033 Palm Green	5138X Deep Forest
Settled or Clarified	2038 Pool Green	5126P Classic Aqua
Finished or Potable	2042 Victorian Blue	5169R Strong Blue
Non-Potable	2041 Venice Blue w/ 2008 Safety Red Bands	5179T Windsor Blue w/Safety Red Bands
Wastewater Lines		
Wastewater	2053 No. 61 Gray	5026P Machinery Gray
Primary Sludge	2051 Charcoal	5024T Cavalier
Waste Activated Sludge	2006 Antique Brown	5070P Brown
Digested Sludge	2005 Suede Brown	5048P Deep Tan
Backwash Waste	2012 Tan Bark	5069P Bark
Chemical Lines		
Alum or Ferric Chloride	Safety Orange	Safety Orange
Ammonia	White	White
Carbon Slurry	2009 Black	5008 Jet Black
Chlorine (Gas & Solution)	Safety Yellow	Safety Yellow
Fluoride	2040 Powder Blue w/ Safety Red Bands	5182P Dawn Blue w/ Safety Red Bands
Lime Slurry	2034 April Green	5143P Clean Green
Potassium Permanganate	Violet	Violet
Sulfur Dioxide	2031 Pale Lime w/ Safety Yellow Bands	5135P Light Willow w/Safety Yellow Bands

<u>Application</u>	<u>Color</u>	
	<u>Tnemec</u>	<u>Porter</u>
Gas Lines		
Aeration Air	2035 Fern Green	5149R Specialty Green
Compressed Air	Safety Green	Safety Green
Natural Gas, Digester Gas, or LPG	Safety Red	Safety Red
Petroleum Lines		
Fuel Oil	Safety Red	Safety Red
Steam Lines	Aluminum	Aluminum

- D. Surfaces to be coated which are not listed in the color coding schedule shall have colors selected by the Engineer.

2.05 Mixing and Tinting:

- A. Coatings, except two part epoxies, shall be delivered to the job site premixed.
- B. Job tinting will not be acceptable, except as approved by the Engineer.
- C. All mixing shall be done in mixing pails placed in suitable sized non-ferrous or oxide resistant metal pans.

PART 3 - EXECUTION

3.01 Inspection:

- A. Inspect all surfaces on which paint is to be applied and notify the Engineer of any defects considered detrimental to the application of materials specified.
- B. If any dirty, rusty, scaly, greasy, damp, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film are painted over, both the removal of paint and repainting the affected area shall be done by the Contractor without additional cost to the Owner.
- C. Provide all scaffolding, staging, and other temporary facilities required for the proper execution of the work. Scaffolding shall be placed so as not to interfere with the work of others. Should it be necessary for the progress of the work on the building in general, the Contractor shall, if so directed and without extra

cost to the Owner, move, relocate, or arrange his scaffolds, ladders, or coverings to permit the Engineer or other crafts to proceed with their work without delay.

3.02 Surface Preparation:

A. General:

1. All surfaces to be coated shall be prepared in a workmanlike manner with the objective of obtaining a clean and dry surface. No coating shall be applied before the prepared surfaces are approved by the Engineer.
2. All preparation and cleaning procedures shall be in strict accordance with the coating manufacturer's printed instructions and as specified in this Section for each particular substrate condition.
3. Remove or otherwise protect hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be painted prior to surface preparation and painting operations. Remove items, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space, reinstall removed items. Such removal and reinstalling shall be done by workmen skilled in the trades involved.
4. Clean surfaces to be coated before applying coating or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Cleaning solvents shall be low toxicity and shall have a flash point in excess of 115°F. Program cleaning and painting so dust and other contaminants from the cleaning process do not fall in wet, newly coated surfaces.

B. Metals:

1. All ferrous metal to be primed in the shop shall have all rust, dust, and scale, as well as all other foreign substances, removed by sandblasting in accordance with SSPC No. 10. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting. Abraded or corroded spots on shop coated surfaces shall be wire brushed and touched up with primer specified in this Section.
2. Store shop coated ferrous surfaces out of contact with the ground in such manner and location as will minimize the formation of water-holding pockets, soiling, contamination, and deterioration of the coating film.

3. All ferrous metals not primed in the shop shall be sand-blasted in the field to SSPC No. 10 prior to application of the primer pretreatment.
4. All non-ferrous metals and galvanized surfaces, whether to be shop or field primed, shall be solvent cleaned prior to the application of a vinyl-phosphoric wash and/or primer.
5. Any piping scheduled for a coating which is supplied with a bituminous coating shall receive two coats of titanium pigmented alcohol-soluble resin before applying primer and colored finished coat.

C. Concrete and Masonry:

1. Surfaces to be coated shall be prepared by removing efflorescence, chalk, dust, dirt, grease, oil, asphalt, tar, excessive mortar and mortar droppings, and by roughing to remove glaze. Surface deposits of free iron shall be removed prior to painting. Fill holes and imperfections in finish surfaces with cement mortar. Do not coat over surfaces where the moisture content exceeds that permitted in the coating manufacturer's written instructions.
2. Where concrete cannot be roughened by rubbing, concrete shall be roughened by sandblasting.

D. Wood:

1. Wood surfaces to be coated shall be cleaned of all dirt, oil, and other foreign substances with mineral spirits, scrapers, and sandpapers as required. Finished surfaces exposed to view shall be made smooth by sandpapering and free of dust. Scrape and clean small, dry, seasoned knots and these shall be given a thin coat of knot sealer before application of priming coat. Fill holes and imperfections in finish surfaces with putty or plastic wood filler, colored to match the finish coat, if natural finish is required, allow to dry, and sandpaper smooth. Coating shall proceed only when the moisture content of the wood does not exceed 12%.

3.03 Application:

A. Coating Thickness:

1. Each coat of material shall be applied at the rate specified by the manufacturer to achieve the minimum dry mil thickness required. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of unthinned material as originally furnished by

the manufacturer must not cover a greater square foot area when applied by spray gun than when applied unthinned by brush.

2. Deficiencies in film thickness shall be corrected by the application of an additional coat(s) of material.

B. Application to Masonry:

1. Application rates will vary on masonry according to surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded.
2. It shall be the Contractor's responsibility to achieve a protective and decorative finish on porous surfaces either by decreasing the coverage rate or by applying additional coats of material.

C. Drying Time:

1. Drying time shall be construed to mean "under normal conditions". Where conditions are other than normal because of the weather or because coating must be done in confined spaces, longer drying times will be necessary. Additional coats of material shall not be applied, nor shall units be returned to service until coatings are thoroughly dry.

3.04 Protective Coating of Non-Ferrous Metals:

- A. Where non-ferrous metals such as aluminum, copper, and galvanized metal comes in contact with concrete or dissimilar metals, a protective coating must be applied. In all cases except on galvanized metal, an alkyd zinc chromate primer should be applied, if the exposure is in a normal environment. If the exposure is semi to severe, then an unmodified epoxy chromate primer should be used. In the case of galvanize, a modified zinc dust galvanize primer should be used in a normal exposure environment. If the environment is semi to severe, an unmodified epoxy chromate primer should be used.
- B. A vinyl gasket may be used in lieu of the protective coating.
- C. The bottom of aluminum railing posts and aluminum clip angles shall be coated with an aluminum impregnated caulking compound (Alumilastic, or equal) prior to erection.
- D. After erection and alignment, opening between non-ferrous metal surfaces and the concrete shall be sealed in a watertight manner with the proper caulking compound, relative to and in accordance with the opening width demand.

3.05 Cleaning:

- A. Touch-up coatings and restore finish where damaged or defaced by construction activities.
- B. Remove coating spatter from all finished surfaces and restore affected finishes.
- C. Remove excess materials, scaffolding, staging, drop cloths, equipment, and rubbish from the job site.

3.06 Certification:

- A. The Contractor shall submit to the Engineer, immediately upon completion of the job, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to properly coat all surfaces.

SECTION 09900

PAINTING AND FINISHING

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to prepare and paint or finish surfaces as hereinafter described, including but not limited to the following:
 - 1. Exposed surfaces that require finishing and are not specifically indicated to be factory finished or finished by others.
 - 2. Provide all temporary lighting, in addition to temporary lighting as may be required to properly illuminate areas in which painting and finishing work is being performed; such lighting shall meet all applicable requirements for temporary electricity.

1.02 Work Not Included:

- A. Contractor shall not prime materials and equipment specified to be furnished with shop or factory applied prime coats. Do not paint of finish materials and equipment specified to be furnished completely shop or factory finished, including grilles, registers, etc. by the Mechanical Contractor. Do not paint mechanical and electrical work where such equipment occurs within unfinished areas.

1.03 Submittals:

- A. Product Schedule: Manufacturer of paint products shall prepare and submit to Owner for approval, a comprehensive typewritten schedule showing all products to be utilized on the project, including surface to be finished, type of finish, product name and the recommended number of coats and application technique.
- B. Manufacturer's Literature: Include with product schedule manufacturer's standard literature and specifications.
- C. Color Samples: Submit complete set of color samples for each product to be used on the project to the Engineer for selection and in order that a finish schedule showing color selections and locations may be prepared.

1.04 Environmental Conditions:

- A. Areas in which finishing work is being performed shall be free from dust, dirt and debris. Do not paint or finish in damp, rainy weather or when ambient temperature is below 50°F. Also adhere to other manufacturer's recommendations in regard to environmental conditions, except as expressly directed to the contrary by Engineer.

1.05 Product Handling:

- A. Delivery: Deliver all paints, stains, varnishes and other related materials to the project site in sealed containers. Each container shall bear manufacturer's label stating manufacturer's name, type of materials contained therein, analysis showing all of materials important constituents (such as alkyd, titanium, zinc, acrylate esters), color of material and instructions for thinning and application.
- B. Storage: Store all paints, stains, varnishes and other related materials in strict conformance to applicable requirements for material storage.

1.06 Protection of Adjacent Surface:

- A. Provide dropcloths, tarps, covers or other suitable protective devices so that painting and finishing work will not damage adjacent work. Adjacent surfaces onto which paint or finish materials have been spilled, dripped, smeared or otherwise contacted shall be cleaned, refinished, repaired, or replaced to satisfaction of the Owner by trade whose work has been damaged; cost of such cleaning, refinishing, repairing or replacing shall be borne by person or organization responsible for work under this section.

1.07 Coordination:

- A. This work shall be scheduled and coordinated with other trades and shall not proceed until other work or job conditions, or both, are as required to achieve satisfactory results.
- B. Contractor shall examine the requirements of other sections for various other trades and shall thoroughly familiarize himself with all their provisions regarding painting. All surfaces that are left unfinished under other sections shall be painted or finished as part of the work covered by this section except as specifically indicated, or directed by the Engineer to the contrary.
- C. Should provisions of other sections conflict with or be detrimental to the requirements of this section, notify Owner and do not proceed in areas in question until so instructed by the Engineer.

PART 2 - PRODUCTS

2.01 Materials:

- A. Paint and finish materials shall be types and qualities specified hereinafter. Basic finishing materials such as turpentine or spirits, thinners, driers, putties and fillers shall be of the highest quality and shall be subject to approval of the Engineer. Primers shall be by same manufacturer as paint used for final coat and shall be type recommended by that manufacturer for particular application.

2.02 Guide to Products:

- A. Substitutions for Proprietary Names: The following is a list of manufacturers for use on this project. Such list shall serve as a guide to quality and shall not be construed as a basis for limiting competition. Manufacturers and products other than those listed may be substituted providing that such substitutions conform to all applicable requirements of specifications and are approved in writing by Owner. Manufacturers are listed hereinafter in alphabetical order; such order shall infer no connotation of preference.
- B. Manufacturers: Devoe; Glidden; Pittsburgh; Sherwin-Williams; Porter; Pratt & Lambert; or equal.
- C. Products: Specific finishing products used shall be only as approved by the Engineer on schedule of materials and coats as set out hereinafter.

PART 3 - EXECUTION

3.01 Conditions of Surfaces:

- A. Surfaces to be painted or finished shall be clean, thoroughly dry and smooth and shall be ready for finishing, except for final sanding and surface preparation. Commencement of painting and finishing work shall mean acceptance of such substrates and subsequent correction due to improper substrates shall be responsibility of person or organization responsible for work under this section. Remove grease, oil, dirt, assembly identification marks, mud, rust and scale as necessary to prepare a surface to receive paint or finish.

3.02 Preparation:

- A. Wood: Manually sand smooth and dust clean. Clean and fill all knots, pitch pockets and snappy portions in wood to be finished and if to be painted, prime with white shellac. Fill nail holes, screw holes, cracks, checks and other surface imperfections with putty tinted to match color of final finish. Sand surfaces between coats and dust clean.

- B. Steel and Iron: Remove grease, oil, dirt, assembly identification marks, rust and scale as necessary to prepare surfaces to receive paint by wire brushing and scraping as required, and by wiping with mineral spirits. Touch up chipped and abraded places in factory applied prime coats with same materials used for such prime coats.

3.03 Workmanship:

- A. Paint Coats: Apply paint in number of coats specified hereinafter and to wet film thicknesses recommended by paint product manufacturer, unless specifically noted to be otherwise. Number of coats specified are minimum requirements; apply additional coats as required to completely cover substrates and eliminate light spots, "show through" and like. Such paint product manufacturer shall furnish assistance in checking such wet film thicknesses (or dry film thicknesses as case may be) if so requested by the Engineer.
- B. Mixing, Tinting and Thinning: Perform project site mixing, tinting and thinning in strict accordance with paint manufacturer's instructions. All final coat materials shall be mechanically premixed or tinted at paint supplier's mixing area and shall be mixed by strict control of formula used to prepare sample previously submitted and approved by the Engineer. Such approved samples will be used to verify color after application at project site.
- C. Application: Apply each coat smoothly, evenly and of uniform color, free from runs, sags, brushmarks, clogging, excessive flooding, or deposits of pigments. Make edges where paint of finish abuts other surfaces sharp and clean without overlapping. Allow time, as recommended by each particular product manufacturer, for each to thoroughly dry before applying each subsequent coat. Tint prime coats and undercoats slightly different in shade and progressively approaching color of final coat; subsequent coats shall completely cover preceding coats. Consult appropriate trades to ascertain if mechanical or electrical items require special painting considerations. Remove all hinged doors, hardware, light fixtures and similar items before painting or finishing; reinstall such items after finishing is completed. Paint all surfaces of doors, including tops and bottoms. Do not paint or finish over Underwriters' Laboratories labels; do not remove such labels.

3.04 Schedule of Materials and Coats:

- A. Exterior Ferrous Metals:

1 coat metal primer
2 coats alkyd enamel

B. Drywall Painted:

1 coat latex wall primer
2 coats eggshell enamel

C. Drywall or Plaster to Receive Wall Fabric (if applicable):

1 coat flat oil base paint

D. Interior Ferrous Metal (Hollow Metal Frame, doors and pipe):

1 coat metal primer
2 coats semi-gloss enamel

E. Finish Carpentry (Painted):

1 coat enamel undercoat (including backpriming)
2 coats semi-gloss enamel

F. Exterior Finish Carpentry and Wood Trim:

1 coat of flat oil base undercoat primer
1 coat of flat oil base paint

G. Paint all new insulated ductwork and piping exposed in equipment rooms.

3.05 Completion of Work:

- A. Remove all spatters, residues, and other undesirable results of work under this section from adjacent surfaces and items. Neatly touch up scratched, marred, defective or otherwise damaged painting and finishing work to match that finish specified. Where such damages require complete refinishing of entire surface to produce quality of work specified, such work shall be performed at no extra cost to the Owner.

SECTION 10251

FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install fire extinguishers, wall brackets or cabinets, and related accessories as shown on the drawings and herein specified.

1.02 Quality Assurance:

A. Standards:

- 1. Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified. Fire extinguisher protection system shall be designed and installed in accordance with the following codes and standards.
 - a. Standards of National Board of Fire Underwriters, as recommended by NFPA.
 - b. Factory Mutual Insurance Company (FM)
 - c. Ohio Basic Building Code
 - d. Local Authorities

1.03 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
 - 2. Manufacturer's product data on all items supplied.
 - 3. Installation and maintenance instructions.

PART 2 - PRODUCTS

2.01 Fire Extinguishers and Cabinets:

- A. All material and equipment shall be furnished by established and reputable manufacturer. All materials and equipment shall be new, unused and of first class construction, designed and guaranteed to perform services required and shall be approved by and in accordance with: NFPA, UL, FM and Ohio Basic Building Code.

PART 3 - EXECUTION

3.01 Installation:

- A. Coordinate final locations and mounting heights with Owner's Representative.

SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install all Toilet Accessory Work indicated or noted on the Drawings and specified herein.

1.02 Submittals:

- A. Contractor is required to submit product data on all toilet accessories specified in this Section.

1.03 Manufacturers:

- A. American Dispenser Co.; Bobrick Washroom Equipment, Inc.; Bradley Corporation; Accessory Specialties, Inc.; or equal.

PART 2 - PRODUCTS

2.01 Materials:

- A. Stainless steel shall be Type 302 and 304 with satin finish, in gauge as specified or standard with the manufacturer for the item specified.
- B. Mirrors shall be 1/4" silvering quality twin polished tempered plate glass.
- C. Mounting kits for concealed mounting shall be complete and shall be furnished as required for the wall condition.
- D. Furnish tamper-proof screws for all accessories.

PART 3 - EXECUTION

3.01 Schedule:

- A. Model numbers listed are of the Bradley Corporation, Moorestown, New Jersey, unless otherwise noted.

1. Grab Bar: 30" x 1-1/2D"
2. Grab Bar: 42" x 1-1/2D"
3. Mirror with Shelf: 1/4" Tempered Glass 16" x 24" each lavatory #725
4. Toilet Tissue Dispenser: Each water closet #505
5. Paper Towel Dispenser Model #250-15
6. Soap Dispenser - each lavatory #6542

SECTION 11114

NON-POTABLE WATER SUPPLY

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install non-potable water supply equipment including piping, valves, fittings and screens for a complete system as shown on the drawing and as herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15060 - Piping and Valves
- C. Section 15061 - Piping Schedules
- D. Section 15130 - Gauges

1.03 Quality Assurance:

A. Standards:

- 1. Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.

B. Equipment:

- 1. Equipment shall be completed by firms specializing in types of equipment required.

1.04 Submittals:

- A. Shop Drawings: Furnish as one submittal, three (3) copies of shop drawings and installation instruction of complete non-potable water supply system.
- B. Operation and Maintenance Manuals: Supply Engineer with three (3) copies of operation and maintenance manual for non-potable water system equipment and associated appurtenances. Index manual as follows:
 - 1. Daily, weekly, monthly, annual, etc., preventive maintenance schedules.
 - 2. Complete operation instructions.

3. Emergency procedures.
4. Complete parts list.
5. Name of nearest authorized repair or service agent.
6. Trouble-shooting procedures.
7. Tips to operator for efficient operation.
8. List of precautions and safety procedures for maintenance, operation, and repair of equipment.

1.05 Storage and Handling:

- A. Transport, store and handle in manner to prevent damage. Warehouse equipment until required for incorporation into work. After installation, protect equipment from damage. Protect electrical and other similar components from weather and dust.

1.06 Guarantee:

- A. The manufacturer(s) of water system components shall guarantee for one (1) year from date of acceptance by Owner that all equipment shall be free from defects in design, materials and workmanship. Water system component manufacturer(s) shall furnish replacement parts for any component proven defective, whether of his or other manufacturer, during guarantee period, excepting only those items which are normally consumed in service, such as grease and oil.

PART 2 - PRODUCTS

2.01 General:

- A. Furnish and install each piece of equipment and related appurtenances in accordance with approved shop drawings, manufacturer's instruction, specifications and plans.

2.02 Pump:

A. Pump Description:

1. Pumped Fluid: Stabilized sewage plant effluent, 1/8-inch screened, temperature from 34 degrees to 80 degrees F., total dissolved solids of 1000 mg per, liter, ph of 6.0+, containing significant concentration of sulphur anions, primarily SO_3^- and SO_4^- .
2. Pump Performance:

<u>GPM</u>	<u>HEAD</u>	<u>EFF.</u>	<u>H.P.</u>
40	90	55	1.65
50	70	53	1.67
32	100	53	1.52

Non-overloading with 2 H.P. motor.

3. General Description: 1-1/4 x 1 x 5 centrifugal pump, close coupled, end suction, top centerline discharge.

B. Pump Construction:

1. Materials of Construction:

- a. Casing Cast Iron
- b. Impeller ASTM A48 - Class 30
Fiberglass Reinforced
Noryl (GFN-2)
- c. Pump Shaft 316 S.S.
ASTM A743 and A744

2. Mechanical Seal: Teepelite vs. Ceramic Surfaces, S.S. Spring, Brass Metal Parts, Buna Bellows (Crane 6 BT-2C1 or equal).
3. Bearings: Grease lubricated with minimum service life of 10,000 hours.
4. Supply with threaded inlet and outlet connections, casing drain, and ductile iron mounting bracket.

- C. Pump Motor: Standard NEMA C-face jet pump motor with 416 stainless steel shaft, non-overloading with service factor, 3500 RPM, 1 phase, 230V.

D. Pump Appurtenances:

1. Inlet Gauge: 3-inch face, 0 to minus 20 feet range for suction head, one required for each pump.
2. Discharge Gauge: 3-inch face, 0 to 50 psig range for positive discharge, one required for each pump.
3. Check Valves: "Silent" check style, flat body, Class 125 fabricated of high tensile cast-iron with bronze trim.
4. Isolation valves: Wafer-style butterfly valves rated for 150 lb. service fabricated of high tensile cast-iron, bronze trim, double o-ring packing, and ductile ni-resistant disk.

2.03 Captive Air Tank:

- A. Furnish and install 85 gallon captive air tank. Tank shall consist of 250 psi rated steel tank with manufacturer's standard paint system, inside and out. Water shall enter heavy vinyl plastic bag. Bag shall be suitably sized and of the thickness needed for the application intended. Tank shall be anchored to floor. If tank furnished does not provide adequate clearance for process piping, Contractor shall furnish concrete supports tied into the floor system to anchor the tank. A welded air stem shall be included to add or remove air.

2.04 Well Jet:

- A. Provide well jet piping from pump to water intake assembly. Provide fittings, connections and supports to deliver 20 gallons per minute against 25 foot vertical lift. Jet system shall include built-in check valve.

2.05 Controls:

- A. Control system by pressure in captive air tank.
- B. Pump Sequence:
 - 1. Pump On: 30 psig
 - 2. Pump Off: 50 psig
 - 3. Automatic Alternation
- C. Pressure sensing lines shall be 1/4" copper. Wiring and mechanical work shall conform to Division 15 and 16.

2.06 Inlet Screen:

- A. Screen Type: Continuous slot wire wound screen consisting of wire, reinforcing bars, and coupling adapter.
- B. Hydraulic Requirements: Entrance velocity not to exceed 6 feet per minute.
- C. Material:
 - 1. Bars: 304 L Stainless Steel
 - 2. Wire: 304 L Stainless Steel
 - 3. Coupling Adapter: 304 L Stainless Steel
- D. Fabrication: Wrap wound wire around reinforcing bar to form one-tenth (1/10) inch aperture. Use wire with cross-section increasing inward, decreasing effective aperture area. Weld reinforcing bar to coupling adapter and wire to reinforcing bar at intervals to provide rigid, structurally sound unit.

2.07 System Piping:

- A. Suction Piping: Piping system shall be ASTM D1785 Schedule 80 polyvinyl chloride, 200 psi pipe. PVC pipe may be threaded or unthreaded. PVC pipe shall not be exposed to direct sunlight at any time during shipping or storage. All piping shall be 4- and 2-inches diameter as indicated, except where connections are made to pumps, captive air tank, and plumbing supply connections and fixtures. Connections to pumps, well points, hydrants, and captive air system shall be ASTM A-53 galvanized steel pipe. Extend PVC piping to 3-feet beyond building foundation. Water system shall be pressure tested and leakage tested in accordance with AWWA C600. Test system at 100 psig.

B. Distribution Piping:

1. Piping Material: Polybutylene water service tubing conforming to AWWA C902, ASTM D2666, SDR 13.5, rated for 160 psi service, or pressure main piping.
2. Compression style fittings.
3. Saddles: Two piece construction with PVC service tap, one bolt assembly stainless steel band, stainless steel hardware, and resilient rubber gasket.

2.08 Hydrants - Post Type: Furnish and install post type hydrants sized to deliver 20 gallons per minute at 50 psig residual pressure. Hydrants shall have the following features:

- A. All hydrants shall have lever handle and shall be the self-closing and non-freeze type.
- B. All working parts shall be brass.
- C. Standpipe shall be galvanized steel provided for bury depth of 5 feet.
- D. All hydrants shall be provided with threaded outlet, drain tape, and tube.
- E. Hydrant shall self drain below frost line when shut off or not in use.
- F. Hydrant handle shall be provided with a locking device for padlock and key. Padlock and four (4) keys shall be provided with hydrant.
- G. Furnish sign 1-1/2' x 1-1/2' on post by all hydrants stating "NON-POTABLE WATER". Letters shall be red on white background.

2.09 Miscellaneous Appurtenances:

- A. Furnish 2 each heavy duty reel-about hose reel - capacity 350 feet of 5/8" hose; steel frame-painted; 4 each - 8-inch diameter wide track wheels; and 6-foot long faucet connector hose.
- B. Furnish 5 each - 50 foot heavy-duty reinforced rubber hoses - 3 layers synthetic fiber reinforcement; pressure rating of 180 psig; 3/4-inch inside diameter; and flexibility range from -35 degrees F. to 160 degrees F.
- C. Furnish 2 each - nozzles, stainless steel and brass construction adjustable from spray to high velocity jet; and capacity equals 20 gallons per minute.

PART 3 - EXECUTION

3.01 Excavation and Backfill:

- A. Excavation and backfill as specified in Division 2 of these specifications.

3.02 Water System Installation:

- A. Install water lines at elevations indicated on plans; clean water lines of all dirt, debris, and other deleterious substances; install appurtenances, fittings, anchors, and support.
- B. Snake plastic water lines in trench to provide 5-percent excess length to permit thermal expansion and trench settlement solvent weld PVC pipe per Manufacturer's instructions.
- C. Install plastic pipe in sleeves at where line penetrates concrete structures such as foundations, floors, and at anchorage points.
- D. Extend rigid Schedule 80 PVC pipe to 3-feet beyond foundation wall.
- E. Install, anchor, align and test pump and captive air tank. Furnish and install all fittings and appurtenances specified, indicated on the plans, and recommended by the manufacturer for a complete and operable assembly.
- F. Install water inlet screen securely anchored on concrete piers.
- G. Install valves and boxes as indicated on the plans and in the Construction Details and specified herein. Align and plumb valves. Test operation of valves.
- H. Provide thrust blocks as specified in Construction Details.

SECTION 11115

LAGOON BAFFLES

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to construct and install baffles to isolate lagoons into separate cells to prevent lagoon short circuiting and promote plug flow through basin, all as shown on the drawings and as herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 11221 - Clarifier/Flocculation Equipment
- B. Section 11230 - Wastewater Aeration Equipment
- C. Section 11304 - Air Lifts
- D. Section 11350 - Fiberglass Weirs

1.03 Submittals:

- A. Contractor is required to submit the following in accordance with Section 01300 hereinbefore.
 - 1. Product data consisting of manufacturer's descriptive literature and recommended method of installation.
 - 2. Certificates: Manufacturer's certification that products meet specification requirements.
 - 3. For baffles constructed on site, provide material analysis and proposed procedures for placement, stabilizing and ballasting of baffle.

1.04 Product Delivery, Storage and Handling:

- A. Deliver materials on manufacturer's original skids, or in original unopened protective packaging.
- B. Store materials to prevent physical damage.
- C. Protective material during transportation and installation to avoid physical damage.

PART 2 - PRODUCTS

- 2.01 General Requirements: Select materials of fabrication and construction with the following properties:

- A. Inert in lagoon environment with ph 6.0 to 9.5 mg per liter hydrogen sulfide, and total dissolved solids of 1000 to 1500.
- B. Inert to degradation due to radiation from sunlight.
- C. Maintains structural integrity and material properties when submerged.

2.02 Fabric Baffle:

A. Fabric Description:

- 1. Bare Fabric: 6.0 oz./sq. yd. woven polyester
- 2. Finished Fabric: 28 \pm 2 oz./sq. yd. polymer coated polyester
- 3. Hydrostatic Resistance: 500 lbs./sq. inch
- 4. Adhesion: 12 lbs. inch
- 5. Cold Crack: Pass @ -30°F
- 6. Color: Black

- B. Flotation: 4-inch or 6-inch diameter unicellular plastic foam logs dielectrically sealed into the floating collar.
- C. Ballast: 1/4" steel chain dielectrically sealed into the training edge of the curtain.
- D. Shore Attachment Unit: PVC grommets set in 4-ply coated fabric reinforced with 2-inch wide webbing 6000 psi yield strength.

PART 3 - EXECUTION

3.01 Installation of Fabric Baffle:

- A. Install baffles per manufacturer's instructions. Furnish floats. Anchor baffle at terminal points and 50-foot intervals. Place ballast to secure curtain wall for hydraulic and wave action forces. Install baffle with sufficient slack to permit 15-inch variation in water level.

SECTION 11221

CLARIFIER/FLOCCULATION EQUIPMENT

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install flocculation equipment and appurtenances necessary to complete work as shown on the drawings and herein specified.
- B. Each flocculator unit shall include rake mechanism assemblies complete with drive unit, drive chain and sprockets, shafts and couplings, bearings, stuffing boxes, and appurtenances. All components of the flocculation equipment shall be furnished by one manufacturer.

1.02 Related Work Specified Elsewhere:

- A. Section 11115 - Lagoon Baffles
- B. Section 11230 - Wastewater Aeration Equipment
- C. Section 11304 - Air Lifts
- D. Section 11350 - Fiberglass Weirs
- E. Division 16 - Electrical

1.03 Quality Assurance:

- A. Standards:
 - 1. Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.
- B. Tests:
 - 1. Upon installation, the equipment shall be tested as specified hereinafter.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:

1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
2. Shop drawings with performance data and physical characteristics.
3. Manufacturer's installation instructions.
4. Manufacturer's operation and maintenance material and manuals.
5. Certified copies of reports of factory tests specified in this section and required by the referenced standards.
5. Manufacturer's complete design calculations.

1.05 Definitions:

- A. NEMA - National Electric Manufacturer's Association

1.06 Product Delivery, Storage and Handling:

- A. The Contractor shall be responsible for the delivery, storage, and handling of products.
- B. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.01 Flocculation Equipment:

A. General:

1. Furnish clarifier/flocculation equipment as specified in this Section and as shown on the drawings.
2. An integral clarifying zone with a hooper bottom shall be provided at the end of the extended aeration basin opposite the influent. The clarifying zone is formed by three concrete walls and a concrete bottom as shown on the plans. Location of the clarifier is as shown on the plans.
3. Clarifier Design: The clarifier shall be designed with an overflow rate of 200 GPD/ft² at minimum water level, based on the design flow rate of 0.08 MGD.
4. Partition Wall: A one-piece partition wall will be provided by Parkson Corporation to separate the clarifying zone from the aeration basin. Flow will enter the clarifier underneath the partition wall. It shall be designed such that flow does not short circuit around the partition wall. The partition wall shall be removable without draining the basin. All hardware for attachment of the partition wall shall be provided by Parkson.

5. Provide protection for other non-submerged moving parts. Equipment protection shall meet the requirements of the Occupational Safety & Health Administration.

B. Flocculating Rake Mechanism:

1. A flocculating rake mechanism will be designed and furnished for each of the integral clarifiers. Each unit shall be furnished complete with all mechanical equipment required for proper operation, including complete drive units, complete rake mechanism and all hardware required for installation.
2. The flocculating rake mechanism shall consist of a drive assembly and a non-drive/pulley assembly. Each assembly shall be located approximately six inches (6") above the clarifiers maximum water level and mounted flush against the clarifier's side walls as located on the plans. The rake mechanism shall be suspended from a 1/4" diameter stainless steel cable stretching across the width of the integral clarifier. The rake mechanism consists of a vertically hung galvanized pipe assembly clamped to the stainless steel drive cable with 304 stainless steel U-bolts, as shown on the drawing. The rake shall be supported by a polyethylene float so that it has approximately neutral buoyancy. From the rake assembly shall be hung steel chains which extend down into the sludge blanket to be used to aid in distribution and concentration of the sludge in the hopper bottom sludge removal zone. The rake mechanism shall run at approximately 9 feet per minute, and only run when the sludge removal system is operating.
3. Each drive unit shall be anchored to the metal support frame located approximately 6" above the clarifiers high water level. The drive unit shall consist of a 3/4 hp worm gear reduction unit with a C flanged T.E.F.C. motor. Both the drive and driven pulleys of this assembly shall be covered for safety.

C. Appurtenances:

1. All bolts, nuts, washers and gaskets necessary for field erection shall be furnished by the manufacturer. It is desired that maximum fabrication possible be done in the shop so field assembly, and the possibility of assembly damage, will be eliminated.
2. All anchor bolts required for the complete flocculator shall be furnished by the manufacturer. Anchor bolts shall be stainless steel or cadmium plated steel and shall be of ample size and strength for the purpose intended.

2.02 Cleaning and Packing:

- A. Thoroughly clean all equipment, components, and subassemblies of all water, sand, grit, weld splatter, grease, oil, and other foreign materials before preparation for shipment. Protect all machined surfaces against physical damage and exposure to the elements during shipment, handling, storage, and installation.
- B. Pack flocculation equipment to provide ample protection from damage during shipment, handling, and storage. Cap and seal all openings.

PART 3 - EXECUTION

3.01 Flocculation Basin Inspection

- A. Examine the flocculation basins. Correct any irregularities prior to installation.

3.02 Installation:

- A. Install the flocculation equipment in accordance with the drawings and manufacturer's written instructions.
- B. Lubricate moving parts as recommended by the manufacturer's written instructions.

3.03 Service:

- A. The equipment manufacturer shall furnish the services of a qualified field representative to check the equipment installation, to supervise start-up and testing, and to instruct operating personnel in the proper maintenance and operation of the equipment. The field representative shall be available for a minimum of two trips of not more than two days per trip at no additional cost to the Owner.
- B. A written report covering the representative's findings and installation approval shall be submitted to the Engineer covering all inspections and outlining in detail any deficiencies noted.

3.04 Cleaning:

- A. Clean grease, oil, or any other debris from the exterior surfaces of the flocculation equipment.

* * * END OF SECTION * * *

11221-4

SECTION 11230

WASTEWATER AERATION EQUIPMENT

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install wastewater aeration equipment as shown on the drawings and as herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 11115 - Lagoon Baffles
- B. Section 11221 - Clarifier/Flocculation Equipment
- C. Section 11304 - Air Lifts
- D. Section 11350 - Fiberglass Weirs
- E. Division 16 - Electrical

1.03 Quality Assurance:

A. Standards:

- 1. Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.

B. Submit the following:

- 1. Manufacturer's Certificate of Compliance certifying compliance with the applicable specifications and standards.
- 2. Certified copies of test reports of factory tests required by the applicable standards.
- 3. Shop drawings with performance data and physical characteristics for water aeration equipment.
- 4. Manufacturer's written installation instructions.

1.05 Product Delivery, Storage and Handling:

- A. Aerator units shall be delivered to the site in such a manner as to avoid damaging units.

- B. Units shall be stored so as to protect from weather or construction activity damage.

PART 2 - PRODUCTS

2.01 Floating Aeration Chain System:

A. General:

1. The manufacturer shall provide a complete aeration chain system including all equipment and hardware for the in-basin components.

B. Float Assembly:

1. The float assembly shall be composed of an outer polyethylene shell filled with closed-cell polyurethane foam. The ends of the float assembly shall be sealed.
2. The float shell shall contain inhibitors to resist ultraviolet deterioration. The float shall be designed such that even with the entire aeration chain filled with water, it will remain afloat.
3. Through the center of the float and extending out each end of the float, will be an air pipe with one hose connection on each side of the float.
4. Air will travel through the air pipe and hose connections, to the downcoming air tubes. Two downcoming air tubes will be provided per float. They will attach to the hose connections in the air pipe by stainless steel clamps. The downcoming air tubes will be made of EPDM (ethylene-propylene diamester material) or equal and have an inside diameter of 3/4". They will connect to a diffuser assembly and be cut to a length so that the diffuser assembly is positioned with the fine bubble diffusers approximately 1 foot off the basin bottom (from the horizontal centerline of the diffusers) at the minimum liquid level. The downcoming air tubes will connect to the diffuser assembly with stainless steel clamps.

C. Flexible Hose:

1. Flexible hose will be used to connect the air pipes from adjacent float assemblies together to form the aeration chains. The flexible hose shall be of multi-layered construction. The outer and inner layer will be made of PVC, with the outer layer impregnated with plasticizers and U.V. inhibitors. The hose will be reinforced in the middle with 2 spiral plies and one longitudinal ply of Vytacord fiber for strength. All layers shall be fused together to form one

continuous hose material. The hose shall have an inside diameter of 4". It shall be provided in 300 ft. rolls and cut to suit at the job site at time of installation.

D. Fine Bubble Diffusers:

1. Connected to the air pipe through the float assembly by EPDM flexible downcoming air tubing, is a fine bubble diffuser /counterweight assembly for introducing the air into the wastewater. The diffuser/counterweight assembly will have PVC or LDPE wetted parts. Each diffuser/counterweight assembly will support either two or four diffusers.
2. Diffusers shall be Wyss Flex-A-Tube. The diffuser shall be of hollow cylindrical shape when the air is being diffused through it and shall be able to collapse into the frame when air is not being diffused.
3. The minimum outside diameter shall be approximately 2.4 inches (6.1 cm) and the overall length approximately 24.5 inches (62.2 cm).

E. Diffuser Sheath:

1. The diffuser sheath shall be composed of a modified, PVC, special soft plastic material. This soft plastic sheath shall be held in place by stainless steel clamps.

F. Diffuser Frame:

1. The diffuser frame shall be one piece construction, acetal or other suitable plastic material. The frame shall have a 3/4 inch NPT inlet. Thread quality shall be such that the diffuser can be installed without pipe sealants.

G. Backflow Check Valve:

1. The diffuser shall have a separate check valve to eliminate backflow into the aeration system. The check valve shall consist of a soft plastic flap, retainer pad and two (2) stainless steel screws. The check valve shall not impede air flow and keep headloss to a minimum.

H. Diffuser Components:

1. Each diffuser consists of:
 - a. One (1) - Frame
 - b. One (1) - Sheath
 - c. One (1) - Retainer Pad
 - d. One (1) - Check Valve
 - e. Two (2) - 304 Stainless Steel Screws
 - f. Two (2) - Stainless Steel Clamps

2. Additional hardware and piping required to complete the diffuser /counterweight assemblies shall be provided and made of PVC or LDPE wetted parts.

I. Aeration Chain Attachment:

1. The aeration chain will be fed air from one/both sides and connect to the air manifold piping by a stainless steel clamp. A butterfly valve will be present at one/both ends of each aeration chain for individual control of the air flow to each chain.
2. An adjustable tension line consisting of plated steel chain will be present at each end of the aeration chain. The tension line will connect to the last float assembly at each end and also to a hook anchored on the basin bank.

2.02 Air Piping Manifold:

A. General:

1. A ductile iron air piping manifold with mechanical joints and other required hardware shall be provided by Contractor, located along one/both side of the aeration basin and one side of the aerated polishing section. This air piping manifold will be continuous for both aerated basins, to feed air to the aeration chain system. The air manifold will be buried. All air piping and piping accessories between the air piping manifold and the blowers will be provided by Contractor. Required concrete thrust blocks and restrained joints will be provided by the Contractor as shown on drawings and as directed by Engineer.

B. Aeration Chain Tee:

1. A tee will be located at the point of attachment of each aeration chain and shall be the same diameter as the aeration chain flexible hose. Between this tee and the aeration chain a butterfly valve will be located for control of the air flow to the chain. The butterfly valve and all hardware between the valve and the aeration chain will be provided by Contractor. Each tee shall be supported by a concrete thrust block, as shown on the plans.

C. Air Quality:

1. The air provided to the aeration chains shall be of a quality equal to or better than air that has been filtered through a 10 micron air filter.

D. Connection to Air Blowers:

1. The air piping header which will be located along one/both side of the aeration basin and will connect to three (3), 3 HP positive displacement blowers. These blowers will be centrally located near the aeration basin. They will be mounted and located as shown on the plans.
2. Expansion joints, flexible connectors and other piping hardware and accessories shall be used in accordance with good air piping practices and as directed by manufacturer.

2.03 Aeration Blowers:

A. General:

1. Contractor shall furnish three (3), 3 HP positive displacement air blowers, complete with electric motors, and all accessories which are called for on the drawings and specifications. One blower shall be for standby operation. The blowers shall be located as shown on the plans.

B. Performance Requirements:

1. Each blower shall be capable of delivering 70 standard cubic feet per minute of air at inlet conditions of 100°F maximum and 14.5 psia against the discharge pressure of 5.00 psig.
2. Each blower unit shall be of the positive displacement rotary type, designed for continuous service and shall be of the manufacturer's standard design and all parts of duplicate machines shall be interchangeable without modification.

C. Construction:

1. Impellers shall be machined from high strength grey iron to an exact involute shape and permanently fastened to steel shafts. Impellers and shafts shall be statically and dynamically balanced to operate without vibration.
2. Head plates shall be machined from grey iron and ground on the interior surface to exact operating tolerances. The grey iron head plates shall be heavily ribbed for rigidity and all mating surfaces shall be precision machined. Bearing fits shall be machined into the head plates to assure exact bearing positioning. Impeller cases shall be machined from cast iron conformed to prevent distortion.
3. Bearings shall be anti-friction bearings designed to handle V-belt pull. They should be self-centering on an axial plane to allow impellers to accurately position themselves between head plates.

4. Cylinder shall be a one piece precision-machined cast grey iron casing.
5. Lubrication of timing gears and gear-end bearing shall be oil-splashed lubricated from an oil-tight housing surrounding the timing gears. Drive-end bearings to be lubricated through fittings. Blowers shall be provided with lip-type seals to prevent oil and grease from entering the impeller chamber.
6. Drive Shaft - The motor shaft shall be operated at 1800 R.P.M. and extended for V-belt drive.
7. Electric Motors - Each blower shall be provided with a constant speed, squirrel cage induction motor designed in accordance with NEMA and AIEE standards. Motors shall be TEFC, foot mounted, 3 horsepower, 230/460 volt, 3 phase, 60 cycle, motors with 1.15 service factor.
8. Bases - Each blower unit shall be mounted on a single heavy, full length, fabricated steel frame, properly braced to form a rigid support for the entire unit.
9. Accessories
 - a. Inlet filter/silencer - shall be canister type and mounted outside.
 - b. Flexible connector on discharge.
 - c. Check valve on discharge of blower to prevent backflow of air into the blower when it is not operating.]
 - d. One discharge, isolation butterfly valve.
 - e. Weighted type pressure relief valve.
 - f. One, 4-1/2" diameter discharge pressure gauge (0-15 psi).
 - g. Discharge silencer

D. Control Panel:

1. A single control panel shall be designed and furnished by Parkson Corporation to control all positive displacement aeration blowers and the integral clarifier. The control panel shall have the following features or provisions for controlling the aeration system:
 - a. 24 hour timers, Qty. (2) total
 - b. H.O.A. switches, one (1) per blower and also waste sludge pump
 - c. Run lights for each blower and waste sludge pump
 - d. Circuit breakers and control power transformer
 - e. Selector switch for selecting timer sequence
 - f. A wall mounted control panel with each item labeled on panel cover - Nema 4 enclosure
 - g. All external wiring by others

2. The control panel shall also control the integral clarifier. this includes controls for the 2 HP blower for the sludge return air lift(s) and the 3/4 HP flocculating rake mechanism drive motor(s). This custom panel as shown on the drawings shall include the necessary controls to operate motor starters, circuit breakers, relays, and timers. Motor starters will be supplied by the Electrical Contractor as a part of the Motor Control Centers; see Section 16920. The custom panel shall include controls for the R.A.S. and W.A.S. flows using a timer schedule. A submersible waste sludge pump, provided by the "GC" will be used to waste sludge as required.

PART 3 - EXECUTION

3.01 Installation:

- A. The aerator shall be installed in accordance with manufacturer's instruction and as specified herein.
 1. Inlet and outlet piping shall be independently supported and shall not use the aerator for support.
- B. Aerator installation shall be properly coordinated with other work to insure smooth interfacing including piping and concrete work.

3.02 Cleaning:

- A. The aerator units shall be thoroughly cleaned of all dirt, dust, grease and foreign material.

3.03 Start-Up Services:

- A. The aerator manufacturer shall furnish the services of a qualified field engineer to check the installation, supervise start-up, and instruct operating personnel in the proper maintenance and operation of the unit.

SECTION 11231

METERING PUMPS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install metering pumps and appurtenances necessary as shown on the drawings and as herein specified.
- B. Each pump shall be diaphragm type, complete with separate pump and reagent head assemblies, manual adjustment mechanism, reagent resistant diaphragm, suction and discharge valves, mounting plate, motor, and appurtenances. All components of the pumping units shall be furnished by one manufacturer.

1.02 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15060 - Piping and Valves
- C. Section 15061 - Piping Schedules
- D. Section 15130 - Gauges
- E. Section 15240 - Vibration Isolation
- F. Division 16 - Electrical

1.03 Quality Assurance:

A. Standards:

- 1. Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.

B. Tests:

- 1. The pumping unit manufacturer shall test each pump for mechanical and electrical correctness.
- 2. Perform field tests specified in this Section.

1.04 Submittals:

A. Submittals shall be as specified in Section 01300.

B. Submit the following:

1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
2. Certified copies of reports of factory tests specified in this Section and required by the referenced standards.
3. Shop drawings with performance data and physical characteristics.
4. Manufacturer's installation instructions.
5. Manufacturer's operation and maintenance material and manuals.
6. Complete detailed instructions for changing the range of each chemical feeder. The instructions shall include lists of the parts which must be changed, together with step-by-step directions for making the changes and for calibrating and adjusting the equipment after the range change.

1.05 Product Delivery, Storage and Handling:

A. The Contractor shall be responsible for the delivery, storage and handling of products.

B. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.01 Chemical Feed Pumps:

A. Furnish diaphragm metering pumps as specified in this Section and as shown on the drawings.

2.02 Materials:

A. Chemical feed equipment shall be of substantial construction with all parts designed for long life under working conditions, including corrosive atmospheres and intermittent or continuous operation.

B. Materials of construction shall be selected for resistance to the pumped solution.

C. All parts which are exposed to corrosive conditions shall be made from corrosion-resistant materials or covered with suitable protective coatings.

2.03 Pump Design and Construction:

- A. Each metering pump shall be a positive displacement, plunger-actuated, single tubular diaphragm pump with internal zero reference diaphragm support tube. Prestressed tubular diaphragm and measuring cylinder shall be specifically designed to permit automatic purging of entrapped gases. Only the exterior surface of the tubular diaphragm shall come in contact with the process fluid. Discharge and suction check valves shall be stackable double configuration. Check valves will be provided without integral threads or interlocking collars so as to permit easy removal for inspection purposes without springing and/or disconnecting the process piping system.
- B. The pump shall be dry lift self-priming and capable of indefinite operation without process fluid. Each liquid end shall include a diaphragm failure detection and alarm switch which shall promptly stop the pump drive motor and provide alarm signals to the control enclosure "Fail" indicating light and to the annunciator on the plant control panel on leakage of the pump diaphragm.
- C. All wearing parts and items requiring adjustment shall be readily accessible. Each unit shall be completely enclosed and dust tight when in operation.
- D. The rate of metering shall be changed by an external manual micrometer type adjustment mechanism to permit 0-100% capacity control while in motion and shall provide positive repeatable settings within plus or minus 1% over the entire range; pump delivery to be repeatable within plus or minus 1% accuracy over a 10:1 range. None of the forces developed by the pumping action shall be reflected back to the capacity adjustment mechanism.
- E. Each pump shall have a internal pressure relief valve sized to pass the maximum displacement of the pump.
- F. Each pump shall be mounted on a structural steel or cast iron base capable of being set on a concrete support. Unless otherwise specified or indicated on the drawings, each item of chemical feed equipment shall be mounted on a concrete base approximately four inches above the adjacent floor. If feeders or other components must be supported at higher elevations above the floor, suitable supplementary bases shall be provided.
- G. The metering pump shall be provided with a metal nameplate, 3-inch x 2-inch, permanently affixed to the pump housing. Each nameplate will indicate manufacturer, model number, liquid handled, rated capacity, rating of back pressure valve, and pressure at maximum capacity.

2.04 Accessories:

- A. Provide accessories for each pump as follows:
 - 1. back pressure valves,
 - 2. surge chambers in pump discharge piping;
 - 3. calibration chambers in pump suction piping.
- B. Back pressure valves shall be sized by the pump manufacturer for the systems shown on the drawings and specified in this Section. Back pressure valve materials shall be resistant to the pumped solution.
- C. Surge chambers shall be sized by the pump manufacturer for the systems shown on the drawings and specified in this Section. Surge chambers shall be fabricated of materials resistant to the pumped solution. Each chamber shall include an air charging valve and air gage.
- D. Calibration chambers shall be transparent and shall be fabricated of materials resistant to the pumped solution. Each chamber shall have bottom inlet fitting and vented top cap.
- E. Chemical feed pump shall be paced by 4-20 ma signal from flow meter.

2.05 Cleaning and Packing:

- A. Thoroughly clean all equipment, components, and subassemblies of all water, sand, grit, weld splatter, grease, oil and other foreign materials before preparation for shipment. Protect all machined surfaces against physical damage and exposure to the elements during shipment, handling, storage and installation.
- B. Pack pumps to provide ample protection from damage during shipment, handling, and storage. Cap and seal all openings.

PART 3 - EXECUTION

3.01 Foundation Inspection:

- A. Examine the pump mounting surface, and also make certain that all bolts are properly located. Correct any irregularities prior to installation.

3.02 Installation:

- A. Install the metering pumps and accessories in accordance with the drawings and manufacturer's written instructions.
- B. Lubricate all moving parts as recommended by the manufacturer's written instructions.
- C. Make sure that each pump is securely anchored. Also, make certain that all connections are tight.

3.03 Testing:

- A. After installation, test each pump in accordance with manufacturer's written instructions.

3.04 Cleaning:

- A. Clean grease, oil, or any other debris from the exterior surfaces of the pumps and motors.

SECTION 11304

AIR LIFTS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install air lifts and appurtenances necessary as shown on the drawings and as herein specified.
- B. A sludge removal system will be designed and furnished by Parkson Corporation to provide a positive and controllable method for removing sludge from the integral clarifier. This system shall be furnished complete with all the mechanical equipment required for proper operation, including air lift and sludge suction piping, submersible pump for sludge wasting. Return sludge will flow by gravity to the front end of the aeration basin.

1.02 Related Work Specified Elsewhere:

- A. Section 11115 - Lagoon Baffles
- B. Section 11221 - Clarifier/Flocculation Equipment
- C. Section 11230 - Wastewater Aeration Equipment
- D. Section 11350 - Fiberglass Weirs
- E. Division 16 - Electrical

1.03 Quality Assurance:

- A. Standards:
 - 1. Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.
 - 2. Upon installation, the air lifts shall be inspected for structural and operational correctness.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:

1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
2. Shop drawings with performance data and physical characteristics.
3. Manufacturer's installation instructions.
4. Manufacturer's operation and maintenance material and manuals.

1.05 Product Delivery, Storage and Handling:

- A. The Contractor shall be responsible for the delivery, storage, and handling of products.
- B. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.01 Air Lifts:

- A. Airlift Blower: The sludge removal system shall utilize one 2 hp, positive displacement blower with the required accessories. The blower shall be capable of delivering 30 cubic feet per minute of air at inlet conditions of 100°F and 14.5 psia against the discharge pressure of 5.3 psig.
- B. Air Piping: A 2" diameter air header for supplying air to the air lift, will be buried along the back edge of the integral clarifier running from the air lift blower to the air lift piping as shown on the plans. The air lift piping shall be removable to allow for cleaning if required. All inserts required for passage of the air piping through the clarifier concrete will be provided by Contractor.
- C. Sludge Suction Piping: Sludge suction piping for removing the settled solids from the clarifier shall be located along the length of the clarifier hopper bottom. Holes shall be spaced along the length of this piping for even removal of sludge. The sludge suction piping shall be of PVC construction, and shall be as shown on the plans. All hardware for installing and supporting the piping shall be provided by Parkson.

PART 3 - EXECUTION

3.01 Installation:

- A. Install the air lifts in accordance with the drawings and manufacturer's written instructions.
- B. Make sure that each air lift is securely installed.

- C. The manufacturer shall provide equipment installation advice, start-up service for placing the equipment in operation, and instruction of the Owner's operating personnel in the use and maintenance of equipment. The services of an experienced installation representative shall be provided for a total of one day. Price shall include travel and living expenses based on one trip to the job site. The Contractor shall advise the resident representative at least 48 hours in advance of the proposed trips with tasks to be performed and confirm in writing the actual time on the job and travel time required for the trip.

3.02 Cleaning:

- A. Clean grease, oil, or any other debris from the exterior surfaces of the air lifts.

SECTION 11306

PACKAGED PUMP STATIONS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all necessary work to install a packaged submersible pump station as shown on the drawings and as described herein.
- B. Station Design Description:
 - 1. Permit ground level removal of pumping units for inspection or service without dewatering wet well or interrupting operation of other pump.
 - 2. Pumps, when lowered into place, to be automatically connected to discharge piping with positive seal.
 - 3. Incorporate fabricated aluminum access frame with provisions for mounting guide rails and hoods to retain pump cables.
 - 4. Pump and motor controls mounted in weatherproof enclosure adjacent to wet well pad.
- C. Equipment provided by Pump Station Manufacturer:
 - 1. Submersible Pumps
 - 2. Float System
 - 3. Slide Rails
 - 4. Access Door - Watertight
 - 5. Motor Control Panel
 - 6. Alarm Devices
- D. Equipment required for complete installation:
 - 1. Wet Well
 - 2. Valve Vault
 - 3. Piping
 - 4. Electrical wire in conduit from wet well to pump motor control panel
 - 5. Vent
 - 6. Drop Tube for Float Controls
 - 7. Miscellaneous equipment and materials as required to provide complete, operating installation.

1.02 Related Work Specified Elsewhere:

- A. Section 02221 - Earthwork for Structures
- B. Section 02731 - Sewage Collection Lines

- C. Section 03300 - Cast-In-Place Concrete
- D. Section 11310 - Submersible Non-Clog Sewage Pumps
- E. Division 15 - Mechanical
- F. Division 16 - Electrical

1.03 Quality Assurance:

A. Standards:

1. All materials and products installed by Contractor shall be of the type approved by the Ohio Basic Building Code and National Electric Code.
2. Executed work in conformance with applicable sections of ASME and AWS code.
3. Furnish equipment rated for service in Class I, Divisions 1 and 2, Groups C and D, hazardous locations by Underwriters Laboratory or NFPA.
4. Factory test unit according to Standards of Hydraulic Institute. During factory operational hydraulic tests, test pump power and control circuits under load. Verify operation of all monitoring circuits and alarms.

1.04 Submittals:

A. Submittals shall be as specified in Section 01300.

B. Submit the following:

1. Shop drawings with performance data and physical characteristics for packaged pump station equipment.
2. Pre-Bid Submittals: Oil filled motor data sheet when proposed to be used as equal to air filled motor specified.
3. Shop drawings and catalog cuts (steel structure, control wiring and other electrical wiring).
4. Pump curves
5. Installation instructions
6. Operation and maintenance instructions
7. Form of warranty
8. UL listing
9. Structural calculations
10. Certification of hydraulic pressure test
11. Mill reports on steel when requested by Engineer

1.05 Product Delivery, Storage and Handling:

- A. Pump station units and related ancillary parts shall be delivered to the site in such a manner as to avoid damaging units or parts.
- B. Units and all parts shall be stored so as to protect from weather or construction activity damage.

- C. Furnish supports, saddles, cover plates at pipe and conduit penetrations and packaging to facilitate handling, transport and storage of pump chamber without damage.

1.06 Warranty:

- A. Warrant equipment free from manufacturing installation defects for period of one (1) year from date of successful operation.
- B. Successful operation date shall be first day of initial thirty (30) day period where pump station functioned without failure due to Contractor's installation or manufacturer's defects in workmanship or materials.

PART 2 - PRODUCTS

2.01 Piping Schedule: Pumped waste inside pump station and to valve vault discharge

- A. Maximum Design Operating Pressure - 150 psig; Temperature - 100°F
- B. Pipe Materials:
 - 1. 1" thru 3" - Schedule 40 PVC solvent weld
 - 2. 4" thru 12" - Ductile iron, Class 50, flanged or mechanical joint as indicated on drawings
- C. Joints: Flanged ANSI/AWWA-C115/A21.15
- D. Fittings: 4" thru 12" - Ductile iron, flanged ends, ANSI/AWWA-C110/A21.10; 1" thru 3" - Sch. 40 PVC solvent weld
- E. Flanges: 250# ductile iron, ANSI/AWWA-C115/A21.15
- F. Gaskets: Ring type
- G. Bolts and Nuts: Machine bolts with hex nuts, regular series, Grade B, cadmium plated
- H. Valves:
 - 1. Eccentric Plug Valve: 4" thru 12" - Specifically designed for sewage applications with 100% port opening (equal to pipe). Iron body and plug, Buna-N rubber coating on plug to minimize wear and corrosion, replaceable bronze seats. Seat rings shall seal at required pressures and with reverse pressures where required. Flanged ends ANSI B16.1. Fixed handwheel operator.
 - 2. Check Valve: Cast iron body. Rubber flapper APCO 104-P or equal. Valve Rating: 175 psi water working pressure, 350 psi hydrostatic test pressure.

2.02 Wet Well Access:

- A. Provide hinged aluminum door for each pump.
- B. Door Materials: 1/4-inch thick aluminum with non-skid diamond tread on upper surface.
- C. Frame: Welded aluminum sections.
- D. Hardware on Access Assembly: Stainless steel with flush upper surface without protrusions.
- E. Door shall be fitted with a recessed latch requiring a special square tool for access.

2.03 Guide System:

- A. Guide Rails: Two lengths of stainless pipe with pilots; 2-inch Schedule 40, stainless steel (304). Top and bottom pilots shall be Class 30 cast iron with flake glass/polyester coating.
- B. Pump Guides:
 - 1. Encapsulated with hard nylon plastic coating.
 - 2. Attached to pump volute with 316 stainless steel hex head cap screws.
- C. Lift Chain: 304 stainless steel, size to support pump with 4 to 1 safety factor.

2.04 Pump Discharge Seal System:

- A. Operation:
 - 1. Permit removal and installation of pump without entering wet well.
 - 2. On lowering pump, hooks on pump shall engage horizontal guide pin rotating pump to effect face-to-face contact between pump discharge flange and discharge elbow.
- B. Construction - Pump Discharge Connection:
 - 1. Ductile iron flange bolted to pump discharge with integral hoods which engage pivot pin on stationary discharge elbow.
 - 2. Lip Seal: Molded neoprene positively retained in dovetail groove on pump discharge flange. Seal lip shall contact mating seal face in static position and shall have adequate flexibility to deflect under pumping pressure to increase seal efficiency, thereby avoiding seal face erosion.

C. Construction - Discharge Elbow:

1. Gray cast iron; Class No. 30.
2. Vertical or discharge leg, 125 lb. cast iron pipe flange for mating to discharge piping.
3. Horizontal or inlet leg, flat machined face for forming an effective seal with lip seal on pump.
4. Integral base for anchoring and support of piping and pump to wet well floor.
5. Hardware: 303 stainless steel pivot pin for engagement of discharge flange hoods on pump.

2.05 Float Tube:

- A. Schedule 80 PVC pipe (diameter as required) to house floats.

2.06 Spare Parts:

- A. Furnish one lot spare parts as recommended by station and pump manufacturers.
- B. Spare parts to include:
1. Two sets of pump seals.
 2. Grease and lubrication materials.
 3. Other items defined as expendable by manufacturers.

2.07 Pump Chamber:

- A. Function: Contain all pumps, piping, accessories and control equipment.
- B. Dimensions:
1. Nominal inside diameter as shown on plans.
 2. Clear height inside from floor to ceiling as shown on the plans.
- C. Construction:
1. Vertical cylinder of circular cross-section with shell of ASTM A283 Grade C steel plate. Minimum Plate - 1/4-inch.
 2. Top and Bottom of Cylinder: Flat head with straight flange to overlap the shell on outside. (Minimum plate - 3/8 inch)
 3. Designed per ASME Boiler and Pressure Vessel Code - Section VIII, Vessels Under External Pressure.
 4. Top head shall contain suitable transition to entrance tube to permit entrance tube installation and fitting by means of field weld.

D. Reinforcing Steel:

1. Pump Chamber Floor; reinforce with beams running parallel to the suction lines, extending one foot beyond edge of pump chamber wall. Beam Size; size for anchoring load and for protection of suction lines during shipment and installation. Spacing; provide additional beams spaced equal distance under center of tank with sufficient strength to stiffen against hydrostatic uplift forces. Minimum Size; two 8-inch x 18.4 I-beams for anchorage; two 6-inch x 12.5 I-beams perpendicular to anchorage beams. Pump Base Plate; per pump manufacturer's recommendation tied to floor to permit field alignment and shimming of pump.
2. Top of Chamber; reinforced by structural steel to carry full weight of overburden and load due to lifting eyes for handling purposes. Minimum Size; four 8-inch x 13.75 I-beams continuously seal welded to top.

E. Construction Features:

1. Lifting Lugs: Inside chamber above pumps for lifting motors from pumps.
2. Sleeves of steel plate welded inside and outside to station wall where suction and discharge lines pass through station walls.
3. Sump: Dimensions; 16-inches dia. x 7-inches. Drain floor to sump.

2.08 Entrance Tube:

A. Description: Vertical cylinder in one or more sections, complete with ladder, conduit and vent lines.

B. Material: ASTM A283 Grade C steel plate - 1/4-inch minimum.

C. Dimensions:

1. Diameter: Minimum dimension shown on plans. Coordinate with pump manufacturer's shop drawings to permit pump and motor removal.
2. Length: Approximately 24-inches above grade at station.

D. Stiffeners:

1. Furnished at top and bottom of each section.
2. Dimensions: Sized for structural load per ASME Boiler and Pressure Vessel Code, Section VIII, Vessels Under External Pressure. Sized to permit watertight field welding of sections without crimping or deflection due to heat stresses.

E. Lifting Lugs: Provide on each section to facilitate handling.

2.09 Access Way:

- A. Stiffened with rolled square box.
- B. Cover:
 - 1. Hinged and balanced for easy opening.
 - 2. Furnish with: Latch mechanism to keep cover open under normal load; heavy rubber gasket for rain tight seal; pin-tumbler, self-locking lock to be opened from within station without key.
- C. Ladder Extension: On tube exterior and under cover to facilitate entry and exit.

2.10 Access Ladder:

- A. 1-inch Schedule 40 pipe side rails with 3/4-inch Schedule 40 pipe spaced on 12-inch centers with non-slip tread surface.
- B. Equipped with brackets for accurate alignment and rubber hose for a smooth transition joint between ladder sections.

2.11 Cathodic Protection:

- A. Two 17 pound magnesium anodes furnished with 6 ft. #8 stranded copper conductors and attachment lugs.

2.12 Float Control System:

- A. Float Switches:
 - 1. Furnish float switch assemblies - mercury type switch sealed in polypropylene housing with not less than 20 feet of cable.
 - 2. Furnish polypropylene cord grips and polypropylene mounting hardware for switch assemblies.
- B. Junction Box:
 - 1. Furnish junction box for installation in wet well.
 - 2. Non-corrosive materials.
 - 3. Conform to specifications for NEMA Type 4X enclosures.
 - 4. Incorporate terminal blocks match-marked or otherwise identified to terminals on intrinsically safe relays.
- C. Level Relays:
 - 1. Furnish intrinsically safe relays in separate level control enclosure.
 - 2. Relays shall be approved or listed as intrinsically safe by nationally recognized testing laboratory.
 - 3. Make connections from relays to feeder lines and motor controls.

D. Enclosure: Furnish separate level control for intrinsically safe relays.

E. High Water Alarm and Alarm Silence:

1. Furnish separate float switch assembly, intrinsically safe relay, signal relay, and alarm silence relay for high water alarm function. Signal relay shall complete 120 volt AC circuit for external alarm device and telemetering equipment. Electrical or mechanical indicator, visible on front of control panel, shall indicate high wet well level exists. Signal relay shall maintain alarm signal until wet well level has been lowered and circuit has been manually reset.
2. Alarm silence switch shall be provided to permit maintenance personnel to deenergize external alarm device while corrective actions are underway. After silencing alarm device, manual reset of the signal relay shall provide automatic reset of alarm silence relay.

2.13 Electrical Equipment by Packaged Pump Station Manufacturer:

A. Panel Enclosure:

1. Description; NEMA 4X weatherproof enclosure; fabrication of 14 gauge 304 stainless steel. Front Panel; 14 gauge steel panel, piano hinge, sized to cover wiring and components mounted on back panel; with provisions for mounting push buttons, switches and control functions, run lights, amp meters, running time meters and instrumentation. Back Panel; 12 gauge removable steel panel sized to mount starters, control equipment and instrumentation. Hardware; stainless steel, continuous vertical hinge to provide 165° swing, three point latching device with water-tight key lock.

B. Instrumentation:

1. Pilot Lights: Run - green; Call - amber; Fail - red.
2. Elapsed Time Meters: Wired to each motor starter to indicate total running time in hours and tenths of hours; 6-digit non-resettable.
3. 125 volt, 20 amp, 2 pole, 3 wire grounding NEMA configuration: 5-20R, 5-20P, 5-20R

<u>Manufacturer or equal</u>	<u>Receptacle</u>
a. Arrow-Hart	5739
b. Bryant	5362
c. General Electric	5362
d. Hubbell	5352
e. Pass & Seymour	6300

C. Grounding:

1. Entire installation to be grounded in accordance with requirements of NEC.
2. Equipment grounding shall be provided for, but not limited to, the following items: panel enclosure, motor frames, receptacles, junction boxes.
3. Ground shall be insulated wire conductors, green color coded, sized according to code.

D. Battery Backup:

1. 12 volt Ni-Cad battery with automatic 120 volt charging system.
2. Shall provide 8 hour continuous operation of alarm light and horn.
3. Shall be mounted inside control panel.

E. Alarm Appurtenances:

1. Alarm Signal shall be initiated by float control system or power failure relay.
2. Exterior Alarm Horn: Supply one 12-volt AC weatherproof alarm horn with projector, conduit box and mounting fixtures. Alarm horn and mounting fixtures shall be designed for mounting to prevent rain water from standing or collecting in projector.
3. Exterior Alarm Flasher: Supply one 12-volt AC alarm light in vapor-tight fixture with red globe, guard, conduit box and mounting fixtures. Alarm light and mounting fixtures shall be designed to permit mounting to prevent rain water from standing or collecting in gasketed area of fixture, between base and globe.
4. Power Failure Relay: Provide relay with N.O. contacts for hookup to an alarm light to be deenergized with contacts closed when power to station is interrupted.
5. High Wet Well Level Alarm: Provide high water alarm float for hookup with pole mounted alarm light and horn. Install separate conduit from control panel to top of entrance tube terminating in separate junction box.
6. Motor Temperature Shutdown: See pump motor specifications. Report failure on pump control panel.
7. Seal Failure Shutdown: See pump motor specifications. Report failure on pump control panel.

F. Duplex Receptacles:

1. One required.
2. UL listed, NEMA WD-1, Federal Specification WC-596E certified (on NEMA 5-15R and NEMA 6-15R). Duplex devices shall have an impact resistant face - urea plastic not acceptable.

PART 3 - EXECUTION

3.01 Site Work:

A. Wet Well:

1. Excavate and pour concrete base. Set seal structure with expanding grout.
2. Promptly place backfill to minimize risk of flotation.
3. Protect and support piping during backfill operations.

B. Valve Vault: Set precast manhole section on poured or precast base. Provide granular backfill for wet well excavation under valve vault.

C. Piping Work: Provide sleeves at manhole and valve vault penetration. Seal sleeves with gaskets.

D. Pump Anchoring: Use base plate as template for drilling individual hole patterns. Mount base plates using 3/4" stainless steel red head anchor bolts. Set up a 60° slope on both sides of wet well bottom as shown on drawings.

E. Guide Rails: Assemble four guide rails to access frame. Plumb assembly.

F. Form up for the upper concrete pad. Install vent and odor control, sleeves for control devices and power conduit and junction box before pouring concrete.

G. Install pumps and piping making sure to plumb assembly for proper alignment and fit.

H. Install power cables using the cable strain reliefs and cord grips.

I. Install pump chain assembly and connect to hook on access frame.

3.02 Electrical Work:

A. Perform operational testing of electrical equipment as part of Factory Witnessed Test. Check pump rotation.

B. Perform continuity tests of control circuits and system ground.

C. Secure electrical system and protect equipment to assure integrity of electrical system during shipment, storage and installation.

3.03 Welding:

- A. Join by electric arc welding with fillets of adequate section.
- B. Welds shall be continuous and watertight to exclude ground water.
- C. Inserts for pipes shall be welded inside and out.

3.04 Steel Surface Preparation:

- A. Chip and grind weld splatter and surface roughness to even uniform surface.
- B. Provide near-white metal surface preparation per:
 - 1. SSPC-10 for sand blast preparation
 - 2. SSPC-8 for pickling preparation

3.05 Surface Finish Paint:

- A. Exterior:
 - 1. Primer - Koppers 654 Epoxy Primer; Mobile 78-D-7 Hi Build Epoxy; or equal
Exterior - Wet Film, 3.4 mil.; Dry Film, 1.5 mil.
 - 2. Intermediate - Koppers Bitumastic No. 300-M Black; Mobile 64-J-2 Val Chem Tar Coat, or equal
Exterior - Wet Film, 11 mil.; Dry Film, 8 mil.
 - 3. Finish - Koppers Bitumastic No. 300-M Black, Mobile 64-J-2 Val Chem Tar Coat, or equal
Exterior - Wet Film, 11 mil.; Dry Film, 8 mil.
 - 4. Total Film - 16 mil. dry minimum.
- B. Interior and Above Ground:
 - 1. Primer - As in A-1 above.
 - 2. Finish - Koppers Glamorglaze; Mobile 20 Series M and F Enamel; or equal
Wet Film, 3.0 mil.
Dry Film, 1.75 mil.
Color - Eye Rest Green
Total Film, 3.0 mil.

3.06 Pipe Sleeves:

- A. Seal void between pipe and sleeve with expanding concrete grout.
- B. Support pipes to isolate piping loads from pumps. See details on drawings.

3.07 Factory Test:

- A. Test shell for water tightness.

3.08 Cleaning:

- A. Flush internals of pipe, valves, strainers, etc., with water of sufficient velocity and quantity that will dislodge sediment or dirt that has accidentally entered the system.

3.09 Hydrostatic Test:

A. Test Procedure:

1. After flushing, fill system with water, venting off entrapped air at high points of system.
2. Apply hydrostatic pressure to 1-1/2 times the operating pressure or 150 psig.
3. Hold test pressure for 30 minutes. Inspect to determine there is not a visible leak or significant pressure variation.
4. If hydrostatic test is satisfactory, drain pipe.

B. Repair of Leaks:

1. Retighten flanged bolts or replace gasket.
2. After repairs, system shall be retested.

3.10 Preparation for Shipment:

- A. Package unit to protect piping from damage during shipment or installation.
- B. Provide closures and supports for piping ports.
- C. Support pipe extensions beyond pump chamber.
- D. Package float control unit to prevent damage during shipment or installation.

3.11 Restoration:

- A. Return site to original or better conditions. Compact, grade and seed disturbed areas.

3.12 Field Services:

- A. Provide services of factory-trained representative for minimum period of eight (8) hours each on two (2) separate occasions, one month apart, to perform initial start-up and to instruct Owner's personnel in pump station operation and maintenance.
- B. Certify proper installation for initiation of one-year warranty period.

SECTION 11337

FIBERGLASS WEIRS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install fiberglass weirs and related appurtenances for sewage works structures as shown on the drawings and as specified herein.

1.02 Quality Assurance:

A. Standards:

- 1. Codes, specifications and standards referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

1.03 Submittals:

- A. Submittals shall be as specified in Section 01300.

B. Submit the following:

- 1. Manufacturer's Certificate of Compliance certifying compliance with the applicable specifications and standards.
- 2. Certified copies of test reports of factory tests required by the applicable standards.
- 3. Shop drawings with physical characteristics for fiberglass weirs and dimensioned layout of weirs.

1.04 Product Delivery, Storage and Handling:

- A. The Contractor shall be responsible for the delivery, storage, and handling of products.
- B. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.01 Fiberglass Weirs:

- A. Furnish all necessary fiberglass weirs of the dimensions shown on the drawings and specified in this Section. Weirs shall be reinforced fiberglass plastic laminate molded by the matched die method.

- B. Glass reinforcement shall consist of chemically bonded surfacing mat and either chopped strand, chopped strand mat, woven roving, or woven cloth, or any combination thereof as required by the finished product. Surfacing mat shall be Type A or Type C, 10 to 20 mils thick, with a silane finish and a styrene-soluble binder; and the glass content of this layer shall not exceed 23% by weight. Chopped strands and chopped strand mat shall be Type E glass, with silane finish and styrene-soluble binder. Strand shall not be larger than Number 130. The glass content of the finished laminate shall not be less than 30% by weight. Woven cloth or woven roving (60 end maximum) shall be Type E glass with silane type finish.

- C. Mechanical properties shall equal or exceed the following:

Laminate Physical Properties 70°F

Ultimate Tensile Strength - psi x 10 ³ (min.)	12
Flexural Strength - psi x 10 ³ (min.)	19
Flexural Modulus of Elasticity - psi x 10 ⁶ (min.)	0.8
Barcol Hardness (min.)	35

1. The procedure to be used in determining the properties listed above shall be in accordance with ASTM Standards, Part 9, and the following designations: Ultimate Tensile Strength - ASTM Designation D638, latest edition; Flexural Strength ASTM Designation D790, latest edition; Modulus of Elasticity - ASTM Designation D790, latest edition.
2. Hardness tests shall be made of the resin-rich surface of the product.
3. Flexural tests shall be made with the resin-rich surface in compression.
4. Test samples shall be full thickness of the item produced and shall not be machined on the surface.

- D. The laminate shall contain a glass content of not less than 30% and not more than 32% using Type E glass with chrome or silane finish. Powdered reinforcements shall consist of 47.5 ± 10% of resin mixture. Final laminate thickness shall be within ± 10% of the nominal specified thickness.

- E. All surfaces shall be resin rich, free of voids and porosity, without dry spots, crazes, or unreinforced areas, and shall provide for increased corrosion resistance and weathering. All machined or cut edges on weir shall be resin sealed.

- F. Weir shall be 1/4-inch thick. Weirs shall be reinforced with fiberglass, aluminum, or stainless steel structural sections as required for strength and to maintain rigidity in the intended service.

- G. Mounting holes shall be located on 12-inch centers, unless otherwise shown on the drawings. Weirs shall be adjustable in both horizontal and vertical directions. Weirs which are to face mounted shall have mounting holes not less than 2-1/2 inches or more than 2-3/4 inches in diameter.
- H. Weir Design: The overflow weir shall be designed such that the weir loading is less than 1,500 GPD/lineal foot of weir length at design flow.

PART 3 - EXECUTION

3.01 Installation

- A. Install fiberglass weirs in accordance with manufacturer's recommendations, as shown on the drawings, and as specified in this Section.
- B. Secure weirs with stainless steel hardware.
- C. Use 5-inch diameter fiberglass washer between fiberglass weir and stainless steel washer when face mounting weirs.
- D. When multiple sections of weir are required, leave a 1/2-inch to 3/4-inch slot between the ends of adjacent weirs. Cover opening between ends of weirs with a fiberglass butt plate, which is of the same height as the applicable weir and not less than 6 inches wide.
- E. Weirs shall be installed level and plumb, unless otherwise shown on the drawings. Weirs shall be within 0.005 foot of the elevation shown on the drawings.

3.02 Cleaning and Adjusting

- A. Weirs shall be cleaned and adjusted for proper operation to the satisfaction of the Engineer.

SECTION 11361

SUBMERSIBLE NON-CLOG SEWAGE PUMPS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install the submersible non-clog sewage pumps as shown on the drawings and as herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 11306 - Packaged Pump Stations (Float Control System and Installation)

1.03 Quality Assurance:

A. Standards:

- 1. Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.

B. Tests:

- 1. Factory test units per procedures of Hydraulic Institute prior to shipment.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.

B. Submit the following:

- 1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
- 2. Shop drawings with performance data, pump curves, and physical characteristics.
- 3. Manufacturer's installation instructions.
- 4. Manufacturer's operation and maintenance material and manuals.
- 5. Form of warranty.
- 6. U.L. listing of motors.

1.05 Warranty:

- A. Warrant equipment for period of one (1) year following successful operation.

- B. Successful operation shall be first day of thirty (30) day period in which equipment functions without failure due to manufacturing defects.

PART 2 - PRODUCTS

2.01 Pump Design:

- A. Pump Medium: Raw, unscreened sewage, 3-inch spherical solids, and stringy materials typical of domestic sewage.
- B. Automatically and firmly connect to discharge piping when lowered into place on its mating discharge connection.
- C. Easily removable for inspection or service, requiring no bolts, nuts, or other fastenings to be disconnected.
- D. Fitted with stainless steel lifting chain to permit raising and lowering the pump for inspection and removal.
- E. Capable of continuous submergence under water without loss of watertight integrity to 65 feet depth.

2.02 Pump Construction:

A. Materials:

- 1. Major parts, including stator casing, oil casing, sliding bracket, volute and impeller: Gray cast iron, Class 30, with smooth surfaces devoid of blow holes and irregularities.
- 2. Protect surfaces in contact with sewage with coating resistant to sewage.
- 3. Exposed bolts and nuts: 304 stainless steel.

B. Impeller:

- 1. Gray cast iron of a non-clogging design capable of handling solids, fibrous materials, and heavy sludge.
- 3. Three vane, dynamically balanced.
- 4. Slip fit to shaft and key driven with non-corroding fasteners.
- 5. Wear Ring: Cast polymer material with molybdenum sulfide additive, or equal.

C. Shaft Seals:

- 1. Two mechanical rotating shaft seals are required to seal oil chamber.
- 2. Seal Faces: Hydrodynamically lubricated, lapped with oil to provide lubricating and cooling medium.

3. Lower seal between pump and oil chamber: One stationary, one positively driven rotating tungsten-carbide ring held in contact by spring system.
4. Upper seal between oil sump and motor housing: One stationary tungsten-carbide ring and one positively rotating carbon ring held in contact by spring system.
5. Operation and Maintenance: Require neither maintenance nor adjustment, but easily inspected and replaceable.
6. Sealing Operating Pressure: 65 feet water head.
7. Capable of 24-hour dry operation without damage to motor or seals.

D. Pump Shaft: Stainless steel ANSI 431.

E. Mating Surfaces of Major Parts:

1. Machined and fitted with nitrile O-rings for watertight sealing.
2. Machining and fitting shall permit sealing by automatic compression of O-rings in two planes for contact on four surfaces.

F. Tolerances shall allow replacement of any part without additional machining to ensure seal.

G. Cooling System: Adequately designed with thermal radiators integral to stator housing, cast in one unit.

H. Moisture Sensing Probes: Installed in mechanical seal cavity of each pump to sense intrusion of pumped liquid into seal cavity. Upon alarm condition, signal mounted alarm device, and shut pump down.

2.03 Pump Motor - Oil Filled:

A. Description:

1. Three-phase with motor and pump furnished as an integral unit.
2. Suitable for Class 1, Group D hazardous locations.
3. Oil filled type with Class B insulation system, Class F materials rated for continuous duty in 40°C liquids.
4. See Drawings and Motor Schedule for H.P. and voltage.

B. Construction:

1. Motor Frame and End Shields: Corrosion-resistant cast iron with stainless steel hardware and shaft.
2. Static seals for moisture exclusion O-ring type.

C. Cable Entry:

1. Threaded extension in top end bell, to permit installation of armored covering or conduit.
2. Electrical leads primarily sealed with a molded neoprene compression grommet.
3. Secondary moisture seal provided by cast epoxy material, encapsulating splice connectors in motor end bell.

D. Ratings:

1. Motor bearings shall be prelubricated at factory and have a minimum B-10 life of 15,000 hours.
2. Motor rated thermally to NEMA MG1-12.42.
3. Motor internal pressure capability: 200 psi.

E. Thermal Protection:

1. Internal thermal sensors.
2. Monitor stator temperatures.
3. One for each phase.
4. Internal thermal sensors shall initiate alarm and automatically shutdown pump for manual reset.

2.04 Pump Motor Cable:

A. Furnish Cable with following wires:

1. Power cable shall be three (3) conductor wires and one (1) ground wire
2. Control Cable
3. High temperature alarm wire shall be one (1) per phase.
4. Moisture Alarm Wire

B. Wire Size:

1. Conductor and Ground Wire: Minimum size per NEC.
2. Allow for three percent (3%) voltage drop.
3. If conductor size not indicated on Drawings, provide calculations for wire selection.

C. Service: Heavy duty, flexible rated for submerged service in hazardous space.

PART 3 - EXECUTION

3.01 Factory Test:

- A. Test pump and motor in accordance with standards of Hydraulic Institute. Recordings of test shall substantiate operation of equipment at design head, capacity, speed and horsepower.

B. Record voltage and amperage draw of pump motor.

3.02 Packaging:

A. Package equipment to prevent damage during shipment or installation.

3.03 Service Representative Services:

A. Provide Factory Service Representative to inspect pump station, validate warranty conditions and supervise dry test, wet test, and start up.

SECTION 11376

SURFACE AERATORS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install an aerator system consisting of aerator(s), controls, control panel, anchor cables and submersible power supply cables as shown on the drawings and hereunder specified. Contractor shall also provide floats and anchor cables for aerators if aerators are shown on plans to be floating.

1.02 Related Work Specified Elsewhere:

- A. Division 16 - Electrical

1.03 Quality Assurance:

- A. Standards:

- 1. All materials and products installed by Contractor shall be of the type approved by the Ohio Basic Building Code and National Electric Code.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Shop drawings with performance data and physical characteristics for surface aerator equipment.
 - 2. Manufacturer's written installation instructions.

1.05 Product Delivery, Storage and Handling:

- A. Aerator units shall be delivered to the site in such a manner as to avoid damaging units.
- B. Units shall be stored so as to protect from weather or construction activity damage.

PART 2 - PRODUCTS

2.01 Surface Aerator:

- A. The aerator shall have all stainless steel (foam filled) floats and mounting brackets. Floats are not required for wall mounted aerators.

- B. Each aerator shall consist of an electric motor flexibly coupled to a solid rotating shaft. A propeller shall be affixed to the lower end of the shaft. The shaft shall be supported along its length by sealed tapered roller bearings and a stationary draft tube shall surround the shaft and protect it. An air inlet hole shall be provided in the draft tube. An air passageway shall exist between the draft tube and the solid shaft so that atmospheric air can be transferred through the unit and into the wastewater.
- C. The shaft shall be a one piece precision machined shaft made of 316 stainless steel. One end shall be splined and threaded for the propeller and the other end fitted with a keyway for the flexible coupling. The shaft shall provide vibration free operation for maximum bearing life.
- D. Tapered roller bearings shall be used to align the shaft and take up all thrust load from the propeller. Minimum bearing L_{10} design life shall be 100,000 hours. Each bearing shall be provided with at least two seals to maintain grease within the bearings and to keep all liquids out. No sleeve type, ball bearing type, or wastewater lubricated bearings will be used.
- E. A non-fouling, low-vortexing hollow-hub propeller shall be used. The propeller shall be made of a corrosion resistant alloy and shall not deform during normal operation. The propeller shall incorporate an impact clutch device to reduce the effect of impact or sudden loads on the shaft and motor.
- F. A stationary draft tube and air inlet hole shall be used to minimize aerodynamic drag and interference. The draft tube shall be made of 304 stainless steel (316 stainless steel available for highly corrosive applications) and shall be shaped in such a way to maximize air flow. Each air inlet hole or slot shall provide the equivalent open area of a 3 inch diameter circle to minimize drag. Rotating hollow shaft or rotating air inlets will not be used.
- G. An air passageway shall be provided between the solid shaft and stationary draft tube to conduct air through the aerator. This passageway shall be at least 7 square inches in cross-sectional area along the majority of its length in order to minimize drag.
- H. The aerator is positioned at an angle in the wastewater with the motor portion and air intake above the surface, and the propeller portion below the surface. The motor rotates, turning the solid shaft which turns the propeller. This moves water at a high velocity through and near the propeller blades, creating a low pressure zone at the propeller hub. The low pressure draws air in through the stationary air intake, down through the stationary

large-diameter draft tube and exits into the water at the propeller hub. Turbulence and flow created by the propeller breaks up the air bubbles, mixes the basin and disperses oxygen. The horizontal water movement maximizes bubble hang time maximizing oxygen transfer.

- I. Each aerator shall be provided with a two pin mounting bracket which fits into a mounting cradle and allows the aerator's angle into the wastewater to be easily moved from nearly vertical to nearly horizontal. A bolt hole circle shall be provided on the mounting cradle which allows the aerator to be bolted at a specific angle. The mounting bracket shall allow the motor to be removed without removing the aerator or mounting bracket and shall also allow the aerator portion to be removed without removing the motor or mounting bracket. The mounting bracket shall be 304 stainless steel.
- J. Mooring cables for floating aerators shall be aircraft grade stainless steel, 1/4" diameter.
- K. The motors shall be suitable for outside installation (i.e. weatherproof TEFC).
- L. The electrical power cable shall be completely submersible and waterproof.
- M. The maximum RPM permitted is 1800, in order to reduce wear.
- N. Each aerator shall provide at least 3 pounds of O₂ per brake HP/hr.
- O. The aerator shall be as supplied by Aeromix System, Inc. of Minneapolis, Minnesota or equal.

PART 3 - EXECUTION

3.01 Installation:

- A. Follow manufacturer's and Engineer's instructions for installation.

SECTION 11396

WASTEWATER SAMPLER

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install composite flow sampling equipment consisting of Electronic Controller Unit, Dual Vacuum Pump Units, Power Unit, and Sample Housing.

1.02 Related Work Specified Elsewhere:

- A. Section 16120 - Electrical Wiring (600 Volts or Less)
- B. Section 16134 - Panelboards
- C. Section 16920 - Motor Control Centers

1.03 Quality Assurance:

- A. All sampling equipment shall be manufactured by only one company.
- B. The sampling equipment manufacturer shall test each component for mechanical and electrical correctness.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Shop drawings with performance data and physical characteristics for wastewater sampling equipment.
 - 2. Shop drawing and catalog cuts
 - 3. Installation instructions
 - 4. Operation and maintenance instructions
 - 5. Spare parts inventory
 - 6. UL listing

1.05 Product Delivery, Storage and Handling:

- A. Equipment shall be delivered to the site in such a manner as to avoid damaging.
- B. Equipment shall be stored so as to protect from weather or construction activity damage.

PART 2 - PRODUCTS

2.01 Sampler Unit - Physical Description:

A. Unit Housing:

1. Outer Shell: 16 gauge aluminum
2. Insulation: Foamed Polyurethane
3. Water Tight: Nema 12
4. Physical Size: Height: 52 inches; Width: 24 inches; Depth: 24 inches

B. Sampling Capability:

1. Sample Capacity: (2) 5 gallon composite containers
2. Sample Volume: (2) 50-500 ml adjustable sample chambers

C. Temperature Requirements:

1. Operating Environment: Ambient Temperature Range shall be 12° to 120°F.
2. Sample Condition: After 24 hours - 15°F below ambient; After 48 hours - 25°F below ambient.

2.02 Electronic Control Unit:

A. Flow Meter Input Requirements: 4-20 ma input.

B. Sampling Frequency: 1 to 9999 minutes between consecutive samples in 1 minute increments, or 1 to 9999 flow pulses in single pulse increments.

C. Sampling Modes: Timed, or flow proportional to external flow meter.

D. Sample Volume Repeatability: ± ml, typical.

E. Time Base Accuracy: Better than 0.007% (quartz crystal controlled clock).

F. Pump intake and purge cycles.

G. Variable Sample Interval: Adjustable from 1-9999 minutes, through 24 separate intervals.

H. Delay Start: Delay program from 1-9999 minutes before start of initial program.

2.03 Pumping Unit:

A. (2) Vacuum diaphragm type pumps, 1/3 hp, 120 VAC.

B. Pump Performance:

1. Suction Lift: 24 feet, maximum.

2. Pump Rate: 5/8" I.D. suction tube: 3000 ml/min.
3. (2) 4-way, direct acting single solenoids, 120 VAC.

C. Tubing for suction (intake) shall be 5/8" I.D. x 20 feet Teflon.

2.04 Power Unit:

A. Power Supply:

1. 120V AC

2.05 Refrigeration Unit:

A. Physical Description:

1. Height - 34", Width - 24", Depth - 24", 6.2 cu. ft. cabinet
2. Stiffen cabinet with rigid foamed in place insulation, bacterial and odor resistant.
3. Sized for refrigeration of 5 gallon polyethylene container.
4. Stainless steel construction.

B. Operation:

1. Calibrated Control: 32° to 46°F.
2. 1/10 - H.P. Compressor minimum.
3. Wrap around evaporator construction for rapid cool down of sample.
4. Self defrosting.

2.06 Enclosure:

A. Heated and Waterproof:

1. 500 watt, 120 VAC heater
2. Thermostat 35°-100°F adjustable

B. One inch rigid polyurethane foam.

C. Louvers: Adjustable; one mounted on each side of top hatch for effective ventilation.

D. Cooling fan with independent thermostat.

E. Material: 16 gauge aluminum.

2.07 Manufacturer:

A. Quality Control Equipment Company Model 2582 or equal.

PART 3 - EXECUTION

3.01 Installation:

- A. Mount fixed unit on 6" concrete base pad. Install tubing in one-inch PVC conduit. Connect power unit to site electric service.

B. Furnish mounting harness for installation in monitoring manholes.

3.02 Start-Up:

A. Furnish services of manufacturer's representative to approve system installation prior to start-up, to observe and advise Contractor during start-up, and to make required field adjustments or accurate flow samples.

SECTION 11397

FLOWMETER

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide an ultrasonic flowmeter of the doppler type and provide for indicating, totalizing and transmitting of flow rate in full pipes.

1.02 Related Work Specified Elsewhere:

- A. Section 15060 - Piping and Valves
- B. Division 16 - Electrical

1.03 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Shop drawings of ultrasonic flowmeter and detailed plans and sections of mounting.
 - 2. Installation Instructions
 - 3. Form of Warranty
 - 4. Operation and Maintenance Manual

1.04 Product Delivery, Storage and Handling:

- A. Flowmeter unit shall be delivered to the site in original factory packaging and in such a manner as to avoid damaging unit.
- B. Unit shall be stored so as to protect from weather or construction activity damage.

PART 2 - PRODUCTS

2.01 Transducer:

- A. Transducer shall be for permanent installation on a 15 inch PVC pipe or as shown on drawings.
- B. The sensing element shall be totally enclosed in a metal housing with one (1) inch conduit connection to protect against impact and designed for submerged installations.
- C. Transducer shall have a 35 foot flexible conduit cable.

- D. The doppler flowmeter shall be non-invasive, not require a spool section and shall operate on a straight section of pipe. Each meter shall be flow-loop tested.
- E. The meter shall operate with the flow sensors mounted externally on the following pipe materials: carbon steel, stainless steel, ductile iron, cast iron, FRP, PVC, and may be epoxy coated or cement-lined pipe.
- F. The electronic flow sensing device (transducer) shall be mounted to the outside of the pipe, installed and removed without interrupting flow in the line. Wetted transducers or electrodes in contact with the liquid are not acceptable. The transducer shall be of the single head type. The transducer shall be designed to operate continuously at temperatures up to 320°F. The transducer shall be self-aligning when mounted by means of a pipe strap and approved sonic coupling compound.

2.02 Transmitter/Indicator/Totalizer:

- A. Transmitter shall produce a 4-20ma DC output and shall operate on 120 VAC and 60 Hz.
- B. The 4-20ma output shall be proportional to flow and isolated. The maximum resistive load shall be 600 OHMS. Output current limiting circuitry shall be provided.
- C. The transmitter circuitry shall employ dual stage damping to detect flow variations and automatically change time constants to track the actual flow change for steady chart readings and smooth flow control.
- D. The transmitter shall include adjustments for range calibration, ma span, ma zero, output signal damping and AGC sensitivity.
- E. The sensing element circuitry shall be solid-state and transformer isolated and designed to meet intrinsic-safe requirements. The receiver circuit shall be double high-Q staged for maximum RFI rejection. The transmit and receive circuitry shall have automatic high voltage bleeds for nearby lightning strikes. The transmit circuit shall be cable length adjustable to permit maximum transmit power to flow sensor cables up to 100 feet in length.
- F. The ultrasonic flowmeter shall respond to flow rates as low as 0.2 FPS when the flow stream is nearly clean or contains particles and/or bubbles.
- G. The transmitter/indicator/totalizer shall be housed in a NEMA-4X weather-tight enclosure with gasketed shatterproof windows for meter viewing. The housing front shall be hinged to provide easy access to all controls and be suitable for wall or pipe-stand mounting.

- H. The transmitter shall contain a digital display of flow rate. The digital readout shall be directly calibrated in engineering units (gallons per minute - gpm). The display shall be an LCD type having 3-1/2 digits with selectable decimal point and multiplier as required for the specific flow range. The rate indicator shall be suitable for local or remote mounting in panels or other enclosures.
- I. The transmitter shall contain electronic means to prevent crosstalk from other in-service sonic flowmeters of the same manufacturer. The transmitter shall contain circuitry to force the output to zero during abnormal backflow conditions. This circuitry shall be activated when sensing a contact closure from a remote relay device.
- J. For ease of service by plant personnel, a built-in calibration checking device shall be provided. This internal frequency standard shall consist of an on-board frequency device and separate reference frequencies.
- K. The manufacturer shall supply a multi-point flow calibration curve for each instrument.
- L. The totalizer shall be the electro-mechanical non-reset type having 6-digits scaled in designated engineering units. The totalizer shall be suitable for remote mounting in panels or other enclosures.
- M. The flowmeter electronics shall be designed to operate at temperatures between -10 and +140°F. All electronic circuits are to be interchangeable with other flowmeters having the same model number. All electronic circuits are to be Mil-Spec coated with an anti-fungus compound. The transmitter circuit and calibration frequency standard shall be crystal controlled. The transmitter shall be powered by 115 VAC or 220 VAC at 50/60 Hz requiring less than 10 watts. All field connections are via screw-type terminals only.
- N. A heater and thermostat assembly shall be provided to insure proper operation of all indicators and readout devices.
- O. An AC power line noise filter and voltage surge protectors shall be provided.
- P. A signal strength meter and/or separate loss-of-signal indication shall be provided via signal-to-noise circuitry to drive all outputs to zero upon loss of signal.
- Q. Ultrasonic flowmeter shall sense from 50 gpm to 3000 gpm.

PART 3 - EXECUTION

3.01 Installation:

- A. Contractor shall install as detailed in drawings and per manufacturer's written recommendations.
- B. Contractor shall calibrate per manufacturer's written recommendations.
- C. Testing shall be per manufacturer's written recommendations.
- D. Warranty shall cover a minimum period of one year and shall include workmanship and materials.

SECTION 11398

CIRCULAR CHART RECORDER

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install 7-day circular chart flow recorder in Laboratory Building.

1.02 Related Work Specified Elsewhere:

- A. Section 11397 - Flowmeter
- B. Division 16 - Electrical

1.03 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Shop drawings of the flow recorder
 - 2. Operation and maintenance manual
 - 3. Factory tests
 - 4. Form of warranty

1.04 Product Delivery, Storage and Handling:

- A. Recorder unit shall be delivered to the site in original factory packaging and in such a manner as to avoid damaging unit.
- B. Unit shall be stored so as to protect from weather or construction activity damage.

PART 2 - PRODUCTS

2.01 Circular Chart:

- A. Report flow on 12-inch diameter uniformly graduated chart designed for 7-day removal.
- B. Signal to be reported:
 - 1. 4 to 20 MaDc
 - 2. One pen and indicator/recorder required.
- C. Operation:
 - 1. Utilize two-phase servo motor for positioning pointer and pen arm.

2. Positioning of servo motor shall be accomplished by use of electronic amplifier utilizing standard solid state devices, with full scale pen travel not exceeding 12 seconds.
3. Entire receiver mechanism shall be mounted on pivoted frame to permit inspection of parts without need for interrupting operation.

2.02 Indicator-Recorder:

- A. Indicate flow on a uniformly graduated flow scale or digital LCD separate from pen arm.
- B. Totalizer: Cyclometer type, reporting seven digits or digital microprocessor based.

2.03 Housing:

- A. Pressed steel, dust and moistureproof.

2.04 Supplies:

- A. Include with meter one (1) year supply of charts, ink and instruction book.

PART 3 - EXECUTION

3.01 Installation:

- A. Install per manufacturer's instructions.

3.02 Start-Up:

- A. Provide instrumentation equipment service representative for coordination of primary and reporting devices.

SECTION 11450

LABORATORY SUPPLIES, EQUIPMENT AND FURNISHINGS

WASTEWATER LABORATORY

PART 1 - GENERAL

1.01 Description:

- A. Furnish items of equipment, supplies and furnishings needed to perform following chemical analysis: pH, dissolved oxygen, suspended solids, chlorine residual and temperature.
- B. Equipment and supplies furnished shall be components of test method/procedure recognized and approved by the Environmental Protection /Agency and Water Pollution Control Federation.

1.02 Submittals:

- A. Furnish submittal material for equipment, supplies and furnishings, manufacturer's description, written and pictorial, of each item furnished. Arrange in catalog manner, divided into sections by analysis item will be utilized to perform.

1.03 Quality Assurance:

- A. Supply new, undamaged first quality items manufactured by reputable manufacturer, recognized in chemical equipment field. All items furnished, except consumable chemicals, shall be guaranteed for one (1) full year after the date of delivery.

PART 2 - PRODUCTS

2.01 Equipment List:

- A. Items are tabulated for Contractor information purposes only to aid in generating proposal for work, presenting examples of equipment and manufacturers meeting specification, and providing check list of items. Owner will show no preference to items shown versus alternate product.

2.03 Laboratory Equipment - Mechanical Units:

<u>Major Lab Equipment Item No.</u>	<u>Manufacturer's Number</u>	<u>Manufacturer</u>	<u>Description</u>
1	----	General Electric	Refrigerator, 15 cubic feed. One interior dimension other than height must exceed 21 inches.
2	AE 2000	Mettler	Electronic analytical balance
3	CP 10	Casio	Calculator/clock/calendar with carrying case, built-in rechargeable batteries, recharger and 10 rolls of paper (CTR P16)
4	SA720	Orion	pH/ISE meter
5	9156	Orion	Combination pH probe
6	9512	Orion	Ammonia probe
7	9770	Orion	CL2-TRC probe
8	54ARC	Yellow Springs Instruments	Dissolved oxygen meter with built-in battery charger and cord
9	5739	Yellow Springs Instruments	Field oxygen probe
10	5750	Yellow Springs Instruments	Non-Stirring dissolved oxygen probe with membrane and KCI kit
11	1250	Labline	Magnetic stirrer with 2 teflon coated magnetic stirring bars
12	PC-351	Corning	Stirrer-hot plate
13	10-029	Fisher 3202	Emergency eye-wash station
14			Raven Solids package: includes 3 settleo-meters, 1 centrifuge w/tubes, 1 sludge sight tube

2.04 Miscellaneous Laboratory Equipment

A. Furnish all miscellaneous equipment as listed below:

Miscellaneous Lab Equipment

<u>Item Number</u>	<u>Quantity</u>	<u>Description</u>
1	1	Armor case for thermometers 12 inches long
2	1	Alcohol burner
3	2	Double buret clamp
4	6	Day pinchcock
5	6	Utility clamp
6	3	Utility clamp
7	1	Cork borers, set of 15
8	1	Cork borer sharpener
9	1	First aid kit
10	3	Forceps, general, straight with sharp points
11	1	Glass cutting knife
12	2	Pipet box, stainless steel, 16" x 2-1/2" diameter
13	1	Pipet cleaning set (polyethylene jar, basket and washer-rinser) for 16" pipets
14	1	Scorer, glass file, triangular
15	2	Spatula, cushion grip stainless steel, 150 mm blade
16	2	Spatula, Spoonula type
17	0	Support, Nessler Color Tubes, 12 place
18	2	Support, revolving pipet, polypropylene
19	3	Support, rectangular, porcelain base, aluminum rod
20	4	Thermometry, double scale, 76 mm immersion, General Grade, -20°C to 110°C, 12" length
21	2	Tongs, Beaker, 100 ml to 1500 ml, fiberglass
22	1	Tongs, flask, stainless steel
23	2	Tray, white enameled steel

2.05 Laboratory Supplies:

A. Furnish all laboratory supplies as listed below:

<u>Lab Supply</u> <u>Item No.</u>	<u>Quantity</u>	<u>Description</u>
1	2	Apron, Neoprene covered, 36" length
2	2	Asbestos boards, 6" x 6" x 1/8"
3	1	Asbestos gloves
4	2	Beaker, Griffin, Low Form, pyrex, 100 ml
5	2	Beaker, Griffin, Low Form, pyrex heavy duty, 250 ml
6	2	Breaker, Griffin, Low Form, pyrex heavy duty, 400 ml
7	2	Beaker, Griffin, Low Form, pyrex heavy duty, 600 ml
8	1	Bottle, aspirator, polyethylene w/tabulation and cap
9	96	Bottle, BOD, numbered consecutively, 300 ml
10	200	BOD bottle overcap
11	2	Bottle, dropping, polyethylene w/dropper, 60 ml
12	6	Bottle, wide mouth, polypropylene and cap, 500 ml
13	1	Bottle, wash, polyethylene, 500 ml
14	1	Brush, Buret, 100 ml
15	2	Brush, imhoff settling cone
16	4	Brush, test tube, 5/8"
17	4	Brush, test tube, 1-3/8"
18	3	Bulb, rubber, 2 ounce
19	2	Buret, straight glass stopcock, dust cap, 25 ml
20	2	Buret, teflon stopcock, dust cap, 50 ml
21	4	Buret, automatic zero, teflon stopcock, 25 ml, w/1000 ml titrant supply bottle
22	3 Cartons	Cleaning tissues, disposable
23	3	Cone, Imhoff settling styrene-acrylonitrile with support
24	1 pkg	Corks, assorted
25	10	Cuvets, round, matched to 1% T, 13 x 100 mm
26	2	Cylinder, graduated, single scale, lifetime red, pyrex, 25 ml and bumpers
27	2	Cylinder, graduated, single scale, lifetime red, pyrex, 100 ml

<u>Lab Supply</u> <u>Item No.</u>	<u>Quantity</u>	<u>Description</u>
28	2	Cylinder, graduated, single scale, lifetime red, pyrex, 500 ml
29	3	Drawer organizers, plastic 12 compartment tray, 17" x 14" for storage of small parts
30	3	Drawer organizers, plastic 20 compartment tray, 17" x 14" for round beakers and flasks having 4 discrete diameters ranging from 2-1/4" to 3-7/8"
31	2	Drawer organizers, plastic 3 compartment tray 17" x 14" with 3 compartments for pipets and thermometers
32	5	Filter funnel, magnetic 47 mm diameter, 300 ml capacity
33	1 box	Filter Paper, Whatman No. 3, 9 cm
34	1 box	Filter Paper, Whatman No. 5, 9 cm
35	1 box	Filter Paper, Whatman GF/C, 9 cm
36	1 box	Filter Paper, Whatman, No. 4, 9 cm
37	2	Flask, Erlenmeyer, narrow mouth, graduated, pyrex, 125 ml
38	2	Flask, Erlenmeyer, wide mouth, graduated, pyrex, 260 ml
39	2	Flask, Erlenmeyer, wide mouth, graduated, pyrex, 500 ml
40	1	Flask, filtering, heavy wall, graduated, pyrex, 500 ml
41	2	Flask, volumetric, standard taper, Class A, pyrex, 50 ml
42	2	Flask, volumetric, standard taper, Class A, pyrex, 100 ml
43	2	Flask, volumetric, standard taper, Class A, pyrex, 250 ml
44	2	Flask, volumetric, standard taper, Class A, pyrex, 500 ml
45	2	Funnel, Buchner, Coors Porcelain, 91 mm ID
46	2	Funnel, polypropylene, 100 mm
47	2	Funnel, chemical, polypropylene, 75 mm
48	1 lb.	Glass rod, 7 mm diameter
49	100	Gloves, polyethylene, disposable
50	2	Gloves, rubber, size 9
51	2	Goggles
52	1	Ink, ceramic marking

Lab Supply
Item No.

Quantity

Description

53	1	Labeler, Dymo type
54	1	Mortar and pestle
55	1 pkg.	Pencils, wax, glass marking, high temperature, red
56	1 pkg.	Pencils, wax, glass marking, high temperature, black
57	1	Pen, laboratory, red
58	1	Pen, Laboratory, black
59	1	Ph paper and dispenser, 6 to 9 range
60	10	Pipet, serological, large tip, color coded, 1 ml
61	20	Pipet, serological, large tip, color coded, 5 ml
62	20	Pipet, serological, large tip, color coded, 10 ml
63	10	Pipet, serological, large tip, color coded, 25 ml
64	100	Pipet, serological, sterile, disposable, 1 ml
65	100	Pipet, serological, sterile, disposable, 10 ml
66	3	Pipettor, ball-valve
67	2 pkg.	Rubber stoppers, assorted, twistit type
68	3	Stirring Bar, magnetic, teflon, 1/2" x 5/16"
69	3	Stirring bar, magnetic, teflon, 1" x 3/8"
70	2	Stirring bar retriever, polyethylene, 12"
71	1	Stopcock lubricant, 2 ounces
72	1	Support, funnel, 4 place
73	6 rolls	Tape, label, write-on
74	25 ft.	Tubing, tygon, 1/4" I.D. x 1/16"
75	30 ft.	Tubing, vacuum, black, 3/16" I.D. x 3/16" wall thickness
76	2	Simplified Laboratory Procedures for Wastewater Examination, WPCF Publication No. 18 (1971) or most recent publication.
77	1	"Standard Methods for the Examination of Water and Wastewater", most recent publication
78	3	Waxed paper, roll
79	2	Aluminum Foil, roll

<u>Lab Supply Item No.</u>	<u>Quantity</u>	<u>Description</u>
80	2	Funnel, separator, 1000 ml pyrex, pear-shaped w/teflon plug and stopcock
81	2	Dispenser and bottle for 1-5 ml range in 0.1 ml increments. With 32 oz. bottle and filling and discharge tubes.
82	2	Dispenser and bottle for 2-10 ml range in 0.25 ml increments. With 32 oz. bottle and filling and discharge tubes.
83	2 pr.	Shears, 7-1/2" full length, black enamel handle, chrome over nickel blades
84	2	6" x 6" wire gauze squares with ceramic fiber center
85	2	Blackenameled cast iron tripod, 9" detachable legs, 5" diameter ring
86	1	Pipetter w/1000 disposable tops, macro-set pipetter (Oxford) 8900 Series

2.06 Chemicals:

A. Furnish all chemicals as listed below in ACS analytical reagent grade unless otherwise specified.

1. Acetic Acid - 5 lb.; glacial.
2. Alkaline-Iodide-Azide Reagent - 1 qt. APHA for dissolved oxygen.
3. Ammonium Chloride - 1 lb.; granular.
4. Ammonium Hydroxide - 4 lb.
5. Buffer Solution - 1 pt.; pH 4.0.
6. Buffer Solution - 1 pt.; concentrate, pH 7.0
7. Buffer Solution - 1 pt.; pH 10.0.
8. Calcium Chloride - 1 lb.; anhydrous, crystal.
9. Drierite - 5 lb.; 4 mesh.
10. Electrode Filling Solution - 100 ml; potassium chloride.
11. Ethyl Alcohol - 1 gal.; specially denatured.
12. Glycerin - 500 ml, white.
13. Hydrochloric Acid - 3 @ 12 lb. ea., 36.5-38%.
14. Hydrochloric Acid Solution - 1 qt.; I.O.N.
15. Hydrogen Peroxide - 1 qt.; 30%.
16. Iodine - resublimed, 1/4 lb.
17. Isopropyl Alcohol - 1 pt.
18. Manganous Sulfate Solution - 1 qt.; APHA for dissolved oxygen.
19. Methyl Alcohol - 1 pt.; absolute.
20. Methyl Orange - powder; 1/4 lb.

21. Methylene Blue Indicator - powder 1/4 lb.
22. Phenolphthalein - powder 1/4 lb.
23. Phosphorous Standard Solution - 1 qt., 100 mg/l as P.
24. Sodium Hydroxide - 10 lb.; special pellets.
25. Sodium Hydroxide Solution - 1 qt., 6.0 N.
26. Sodium Hydroxide Solution - 1 qt.; 1.0 N.
27. Sodium Hydroxide Solution - 1 gal., 0.1 N.
28. Sulfuric Acid - 3 @ 18 lb. ea., 95-98%.
29. Sulfuric Acid Solution - 1 qt., 1.0 N.

PART 3 - EXECUTION

3.01 Delivery, Inventory and Storage:

- A. Furnish equipment, supplies and furnishings in original, undamaged containers.
- B. Preparing packing lists from shop drawings and specification listings. Assign Mark No. to each package. Forward copy of packing list to Engineer and with container.
- C. Stencil containers with Mark Nos. referencing Shop Drawings, Specifications, and catalogue numbers. Firmly attach packing list to container exterior.
- D. Break and inventory containers under observation of Owner's Representative.
- E. If laboratory furniture, fixtures and casework are not ready for use, reseal packages and store in secure, heated, dry space.
- F. Mark chemicals with asterisk (*) considered dangerous. Care shall be taken in handling and storing all dangerous chemicals. Make Code to indicate class of dangerous chemical and color of label required for shipping chemical. All label information shall be reproduced and posted prominently at any temporary storage location during construction. Classification codes are as follows: F.L. - Flammable Liquid; Cor. L - Corrosive Liquid; Pois. B. - Class B Poison.

* * * END OF SECTION * * *

11450-8

SECTION 11809

PORTABLE PUMP

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall furnish portable pumping unit including 4-inch by 4-inch suction lift pump, motor controls, hoses, fittings and appurtenances as herein specified.

1.02 Quality Assurance:

- A. Furnish equipment manufactured in America (see EPA "Buy American Regulations") for heavy duty service handling abrasive solids in open uncovered area.

1.03 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
 - 2. Shop drawings with performance data and physical characteristics.
 - 3. Manufacturer's operation and maintenance material and manuals.

1.04 Delivery and Storage:

- A. Delivery equipment with ports closed in skid or packaging to protect from damage.
- B. Store equipment under cover in clear, dry area. Following testing and prior to acceptance by Owner, clean equipment, lubricate and add lubricants to all reservoirs.

PART 2 - PRODUCTS

2.01 Portable Pump:

- A. Furnish portable pump rated at 150 GPM and 67 ft. TDH continuous service. Furnish pump with following characteristics:
 - 1. Size: 4-inch x 4-inch, NPT, Female
 - 2. Casing: Gray Iron 30 (Max. Operating Pressure: 110 lbs.)
 - 3. Impeller: Open Type 2 Vanes, Ductile Iron 60-40-18 (handles 3 inches diameter spherical solids)

4. Impeller Shaft: Steel 4140
5. Cover Plate: Removable, Gray Iron
6. Wear Plate: Replaceable, Steel
7. Intermediate Bracket: Gray Iron
8. Seals:
 - a. Double Grease Lubricated Seal with Spring Loaded Grease Cup
 - b. Sintered Bronze, Stationary Seat
 - c. Rotating Faces: Steel
9. Radial Bearing: Roller Type
10. Thrust Bearing: Roller Type
11. Flanges: Gray Iron 30
12. Gasket: Buna, Rubber
13. Standard Equipment:
 - a. Strainer
 - b. Hoisting Bail
 - c. Skid Base
 - d. 90° Discharge Elbow
14. Discharge Pressure Gauge: 2-1/2-inch diameter face

2.02 Portable Pump Engine:

- A. Furnish engine with following general construction and operating specifications.
 1. Type: 4 cycle, air cooled
 2. Displacement Cu. In.
 3. Governor: Mechanical
 4. Lubrication: Full pressure
 5. Air Cleaner: Dry type
 6. Fuel Tank: 20 U.S. Gallons
 7. Operation Time: Full load - 11 hours
 8. Starter: 12 volt electric
 9. Max. Cont. BHP @ 2,000 RPM; 15 HP
 10. The engine with Nema 3R enclosure and fuel tank shall be mounted on a portable trailer. the base shall maintain rigid alignment of the engine/pump unit. Vibration isolator base shall be provided. The "over-the-road" trailer shall have two 8-ply tires, adjustable hitch leveler with both ball hitch and pintle eye, rear stabilizer jacks, front 2000 lb. leverer jack, fenders and lights.
 11. Safety shutdown controls for high engine temperature, low oil pressure, starting battery failure, overspeed and overcrank with restart lockout, plus 5 minute unloaded running time.

2.03 Fittings and Appurtenances:

- A. Suction Hose: Two lengths 20-feet x 4-inch diameter Spiralite Number 110 PVC reinforced hose with coupling and suction strainer.

B. Pressure Hose: Four lengths 25-feet x 4-inch diameter Spiralite Number 110 PVC reinforced hose with couplings.

C. Spare Parts: Furnish one lot of spare parts as recommended by Pump Manufacturer.

PART 3 - EXECUTION

3.01 Initial Operation:

A. Prior to acceptance by Owner, wet test motor and pump by operating equipment for 10-hours under light load. Attach and operate appurtenant equipment.

3.02 Service Maintenance:

A. Upon 100-hours operation, check mechanical systems for wear and defects.

3.03 Guarantee:

A. Warrant equipment for period of one year from substantial completion.

SECTION 12345

LABORATORY CASEWORK AND FIXTURES

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install laboratory and office furniture, including conventional base and wall cabinets with end panels; service shelves, ledges and decks; cabinet tops, tables, desk file cabinet, chairs, stools, wastebasket and miscellaneous items of equipment.
- B. Provide cutouts and openings for plumbing and electrical services. Install filler panels and scribe strips where equipment abuts wall or corner to obtain enclosed assemble.

1.02 Related Work Specified Elsewhere:

- A. Division 15 - Mechanical, Heating, Ventilating and Air Conditioning: Bring services to and install services to laboratory furniture and equipment to provide complete operating laboratory facility.
- B. Division 15 - Plumbing: Install and connect all piping, fixtures and fittings, including faucets, traps, valves, vacuum breakers, sink outlets, overflows, drain lines, air lines, gas lines, and water lines to provide complete operating laboratory facility.
- C. Division 16 - Electrical: Furnish, install and connect electrical service, conduit, wiring, fixtures, outlets, service strips and special electrical equipment and accessories necessary for complete operational installation.

1.03 Quality Assurance:

- A. Furnish laboratory furniture equal to that manufactured by Hamilton or equal. Brand and catalogue numbers are specified to indicate type and quality of furniture required.

1.04 Submittals:

- A. Samples:
 - 1. Casework finish
 - 2. Bench top
 - 3. Drawers and cabinet doors hardware, closures and bearings
- B. Shop drawings, manufacturer's literature and installation instruction catalogued by specification items with Mark No. Identification.

C. Rough-in Drawings

- D. Packing Lists: Location of waste, vents, water supply, electrical outlets indicated on mechanical and electrical drawings are approximate. Furnish cuts and rough-in dimensioned drawings accurately locating from walls up from floors, all cutouts and holes to receive rough-in by other trades.

1.05 Shipment, Handling and Storage:

- A. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.
- B. Ship equipment in rugged packaging with Mark Nos. stenciled on packaging exterior.
- C. Ship Packing Lists in duplicate; one to Engineer, and one securely attached to package exterior.
- D. Inventory and inspect packages upon delivery to project site. Verify packing lists against package content with Owner's Representative.
- E. Reseal packaging and store in clean, secure, dry area until incorporation into work.

PART 2 - PRODUCTS

2.01 Acceptable Manufacturers:

- A. Kewaunee Scientific Equipment Corp., Adrian, Michigan; Hamilton Manufacturing Co., Two Rivers, Wisconsin; Classic Modular Systems, Inc., Two Rivers, Wisconsin; or equal.
- B. Configuration of cabinets, location and type of service, plumbing and electrical fixtures, sinks, tops, etc. shall be as shown on plans.

2.02 Materials:

A. Metal Units:

1. 18 gauge sheet minimum steel, prime grade, cold rolled, stretcher leveled furniture stock, coated with corrosion resistant finish after fabrication.
2. Cabinets shall be flush type construction with exposed seams and joints welded and ground smooth. Cabinets shall be processed with phosphate based treatment and painted with first quality enamel and then baked to cure the paint for maximum durability. Color as selected from manufacturer's standard colors.
3. Doors and drawers shall be double wall construction with nylon-tired ball bearing rollers with stops and covered drawer bottoms.

B. Wood Units:

1. **Chem-Guard** - Surface covering meets Class 1 interior finish material requirements listed with Underwriters Laboratories, Inc. (Guide BWSZ; R6738). Highly chemical resistant, durable, will resist scuff, tear and gouge. Thickness .028".
2. **Melaface** - A two sided Melamine surface particleboard panel, 45 lb. density, sealed on two sides against moisture absorption, free of internal voids, cracks or planes or weakness.
3. **Lumber** - All lumber shall be hardwood, free and clear of imperfections, kiln dried to a moisture content not to exceed 6 percent.
4. **Hardboard** - A 1/4" thick panel, composed of wood fiber and resinbinder molded under pressure to a tensile strength of 3500 p.s.i. and shear strength of 4500 p.s.i. and shall be vinyl covered on one side.
5. **Vinyl Clad Drawer Bodies** - Machined 12.5mm-1/2" particle-board core with .18mm durable vinyl wrapped on all surfaces.
6. **Edgebanding** - Black PVC 200 mil, bonded under pressure with hot melt glue.
7. **Hardware:**
 - a. Base unit door and drawer pulls and wall case pulls shall be of high impact rigid PVC. The "F" shaped pull will be used throughout all base cabinets.
 - b. Hinges shall be Blum model 90 concealed hinge with 125 degree swing, spring loaded hinge arm, nickel plated and three dimensional independent adjustability.
 - c. Drawer slides shall be Blum Tandem series BS 525, epoxy coated for optimal protection against corrosive agents. Two lateral rollers and eight nylon support rollers captive in each side carriage gives a silent, grease free operation with no side to side movement, even for extremely wide drawers. Each slide is guaranteed for 100,000 pulls with 60 lbs. and capable of 140 lbs. maximum load.
8. Cabinet ends shall be 3/4" thick Melaface with all exposed particleboard edges banded with black PVC edge banding.
9. Cabinet backs shall be two piece 3/4" thick Melaface with Rabbet cutout for access to mechanical services. Access panels will be 1/4" thick vinyl for all cupboards.
10. Drawer fronts shall be constructed of 11/16" core laminated on one side Chem-Guard, and other side cabinet liner. All drawer fronts shall be edge banded with black PVC banding and have full length PVC pull across the top edge. Drawer bottoms to be 1/4" thick vinyl covered hardboard. Drawer fronts shall be attached to drawer body with 1/4-20 machine screws into threaded inserts. This provides for easy rearrangement of color or replacement. All file drawer followers shall have a metal back engaging on a steel bottom track and have a spring positioning lock.
11. Shelves that are full width shall be 1" core Melaface, adjustable on 1-1/4" centers. All shelves shall be edge banded on all edges with black PVC banding.

- C. Counter top and box curb shall be molded from modified epoxy resins, with curing resins to produce a thermosetting material equal to Kemresin as manufactured by Kewaunee or equal. Tops will be 1" thick with exposed edges and vertical corners radiused 1/4".
- D. Bench Tops:
 - 1. 1-1/4 inches thick
 - 2. Made of:
 - a. Resin-impregnated natural stone such as Hamilton "Imperial Stone", Kewanee "Kemrock", or equal.
 - b. Composition cement (Tek Top or equal).
 - 3. Provided with 1-inch overhangs and drip grooves.
 - 4. Section of bench tops shall be field-joined into continuous surface with chemical-resistant cement at least as strong as stone top.

2.03 Metal Cabinets:

- A. Members of metal units shall be die formed, notched, assembled in jigs, with exposed welds polished smooth. Units extending to floor shall be provided with leveling devices and rubber base molding. Adjoining units shall be fastened together with concealed bolts.
- B. Metal Gauge:
 - 1. General Fabrication: 18 gauge
 - 2. Horizontal Space Rails, Posts, Runs and Gussets: 16 gauge.
 - 3. Cabinet Runs: 14 gauge
 - 4. Leg Clamps, Frame Reinforcements: 13 gauge
- C. Fabricate base cabinets for field interchangeability of drawers and hinged doors, without special tools. Horizontal cross rails shall be concealed.
- D. End panels shall be of one-piece construction with front and rear posts. Back post shall provide for recessed back and shelf supports; front post shall provide support for rails, runs, hinges and shelf support.
- E. Top rails shall be formed to provide channels and stops for swinging and sliding doors, bottom rails to provide toe space and channels for doors.
- F. Concealed intermediate rails shall support center posts and drawers and interlock into unit corner posts. Cabinet bottoms in sink units shall be removable.
- G. Drawers shall have rubber bumpers and stops to prevent accidental drawer removal. Drawers shall be supported on ball bearings or nylon rollers. Drawer fronts shall have double wall construction.

2.04 Hardware:

- A. All units extending to the floor shall have rubber cove base moldings 4 inches high, with stainless steel corners. Leg shoes of black rubber shall be furnished with provisions for floor clips.
- B. Cabinet doors shall have nylon roller friction clips. Hinges shall be five knuckle with satin chrome finish. Locks shall be 8-or 14-tumbler units with heavy duty cylinders and satin chrome nose. Each door and drawer shall have a 1-inch x 2-inch steel label holder, with satin chrome finish. Drawer and door pulls shall have satin chrome finish.

2.05 Finish:

- A. Steel units shall be treated to resist corrosion. Treatment shall consist of successive stages of cleaning, rinsing, spraying with zinc phosphate, rinsing, treating with chromic acid. All parts shall receive two coats of high quality, laboratory grade acid-, alkali- and solvent-resisting enamel on all exposed and interior surfaces. Finish coat shall have a satin finish.

2.06 Service Fixtures:

- A. Laboratory furnishings shall be provided with service fixtures as shown on plans or as recommended by furniture manufacturer.
- B. Service faucets shall be provided for double service (hot or cold mixing) as required. Faucets shall be furnished with goosenecks or in other configurations, to provide at least 7-1/2 inch clearance between outlet and sink. Each faucet shall be furnished with a serrated hose connector and filter pump for vacuum to 28 inches high. Each faucet shall have vacuum breaker and backflow preventor as approved by the regulatory agency. Color-coded index buttons shall be furnished for each faucet.
- C. Electrical fixtures shall normally be furnished for 115 volt, 15 amp service, using polarized 3-wire grounding type receptacles. For special installations where shown on plans, furnish receptacles for high voltage and amperage.

PART 3 - EXECUTION

3.01 Installation:

- A. Install plumb, level, true and straight with no distortions. Shim as required, using concealed shims. Where laboratory furniture abuts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed.

- B. Set base cabinets straight, plumb and level. Adjust with 1/16" of single plane. Where required, assemble units into one integral unit with joints flush, tight and uniform. Align similar adjoining doors and drawers to tolerance of 1/16". Provide holes for mechanical and electrical work.
- C. Securely fasten wall cabinets to solid supporting materials, not plaster, lath or wallboard. Anchor, adjust and align wall cabinets as specified for base cabinets. Reinforce stud walls to support wall-mounted cabinets during wall erection working from laboratory furniture shop drawings.
- D. Adjust all equipment and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- E. Protect materials and scientific laboratory furniture from damage until acceptance of the work.

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install all mechanical equipment, materials, and mechanical systems associated with this project. All mechanical work shall be as specified within this Division, related sections and as shown on the drawings. Provide such fittings, valves and accessories as may be required to meet each condition.
- B. Plumbing:
 - 1. Provide a complete and fully operational plumbing system for the lab building, commencing with the fixtures within the building and terminating with the connection of the building sewer to five feet outside of the building.
 - 2. Provide water piping and related accessories shown on the drawings and as specified herein.
 - 3. Provide gas piping and accessories shown on the drawings and as specified herein.
 - 4. Provide air piping and accessories shown on the drawings and as specified herein.
- C. Heating and Cooling:
 - 1. Provide a complete and fully operational heating and cooling system using all new components, except where otherwise noted, in structures as shown and to the extent indicated on the drawings.

1.02 Requirements of Regulatory Agencies:

- A. Except as otherwise specified herein, all piping work and materials shall conform to American Standards Association Code for Pressure Piping.
- B. All unfired pressure vessels furnished and installed under this contract shall conform to all requirements of current edition of State of Ohio "Ohio Boilers and Unfired Pressure Vessel Rules". Copies of all certificates of tests and construction as required by this code shall be turned over to the Owner.

PART 2 - PRODUCTS

2.01 Equipment Delivery Schedule:

- A. Submit at pre-construction meeting a schedule listing equipment and materials required for complete installation, quantity ordered, date of placing order and the promised delivery dates. Any and all delivery delays shall be identified at the pre-construction meeting.

2.02 Shop Drawings and Submittals:

- A. Contractor review shall insure that equipment will fit in available space and is compatible with other trade requirements shown on drawings and specifications (i.e., electrical requirements, cfm, etc.).
- B. Contractor shall submit any proposal for "or equal" when shop drawings are given to the Engineer. Engineer shall review product or manufacturer at this time. If submittal is not deemed as an "equal", Contractor shall, at no additional cost, resubmit product or manufacturer as specified until "approval" is obtained.
- C. Under no condition shall a Contractor procure, or order any material or equipment not approved by the Engineer in writing.

PART 3 - EXECUTION

3.01 Miscellaneous Work:

- A. New openings in the walls or roof structure which are required but not shown on the drawings as to exact location shall require written location placement and approval from the Engineer prior to cutting.
- B. Contractor is responsible for correct size, location, and installing all anchoring devices and wall or ceiling access panels. Finish of access panels shall be submitted and approved by Engineer prior to installation or application.
- C. All equipment pads shall have chamfered edges.
- D. Chromeplated pipe escutcheons shall be installed on all exposed pipe at wall, floor and ceiling penetrations within laboratory building.
- E. Install 18 gauge, 14" high galvanized steel, painted kickplates on all insulated pipes at floor level where located in exposed locations. Kickplate shall extend into floor sleeve.

F. Platforms and Supporting Stands:

1. Each piece of equipment or apparatus suspended from ceiling or mounted above floor level shall be provided with suitable structural support, platform or carrier in accordance with best recognized practice.
2. Contractors shall exercise extreme care that structural members of building are not overloaded by such equipment. In all cases, details of such hangers, platforms and supports together with total weights of mounted equipment shall be approved in writing by the Engineer prior to installation.

G. Cap existing utilities that are to be abandoned.

3.02 Attaching to Building Construction:

- A. Equipment and pipe supports shall be attached to structural members (beams, joints, etc.) rather than to floor or roof.
- B. Where piping is suspended from structural steel building framing or supporting members, furnish and install beam clamps for attaching piping support device to building member.
- C. Obtain written approval from Engineer before cutting or welding to structural members, or before hanging heavy equipment.

3.03 Labelling and Tagging:

- A. Label all electrical equipment or controls provided by the General Contractor by means of engraved laminated plastic plates screwed or riveted to the device. Height of letters to be not less than 1/4" unless otherwise specified or directed.
- B. Items to be labeled shall include but not be limited to the following: all motor starters, all remote pushbutton stations, and all motors which cannot be readily identified by their starter label when observer is standing at the motor.
- C. Printed card labels may be used on items of equipment furnished with plastic windows. Labelling of card shall be neatly printed using lettering device such as a Leroy instrument.

3.04 Cleaning and Touchup:

- A. All mechanical equipment, cabinets, control panels and other enclosures shall be cleaned and paint touched up as necessary to duplicate factory finished appearance. Touchup paint shall exactly match color, composition and quality of factory applied finish.

3.05 General Completion Startup:

- A. Provide all necessary work required to perform startup of equipment and systems installed in project and provide operating instructions to the Owner.
- B. Startup procedures for mechanical systems shall be strictly adhered to and are as follows:
 - 1. Inspect bearing for cleanliness and alignment and remove any foreign materials found. Grease as necessary and in accordance with manufacturer's recommendations. Replace bearings that run rough or noisy.
 - 2. Adjust tension in V-belt drives, adjust vari-pitch sheaves and drives for proper equipment speed. Change belts and sheaves if necessary to obtain proper equipment speed, remove any foreign materials from sheaves or belts before starting operations, adjust drives for alignment of sheaves and V-belts. Construe proper speed as that which produces intended performance.
 - 3. Adjust direct drives for proper alignment of flexible couplings, provide lubrication of particular couplings so required, check security of couplings to driver and driven shafts, set drive components to assure free rotation with no undesirable stresses present on coupling or attached equipment.
 - 4. Check pump packing glands or mechanical seals for cleanliness and adjustment before running pump. Inspect shaft sleeves for scoring and proper placement of packing, replace if necessary. Inspect mechanical faces, chambers and seal rings and replace if necessary. Make sure piping system is free of dirt and scale before circulating liquid through pumps.
 - 5. Tighten flanges and packing glands after system has been placed in operation. Replace gaskets in flanges that show any signs of leakage after tightening.
 - 6. Inspect both hand and automatic control valves, clean bonnets and stems, tighten packing glands to assure no leakage, but permit valve stems to operate without galling. Replace packing in valves that require same to retain maximum adjustment after system is judged complete. Replace entire packing in any valve that continues to leak, coat packing gland threads and valve stems with surface preparation similar to MolyCote or FelPro after cleaning.
 - 7. Inspect and make certain that all control valve seats are free from foreign material and are properly positioned for intended service.
 - 8. Inspect screwed joints for leakage and remake each joint that appears to be faulty. Do not wait for rust to form. Clean threads on both parts, apply compound and remake joint.

9. Clean strainers, dirt pockets, orifices, valve seats and headers in all fluid systems after system has been placed in operation to assure they are being free from foreign materials.
 10. Adjust pipe hangers and supports for correct pitch and alignment.
 11. Remove rust, scale and foreign materials from equipment and renew any defaced surfaces. If equipment is badly marred, Engineer shall have authority to request that new materials be provided.
 12. Renew air filters to new condition.
 13. Inspect each pressure gauge and thermometer for calibration and replace those that are defaced, broken or read incorrectly.
 14. Repair insulation that may be damaged.
 15. After each system has been put into operation, repeat certain checks described in preceding paragraphs.
 16. Complete all applicable startup procedures described in preceding paragraphs and in the associated articles for particular systems prior to occupancy of building.
 17. Provide such continuing adjustment services as necessary to insure proper functioning of all mechanical systems after building occupancy and during guarantee period.
 18. Verify correct motor rotations.
- C. A pre-startup coordination meeting shall be scheduled by the General Contractor for the specific purpose of achieving a coordinated systems startup, with Engineer and Owner.
- D. The General Contractor, Electrical Contractor, and all relative Sub-Contractors shall be present at the pre-startup meeting and at the initial startup of each mechanical system.
- E. All involved Contractors shall submit to the decision of the Engineer, of any conflict of responsibility.

3.06 Temporary Use of New Equipment:

- A. Should it become necessary or desirable to operate any equipment before final acceptance, the Owner shall be allowed to do so, but only after proper adjustments and trial operation by Contractor specified. General Contractor shall be responsible for instructing Owner, or his Representative as to proper operation and care of equipment so used. If equipment is used by Owner prior to final acceptance of job, date of documented first usage will begin warranty period.

3.07 Temporary Heat:

- A. General Contractor shall be responsible for furnishing, installing, maintaining and subsequent removal of temporary heating system within new building or other structures as weather and construction conditions demand.

- B. Provide and pay for all materials, labor, water, tools, electric wiring, electric power, operating services and any items incidental and required for complete and operable system of temporary heat operation.
- C. Maintain system of temporary heat until substantial completion.
- D. Temporary heat equipment may be oil or gas fired-electric blower operated or steam-electric blower operated.
- E. Maintain all spaces where temporary heat is required for mechanical work at minimum of 50°F, during working hours and 35°F during non-working hours.
- F. None of permanent heating systems nor any of their component parts shall be available for temporary heat until building is accepted or by expressed written permission of Owner. Any use of permanent heating system on temporary basis will in no way affect warranty period of Owner after final acceptance of building.
- G. Cost of fuel shall be paid by the General Contractor.
- H. Any temperature requirements other than for mechanical work by any trade shall be provided and paid for entirely by that trade thru his own temporary heat source (or by negotiation with General Contractor). Temporary heat shall be maintained for a minimum of 7 days prior to any interior finishing (wood, painting, varnishing, resilient tile, acoustical ceilings, etc.) and maintained until substantial completion or during partial occupancy by Owner. Temperatures shall be maintained according to manufacturer's recommendations and design conditions on a 24-hour, 7-day basis or at 70°F to 85°F during working hours and 60°F minimum at all other times.

3.08 Temporary Toilets:

- A. These facilities shall be for the exclusive use of workmen and shall be furnished on the following basis:
 - 1. One toilet for maximum of 20 men or any part thereof.
- B. Toilets shall be moved as necessary to locations where heaviest concentration of men are engaged.
- C. Location, type and quantity of toilet facilities are subject to approval of Owner's Representative or Inspector.

SECTION 15060

PIPING AND VALVES

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15061 - Piping Schedules
- C. Section 15130 - Gauges
- D. Section 15250 - Mechanical Insulation
- E. Section 15251 - Mechanical Insulation Schedules

PART 2 - PRODUCTS

2.01 Piping System Material:

- A. Refer to Piping Schedules, Section 15061, for the proper selections.
- B. All pipe hangers and supports shall conform to the latest requirements of ASA Code for Pressure Piping B31.1.

2.02 Pipe Hangers and Supports:

A. Uninsulated Pipe

- 1. Hangers: Steel and cast iron pipe 2" and smaller shall be adjustable split pipe ring by Grinnell Fig. 108, Fee & Mason Fig. 212, Elcen Fig. 10A, or equal. Larger than 2" shall be adjustable clevis by Grinnell Fig. 260, Fee & Mason Fig. 239, Elcen Fig. 12, or equal.
- 2. Hangers: Copper pipe 2" and smaller shall be copperplated adjustable split ring by Grinnell Fig. CT-109, Fee & Mason Fig. 360, Elcen Fig. 310A, or equal. Larger than 2" shall be copperplated adjustable clevis by Grinnell Fig. CT-65, Fee & Mason Fig. 364, Elcen Fig. 312, or equal.
- 3. Riser Clamps: Steel and cast Iron Pipe by Grinnell Fig. 261, Fee & Mason Fig. 241, Elcen Fig. 39, or equal.
- 4. Riser Clamps: Copper pipe by Grinnell Fig. CT-121, Fee & Mason Fig. 368, Elcen Fig. 339, or equal.

5. Floor Supports: Steel and cast iron pipe 2" and smaller shall be U-bolt on structural steel channel secured to floor with angle clips by Grinnell Fig. 137, Fee & Mason Fig. 176, Elcen Fig. 68A, or equal. Larger than 2" shall be adjustable pipe saddle by Grinnell Fig. 264, Fee & Mason Fig. 291, Elcen Fig. 50, or equal.
 6. Floor Supports: Copper pipe 2" and smaller shall be U-bolt on structural steel channel secured to floor with angle clips by Grinnell 120, Fee & Mason Fig. 379, Elcen Fig. 368, or equal.
 7. Supports at Walls and Columns shall be cast iron or steel brackets properly selected to support weight suspended by Grinnell Fig. 195, 199, 202, Fee & Mason Fig. 150, 151, 155, Elcen Fig. 56, 57, or 58, or equal.
 8. Supports with pipe chases may be prefab, high impact polystyrene, pipe support assemblies if permitted by the state and local authorities. Assemblies shall be by Sumner, or equal.
 9. Trapeze Hangers: Where parallel pipes are grouped at approximately same elevation. Construct of structural steel angles or channels with rods of sufficient strength to support weight. For securing individual pipes on trapeze, use U-bolts specified above.
 10. Rods: Solid steel hanger rods, threaded both ends.
 11. Turnbuckles: Where required to adjust pipe elevation.
- B. Insulated Pipe: Provide hanger and support materials similar to those for uninsulated pipe but with the following exceptions.
1. Size hanger ring to fit outside insulation.
 2. Copperplated rings are not required.
 3. Wooden support plugs shall be provided to protect insulation.
- C. Insulation Cradles
1. Hot Insulated Pipes with lugs to suit insulation thickness by Grinnell Fig. 160 thru 166A, Fee & Mason Fig. 171 and 1732, Elcen Fig. 251 thru 256, or equal.
 2. Cold Insulated Pipes: #14 USG plates curved to fit exterior of insulation extended 6" on either side of each hanger and with lateral surface covering lower 1/3 of insulation circumference.
- D. PVC Pipe: Provide hanger and support materials similar to those for uninsulated pipe but with the following exceptions.

1. Size hanger to accept closed cell vibration isolation material as may be required to isolate vibration from piping - 1" by Armstrong ArmaFlex, or equal.
2. Plated rings are not required.

2.03 Anchors and Guides:

- A. Anchors as shown on the drawings, or as required by standard engineering practice.
- B. Guides shall be Flexonics Flexon Pipe Alignment Guide or equal.

2.04 Sleeves and Plates:

- A. All sleeves shall be Schedule 40 black iron pipe unless otherwise specified.
- B. Special sleeves and sealing as shown on drawings.
- C. Plates shall be Fee & Mason 2804 or equal chromiumplated for finished areas and plain cast iron elsewhere.

2.05 Pipe Identification:

- A. Use setmark system of pipe markers as manufactured by Seton Name Plate Corp. of New Haven, CT 06505. Other brands must be equal and shall meet ANSI specifications.

2.06 Valve Identification:

A. Main Shutoff Valves

1. Install a 1-1/2" x 4" tag on each main shutoff valve for each service and identify type of services (Cold Water, Gas, Steam, etc.). Tags to be laminated plastic with white facing and 3/8" black letters engraved. Connect tag to valve with stainless steel chain.
2. Tags to be manufactured by Identifications, Box 503, Urbana, Illinois 61801, or equal.

B. All Other Valves

1. Install consecutively numbered, aluminum tags (1-1/2" square) on each operating valve in this contract (i.e. main or branch line shutoff valves, manual and automatic flow control valves, temperature control valves, etc.).
2. Valves whose function is obvious (i.e. radiator valves, shutoff valves located inside cabinet at the equipment, etc.) need not be tagged. Use standard abbreviations for service indication. Attach tags with nickel plated bead chain.
3. Provide thumbtack in ceiling below valves located above ceiling.

4. This Contractor shall also prepare a typewritten chart to show valve number, valve function and valve location. Valve chart shall be included in the Operations and Maintenance Manual.
5. Use Seton Name Plate Corporation tags or equal. System shall meet ANSI A13.1-1975 specification.

PART 3 - EXECUTION

3.01 Installation:

A. Piping Systems - General

1. Install all piping systems in accordance with OBBC piping requirements.
2. Piping shall be parallel to building walls unless shown otherwise. Changes direction with pipe fittings as specified herein.
3. Provide ample space between piping and walls for proper insulation covering thickness.
4. Provide adequate protection for piping and equipment against freezing.
5. All damage resulting from leaking pipes shall be paid for by Contractor whose work is at fault.
6. Offset piping, in approved manner, where required to avoid interference with other work, to increase headroom under piping, or to improve appearance of the work.
7. Provide eccentric reducing couplings in all cases where air or water pockets would occur due to a reduction in pipe size. Do not use bushings.
8. Use flanges or unions at all final connections equipment and fixtures.
9. Bonney Weldolets may be used where steel with welding fittings are specified in lieu of reducing outlet tees wherever the branch is sizes smaller than the main. All other tees straight patterns.
10. Use galvanized fittings and unions with galvanized pipe.
11. Use copper or brass unions or flanges with copper pipe.
12. Use die-electric couplings when joining dissimilar piping materials.
13. Welding in accordance with ASME welding qualifications.

3.02 Pipe Supporting:

A. General

1. Furnish and install supports, guides, anchors and swaybraces required for proper installation and support of pipe lines except supports noted to be furnished by others.

2. Pipe suspensions shall prevent excessive stress and excessive variation in supporting force. Fabrication and installation of supports for pipe lines shall not constrain piping to cause excessive transfer of load from supports to piping, or from support to support when expansion or contraction occurs. Supports shall be capable of taking entire piping load imposed by expansion or contraction.
3. Where pipe vibration transmits objectionable vibration to building structure or attached equipment, hangers shall be supplemented by spring cushions or an energy absorbing means in supports themselves, or through addition of flexible piping connectors or other auxiliary equipment.
4. Piping system where flexibility is not desired, shall be supported by rigid hangers.

B. Pipe Hanger and Supports

1. The following piping must be suspended by individual pipe hangers, rather than being suspended with other piping on trapeze type supports.
 - a. All drain, waste and vent piping, in order provide the proper pitch. Vents must be self draining.
2. Piping, other than as specified above, may be suspended by individual pipe hangers, or where 2 or more pipes are paralleling each other at same elevation, Contractor may, at his option, support them on common trapeze bars. Construct of structural steel angles or channels with rods of sufficient strength to support weight and of design satisfactory to the Owner. Use U-bolts for securing individual pipes in trapeze.
3. All piping, other than as specified above, may be suspended by individual pipe hangers, or, where 2 or more pipes are paralleling each at same elevation, may be supported on common trapeze bars.
4. Where smaller piping must be suspended closer to overhead construction than is possible with single rod hangers, use double rod supports.
5. Spacing:
 - a. All pipe hanger spacings specified below are also applicable to trapeze hangers shall be determined by smallest pipe among pipes carried on trapeze.

- b. Spacing of hangers or supports for steel pipe as scheduled below.

	<u>Pipe Size</u>	<u>Max. Spacing</u>
1.	1/2" and 3/4"	6'-0"
2.	1" and 1-1/4"	8'-0"
3.	1-1/2" and 2"	10'-0"
4.	2-1/2" and 3"	12'-0"
5.	4" to 8"	12'-0"
6.	10" to 30"	12'-0" max.

- c. Spacing of hangers or supports for copper, brass, or stainless steel pipe as scheduled below.

	<u>Pipe Size</u>	<u>Max. Spacing</u>
1.	3/8" thru 3/4"	5'-0"
2.	1" and 1-1/4"	6'-0"
3.	1-1/2" thru 2-1/2"	9'-0"
4.	4" to 8"	10'-0"

- d. Spacing of hangers or supports for cast iron pipe shall be 5'-0" maximum. Place hanger close to joint.

- e. Follow pipe manufacturer's specific recommendations for support frequency for PVC, maximum spacing 3'-0". Avoid bind or cramping pipe in racks or spaces that would limit natural flexing of the pipe.

C. Securing Hangers and Supports at Building Construction

1. Provide, as required, steel or malleable iron inserts in poured concrete construction. Maximum load which may be applied to any one foot length of continuous insert shall not exceed 1000 lbs.
2. Where piping is suspended from structural steel building framing or supporting members. Furnish and install beam clamps for attaching piping support device to building member. Beam clamps made of heavy steel forged to fit structural member (I-beam, angle, channel) and securely fastened in place. No building member to be drilled, welded, cut or otherwise deformed in attaching pipe supports unless approved by the Owner.
3. Do not suspend hangers from deck unless indicated.
4. Provide additional bracing and supports wherever needed, in opinion of Owner's representative. Install structural steel members, attached to building framing, where required, to provide additional points of support. Drill building structural and miscellaneous steel only as directed by the Owner's representative.

D. Underground Piping

1. Lay underground piping on only solid undisturbed ground except where crossing another trench or excavation adjacent to building wall or foundation, and there support piping on approved foundations of concrete, brick piers, cradles or on sand fill. Tamp bottoms of trenches, grade to secure required pitch and shape to give substantial uniform support to lower third of full length of pipe. Then cover pipe with sand.
2. Support and protect underground piping so that it remains in place without settling and without damage during and from backfilling. Replace any piping so settling or so damaged.
3. Wherever, in opinion of Architect/Engineer, ground is unsuitable to support piping, install foundations of concrete or brick piers or cradles under piping as directed.
4. Lay underground piping on bed of sand. Sand to fill from trench bottom to cover top of pipe.

E. Vertical Pipe Risers

1. Support vertical runs under 10' long with hanger adjacent to elbows.
2. Support vertical runs over 10' with steel riser clamps. Weld clamps to pipe and support on pipe sleeve or building structure.
3. Cast iron risers shall be supported at the base.
4. Malleable iron risers shall be supported at the base.
5. Plastic DWV risers shall be supported at each branch, change in direction, at the base and at-story.
6. Plastic water risers shall be supported at the base and at mid-story.
7. Provide floor supports at the bottom of risers with structural steel, supports of Owner approved design. Secure to floor with angle clips.

- F. Anchors and Guides: Provide rigid anchors as indicated on Drawings with not less than 2 guides in piping at each side of anchor unless otherwise indicated.

3.03 Sleeves and Plates:

- A. Furnish, locate and set pipe sleeves where piping passes through floors, walls and other concrete or masonry structural materials.
- B. Wall sleeves shall finish flush with walls. Floor sleeves shall extend 1-1/2" above finished floors unless otherwise specified.
- C. Sleeves shall be in accordance with following schedule unless otherwise specified.

Sleeve Schedule

<u>Pipe Size</u>	<u>Unins</u>	<u>1" Ins</u>	<u>1-1/2" Ins</u>	<u>2" Ins</u>
1"	2"	4"	6"	6"
1-1/2"	3"	4"	6"	8"
2"	3"	6"	8"	8"
3"	4"	6"	8"	10"
4"	6"	8"	10"	10"
6"	8"	10"	12"	12"

- D. Furnish and install chrome plated escutcheons on piping exposed at walls and ceilings, 4" and smaller in size.

3.04 Unions and Flanges:

- A. Provide at intervals and locations where they will facilitate disconnection and removal of piping, at all valves at connection to equipment and elsewhere as shown.

3.05 Valves:

- A. Contractor shall furnish and install all valves on the drawings and specified herein. Shutoff valves shall be provided at all equipment.
- B. Unless otherwise indicated, provide valves in accordance with following.
1. Valves same size as lines in which they are installed.
 2. Provide globe, angle, plug or needle pattern valves for throttling purposes.
 3. Provide globe valves for manual bypass lines.
 4. Install valves with stems vertical where possible but in no case lower than horizontal position, except as noted in Piping Schedules (Section 15061).
 5. Mount all globe valves to close against flow pressure. Flow should be against bottom of plug.
 6. Remove bonnets and trim from all valves before soldering, brazing or welding in piping system. Protect seating surfaces during installation with asbestos packing. Clean valve parts thoroughly before reassembling. Install bonnet with valve in open position.
 7. Install all valves with discs or plugs in open position. Close only when assured that sealing parts are free from foreign material. Weld scale or similar foreign materials found embedded in sealing surfaces will require installation of new trim or complete valves.
- C. Unless otherwise indicated, provide valves in locations in accordance with the following.

1. Wherever indicated on drawings.
2. Locate valves to permit easy removal of fixture and equipment they serve.
3. Provide shutoff valves in all branch domestic hot and cold water lines immediately beyond their point of connection with mains. A branch may be defined as a pipe that serves only one room or a single grouping of fixtures.
4. Provide shutoff valves in inlet and outlet connections of each piece of equipment, including each heat transfer surface, unless otherwise shown on flow diagram or detail.
5. Valve each service branch at point in which they are installed.
6. Provide globe or plug pattern for draining low points in water lines. Provide hose end adaptor with each valve suitable for attaching a 3/4" garden hose. Crane 1. Provide cap and chain.

3.06 Pipe Identification:

- A. All piping shall be identified with labels. Labels to appear at each valve, at every branch takeoffs at every 50'.
- B. Labels need not be applied at branch takeoffs and valves if another label on the same line is within 10' and is readily visible.
- C. Identification to include arrows to indicate direction of flow.

SECTION 15061
PIPING SCHEDULES

SCHEDULE 1:

- | | |
|--------------------------|--|
| A. <u>Service</u> | Water Underground |
| B. <u>Maximum Design</u> | Pressure 150 psig
Temperature 100°F |
| C. <u>Pipe</u> | |
| 1. Copper | |
| 3/8" thru 2-1/2" | Soft type k, seamless copper plain cut ends |
| 2. Ductile Cast Iron | |
| 3" thru 12" | Bell and spigot type, centrifugally cast ductile iron with asphaltum coating, class as noted in Schedule ANSI A21-51, AWWA C151 and listed by UL J.B. Clow & Sons "Super Bell-Tite", American Cast Iron "Fastite", U.S. Pipe & Foundry "Tyton", or equal |
| 3. PVC | Non-potable service water only |
| D. <u>Joints</u> | |
| 1. Copper | Brazed (silver alloy) |
| 2. Ductile Cast Iron | Compression or push-on type, ductile cast iron consisting of an integral bell with recess to accept rubber gasket |
| E. <u>Fittings</u> | |
| 1. Copper | 150# wrought copper |
| 2. Ductile Cast Iron | 250# ductile cast iron, bell ends ANSI A21.10 & AWWA C110 |
| F. <u>Gaskets</u> | Rubber fabricated by manufacturers per their recommendations |

G. Valves

1. Shutoff Gate or Ball

a. 3/8" thru 2"

Bronze body and trim, double wedge disc, screwed bonnet, rising stem, soldered
125# Lunkenheimer 2131
125# Jenkins 1243
125# Powell 1821-DW
or equal

b. 3" thru 12"

Iron body, bronze disc or bronze disc rings, renewable bronze seats, bolted bonnet, non-rising stem, inside screw, ends as indicated.

1. Bell Ends

200# Kennedy 597X
200# J.B. Clow F5085
200# Mueller A-2380-5
or equal

2. Bell Ends

200# Kennedy 56X
200# J.B. Clow F5080
200# Mueller A-2480
or equal

3. Mech. Ends

200# Kennedy 571X
200# J.B. Clow F5065
200# Mueller A-2480
or equal

c. Bell valve

shall be red-white #5022 or 5034, watts No. B-6080 or 6081 or equal

H. Testing

Testing shall be in accordance with Ohio Basic Building Code. Entire system to be tested in accordance with hydrostatic test procedure of this piping system. Repair all leaks and retest as required before covering.

I. Sterilization

Sterilization shall be in accordance with Ohio Basic Building Code and the State Health Department. Entire system to be sterilized in accordance with and in conjunction with sterilization of system procedure of designated Piping System Schedule.

SCHEDULE 2:

A. Service

Domestic Hot and Cold Water (Potable)

B. Maximum Design

Pressure 150 psig
Temperature 150°F

C. Pipe

1. 3/8" thru 2-1/2"

Type L, hard drawn, seamless copper or
galvanized steel Sch. 40

2. 3" thru 4"

S40, galvanized steel, A-120, grooved
ends

D. Joints

1. 3/8" thru 2-1/2"

95-5 soldered, or screwed

2. 3" thru 12"

Victaulic type coupling

E. Fittings

1. 3/8" thru 2-1/2"

Wrought copper or malleable iron

2. 1/2" thru 2-1/2"

Mechanically Formed Tee Connections

Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. The collaring device shall be fully adjustable as to insure proper tolerance and complete uniformity of the joint.

The branch shall be notched to conform with the inner curve of the run tube and dimpled to insure penetration of the branch tube into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube.

All joints shall be brazed in accordance with the Copper Development Association Copper Tube Handbook using B-cup series filler metal. Note: Soft soldered joints will not be permitted.

All mechanically formed branch collars shall be listed by BOCA and Underwriters Laboratory.

3. 3" thru 4"

150# wrought steel, grooved ends

F. Flanges

3" thru 12"

150# carbon steel, slip on

G. Gaskets

1/8" F.F. rubber gaskets,
Johns-Manville, JM 110, or equal

H. Bolts and Nuts

Machine bolts with hex nuts, Grade B,
regular series

I. Pipe Dope

Teflon tape, specific gravity, 1.5

J. Valves

1. Shutoff

a. Gate

1/4" thru 2-1/2"

Bronze body and trim, single wedge disc,
screwed bonnet, non-rising stem,
soldered
125# Crane 1324
or equal

3" thru 4"

Iron body, bronze trim, solid wedge
disc, bolted bonnet, outside screw and
yoke, renewable seats, rising stem,
flanged
125# Crane 465-1/2
or equal

b. Globe

1/2" thru 2"

Bronze body, brass bonnet, TFE disc,
bronze stem swivel type disc-stem
connection to minimize disc scoring,
solder ends, Class 125
Crane #1703S
or equal

c. Ball 1/4" thru 2"

Shall be red-white #5022 or 5034, watts
B-6080 or 6081 or equal

2. Check

a. Horizontal Swing

1/4" thru 2-1/2"

Bronze body and disc, horizontal swing,
renewable disc, screwed cap, soldered
125# Lunkenheimer 2145
300# Stockham B-309
125# Powell 1825

K. Testing

Entire system is to be tested per
Schedule 10 and the Ohio Basic Building
Code

L. Sterilization of System

1. To be in accordance with the Ohio Basic Building Code and the State Health Department.

SCHEDULE 3:

A. <u>Service</u>	Sanitary and Vents (Within Building Walls)
B. <u>Maximum Design</u>	Pressure Gravity Vented Temperature 150°F
C. <u>Pipe</u>	
1. Aboveground	
a. Steel	
1-1/4" thru 12"	S40, galvanized steel, A-120, threaded ends and plain end
b. PVC	
1-1/2" thru 10"	S40, polyvinylchloride, Class as scheduled, plain cut ends
2. Above or Belowground	
a. Copper	
3/4" thru 10"	DWV, hard drawn seamless copper plain cut ends
b. Cast Iron	
2" thru 10"	Service weight, centrifugally cast iron, class as scheduled, bell and spigot (below grade) and bell and spigot or no-hub (above grade)
D. <u>Joints</u>	
1. Steel	
a. 3/4" thru 2-1/2"	Threaded and coupled
b. 3" thru 12"	Welded
2. PVC	Solvent weld
3. Copper	50-50 antimony solder
4. Cast Iron	Clamping collar gasket with stainless steel rings, or lead and oakum caulk.

E. Fittings

- | | |
|--------------|--|
| 1. Steel | 125# galvanized steel, DWV |
| 2. PVC | S40, DWV |
| 3. Copper | Wrought copper, DWV |
| 4. Cast Iron | Service weight, cast iron, DWV (no-hub or caulked) |

F. Gaskets

- | | |
|--------------|--|
| 1. Steel | 1/16" compressed fiber, ungraphited, Johns-Manville, Garlock, or equal |
| 2. PVC | None |
| 3. Copper | 1/16" compressed fiber, ungraphited, Johns-Manville, Garlock, or equal |
| 4. Cast Iron | Rubber ring for no-hub |

G. Pipe Dope

Permatex, or equal, pipe compound 51 or plastic lead seal 2

H. Test

Entire system is to be tested per Schedule 11 and the Ohio Basic Building Code.

I. Special Conditions

1. Route sanitary to 5' outside of foundation walls.

SCHEDULE 4:

A. Service

Underground Sanitary Sewer (Outside Building Walls)

B. Maximum Pressure

Pressure	Gravity	Vented	Temperature
150°F			

C. Pipe

1. Below Unpaved Areas

a. PVC

4" thru 12"

Polyvinyl chloride pipe ASTM D-3034 (SDR 35)

b. VCP

4" thru 12"

Vitrified clay pipe service weight bell
and spigot ASTM C-700-78a

2. Below paved areas such as streets and parking lots.

a. Standard strength concrete pipe ASTM C-74 or extra strength vitrified clay pipe ASTM C-700-78a (1983) with minimum of 4 ft. of cover.

D. Joints

1. PVC

Solvent weld

2. VCP

Bell and spigot compression joints

3. Concrete

Cemented plastered tounge and groove joints

E. Fittings

1. PVC

Schedule 40 DWV

2. VCP

Vitrified clay bell ends

F. Testing

Test shall be in accordance with the Ohio Basic Building Code and approved by this Engineer.

SCHEDULE 5:

A. Service

Acid Waste and Vent Piping

B. Maximum Design

Pressure Gravity Vented Temperature
225°F

C. Pipe

1. Duriron

3" thru 12"

High silicon, centrifugally cast iron, bell and spigot ends. Duriron Co., Inc., Pacific Foundry Co. or equal

2. Glass

1-1/2" thru 6"

Regular Schedule, borosilicate glass pipe, Fed. Spec. DD-G-541A, Owens Illinois, Corning Glass Works or equal

3. Polypropylene

1-1/2" thru 4"

Sch. 40 wall thickness, acid resistant, flame retardant (2 second flame time, maximum of 20 MM burned per ASTM D635) Lab-Line/Enfield, or equal

D. Joints

1. Duriron

Caulked with manufacture approved rope; packing until half full, pour lead and caulk

2. Glass

Flanged, torque wrench bolts

3. Polypropylene

1-1/2" thru 4"

Mechanical joint, to be of same manufacturer as pipe and fittings

E. Fittings

1. Duriron

High silicon cast iron bell ends

2. Glass

Borosilicate glass flanged

3. Polypropylene

Mechanical joint, flame resistant polypropylene (80 sec. flame time, maximum burned 20 MM per ASTM D635).

F. Gaskets

1/16" virgin teflon or polypropylene to be compatible with polypropylene system.

G. Bolts and Nuts

Machine bolts, regular series, stainless steel, hex nuts, regular series, monel

H. Testing

Shall be in accordance with Schedule 11 and the Ohio Basic Building Code.

I. Local Approval

Contractor shall obtain local and state approvals (in writing) for materials specified herein, or otherwise approved by the Engineer, which are not specifically approved in the Ohio Basic Building Code by ASTM or ANSI numbers

SCHEDULE 6:

- | | | |
|----|--|---|
| A. | <u>Service</u> | Underground Acid Sewer |
| B. | <u>Maximum Design</u> | Pressure Gravity Vented Temperature
225°F |
| C. | <u>Pipe</u> | |
| | 1. Duriron | |
| | 3" thru 12" | High silicon centrifugally cast iron,
bell and spigot ends. Duriron Co.,
Inc. and Pacific Foundry Co. |
| | 2. Vitrified Tile | |
| | 3" thru 12" | Extra strength vitrified clay tile,
bell and spigot ends. AMVIT and
Cannelton Pipe Co. |
| D. | <u>Joints</u> | |
| | 1. Duriron | Caulked with manufacture approved
rope; packing until half full, pour
lead and caulk |
| | 2. Vitrified Tile | Wedge lock compression type |
| E. | <u>Fittings</u> | |
| | 1. Duriron | High silicon cast iron bell ends |
| | 2. Vitrified Tile | Extra strength vitrified clay, bell
ends |
| F. | <u>Testing</u> | Testing shall be in accordance with
Schedule 11 and the Ohio Basic
Building Code |
| G. | <u>Special Conditions</u> | |
| | 1. Pipe to be laid on a clean sand bed of a minimum 6" in depth and have a minimum top cover of 6" sand. | |

SCHEDULE 7:

A.	<u>Service</u>	Natural Gas
B.	<u>Maximum Design</u>	Pressure 125 psig Temperature 200°F
C.	<u>Pipe</u>	
1.	Aboveground	
a.	1/2" thru 2"	S40, black steel, A-120, buttwelded, threaded ends
b.	2-1/2" thru 4"	S40, black steel, A-120, buttwelded, beveled ends
2.	Underground	
	1" thru 4"	S40, black steel, A-120, buttwelded, beveled ends, mill wrapped
D.	<u>Joints</u>	
1.	1/2" thru 2"	Threaded and coupled
2.	2-1/2" thru 4"	Welded
3.	Underground	Welded
E.	<u>Fittings</u>	
1.	1/2" thru 2"	150# malleable iron, threaded
2.	2-1/2" thru 4"	125# wrought iron, beveled ends
3.	Underground	125# wrought iron, beveled ends
F.	<u>Unions</u>	
	1/2" thru 2"	150# malleable iron, ground seat
G.	<u>Flanges</u>	
1.	2-1/2" thru 4"	150# carbon steel, slip on
2.	Underground	None
H.	<u>Gaskets</u>	1/8" Johns-Manville, or equal, compressed fiber sheet or equal

- I. Bolts and Nuts Machine bolts with hex nuts, regular series, Grade B
- J. Pipe Dope Permatex pipe joint compound 51 or Garlock A or equal
- K. Valves
1. Shutoff
 - a. Ball
1/2" thru 3" Bronze body and chrome plated ball, teflon seats and seals, lever operated, threaded, UL approved
150# Jamesburg 2111-UL
150# Metraflex IT or equal
- L. Testing Testing shall be in accordance with Sch. 10 and the Ohio Basic Building Code
- M. Special Conditions
1. Cast iron fittings are not permitted.
 2. Welding is to be in accordance with regulations.
 3. Bushings are not to be used, unless for a reduction of at least two piping sizes.

SCHEDULE 8:

- A. Service Compressed Air (Laboratory)
- B. Maximum Design Pressure 100 psig Temperature 150°F
- C. Pipe
1. Copper Type L or type K, seamless copper tubing, brazed (ASTM-B-88) hard temper.
- D. Joints
1. All Silver brazing, alloy, Grade A
- E. Fittings
1. 1/2" and smaller 150# wrought copper
2. 1/2" thru 1" Mechanically Formed Tee Connections

Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. The collaring device shall be fully adjustable as to insure proper tolerance and complete uniformity of the joints.

The branch shall be notched to conform with the inner curve of the run tube and dimpled to insure penetration of the branch tube into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube.

All joints shall be brazed in accordance with the Copper Development Association Copper Tube Handbook using B-cup series filler metal. NOTE: Soft soldered joints will not be permitted.

All mechanically formed branch collars shall be listed by BOCA and Underwriters Laboratory.

F. Unions

Brass seats

G. Valves

1. Shutoff

a. Ball

1/2" thru 2"

Bronze body and chrome plated ball,
teflon seats and seals, lever operated
threaded

150# Apollo 70-100

150# Jamesbury 2111

150# Metraflex 1T

or equal

H. Testing

1. Each section of the piping system shall be subjected to a test pressure of one and one-half times the maximum working pressure, but no less than 150 psi, by means of oil-free dry air, or nitrogen. This test pressure shall be maintained until each joint has been examined for leakage by means of soapy water. All leaks shall be repaired and the section re-tested.
2. A visual inspection of each brazed joint shall be made to assure the alloy has flowed completely in and around the joint and that hardened flux has not formed a temporary seal. Remove all excess flux for a clear inspection of brazed joints. Repair all leaks and re-test.
3. A 24-hour standing pressure test with oil-free dry air, or nitrogen at one and one-half times maximum working pressure, but not less than 150 psi, shall be made to check the completeness of previous joint tests. Pressure shall remain constant over a 24 hour period.
4. Each test mentioned above shall be conducted whenever changes are made to a piping system.
5. Contractor shall furnish in writing, to the Engineer, assurance that all of the tests required have been conducted in their proper sequence and each system has passed said tests. The Contractor shall submit a copy of the test results to the Engineer at the end of the project.

SCHEDULE 9:

- | | |
|--------------------------|---|
| A. <u>Service</u> | Vacuum (Laboratory) |
| B. <u>Maximum Design</u> | Pressure 26" mercury |
| C. <u>Pipe</u> | |
| 1/2" thru 2" | Type L or type K, seamless copper tubing, brazed (ASTM-B-88) hard temper. |
| D. <u>Joints</u> | Brazed, silver alloy and compatible flux |
| E. <u>Fittings</u> | |
| 1. 1/2" and smaller | 150# wrought copper |
| 2. 1/2" thru 1" | Mechanically Formed Tee Connections |
| | <p>Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. The collaring device shall be fully adjustable as to insure proper tolerance and complete uniformity of the joints.</p> <p>The branch shall be notched to conform with the inner curve of the run tube and dimpled to insure penetration of the branch tube into the collar is of sufficient depth of brazing and that the branch tube does not obstruct the flow in the main line tube.</p> <p>All joints shall be brazed in accordance with the Copper Development Association Copper Tube Handbook using B-cup series filler metal. NOTE: Soft soldered joints will not be permitted.</p> <p>All mechanically formed branch collars shall be listed by BOCA and Underwriter Laboratory.</p> |
| F. <u>Unions</u> | Brass seats |

G. Valves

1. Shutoff

a. Ball

1/2" thru 3"

Bronze body and chrome plated ball,
teflon seats and seals, lever
operated, threaded

150# Jamesbury A015011TT

150# Metraflex 1T

150# Hammond BV711-T

or equal

H. Testing

1. Each section of the piping system shall be subjected to a test pressure of one and one-half times the maximum working pressure, but no less than 150 psi, by means of oil-free dry air, or nitrogen. This test pressure shall be maintained until each joint has been examined for leakage by means of soapy water. All leaks shall be repaired and the section re-tested.
2. A visual inspection of each brazed joint shall be made to assure the alloy has flowed completely in and around the joint and that hardened flux has not formed a temporary seal. Remove all excess flux for a clear inspection of brazed joints. Repair all leaks and re-test.
3. A 24-hour standing pressure test with oil-free dry air, or nitrogen at one and one-half times maximum working pressure, but not less than 150 psi, shall be made to check the completeness of previous joint tests. Pressure shall remain constant over a 24-hour period.
4. Each test mentioned above shall be conducted whenever changes are made to a piping system.
5. Contractor shall furnish in writing, to Engineer, assurance that all of the tests required have been conducted in their proper sequence and each system has passed said tests. The Contractor shall submit a copy of the test results to the Engineer at the end of the project.

SCHEDULE 10:

A. Service - Testing

1. Service Lines: Schedules 2, 7

B. Cleaning

1. Flush internals of pipe, valves, strainers, etc., with water of sufficient velocity and quantity that will dislodge sediment or dirt that has accidentally entered the system.

C. Hydrostatic Test

1. After flushing, fill system with water, venting off entrapped air at high points of system.
2. Conduct test per Ohio Basic Building Code.
3. If hydrostatic test is satisfactory, the water shall be drained to the sanitary sewer.
4. All drain valves and strainers shall be dismantled, cleaned and reinstalled.

D. Air Test

1. Conduct test only on the natural gas piping system, per the Ohio Basic Building Code.

E. Repair of Leaks

1. Welded Joints

- a. Defective welded joints shall be repaired by removing defective weld metal by chipping, grinding or flame gouging and material rewelded following New Work Procedure.
- b. Under no condition will repair be attempted by adding weld metal to defective area.

2. Screwed Joints

- a. Leaking threaded joints shall be repaired by:
 - (1) further tightening using discretion, and/or
 - (2) taking joint apart and replacing defective material.
 - b. Caulking shall not be attempted for repairs to screwed joints.
3. After repairs, system shall be retested.

SCHEDULE 11:

A. Service - Testing

Sanitary: Schedules 3, 5, 6

B. Cleaning

Flush inside of pipe with water of sufficient velocity to dislodge all sediment or dirt that has accidentally entered system.

C. Hydrostatic Test

1. Conduct test per the Ohio Basic Building Code.
2. When testing by sections, the upper 10 ft. of each section shall be included in next test.

D. Final Air Test (unless waved by the Engineer)

Fill all air traps with water. Apply air pressure equivalent to 1" of water column. System must contain pressure for 15 minutes.

SECTION 15130

GAUGES

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install all gauges and thermometers at locations indicated on the drawings and as specified herein.

1.02 Related Work Specified Elsewhere:

- A. Section 11311 - Vertical Non-Clog Centrifugal Pumps
- B. Section 11375 - Wastewater Aeration Equipment
- C. Section 15060 - Piping and Valves
- D. Section 15400 - Plumbing

1.03 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Contractor is required to submit product data on all gauges and thermometers specified in this section.

PART 2 - PRODUCTS

2.01 Pressure Gauges:

- A. Dial Size: 3-1/2"
- B. Case: Open front style, black, phenol or stainless steel
- C. Bourdon Tube: Bronze
- D. Connection: Lower or back as required
- E. Accuracy: 1% mid range
- F. Range: Refer to Application - Part 3: Execution
- G. Manufacturer: Ashcroft, Trerice, Weiss & Son, Inc., or equal.

2.02 Thermometers:

- A. Thermometer: V-shape design, mercury filled-magnifying lens "Red Reading" tube.

- B. Mounting - Size:
 - 1. 0'-0"-12'-0" AFF - Use 7" scale
- C. Case: Die cast aluminum
- D. Stem: 3/4" - 1" NPT
- E. Stem Length: Minimum 3-1/2"
- F. Tube & Capillary: Mercury filled
- G. Accuracy: Within 1% of scale range
- H. Range: Refer to Application - Part 3: Execution
- I. Manufacturer: Ashcroft, Trerice, Weiss & Son, Inc., or equal.

PART 3 - EXECUTION

3.01 Pressure Gauges - Installation or Application:

- A. Connection in Piping: Provide a pressure gauge cock ahead of each gauge. Mount gauges for maximum visibility.
- B. Scale Ranges:
 - 1. Domestic Water: 0-160 psig
 - 2. Compressed Air: 0-30 psig
 - 3. Large Sewage Pumps: 0-160 psig
 - 4. Small Sewage Pumps: 0-30 psig

3.02 Thermometers - Installation or Application:

- A. Connection in Piping: Male threaded NPT connection.
- B. Scale Ranges:
 - 1. Domestic Hot and Cold Water: 0-200°F

3.03 Location Requirements:

- A. Pressure Gauges:
 - 1. Provide pressure gauge on any new incoming water service.
 - 2. Provide pressure gauge in air line at air compressor.
 - 3. Provide pressure gauge in sewage outlet line at sewage pumps.
 - 4. Provide pressure gauges in additional locations where shown on drawings.

B. Thermometers:

1. Provide submersion type thermometers with a twelve (12') foot length of 12.5 gauge stranded stainless steel anchor cable in the sequencing batch reactor tanks and the chlorine contact tank.
2. Provide thermometers in the inlet and outlet pipes of any new heat exchangers, preheat tanks or domestic water heaters.
3. Provide additional thermometers where shown on drawings.

SECTION 15170

MOTORS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install electric motors for all motorized equipment as shown on the drawings and herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 11311 - Vertical Non-Clog Centrifugal Pumps
- B. Section 11317 - Sump Pumps
- C. Section 11330 - In-Line Channel Comminutors
- D. Section 11375 - Wastewater Aeration Equipment
- E. Section 11376 - Surface Aerators

1.03 Quality Assurance:

A. Standards:

- 1. Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.

B. Submit the following:

- 1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
- 2. Certified copies of reports of factory tests specified in this Section and required by the referenced standards.
- 3. Product data with performance data and physical characteristics.

PART 2 - PRODUCTS

2.01 Electric Motors:

A. Components:

1. Enclosures: Hazardous areas - explosion-proof outside; all others - open drip-proof
2. Sealed ball bearing
3. Normal torque squirrel cage
4. NEMA Design B
5. Air vent screens
6. Class B insulation.
7. Base: Cast iron or steel with adjustable slide rail

B. Voltage Characteristics: Provide the following unless otherwise specified:

1. 1/2 HP and up: As noted
2. Less than 1/3 HP: 115V/1 phase/60 cycle
3. Power Factor: 10 to 99 HP motors shall have minimum power factor of 0.84 at full load. 100 HP and larger shall have minimum power factor of 0.88. All motors 7-1/2 HP and larger will have power factor correction capacitors designed to achieve a .95 power factor. Capacitors supplied by Contractor. Manufacturer shall recommend to Contractor with submittals, the proper KVAR rating of capacitor to be used.
4. Rating: Motors specified for voltage of 208 volts shall be designed and nameplated for 200 volts.

C. Manufacturers:

1. Allis Chalmers
2. General Electric
3. Louis-Allis
4. Reliance
5. Westinghouse
6. or equal

PART 3 - EXECUTION

3.01 Motor Sizing:

- A. Select motors to have required capacity to operate driven equipment under all conditions of operation without overload.
- B. Do not include motor service factor when determining motor size.

SECTION 15240

VIBRATION ISOLATION

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements

1.02 Work Included:

- A. Set vibration isolators as specified herein, below the air compressor and vacuum pump receiver tanks.

PART 2 - PRODUCTS

2.01 Neoprene Pad (Vacuum Pump):

- A. Cross ribbed pad 3/8" thick.
- B. Vibration Mountings Shear Flex Pads; Korfund Elastogrip, or equal.

2.02 Cork Rib Pad (Air Compressor):

- A. 1" thick laminated pad consisting of cork boned between 2 layers of ribbed neoprene.
- B. Vibration Mountings Cork Rib Pad; Korfund Elastogrip, or equal.

2.03 Vibration Isolators:

- A. Provide vibration isolators as required by the manufacturer of the heating and cooling unit.
- B. Provide vibration isolators for each exhaust fan, mounted on the roof, as per manufacturer's requirement.

PART 3 - EXECUTION

3.01 Acceptable Consultants:

- A. Consolidated Kinetics
- B. Mason
- C. Or equal

SECTION 15250

MECHANICAL INSULATION

PART 1 GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install all insulation for mechanical systems as shown on the drawings and as herein specified.
- B. Systems shall include the following:
 - 1. Domestic Hot and Cold Water Piping Systems
 - 2. Sanitary Waste System
 - 3. Air Conditioning Supply Distribution Systems
- C. Work shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for piping, ducts and related mechanical equipment in the plumbing, heating, ventilating and air conditioning systems.

1.02 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15060 - Piping and Valves
- C. Section 15061 - Piping Schedules
- D. Section 15251 - Mechanical Insulation Schedules

1.03 Quality Assurance:

- A. Insulation shall be installed by skilled workman regularly engaged in this type of work.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Shop drawings which indicate complete material data, a list of materials proposed for this project and indicate thickness of material for individual services.
 - 2. Samples of proposed insulating materials.

1.05 Product Delivery, Storage and Handling:

- A. The Contractor shall be responsible for the delivery, storage and handling of products.

- B. Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.
- C. Store material in dry and secure location out of weather. Do not allow products to become wet.
- D. Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.
- E. Promptly remove damaged products from job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.01 Insulation Material - Flame Spread and Smoke Rating:

- A. Pipe insulation coverings and adhesives on pipes used in chases, shafts or other concealed spaces shall have a flame spread rating not exceeding twenty-five (25). Pipe insulation and coverings on pipe used in plenums and shafts serving as supply or return air ducts shall have a flame spread rating not exceeding twenty-five (25) and a smoke-developed rating not exceeding fifty (50).

2.02 Insulating Materials - Piping:

- A. Fiberglass:
 - 1. Cold Piping: Fine inorganic fibrous glass insulation, with factory applied vapor barrier jacket, molded to conform to piping, "K" value at 75°F, maximum 0.24 btu/in./sq. ft./degrees F/hr.
 - 2. Hot Piping: Fine inorganic fibrous glass insulation with factory applied general purpose jacket molded to conform to piping, "K" value at 75°F, maximum 0.25 btu/in./sq. ft./degrees F/hr.
- B. Foamed Plastic: Closed cellular material, odorless, self-extinguishing, UL approved maximum water vapor transmission rating of 0.1 perms. "K" value at 75°F, maximum 0.28 btu/in./sq. ft./degrees F/hr.
- C. Phenolic Foam: Continuously molded rigid pipe insulation made from chemically neutral phenolic foam with factory applied vapor barrier jacket molded to conform to piping.

2.03 Insulating Materials - Equipment:

- A. Hot Equipment:
 - 1. Rigid fibrous glass insulation; density shall be 5# per cu. ft., "K" value at 75°F, maximum of 0.24 btu/in./sq. ft./degrees F/hr.

2. Calcium Silicate: Rigid Hydrous calcium silicate insulating block designed for use up to 1200°F. Density shall be 11# per cu. ft.

2.04 Insulating Materials - Ductwork:

- A. Rigid Board Fiberglass Duct Insulation: Shall be .22 maximum "K" factor at 75°F mean temperature, minimum density 4.25# per cu. ft. with integral non-asphaltic fire resistant, laminated vapor barrier jacket of .001" thick aluminum reinforced foil facing-glass fiber scrim, flameproof laminate, UL approved.
- B. Adhesives: Adhesives tapes or mastics used in manufacture of insulating materials or in application of same shall be fire retardant. Tape to be Morgan, Fasson, Arno and Nashua tapes complying with SMACNA standard AFTS-100-73.

2.05 Miscellaneous Jacket Materials:

- A. Flame Resistant: 2 layer laminate of flame resistant creped kraft laminated to .0007 aluminum foil.
- B. Aluminum Jacket: Corrugated aluminum with factory attached 30-9-30 duplex waterproof asphalt laminated paper as manufactured by Childers (.010" thickness). Childers Ell-Jacs, or approved equal for fittings.
- C. Roofing Felt: Rag felt base, saturated and coated with asphalt. 35, 45 or 55# as noted on Schedule.
- D. Vinyl Film: .004 thick, gray, green or white, as noted on the Schedule.
- E. Reinforced Foil and Paper: FSK (foil-skim-kraft) aluminum foil reinforced with fiberglass yarn mesh and laminated to 40# chemically treated, fire resistant kraft. UL rated.

2.06 Acceptable Manufacturers:

- A. Insulation:
 1. Owens-Corning
 2. Johns-Manville
 3. Armstrong
 4. CSG Industries
 5. Certainteed Corp.
 6. Knauf
 7. or equal
- B. Insulation Sundries and Adhesives:
 1. Benjamin Foster
 2. Childers

3. Morgan, Fasson, Arno & Nashua
4. Vimasco
5. or equal

PART 3 - EXECUTION

3.01 General Requirements:

- A. See Section 09900 for Painting.
- B. Application of insulation materials to piping shall be done in accordance with manufacturers' written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use.
- C. "Concealed" where used herein-under, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts or hung ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined herein-above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas or unfinished rooms is to be considered as "exposed".

3.02 Preparation:

- A. Apply insulation only after pipes, ducts and equipment have been tested and cleaned.
- B. Protect equipment, ducts, pipes, etc. with tarpaulins. Keep premises clean.
- C. Insure surface is clean and dry prior to installation. Insure insulation is dry before and during application. Finish with systems at operating conditions.

3.03 General Installation:

- A. Provide removable sections of insulation or insulation boxes at all points where access is required for servicing of the equipment.
- B. All insulation shall be continuous through wall and ceiling openings and sleeves. All covered pipe and ductwork is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. (If necessary, extra fittings and pipe are to be used.)
- C. Vapor barrier jackets shall be applied with a continuous, unbroken vapor seal. Pipe hangers on cold lines (under 50°F) are to be sized large enough to be installed over the outer surface of the insulation. Load distributing corrosion-resistant metal shields shall be installed around the lower 1/3 circumference of

the insulation. Shields shall be 12" up through 6" dia.; 16" for 6" through 12" dia.; and 20" over 12" IPS.

- D. Pipe sizes greater than 3" IPS (4" for Types II and IV) require supplementary load bearing material, the same thickness as the insulation, used in combination with the hanger shields to resist compression of the insulation.

3.04 Application of Pipe Insulation:

- A. All pipe insulation shall be installed with joints butted firmly together.
- B. Seal all punctures in vapor barrier jacket with vapor barrier adhesive on cooling piping and air conditioning ducts.
- C. Pipe insulation shall be protected by use of wooden plugs and blocks.
- D. Apply .016 aluminum metal jackets on all pipe in finished area subject to wear from normal traffic.
- E. Jackets on pipe insulation may be stapled using outward clinch staples spaced 3" apart at least 1/4" in from the lap edge on systems operating at 50°F and above; below 50°F the laps are to be vapor sealed using self-sealing lap, lap-seal tape gun or adhesive such as 520. All insulation ends are to be tapered and sealed regardless of service.
- F. Insulation of Pipe Fittings, Flanges, Valve Bodies, Etc.:
 - 1. On lines for heating service only, pipe fittings 3" and smaller may be insulated with insulating cement equal in thickness to adjoining pipe insulation and troweled to smooth even finish. Do not insulate heating only valves or unions.
 - 2. Cover insulated fittings with same jacket as piping.
 - 3. Cover insulated elbows with "Zeston", or equal, elbow covers.
 - 4. All valves and fittings shall be insulated with mitered sections of insulation equal in density and thickness to the adjoining insulation, with insulating cement equal in thickness to the adjoining insulation, or with "Zeston", or equal, type, pre-molded PVC fittings installed in accordance with the manufacturer's instructions.
 - 5. Fittings are to be finished with 8 oz. glass mesh and mastic (use breather mastic on systems operating from 50°F down).

3.05 Application of Duct Insulation:

- A. Secure insulation without puncturing duct.

- B. Insulate ducts by attaching with mechanical pins welded to duct and secured with metal discs applied on 12" centers.
- C. Seal all punctures on vapor barrier jacket with vapor barrier mastic.
- D. Clip all pins with appropriate tool to prevent injury on externally applied insulation.

3.06 Application of Equipment Insulation:

- A. General: Insulate all manholes, removable heads, access doors, so they may be removed.
- B. Round Equipment: Secure insulation with 1/2" wide metal bands 12" o.c. or with mechanical pins welded to equipment 12" o.c.
- C. Flat or Irregular Equipment (metal partitions, plenums, etc.): Secure insulation with mechanical pins welded to equipment 12" o.c.
- D. Finish: Equipment insulation exterior surfaces shall be finished by applying two reinforced coats of a fiberglass cement as recommended by the insulation manufacturer. Second coat shall be 1/3 (by weight) Portland cement troweled to smooth, hard finish. Apply jackets over finished cement as specified herein.

3.07 Application of Jackets Over Insulation (as required):

- A. General: Apply jackets over insulation as specified in Schedules in neat and workmanlike manner and lapped and secured in the following manner.
- B. Canvas: Secured with high strength lagging adhesive.
 - 1. Manufacturers: Armstrong Insulcolor; Arobol; Foster Lagfas; or equal.
- C. Vapor Barrier Jackets (all types): Non-breathing secured with mastic vapor barrier adhesive.
 - 1. Manufacturers: Owens-Corning Fiberglass or equal.
- D. Roofing Felt: Seal with vapor barrier adhesive and tie with 16 gauge copper wire 9" on center.
- E. Aluminum: Straight lengths secured with aluminum straps 8" o.c. Fittings held with sheet metal screws. Lap and seal per manufacturer's instructions.

SECTION 15251

INSULATION SCHEDULES

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15060 - Piping and Valves
- C. Section 15061 - Piping Schedules
- D. Section 15250 - Insulation

PART 2 - PRODUCTS

2.01 Schedule 1: Heating Service - Pipe Insulation:

A. Service

- 1. Domestic Hot Water and Return Systems: all locations - type (1) or (3).

B. Materials

	<u>Types</u>		
	(1)	(2)	(3)
1. Insulation	Fiberglass	Fiberglass	Phenolic
2. Jacket	Factory ASJ/SSL	Factory ASJ/SSL	Factory ASJ/SSL
3. <u>Pipe Size</u>	<u>Insulation Thickness</u>		
1" & less	3/4"	1"	3/4"
1-1/4 - 2"	1"	1-1/2"	1"
2-1/2 - 4"	1"	1-1/2"	1"
5" and 6"	1"	2"	1-1/2"

2.02 Schedule 2: Cold Service - Pipe Insulation:

A. Service

- 1. Domestic Cold Water: All locations - type (1) or (2)
- 2. Refrigerant Suction: All locations - type (1) or (2)
- 3. Refrigerant Hot Gas: In locations below 7'-0", inside only
- type (1) or (2)

B. Materials

		<u>Types</u>	
		(1)	(2)
1.	Insulation	Fiberglass	Foamed Plastic
2.	Jacket	Factory ASJ/SSL	Not Required
3.	<u>Pipe Size</u>	<u>Insulation Thickness</u>	
	1/2" thru 4"	1/2"	3/8"
	5" and up	1"	1/2"

2.03 Schedule 3: Drainage Service - Pipe Insulation:

A. Service

- Sanitary - as noted on drawings: Types (1) or (3)
- Cooling Coil Condensate Drain Lines (concealed): Types (1) (2) or (3)

B. Materials

		<u>Types</u>		
		(1)	(2)	(3)
1.	Insulation	Heavy Density Fiberglass	Foamed Plastic	Phenolic Foam
2.	Jacket	Factory ASJ/SSJ	Not Req'd.	Factory ASJ/SSL
3.	<u>Pipe Size</u>	<u>Insulation Thickness</u>		
	1" to 6"	1"	3/4"	1"
	8" and up	1/2"	1"	1/2"

2.04 Schedule 4: Air Conditioning Service Duct Insulation:

A. Service

- This portion of the Specification shall apply when ductwork has been constructed of metal, or any material that does not already have an insulated coating.
- Air Conditioning Supply: Concealed in conditioned areas, in attics or plenums and in unconditioned spaces: Type (1)

B. Materials

		<u>Type</u>
		(1)
1.	Insulation	2/4" Flexible Fiberglass
2.	Jacket	FSK
3.	<u>Duct Size</u>	<u>Insulation Thickness</u>
	All sizes	1-1/2"

C. Notes

1. Do not insulate air condition duct within conditioned spaces. (Space directly supplied with that respective conditioned air.)
2. All return air, relief air and outside air ductwork will be lined internally by Contractor.

SECTION 15400

PLUMBING

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install all plumbing fixtures with supply lines and water heater where applicable, sanitary drainage components, and domestic water service for buildings as shown on the drawings and herein specified.
- B. Plumbing fixtures shall include traps, stops, supplies, vacuum breakers, hot and cold water lines, water heater and carriers where applicable unless called out otherwise.
- C. Sanitary drainage system shall include toilet rooms, shower, floor drains, acid resistant waste from laboratory and related accessories.
- D. Domestic water service shall include a complete domestic water service from 5' outside building to connection with City Water Company main or well as applicable. Contractor shall pay all costs not borne by the Water Company.

1.02 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15060 - Piping and Valves
- C. Section 15061 - Piping Schedules
- D. Section 15130 - Gauges
- E. Section 15250 - Mechanical Insulation
- F. Section 15251 - Mechanical Insulation Schedules
- G. Division 16 - Electrical

1.03 Quality Assurance:

- A. Standards:
 - 1. Standards referred to hereafter by basic designation only, form part of this specification to the extent indicated by reference thereto. Latest revisions shall apply, unless otherwise specified.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Product data on plumbing fixtures; fixture trim, valves, seats and carriers; floor drains and cleanouts; and water heaters as applicable and as specified herein. This data shall include the manufacturer's description, written and pictorial, of performance data and physical characteristics for all components furnished.
 - 2. Manufacturer's operation and maintenance material and manuals.
 - 3. Form of warranty.
 - 4. Test results.

1.05 Acceptable Manufacturers:

- A. Fixtures:
 - 1. American Standard
 - 2. Bradley
 - 3. Eljer
 - 4. Fiat
 - 5. Just
 - 6. Kohler
 - 7. Powers
 - 8. Stern-Williams
 - 9. Mustee
 - 10. Speakman
 - 11. Symmons
 - 12. or equal
- B. Floor Drains and Cleanouts:
 - 1. Wade
 - 2. J.R. Smith
 - 3. Josam
 - 4. or equal
- C. Water Heaters:
 - 1. A.O. Smith
 - 2. State
 - 3. PVI
 - 4. Lochinvar
 - 5. or equal

D. Trim (Faucets, Supplies & Stops):

1. Chicago Faucet
2. Speakman
3. T&S Brass
4. McGuire Traps & Tail Pieces
5. or equal

E. Flush Valves:

1. Delaney
2. Sloan
3. or equal

F. Seats:

1. Bemis
2. Beneke
3. Olsonite
4. Church
5. or equal

G. Water Cooler:

1. Elkay
2. Halsey-Taylor
3. Oasis
4. Western-Sunroc
5. Haws
6. White-Westinghouse
7. or equal

H. Carriers:

1. Josam
2. Smith
3. Wade
4. Zurn
5. or equal

I. Showers:

1. Bradley
2. Powers
3. Speakman
4. Symmons
5. or equal

PART 2 - PRODUCTS

2.01 Floor Drains:

A. F.D.-1:

1. Drain shall be iron body with inside caulked connection, flashing collar, round nickel bronze adjustable strainer, secured grate, integral 4" deep trap and cleanout. J.R. Smith #2040-A, or equal.

B. F.D.-2:

1. Drain shall be cast iron body and flashing collar ductile iron grate. J.R. Smith Model 2320-XP-M, or equal.
2. Trap: Cast iron, minimum 4" deep seal P-trap. J.R. Smith #7230 or equal.

2.02 Cleanouts:

A. Construction, location and installation of cleanouts shall be in accordance with the Ohio Basic Building Code.

1. Cast iron or brass ferrule to match pipe with cast brass threaded plug and lead seals.
2. Cleanouts shall be same size as pipe up through 4" and not less than 4" on larger pipe.
3. Located at base of each stack, every 50 ft. in lines 4" and smaller; every 100 ft. in lines 4" and larger and where drains leave building.
4. Access covers are required for all floor cleanouts and wall cleanouts in finished areas. Covers shall be compatible with adjacent surface finish per manufacturer and the Engineer.
5. Provide flange and flashing collar when located in an area with waterproofing membrane.

B. Schedule of Floor Cleanouts (Inside Building):

1. Vinyl Tile Floors: Cast iron ferrule with adjustable housing, bronze plug, lead seal, nickel bronze round frame recessed 1/8" for tile covering. J.R. Smith #4143, or equal.
2. Quarry Tile Floor: Cast iron body, round adjustable top recessed 1/2" for tile insert. Top to be secured and of nickel bronze. Brass plug with lead seal. J.R. Smith #4183, or equal.
3. Terrazzo or Other Special Floor: Cast iron ferrule with adjustable housing, bronze plug, lead seal, round cast iron frame and scoriated nickel bronze top. J.R. Smith #4023, or equal.

4. Finished Concrete Floor: Cast iron ferrule with adjustable housing, bronze plug, lead seal, round cast iron frame and scoriated nickel bronze top. J.R. Smith #4023, or equal.

C. Schedule of Exterior Cleanouts:

1. Yard Cleanouts: Cast iron ferrule and housing, bronze plug, lead seal, nickel bronze scoriated cover. Housing shall be totally separate from the ferrule and shall be set in a 20" x 20" x 12" thick concrete pad. J.R. Smith #4253, or equal.

D. Schedule of Wall Type Cleanouts:

1. Wall Cleanouts and Access Cover: Bronze plug and lead seal. Round, smooth chrome plated access plate with screw of required length. J.R. Smith #4472 or #4402, or equal.

E. Schedule of Concealed Accessible Cleanouts:

1. Bronze plug and lead seal. J.R. Smith #4400 or #4405, or equal.

2.03 Water Closet - P-1:

- A. American Standard 2108.408 elongated cadet water-saver toilet, siphon jet action, vitreous china, 18" high bowl, close-coupled tank, church 5321.112 open front seat or equal.

2.04 Lavatories - P-2:

- A. American Standard No. 9141.011, wheelchair lavatory for the handicapped, vitreous china with front overflow, for concealed arm support. Heritage centerset faucet 2103.786, 4" centers, 3-1/2" spout, aerator, pop-up drain, 1-1/4" tail piece, chrome finish 4" wrist handles or equal.

2.05 Lab Sink - P-3:

- A. Rough-in and final connections.

- B. Rough-in's shall included:

1. Chrome plated brass angle stop, slow compression, with handwheel and 1/2" IPS inlet/outlet for hot and cold water. Provide chrome plated escutcheons, pipe nipples and elbows (where exposed inside casework) as well as 1/2" galvanized nipples and fittings (where concealed) to back mounted trim specified in Section 12345. Angle stops shall be Chicago Faucet #442, or equal.
2. Acid resistant waste piping commences from bottom of the tailpiece (on each side of the double bottom sink) and includes the following:

- a. 2" horizontal waste piping.
- b. 2" P-trap with cleanout on bottom, or a deep seal drum trap with means of accessing for cleanout.
- c. 2" waste arm and escutcheon.
- d. Refer to Section 15061 for type of materials.

2.06 Service Sink P-4:

A. Basin and Accessories: Florestine Model FM (15440/FLO) or equal

- 1. Made from fiberglass reinforced polyester resistant.
- 2. Rust and corrosion resistant.
- 3. 21 gallon capacity.
- 4. Rust free legs and aluminum levelers for floor mounting.

B. Faucet:

- 1. Combination service sink fitting with vacuum breaker, with 3/4" hose thread on spout, lever handles, wall brace, pail hook, and flanged female adjustable arms with integral stops. Polished chromium plated brass body, Chicago Faucet #897 or equal.

2.07 Neutralization Basin:

- A. Neutralization basin for acid waste shall be located in the floor as indicated on the drawings. Neutralization basin shall be an Enfield Model T0015 or equal.

2.08 Wall Hydrant:

- A. Wall hydrant shall be J.R. Smith #5609 "Line-Gard" with integral vacuum breaker, loose "T" handle key, bronze body with chrome plated face, and optional adjustable wall clamp or equal.

2.09 Water Heaters:

- A. Water heater shall be electric water heater W/2-4500W elements, 20.5 GPM @ 90°F rise. A.O. Smith Model ELSF-30 or equal.

PART 3 - EXECUTION

3.01 Fixture Installation:

- A. Contractor shall grind the fixture to proper fit, if necessary, to secure a perfect fit at walls and floors.
- B. Vitreous china fixtures to be white, unless color is specifically noted. All enamelware to be acid resisting.
- C. Exposed fixture metal and fittings shall be chrome plated brass.
- D. Fixtures shall be set plumb to wall lines. Fasten securely in place and caulk between fixture and all adjacent surfaces such as wall or floor. Caulk shall be a clear, flexible, non-yellowing, silicon material specifically designed for this purpose. Caulk shall resist mildew and fungus. Dow-Corning, or equal.
- E. Fixtures and trim protected by Contractor until final acceptance. Clean fixtures and trim before final inspection and maintain in same condition until turned over to the Owner. Cracked fixtures or scratched trim shall be replaced by Contractor before final acceptance.
- F. Fixtures and equipment shall be equipped with anti-siphon devices or constructed to eliminate possibility of siphoning waste material into water supply.
- G. Chromium plating to be in accordance with the U.S. Government Standards, under license from Chrome Corp. of America. Brassplate steel or cast iron and nickelplate brassplating before chromium plating. Satin or polished finish as specified.
- H. All equipment piped with steel or copper pipe shall have valved inlets and outlets and with unions.
- I. All sinks, specified for areas such as laboratory, noted to be acid resistant or to have acid resistant waste shall be provided with acid resistant trap and vent piping.

3.02 Connections - Fixtures:

A. Water Supplies:

- 1. Unless otherwise specified, Chicago Faucet #1016 angle sink supplies with 3/8" x 12" long flexible risers, chrome plated 3/8" angle loose key stops with stuffing box and chrome plated brass nipple with escutcheon.
- 2. 1/2" copper supplies with brass stops.
- 3. Supplies to be held tight to back wall and to underside of handicap lavatory/sink, or hot water supply to be insulated.

B. Waste and Trap:

1. Chrome plated brass continuous wastes, and P-trap with bottom cleanout, CP waste to wall, 17 gauge construction.
2. Horizontal offset waste assembly for handicap lavatories or sinks.
3. Ips wastes and cast iron P-trap with c.o. pipe to wall.

3.03 Drainage System:

- A. Refer to Basic Mechanical Requirements and Piping and Valves for pipe, fittings and valves.
- B. Refer to Insulation Section 15250 and 15251 for insulation noted on the Plans.
- C. Run local horizontal drainage piping at grade of 1/4" per foot wherever possible but not less than 1/8" per foot. Make changes in direction of draining piping by appropriate use of 45° wyes, long sweep quarter, sixth, eighth, or sixteenth bends, except that where space conditions require, short turn sanitary tees may be used on vertical lines. Slip joints are permitted only on fixture trap inlets or elbows connecting to fixture tailpieces. Unions are not to be permitted on sewer side of traps; use Tucker or hub end fittings.
- D. Each plumbing fixture shall be vented, as required by code.

3.04 Domestic Water Service Installation:

A. General:

1. Cut pipes accurately to measurements established at job. Install piping without springing or forcing.
2. Install exposed pipes inside building parallel to building lines. Install vertical pipes plumb.
3. Reductions in pipe size are to be made with reducing fittings; use no bushings.
4. Use standard pipe fittings for making changes in the direction of piping and for connecting branch lines to mains and risers.

B. Special Conditions:

1. Where water lines and sewers cross and the water line cannot be placed above or below the sewer with a minimum of 18 inches vertical clearance, one of the following installation methods must be used:
 - a. The sewer shall be constructed of water works grade cast iron pipe with mechanical joints within ten feet of the water line.

- b. Water line shall be installed in a water works grade cast iron pipe casing extending ten feet either side of the sewer line.
- 2. Where water lines and sewers horizontal clearance of ten feet cannot be maintained, one of the following installation methods must be used:
 - a. Avoid laying water lines and sewers in the same trench. The bottom of the water line shall be at all points a minimum of twelve (12) inches above the top of the sewer line. Both sewer and water service shall be of water works grade cast iron pipe.
- C. Test:
 - 1. Test all piping in accordance with Ohio Basic Building Code. Notify Owner's Representative not less than two full working days before each test. Conduct all tests in presence of Engineer.
 - 2. Conduct tests before permanently enclosing work in any manner. Furnish required tools, materials and test equipment. Disconnect devices, equipment and attached piping for which test pressure higher than permissible. Install blind flanges or plugs.
 - 3. Replace all work found defective, or repair, if directed. After replacement or repair, test work again as specified. Repeat until satisfactory.
- D. Flushing:
 - 1. After tests are completed, flush piping inside of the building with sufficient water to produce minimum velocity of 2.5' per second through piping being flushed. Continue all flushing until discharge water shows no discoloration. Drain at low points.
- E. Final Approval:
 - 1. Contractor shall furnish at his own expense all components as may be required to secure approval of finished installation.
 - 2. Contractor shall submit to Engineer written evidence of final approval of complete installation.

3.05 Water Heater Installation:

- A. Inspection: Examine the water heater mounting area and correct any irregularities prior to installation.
- B. Install water heater in accordance with the drawings and manufacturer's written instructions.

- C. Make sure water heater is securely anchored. Also, make certain that all connections are tight..
- D. Water heater shall be operated through three heating cycles to insure proper operation. Temperature data shall be maintained and verified against thermostat settings.
- E. Clean all exterior surfaces of the water heater.

SECTION 15455

WATER SOFTENER

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary for the installation of water softener equipment and accessories as herein specified and as shown on the drawings.

1.02 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15060 - Piping and Valves
- C. Section 15061 - Piping Schedules
- D. Division 16 - Electrical

1.03 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
 - 2. Certified copies of reports of factory tests specified in this Section and required by the referenced standards.
 - 3. Shop drawings with performance data and physical characteristics.
 - 4. Manufacturer's installation instructions.
 - 5. Manufacturer's operation and maintenance material and manuals.
 - 6. Wiring diagrams for automatic controls.

1.04 Product Delivery, Storage and Handling:

- A. The Contractor shall be responsible for the delivery, storage and handling of products.
- B. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.01 Tanks:

A. Softener:

1. See drawings for exchange and service flow rate capacities, as well as pressure drop.
2. Baked phenolic lined interior, with high capacity cation resin and gravel supporting bed.
3. Design pressure shall be 100 psig and system test pressure of 150 psig.
4. Side shell height shall be designed to have sufficient free board space to allow for resin expansion during backwash.
5. Internals shall be brass and PVC, for corrosion resistance.
6. 1" pipe manifold; Sch. 40 galvanized pipe and 125# malleable iron fittings.
7. 12 day time clock control, 115V/60 cy./1 ph. for complete automatic regeneration cycles.
8. Complete assembled unit to be factory tested, hydrostatically.

B. Brine:

1. 150 lbs. capacity, polyethylene, with top cover.
2. Combination salt storage and brine measuring tank.
3. Salt shelf design for storing dry salt, with a properly designed brine collection header below.
4. A chamber shall house an automatic air eliminating device.

2.02 Controls:

- #### A. Multi-port control shall house integral diaphragm valves (eliminating water hammer), brine injector and flow control (for a constant brine and rinse flow at any pressure, from 30 to 100 psig).

1. Diaphragm valve shall be fully guided around its perimeter to eliminate sticking and assure positive shut-off. Valve to be one piece molding of Noryl, or equal material.
2. All parts shall be readily accessible for servicing and inspection.
3. If special tools are required to service the controls, they shall be provided.

2.03 General Requirements:

- #### A. Softener and brine tank shall be a match pair. Brine tank shall be capable of storing enough salt for five regeneration at maximum dosage.
- #### B. Units shall be factory tested and shipped ready for installation.

2.04 Water Testing Equipment:

- A. Softener shall come complete with sample cock installed for obtaining samples of effluent water. A complete water testing kit will be furnished. A soap test will be conducted.

2.05 Instructions:

- A. A complete set of instructions covering installation and operation of water softener will be provided in booklet form.

2.06 Guarantee:

- A. Water softening equipment will be guaranteed against failure due to faulty workmanship, materials and corrosion for period of one year.

2.07 Manufacturer:

- A. Bruner Corp. Model #30BA1
- B. Culligan
- C. or equal

PART 3 - EXECUTION

3.01 General Performance:

- A. The water softener equipment herein specified shall remove hardness (expressed as CaCO₃) to the extent that the effluent from the water softener will contain not more than 0 grains per gallon of hardness, as determined by an accepted soap hardness test method when operated at rated capacity and in accordance with the operating instructions.

3.02 Installation:

- A. Water softener equipment shall be installed as per manufacturer's recommendations.

SECTION 15494

NON-POTABLE WATER SERVICE CIRCULATING PUMP

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install a non-potable water service circulating pump system consisting of a hydropneumatic tank, pump, pressure switches, gauges, and related piping accessories all as indicated on the drawings and herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15060 - Piping and Valves
- C. Section 15061 - Piping Schedules
- D. Section 15130 - Gauges
- E. Division 16 - Electrical

1.03 Quality Assurance:

A. Standards:

- 1. Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.

1.04 Submittals:

A. Submittals shall be as specified in Section 01300.

B. Submit the following:

- 1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
- 2. Certified copies of reports of factory tests specified in this section and required by the referenced standards.
- 3. Product data with performance data, pump curves and physical characteristics.
- 4. Operation and maintenance manuals.
- 5. Form of warranty.

PART 2 - PRODUCTS

2.01 Water Circulating Pump (Base-Mounted Centrifugal):

- A. Capacity, head, rpm, motor size, electrical characteristics, mounting arrangement as shown on the drawings.
- B. Pump to have body mounted on cast iron drip base and connected to motor shaft with heavy duty flexible coupling.
- C. Casing or Volute: Close grained cast iron with smooth waterway- designed for 1-1/2 times working pressure but not less than 75 psig. Casing to have tapped drip pockets with plug and air vent cock at high point.
- D. Impeller: Cast bronze, enclosed type statically and dynamically balanced, non-overloading centrifugal volute, keyed to shaft.
- E. Wearing Ring: Bronze, steel coupling guard.
- F. Pump Shaft:
 - 1. On small sizes: 416 stainless steel.
 - 2. On large sizes: Carbon steel with stainless steel shaft sleeve.
- G. Pump Shaft Seal:
 - 1. Mechanical seal to be constructed in accordance with seal manufacturer's published recommendations for service requirements encountered, considering temperature, pressure, liquid and flash point of liquid.
 - 2. Packed seal complete with packing rings, adjustable gland, integral packing box.
- H. Pump Base:
 - 1. Either steel or cast iron with raised drainage lip and tapped drain outlet.
- I. Pump shall be of self-priming type with 15' suction lift.
- J. Motor: To be heavy duty, ball bearing, open dripproof. Motor sized for continuous operation without undue heating or overload.
- K. Motor starter: By Electrical Contractor.
- L. Pump and Motor size as shown on drawing.

M. Manufacturers:

1. Gorman-Rupp
2. Worthington
3. Peerless
4. Aurora
5. Chicago Type
6. Pacific Pump

2.02 Pneumatic Tank - Above Ground:

- A. Capacity, arrangement, shell length, diameter and openings as shown on the drawings.
- B. Tank shall be vertical.
- C. Material: galvanized steel, designed for 125 psi working pressure with ASME label, with replaceable diaphragm.
- D. Operating range: 20 psi to 60 psi.
- E. Manufactured by Amtrol or equal.

2.03 Pressure Switch:

- A. Mechanical contact.
- B. 30 psi to 50 psi operating range (0 psi to 90 psi adjustable).
- C. Manufactured by Allen Bradley, Square D or equal.

PART 3 - EXECUTION

3.01 Installation:

- A. Install circulating pump and hydropneumatic tank in the locations and arrangement indicated on the drawing and in accordance with the manufacturers recommended installation instructions and the Ohio Basic Building Code.

SECTION 15800

AIR DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15251 - Mechanical Insulation Schedules
- C. Sections 15820 thru 15879 - Air Distribution

1.02 Work Included:

- A. Supplying of conditioned air from a HVAC unit located in the mechanical room. Return air and exhaust air ductwork shall be located as shown on the drawings. The ductwork for the supply, return and exhaust air shall be fabricated from sheet metal for rectangular ducts and "Round/Certaflex" for round or flexible ductwork. Round duct shall be as manufactured by Certainteed Corp. or equal.
- B. Each unit shall be controlled by a thermostat which shall control air temperature in the system. Thermostat, and unit controls to be furnished by same manufacturer.
- C. The HVAC units, inside and outside shall be as shown on the drawing.

SECTION 15820

FANS

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Division 16 - Electrical Wiring and Connections

PART 2 - PRODUCTS

2.01 Centrifugal Exhaust Fan:

- A. Description: Unit shall be complete with motor and centrifugal fan. Performance of all units shall be based on tests conducted in accordance with AMCA Standard 210, Test Code of Air Moving Devices.
- B. Construction: steel or aluminum.
- C. Motors: permanent lubricated, ball bearing type, totally enclosed if in airstream.
- D. Dampers: supplied with backdraft dampers.
- E. Electrical: disconnect switch by manufacturer. Supply motors with two windings where two-speed fans are noted. Multi-speed starters by manufacturer.
- F. Direct drive units shall be:
 - 1. Carnes
 - 2. Penn
 - 3. or equal
- G. Exhaust fans shall be as shown on drawings.

SECTION 15835

ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install electric unit heaters as shown on the drawing and herein specified.

1.02 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Division 16 - Electrical

1.03 Quality Assurance:

- A. Standards referred to hereafter by basic designation only form a part of this specification to the extent indicated by reference thereto. Latest revisions shall apply, unless otherwise specified.

1.04 Submittals:

- A. Submittals shall be as specified in Section 01300.
- B. Submit the following:
 - 1. Product data with performance data and physical characteristics.
 - 2. Wiring diagrams for automatic controls.
 - 3. Manufacturer's operation and maintenance manuals.
 - 4. Form of warranty.

PART 2 - PRODUCTS

2.01 Electric Unit Heaters:

- A. Units shall be complete with propeller type fan directly connected totally enclosed fan motor; replaceable, electric resistance heating elements sheathed in steel; adjustable discharge louvers; sturdily constructed casing with mounting brackets; and wire fan guard.
- B. Element protected against overheating by built-in thermal cutout.
- C. Units to bear U.L. label.

D. Unit manufacturer shall furnish:

1. Thermostat
2. Disconnect Switch
3. MMB Mounting Bracket

E. Manufacturers:

1. Chromalox
2. ILG
3. Square D
4. or equal

PART 3 - EXECUTION

3.01 Installation:

- A. Install electric unit heater in the location indicated on the drawing in accordance with the manufacturer's recommended installation instructions, the Ohio Basic Building Code and the National Electric Code.

SECTION 15840

LOW PRESSURE DUCT SYSTEM

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15860 - Duct System Accessories
- C. Section 15870 - Diffusers and Grilles

1.02 Work Included:

- A. Furnish and install equipment, specialties and accessories to provide systems as shown on the Drawings and herein specified.
- B. Systems shall include the following.
 - 1. All ductwork, both rectangular and round.
 - 2. All dampers and in-line controls.

1.03 Reference Manuals:

- A. Low Velocity Duct Manual refers to Low Velocity and Duct Construction Standards, 4th edition 1969, as published by SMACNA.
- B. ASHRAE Guide and Data Book, latest edition, chapter on Air Duct Design.
- C. Low pressure duct construction as published by SMACNA.

1.04 General Requirements:

- A. Galvanized iron
- B. Fiberglass

PART 2 - PRODUCTS

2.01 Low Pressure Rectangular Duct: (2" W.G. Maximum - 2000 FPM Maximum)

- A. Construct rectangular duct of first quality materials in accordance with pages 8 to 81 of the Low Velocity Duct Manual (1969). Crossbreak except where rigid insulation is specified.
- B. Support ducts suspended from roof structure with band type hangers if maximum is inside 48" and with trapeze type hangers if over 48".

C. Fittings:

1. Elbows: Use standard radius elbow. Radius shall be 2-1/2 times width of fittings unless noted otherwise on the drawings.
2. Elbows: Equare elbows with turning vanes. Elbows less than 36" wide shall have single bladed vanes. Elbows 36" wide and over shall have double bladed vanes in airfoil pattern.
3. Main Tee Connections: Radius or square depending on size duct reduced to. Adjustable splitter damper shall be provided ahead of Tee in all cases.
4. Branch Tee Constructions: 90° straight tap-in, with adjustable air extractors. Balancing damper in branch will replace vanes when shown on the drawings.
5. Transitions, Raises and Drops: Built so that change in direction of side of duct does not exceed angle to projected same side.

2.02 Low Pressure Round Duct:

- A. Construct round duct of first quality materials in accordance with pages 38 to 81 of the Low Velocity Duct Manual (1969) and recommendations of 1975 ASHRAE Guide, Chapter I.
- B. Support horizontal duct with ban iron strap and hanger rods or straps.
- C. Fittings: Use standard radius elbows.

2.03 Access Doors:

- A. Construction: Steel with 1/2" of fiberglass insulation between door and door pan. Sponge rubber gasketing to be on inside of door frame and between duct and door frame. Door metals to be of sufficient gauge for minimizing leakage at various duct pressures. Hinges not to exceed 12" apart and 2 handle type latches to be used for sides exceeding 12".
- B. Manufacturers: Duro-Dyne: Vent Fabrics or equal.

2.04 Test Holes:

- A. Test holes shall be provided before and after coils, filters, mixing plenums, etc.
- B. Manufacturers: Duro-Dyne Model TH-1 #8036 or equal.

2.05 Turning Vanes:

- A. Turning vanes (single vane) shall be constructed and spaced as called for in Low Velocity Duct Manual, page 53.

- B. Turning vanes (double vane) shall be constructed and spaced as called for in Low Velocity Duct Manual, page 53.

2.06 Air Extractors:

- A. Air extractors shall consist of bank of curved blades and 4 heavy side rails. Unit pivots on attached plate. Each blade shall be synchronized with other so that unit deflects air uniformly across branch takeoff or grille. Mechanism shall be provided which will allow adjustment of unit from outside of duct.
- B. Blades shall be minimum of 26 gauge galvanized metal. Side rails shall be minimum of 14 gauge galvanized metal.
- C. Unit shall be same manufacturer who provides registers and grilles on the job, like Titus Model AG225, or equal.

PART 3 - GENERAL REQUIREMENTS

3.01 General Requirements:

- A. Maintain ducts tight to walls, partitions and underside of the floors. Provide offsets to accomplish this and avoid conflicts with other work.
- B. All ductwork shall have minimum 1" thick, 1 lb. density fiberglass insulation.
- C. Furnish, locate and set suitable sleeves where ducts pass through floors, walls and other concrete or masonry materials.
- D. Install dampers for automatic control furnished by others. Verify the exact damper size with supplier.
- E. All duct dimensions shown on drawings are inside dimensions, including ducts insulated on inside.
- F. Clean and lubricate all equipment. cover air outlets with cheesecloth if ready for occupancy.
- G. Provide for access to fire dampers, coils, dampers, damper operators, humidifiers, filters, etc., or where noted on the drawings.

SECTION 15844

FLEXIBLE DUCTWORK

PART 1 GENERAL

1.01 Work Included:

- A. Furnish and install flexible duct where shown on drawings.
- B. Generally, this includes runouts to diffusers from low pressure metal ductwork.
- C. Runouts shall not exceed 5 feet in length in any case.

1.02 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15860 - Duct System Accessories
- C. Section 15800 - Air Distribution System

1.03 Submittals:

- A. Submit Shop Drawings as per Section 01300.

PART 2 - PRODUCTS

2.01 Insulated Flexible Duct:

A. Construction:

- 1. Inner liner shall be aluminized mylar construction laminated to a corrosion resistant steel wire helix.
- 2. Insulation shall be 1" thick, 1 lb. density fiberglass.
- 3. Provide vapor barrier .004" thick seamless vinyl sleeve, gray.
- 4. Flexible duct shall meet NFPA Standard 90A.

B. Manufacturers:

- 1. Certainteed Corporation Type-Certaflex.

PART 3 - EXECUTION

3.01 General:

- A. Install flexible duct as straight as possible, eliminating unnecessary bends but still allowing adequate flexible movement.
- B. Flexible duct shall be connected with metal collar bands and sealed with duct tape.

SECTION 15860

DUCT SYSTEM ACCESSORIES

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15840 - Low Pressure Duct System

PART 2 - PRODUCTS

2.01 Backdraft Dampers:

- A. Installed where shown and to limit airflow in one direction.
- B. Constructed of steel or aluminum with formed edges padded with felt. Damper to have adjustable balancing device, brass bearings and leakproof stop around damper perimeter. Dampers in ducts deeper than 12" to be multi-blade.

2.02 Remote Control Damper and Damper Operator:

- A. Control damper D-1 and D-2 as shown on drawing.

2.03 Balancing Dampers (BD):

- A. Furnish and install where shown on the drawings.
- B. Construction to be galvanized steel, minimum 16 gauge. Shaft shall be steel with brass bearings. Blades shall not exceed 12" wide and 48" long. Frames of same gauge metal are required where 2 blades or more are used.
- C. Damper Operators: Balancing dampers to have lock type damper operator and linkage as best suits construction and access conditions. Dampers with accessible operators to be provided with locking nuts and graduated scale.

SECTION 15870

DIFFUSERS & GRILLES

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15840 - Low Pressure Duct System

PART 2 - PRODUCTS

2.01 Grilles and Registers:

- A. Capacity and size as shown on drawings.
- B. Constructed steel or aluminum.
- C. Finish: Color shall be aluminum or white.
- D. Metal Plaster Frames: For grilles mounted on plaster, masonry, fiber or metal construction surfaces.
- E. Volume Damper: Opposed blade key or screwdriver operated through grille face.
- F. Deflecting Blades: 3/4" deep, streamline. Single or double deflection as noted. Horizontal blades always mounted nearest grille face.
- G. Supply Grilles: Sponge rubber gasket, double deflection. Provide volume controller immediately behind grille.
- H. Return Grilles: Single deflection blades fixed at 45° down with volume damper.
- I. Exhaust Grilles: Single deflection blades fixed at 45° down with volume damper.
- J. Air Extractors: Provide where shown on the drawings.
- K. Manufacturers:
 - 1. Lima Register Co.
 - 2. Carnes
 - 3. Anemostat
 - 4. or equal.

SECTION 15879

LOUVERS

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere:

- A. Section 15010 - Basic Mechanical Requirements
- B. Section 15840 - Low Pressure Duct System

1.02 Submittals:

- A. Submit Shop Drawings as per Section 01300.

PART 2 - PRODUCTS

2.01 Weather Louvers:

- A. Installation: Secure louver frame to perimeter of opening at minimum of two points per side (on each side) on small louvers and at 2'-0" on center on large louvers.
- B. Seal between frame and wall with thiokol compound.
- C. 4" Extruded Aluminum Louvers 50% FA
 - 1. Factory fabricated nominal 4" width frame for recess mounting (no flange overlap).
 - 2. Blades: 6063T5 alloy minimum cross section .080", two weather stops. All blades longer than 36" to have concealed vertical bracing.
 - 3. Frame: Same material and thickness as blades.
 - 4. Screen: 1/2" mesh, .047" wire. Locate screen behind blades; screen permanently attached.
 - 5. Louver and screen constructed of aluminum.
 - 6. Louvers to have minimum of 50% free area.
 - 7. Finish: Aluminum
- D. Manufactures:
 - 1. Carnes
 - 2. American Warming and Ventilating
 - 3. Louvers and Dampers, Inc.
 - 4. or equal

* * * END OF SECTION * * *

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 Work Included:

- A. Contractor shall provide all work necessary to install all electrical equipment and materials and perform all electrical construction associated with this project, as outlined in these Specifications and shown on the Drawings.
- B. Work includes the completion of the electrical systems listed below.
 - 1. Primary Service Entrance System
 - 2. Primary Distribution System
 - 3. 277/480V "Wye" Distribution System
 - 4. 120/208V "Wye" Distribution System
 - 5. Emergency Generator
 - 6. Telephone Conduit System
 - 7. Building Grounding System
 - 8. Lighting Systems
 - 9. Conduit and Wiring Systems
 - 10. Motor Control and Power Wiring Systems

1.02 Contract "EC" - Electrical Contractor:

- A. Applicable Specification Sections are as follows:
 - 1. Division 0
 - 2. Division 1
 - 3. Division 2
 - 4. Division 16

1.03 Time of Completion:

- A. Refer to Bidding Documents.

1.04 Narrative Description of Electrical Systems:

- A. Site Work
 - 1. Provide and install complete all underground conduit and wire as indicated on Drawings and in Specifications.
 - 2. Provide and install complete all site lighting as indicated on Drawings and Specifications.
 - 3. Provide and install complete pump and motor disconnects and stands as indicated on Drawings and Specifications.

B. Building

1. Provide and install complete power distribution system, lighting system, and telephone system as indicated on Drawings and Specifications.

1.05 Requirements of Regulatory Agencies:

- A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations.
- B. In case of difference between building codes, specifications, state laws, local ordinances, industry standards and utility company regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Engineer in writing of any such difference.
- C. Non-compliance: should contractor perform any work that does not comply with requirements of applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.
- D. Permits: Each contractor shall obtain and pay for all building permits required by his work. In addition, the contractor shall pay and obtain permits for opening streets and for connection to various utilities and any other requirements necessary to carry out his work.
- E. Applicable Codes and Standards shall include all state laws, local ordinances, utility company regulations and applicable requirements of the latest approved edition of the following nationally accepted codes and standards. These requirements are to be considered minimum and are to be exceeded when so indicated on the drawings or herein specified.
 1. ACI: American Concrete Institute
 2. AISC: American Institute of Steel Institute
 3. ANSI: American National Standards Institute
 4. ASA: American Standards Association
 5. ASTM: American Society of Testing Materials
 6. AWS: American Welding Society
 7. FIA: Factory Insurance Association
 8. FM: Factory Mutual
 9. MSS: Manufacturing Standards Society
 10. NBS: National Bureau of Standards
 11. NEC: National Electric Code
 12. NEMA: National Electrical Mfrs. Association
 13. NFPA: National Fire Protection Association
 14. OSHA: Occupational Safety and Health Act
 15. UL: Underwriters Laboratories
 16. NECA: National Electric Contractors Association

17. Ohio Basic Building Code
18. State of Ohio Department of Building and Inspections
19. State Board of Health of Ohio
20. Local Fire Chief
21. State Fire Marshall of Ohio
22. Insurance Services Office - Ohio

1.06 Work and Workmanship:

- A. Provide all required labor, materials, equipment and contractor's services necessary for the complete installation of systems required in full conformity with requirements of authorities having jurisdiction; all as indicated on Drawings and herein specified.
- B. Finished job shall be functional and complete in every detail including any and all such items required for complete system whether or not these items be specified or shown on Drawings.
- C. Special attention shall be given to accessibility of working parts and controlling parts. Adjustable parts shall be within easy reach. Removable parts shall have space for removal.
- D. Each contractor shall acquaint himself with details of all work to be performed by other trades and take necessary steps to integrate and coordinate his work with the other trades.
- E. It is assumed that the Electrical Contractor is familiar with standard first class installation procedures. Therefore, these specifications do not attempt to include every detail or operation necessary for a complete installation.
- F. It should be particularly noted that the terms "furnish" and "provide" are interchangeable and that each of these terms means to provide, install and connect, unless otherwise stated.
- G. When tables or schedules show quantities of materials, they shall not be used as a final count. These figures serve only as a guide to Contractor. Each contractor shall be responsible for furnishing all the materials on Drawings or as specified.

1.07 Drawings and Minor Deviations:

- A. Electrical Drawings show general arrangement of all conduit, equipment and appurtenances. They shall be followed as closely as actual building construction and work of other trades will permit. Electrical work shall conform to requirements shown on all Drawings. General and Structural Drawings shall take precedence over Electrical Drawings. Because of the small scale

of Electrical Drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate structural and finish conditions affecting work and shall arrange his work accordingly providing such fittings and accessories as may be required to meet such conditions. Do not scale from Drawings.

- B. In event of conflict of requirements detailed in the Drawings, General Conditions, these General Provisions and any subsequent sections of these Specifications, the Bidder shall inform the Engineer of such conflict in writing not later than 7 days before the bids are due. If such notification is not provided, the Contractor shall accept Engineer's decision in resolution of such conflict without any further compensation.
- C. For purpose of clarity and legibility, distribution systems are essentially diagrammatic, although size and location of equipment and conduits are drawn to scale where possible. Verify Contract Documents information at the site.

1.08 Guarantee:

- A. Except as otherwise specified, under individual equipment sections, all workmanship, materials and equipment shall be guaranteed for a period of one year after final acceptance of project by Owner.
- B. Contractor agrees to make good all damage to construction of building or site, or equipment which in opinion of Engineer, is result of, or incidental to the use of materials, equipment or workmanship which are inferior, defective or not in accordance with Specifications.
- C. Contractor shall keep works in good repair during guarantee period. In case such repairs become necessary, Owner shall give written notice to Contractor to commence such repairs within 30 days after such notice is given. Owner may make such repairs either by its own employees or by independent contract and may thereupon recover from the Contractor and his Sureties cost of repairs so made together with cost of supervision and inspection thereof. Owner shall have 60 days after expiration of said guarantee period in which to notify Contractor of any such repairs necessary on date of such expiration.
- D. Determination of the necessity for repairs shall rest entirely with Engineer whose decision upon the matter shall be final and obligatory upon the Contractor. Guarantee herein stipulated shall extend to the whole body of improvement and all its appurtenances.

1.09 Occupational Safety and Health Standards:

- A. All work shall comply with the current requirements of the U.S. Department of Labor - Occupational Safety and Health Administration, entitled Occupational Safety and Health Standards; National Consensus Standards and Established Federal Standards.

PART 2 - PRODUCTS

2.01 Equipment Delivery Schedule:

- A. Submit at pre-construction meeting a schedule listing equipment and materials required for complete installation, quantity ordered, date of placing order and the promised delivery dates. Any and all delivery delays shall be identified at the pre-construction meeting.

2.02 Product and Material Approval:

- A. A Specification followed by one or more manufacturers and "or equal" is open to all equal products or materials. However, Contractor shall supply one of listed manufacturers at no additional cost if Engineer finds substituted product unsatisfactory.

2.03 Shop Drawings:

- A. Submit Shop Drawings of all equipment listed below.
 - 1. Motor Control Center
 - 2. Panel Board
 - 3. Transformer
 - 4. Emergency Generator
 - 5. Fire Alarm Panel
- B. Review of Shop Drawings does not relieve Contractor of responsibility for correct ordering of materials and equipment. Contractor review shall insure that equipment will fit in available space.
- C. Information to be included in the submittal:
 - 1. Manufacturer's model number or catalog number, size and performance data.
 - 2. Indication of all performance data, construction materials, finishes and modifications to manufacturer's standard design called for in the specifications.
 - 3. Location of connections for all conduit and wiring required.
 - 4. Roughing-in, foundation and support point dimensions.
 - 5. Wiring diagrams or connection diagrams conforming to NEMA Standard 101-1.293.
 - 6. Data shall be coordinated and included in single submittal.

7. For submissions, such as catalogs, delete or strike out information not pertinent to the work so there is no confusion or identify by arrow exactly which piece of equipment is being submitted for approval.

D. Submit minimum of 8 copies; 1 will be retained, 7 will be returned for inclusion in Maintenance Manual.

E. Submit Shop Drawings in brochure form and include all related equipment in one brochure.

F. After award of Contract, submit within (30) days.

G. Contractor is to affix his company name, in the form of a stamp, to all Shop Drawings and Submittals before submitting.

2.04 Record Drawings (As Builts):

A. Contractor shall be responsible for furnishing to Engineer a complete, accurate and neat set of marked-up blueline drawings. This set shall contain all deviations between actual construction and Contract Drawings.

B. This marked-up set shall be returned to Contractor as many times as necessary in order to obtain desired results.

C. Engineer's employees shall inspect drawings regularly for accuracy and omissions.

2.05 Maintenance Manual:

A. Contractor shall submit at 50% of job completion, 4 Maintenance Manuals.

B. Maintenance Manuals are to include all information relative to maintenance and operating instructions for all new electrical equipment.

C. Maintenance manuals shall be in following form:

1. First: index of complete contents.

2. Second: title of job, Owner, address, dates of submittal, names of Contractor and Engineer.

3. Third: include description of operation of each electrical system.

4. Fourth: copy of each system test reports.

5. Fifth: each piece of equipment which is submitted for approval shall be bound into this manual in the following form:

a. Name of equipment

b. Manufacturer's model and serial number (if one exists)

c. Vendor

- d. Shop drawings
- e. Installation, operation and maintenance instructions which are to be supplied by vendors
- 6. Sixth: any special emergency operating instructions or list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of system.

D. Information for each piece of equipment shall be separated by pasteboard tabbed divider, identifying equipment by same name as listed in Index.

E. All information shall be arranged in as many 3-ring vinyl coated notebooks as necessary.

F. Electrical Contractor shall prepare Maintenance Manual.

2.06 INSPECTION:

- A. Provide in triplicate, a Certificate of Inspection at completion of the work. Inspection to be performed by local authority having jurisdiction (i.e., City Inspector, County Inspector, etc.).

2.07 REPORTS:

- A. Submit for attachment to Substantial Completion Certificate the following:
 - 1. Letter certifying that all electrical installations comply with latest approved edition National Electrical Code.
 - 2. Letter certifying that the fire alarm system complies with latest approved edition of Ohio Basic Building Code, as supplemented by NFPA Standards, 72A, B, C, D and E (i.e., grounding, cable test, etc.). Letter certifying that all smoke detection systems comply with latest approved edition of Ohio Basic Building Code supplemented by NFPA Standards.

PART 3 - EXECUTION

3.01 Assignment of Miscellaneous Work:

A. Painting

- 1. Painting shall be by General Contractor.
- 2. Electrical Contractor shall thoroughly clean all their own equipment, apparatus and conduits in manner satisfactory to Owner and Engineer.
- 3. Equipment furnished with factory applied finish shall be protected from injury and any damaged surface shall be repaired by the installing contractor to match original finish or shall be replaced before final acceptance.

- B. Lintels: shall be provided by General Contractor. Electrical Contractor shall be responsible for giving General Contractor correct location.
- C. Roof Openings: openings will be provided as shown on Architectural and/or Structural Drawings. Openings not shown shall be provided by Electrical Contractor for his respective work. New openings shall require approval from Structural Engineer.
- D. Roof Flashing: shall be by General Contractor.
- E. Wall Openings: openings will be provided in structural wall members where shown on Structural Drawings. All other openings are responsibility of Electrical Contractor.
- F. Floor Openings: openings will be provided as shown on Architectural and/or Structural Drawings. Openings not shown shall be provided by Electrical Contractor for his work. New openings shall require approval by Structural Engineer.
- G. Concrete pads shall be by Electrical Contractor for his respective work. Electrical Contractor is responsible for correct size, location, and installing all anchoring devices. Unless otherwise indicated 4" pads shall be used where noted on drawings for motor control centers, etc. Set equipment level and grout in place. All pads to have chamfered edges.
- H. Excavating and Backfilling: by Electrical Contractor for electrical work.
- I. Ceiling Access Panels: shall be provided by General Contractor. Electrical Contractor shall be responsible for giving General Contractor correct size and location.
- J. Wall Access Panels: shall be provided by General Contractor. Electrical Contractor shall be responsible for correct size and location.
- K. Cutting and Patching: shall be provided by General Contractor of finished areas, who will backcharge contractor requiring the work.
- L. Fuel oil tank shall be filled by Electrical Contractor.
- M. Pipe Sleeves: each contractor shall set sleeves for their respective work.
- N. Escutcheons: each contractor shall provide escutcheons for their respective work. Install chromeplated pipe escutcheons on exposed pipe at wall, floors and ceiling.

O. Platforms and Supporting Stands: provided by Electrical Contractor for his respective equipment.

1. Each piece of equipment or apparatus suspended from ceiling or mounted above floor level shall be provided with suitable structural support, platform or carrier in accordance with best recognized practice.
2. Contractors shall exercise extreme care that structural members of building are not overloaded by such equipment. In all cases, details of such hangers, platforms and supports together with total weights of mounted equipment shall be approved by Structural Engineer.

3.02 MATERIAL STORAGE:

- A. Provide suitable protection from weather and vandalism for all materials and equipment to be installed. Storage shall be dry, clean and safe. Any materials or equipment damaged, deteriorated, rusted, or defaced due to improper storage shall be fully repaired, refinished or replaced, as directed by Owner.

3.03 PROTECTION AND TREATMENT OF PROPERTY:

- A. Repair and replace all property damaged in the installation of underground lines to meet approval of Owner and authorities having jurisdiction.
- B. Replace base and wearing surfaces of streets with same kind and thickness of material as existing. Replace brick, concrete and asphalt surface to a width 6" wider than disturbed area. Replace entire surface if more than 30% has been disturbed.
- C. Replace sidewalks, curbs, gutters, driveways, with same kind and thickness of material. Replace the entire section of concrete walks or driveways.
- D. Regrade and replant lawn areas.

3.04 COORDINATION BETWEEN CONTRACTORS:

- A. Each contractor and subcontractor shall study all the Drawings applicable to this work, so complete coordination between trades will be effected. Special attention shall be given to points where conduits cross other conduits, ducts or piping, where lights fit into ceilings and where pipe, ducts and conduit pass through walls.
- B. It is responsibility of each contractor and subcontractor to leave necessary room for other trades. No extra compensation will be allowed to cover the cost of removing piping, conduit, ducts or equipment found encroaching on space required by others.

3.05 EXCAVATING AND BACKFILLING:

- A. Refer to Division 2 for project conditions and requirements.
- B. Properly support banks of excavation with safety sheet pile. Install necessary guards. Provide adequate pumping equipment and keep excavation free of water.
- C. Excavate conduit trenches to proper depth. Where rock is encountered, excavate to 6" below conduit and refill to grade with sand and gravel.
- D. Backfill with clean earth, crushed rock, gravel or sand. Carefully fill around conduits. Fill first two feet in 6" layers and rest in 12" layers. Tamp and puddle each layer. No earth shall be used inside building.
- E. Backfill under building, roads, sidewalks and parking lots with compacted sand or pea gravel only.
- F. Backfill all excavations under footings with concrete only.
- G. Dispose of surplus excavated materials.

3.06 CAST-IN-PLACE CONCRETE:

- A. Refer to Division 3 for cast-in-place concrete requirements.

3.07 ELECTRICAL CONNECTIONS TO EQUIPMENT:

- A. In event that supplier of equipment requires larger starter or disconnect than those indicated on documents, he shall reimburse contractor supplying those items for difference.
- B. Connections and wiring diagrams shown on Drawings or described in Specifications are typical and are for bidding purposes only. Detailed diagrams and instructions shall be provided by contractor supplying equipment if connections are different from those shown on Drawings.
- C. Additional relays, switches, contactors, etc., which may be required for control purposes, in addition to those specified for and indicated on Drawings, shall be provided by Electrical Contractor and his subcontractors. These devices shall be mounted by supplier within 5'-0" of apparatus to be installed. Electrical Contractor shall provide all additional conduit, wire and electrical connections without additional charge to Owner.
- D. Wiring diagrams shall be specially drawn so they will apply specifically to this project. "Typical" wiring diagrams will not be acceptable for installation purposes. In event that several

pieces of mechanical equipment from different suppliers are combined in one system, Mechanical Contractor shall furnish complete wiring and control diagram to enable Electrical Contractor to make proper connection. Diagrams shall be submitted to Engineer for approval prior to actual wiring.

- E. Mechanical Contractor shall furnish to Electrical Contractor written notice of approval and acceptance of all control wiring installed for mechanical systems by Electrical Contractor. Such approval shall be given within 30 days of completion of all such control wiring. Two copies of letter shall be sent to Engineer.

3.08 LABELING AND TAGGING:

- A. Label all electrical equipment or controls provided by Electrical Contractor by means of engraved laminated plastic plates screwed or riveted to the device. Height of letters to be not less than 1/4" unless otherwise specified or directed.
- B. Items to be labelled shall include but not be limited the following:
 - 1. Main circuit breakers or switches.
 - 2. All motor starters.
 - 3. All panelboards.
 - 4. All remote disconnect switches.
 - 5. All other cabinets and controller provided by contractor.
 - 6. All motors which cannot be readily identified by their starter label when observer is standing at the motor.
 - 7. All remote control switches for lights, contactors, time clocks, etc.
- C. Printed card labels may be used on items of equipment furnished with plastic windows. Labelling of card shall be neatly printed using lettering device such as Leroy instrument.
- D. Directories on inside of panelboards shall be typewritten and shall show list of circuits and points, equipment or areas supplied.
- E. Motor starters interlocked with other starters or controls to be provided with labels on inside of cover stating nature of interlock system. (Example: Interlocked with 120V circuit from PRV#1.)

3.09 CLEANING AND TOUCHUP:

- A. All panelboards, cabinets, switchboards, motor controllers, control panels and other enclosures shall be cleaned and paint touched up as necessary to duplicate factory finished appearance. Touchup paint shall exactly match color, composition and quality of factory applied finish.

3.10 TEMPORARY LIGHT AND POWER:

A. Light

1. Install and maintain general area lighting consisting of 100 watt incandescent lamps in weatherproof pigtail sockets at minimum density of 0.25 watts per square foot (or 5 FC minimum, whichever is greater).
2. Protect circuits with ground fault interrupters.
3. Additional lighting required by other trades shall be provided by respective trade. Electrical Contractor to make connection to panels.

B. Power

1. Install and maintain up to ten 3-pin, U-ground, duplex 120 volt receptacle per temporary service panel.
2. All extensions from receptacles shall be protected with ground fault interrupters provided by contractor making extension.

3.11 TEMPORARY USE OF NEW EQUIPMENT:

- A. Should it become necessary or desirable to operate any equipment before final acceptance, Owner shall be allowed to do so, but only after proper adjustments and trial operation by contractor specified. Electrical Contractor shall be responsible for instructing Owner, or his Representative, as to proper operation and care of equipment so used. If equipment is used prior to final acceptance of job, date of first usage will begin warrantee period.

SECTION 16110

CONDUIT

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16120 - Wiring
- C. Section 16130 - Outlet and Junction Boxes

PART 2 - PRODUCTS

2.01 Metallic Type Conduits:

- A. Rigid-Steel-Heavy Wall Type
 - 1. Full weight mild steel pipe of standard pipe dimensions; threaded; hot dip galvanized, or sherardized.
- B. Electrical Metallic Tubing (Thinwall)
 - 1. Galvanized or sherardized steel type.
- C. Flexible Type
 - 1. Galvanized, single strip type with smooth wiring channel. Neoprene jacketed in moist locations and for connections to motors.
 - 2. American Brass Sealtite or equal.

2.02 Polyvinyl Chloride Type (PVC)

- A. PVC pipe of standard pipe dimensions suitable for use with socket type couplings, boxes and fittings.
- B. Conduit shall be PVC type 40 (90°C) for application in underground, encased and exposed applications in accordance with NEC.
- C. PVC conduit and fittings shall be UL rated for electrical use. Material shall comply to NEMA Specifications TC-2, TC-3, Federal Specifications W-C-1094A, UL-651, and ANSI C33.91.

- D. Conduit shall be made from virgin polyvinyl chloride C300, to reduce smoke and HCL emissions in a fire situation.
- E. Conduits, fittings and cement shall be produced by same manufacturer to assure systems integrity.
- F. Manufacturer: Carlon PV-duct plus systems or equal.

2.03 Polyvinyl Chloride Type Non-Metallic Boxes:

- A. Junction boxes in exposed overhead conduit runs shall be the round type with four (4) 1/2" or 3/4" knockout socket openings. Similar to Carlon E970D and E970E.
- B. Outlet and switch boxes in walls shall be single gang type with one or two 1/2" or 3/4" knock-out socket openings. Similar to Carlon FSS or FSC series.
- C. Junction boxes with screw down covers shall be fully gasketed and shall be available in following sizes:
 - 4" x 4" x 4" similar to Carlon E987N
 - 6" x 6" x 6" similar to Carlon E987R
 - 8" x 8" x 8" similar to Carlon E989R
 - 12" x 12" x 6" similar to Carlon E989R

PART 3 - EXECUTION

3.01 Conduit Usage:

	RGS	CONDUIT TYPES		
		EMT	PVC	FMC
Underground electrical & telephone service entrance	X			
Electrical & telephone services other than underground	X			
Conduits below lowest floor slab	X			
Conduits in moist locations or exposed to weather	X			

	CONDUIT TYPES				
	RGS	EMT	PVC	FMC	
Feeders, power circuits branch lighting and receptable circuits	X	X			
Underground to remote locations when concrete envelope not indicated on drawings	X		X		Rigid must be liberally coated with asphaltum
Final Connections to motors, transformers or other equipment requiring vibration isolation				X	With neoprene jacket
From junction box to recessed lighting fixture				X	
Short connections where use of rigid is impractical				X	
For mechanical protection	X				
All other locations unless otherwise noted		X			
For underground entrance wall penetrations	X				To protect cables in case ground settles
90 degree EL Riser through floor slab	X				

NOTES:

RGS - Rigid Galvanized Steel
 EMT - Electrical Metallic Tubing
 PVC - Polyvinyl Chloride
 FMC - Flexible Metal Conduit

3.02 PULL WIRES:

- A. RGS, EMT: Use steel or nylon pull wires.
- B. PVC, FMC: Use nylon only.

METALLIC CONDUIT INSTALLATION:

- A. Rigid conduit fittings to be threaded type.
- B. Conduit system to be electrically continuous and shall be grounded in accordance with NEC. Provide code size green grounding conductor in all new raceways. See NEC Table 250-95.
- C. All conduit terminations to be equipped with locknuts and bushings. Conduits 1-1/4" and larger shall have insulating bushings and shall have locknuts inside and outside the enclosure.
- D. Conduits to be supported by pipe straps or trapeze hangers shall not be spaced more than 8'-0" on center. Secure supports by means of toggle bolts, inserts or expansion bolts.
- E. Conduits to be supported by wall brackets shall not be spaced more than 4'-6" on center, secure supports by means of toggle bolts, inserts or expansion bolts.
- F. Conduits above ceilings greater in size than 1" to be supported from structural system, not from ceiling suspension system. Additional supports shall be provided at junction or pull boxes.
- G. Conceal raceways in floors, walls, ceilings or furred spaces in finished areas wherever possible.
- H. Support single conduits 1-1/4" and larger by means of rod and cast ring hangers. Support multiple runs in similar manner or use common trapeze hanger similar to Unistrut P2000 or P4000 as required for span and loading. Provide end caps on Unistrut type hangers in mechanical rooms. Conduits on Unistrut may be fastened by means of approved heavy strap galvanized supports.
- I. Surface mounted conduit supports on walls up to a height of 8'-0" above the floor shall be two hole sheet metal pipe straps. Pinch type hangers similar to Mimerallac type may be used at heights greater than 8'-0".
- J. Protect conduits during construction with temporary plugs or caps.

- K. Use concrete-tight Indenter or Tomlc type connectors for exposed EMT.
 - 1. EMT up to 1" in size, concealed above ceilings may be supported by ceiling members at intervals not greater than 8'-0".
- L. Minimum conduit size - 1/2".
- M. Conduit fittings similar to Condulet type shall be used as required to keep conduits close to building surfaces.
- N. Convenience outlets, switches or other devices located on walls shall be serviced from ceiling.
- O. Provide pull wire in all conduits where other contractors or utilities are to install cables.

3.04 EPC-40-PVC CONDUIT INSTALLATION:

- A. Conduit system to be continuous in accordance with NEC.
- B. All conduit terminations to be equipped with bushing type box adapters.
- C. Conduits to be supported by wall brackets or pipe straps on trapeze hangers spaced not more than 4'-0" on center. Secure supports by means of toggle bolts, inserts or expansion bolts. Pipe straps shall be so designed to allow expansion and contraction of pipe.
- D. Conduits above ceilings to be supported from structural system, not from ceiling suspension system. additional supports shall also be provided at junction or pull boxes locations.
- E. Conceal raceways in floors, walls, ceilings or furred spaces in finished areas wherever possible.
- F. Protect conduits during construction with temporary plugs or caps.
- G. Short conduit runs of between 50' to 100' shall have expansion couplings with expansion capabilities of 2". Conduit runs over 100' shall have expansion couplings capable of expanding up to 6". Expansion couplings shall be spaced on 150' centers maximum for runs in excess of 300'.
- H. Minimum conduit size - 1/2"

- I. Convert to steel conduit by means of adapters when entering building, rising up pole, or rising up through ground floor.

3.05 CONDUIT PENETRATIONS:

- A. Seal conduit penetrations through all fire rated walls and floors with UL approved sealing materials.

SECTION 16120

ELECTRICAL WIRING (600 VOLTS OR LESS)

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16110 - Conduit
- C. Section 16130 - Outlet and Junction Boxes

PART 2 - PRODUCTS

2.01 Wire and Cable (Up to 600 Volts)

- A. Insulation: color coded thermosetting or thermoplastic type rated 600 volts, as indicated below, except where otherwise noted.
- B. Conductors: soft drawn copper, each strand individually tinned or coated with approved alloy.
- C. Conductors #10 and smaller:
 - 1. For final connections to motors and all locations where vibration or movement is present: stranded conductors.
 - 2. For all other locations: solid conductors.
- D. Conductors #8 and larger: double braid, stranded.
- E. Minimum Wire Size: General #12; over 100' - #10; over 150' - #8; Control - #14; Signal - #18 or as detailed in appropriate section of the specifications, or as shown on the Drawings.
- F. Types and Uses (75 or 90°C) (unless otherwise specified or indicated on drawings)
 - 1. Feeders and service entrance conductors: XHHW
 - 2. Power circuits above 40 amps: THW (#8 and larger)
 - 3. Branch lighting, receptacle and small power circuits: THHN (#12 and #10)
 - 4. Branch circuits in wiring channels of continuous rows of fluorescent lighting fixtures: THHN
 - 5. Final connections to 120 volt recessed incandescent lighting fixtures: XFF
 - 6. Direct burial feeders and branch circuits: UF
 - 7. Control (#14): THHN or XHHW

G. Wire Tags

1. Main and feeder cables shall be tagged in all pull boxes, wireways and wiring gutters of panels. Tags shall identify wire or cable number and/or equipment served as shown on the Drawings. Tags shall be of flame resisting adhesive material, T & B type WSL or equal.

2.02 Cable Terminals and Connectors (For Copper Conductors Only)

- A. For conductor sizes #8 or smaller, to include compression/indenter type terminals, splices and wire joints.
 1. For terminals (rings, forks, disconnects): Thomas & Betts Stakon; Burndy Hydent; Buchanan Press-Sure; or equal.
 2. For splices (butt-type): Thomas & Betts Stakon; Burndy Hydent; Buchanan Press-Sure; or equal.
 3. For joints (twist-on): Thomas & Betts Piggy; Scotchlok; Ideal Wing-Nut; or equal.
- B. For conductor sizes larger than #8, to include mechanical set screw, or split bolt type connectors.
 1. For mechanical or set-screw type connector: Thomas & Betts Lugit; Bundy Quiklug; Penn Union EZ; or equal.
 2. For split-bolt type connectors: Thomas & Betts; Burndy; Penn Union; or equal.
- C. For compression connections sizes #8 and larger, to include one hole lugs, two lugs, butt splices, H-taps, C-taps and anti-oxidizing compound: Thomas & Betts; Burndy; Penn Union; or equal.

2.03 Pulling Cables

- A. Steel Conduit: Nylon or steel
- B. Plastic Conduit: Nylon

PART 3 - EXECUTION

3.01 Installation

- A. Run all wire in approved conduit, unless otherwise specified, shown on the drawings, or directed.
- B. Run all wires of same circuit in same conduit.
- C. No wire to be pulled until conduit installation is complete.
- D. Pull no thermoplastic wire at temperatures lower than 33°F.

- E. Use approved pull-in compound (similar to Wire-Lube or Y-Ex-Ease) to facilitate pulling of wire.
- F. Splice and connect wires only in readily accessible boxes.
- G. Run direct burial cable, when indicated on drawings, in 3" sand envelope and not less than 30" below finished grade.

3.02 Wires and Cables Identification

- A. Color code wire #10, #12 and #14 AWG as follows:

	<u>208/120 volts</u>	<u>480/277 volts</u>
1. Phase A	red	brown
2. Phase B	black	orange
3. Phase C	blue	yellow
4. Neutral	white or gray	white or gray
5. Ground	green or green with yellow stripes	green or green with yellow stripes

- B. Identify control wires at terminations with numbers.
- C. Train and lace wiring inside equipment and panelboards with plastic tie wraps for a neat appearance.
- D. Make all spare wires in cabinets or panelboards of adequate length for connections. Terminate with insulating tape and tag.
- E. Install DC signal wiring in conduits separate from power, lighting and control wiring. Install such wiring continuous without splices from sensing element to instrument.

3.03 Wire Connections and Devices

- A. Thoroughly clean wires before installing lugs and connectors so that joint will carry full capacity of conductors without perceptible temperature.
- B. Use lugs or connectors of approved size for conductor. Lugs or connectors shall be installed as per manufacturer's recommendations.

3.04 Pulling Cables

- A. Insert nylon pulling cables with carbon dioxide, compressed air or vacuum.

3.05 120 Volts to 600 Volt Circuits

- A. Test cables with 1000 volt megger between phases and between each phase and ground, with test maintained until readings are steady for three minutes.
 - 1. Readings to be equivalent to the manufacturer's specifications and similar readings not to deviate more than 5%.
- B. Tests must be conducted in the presence of the Owner's Representative.

SECTION 16130

OUTLET AND JUNCTION BOXES

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16110 - Conduit
- C. Section 16120 - Electrical Wiring
- D. Section 16140 - Wiring Devices

PART 2 - PRODUCTS

2.01 Outlet Boxes

- A. General: stamped steel, code gauge, galvanized.
- B. In Masonry or Tile Walls: rectangular boxes without external ears and with square corners or 4" outlet boxes with raised covers having square corners.
- C. In Partitions: narrow boxes with internal ears, 1-5/16" wide x 1-5/8" deep. Raco 426/7/8 or equal.
- D. Wall Brackets: with fixture stud, except where box accommodates lampholder only.
- E. Exterior Use: weatherproof type.
- F. Exposed boxes for receptacles and switches. Cast aluminum type with threaded hubs.

2.02 Junction and Pull Boxes

- A. Type: code gauge sheet steel, galvanized, sized in accordance with NEC.
- B. Covers: screw attached, except as noted.

PART 3 - EXECUTION

3.01 Outlet Box Installation

- A. Set box square and true with finished building surfaces and trim.
- B. Secure boxes firmly to building structure.

- C. Verify location of outlets and switches in finished rooms with Architectural Drawings of interior details and finish. In centering outlets and locating boxes allow for overhead pipes, ducts and mechanical equipment; variations in fire proofing and plastering; window and like; and correct any inaccuracy from failure to do so without expense to the Owner.
- D. Maintain symmetry of all outlets as closely as possible within Architectural Section contained. For example, center light fixture over doorway or receptacle in section of masonry wall, if shown in that approximate position. If receptacle is shown in same location as counter or bench, determine counter top height and set receptacle to clear top and trim of counter and render outlet easily accessible.
- E. In event of conflict between locations of electrical outlets as shown on electrical drawing and on architectural drawing, outlets shall be installed in accordance with the latter.
- F. Locate light switches on latch side of door and verify door hinge location in field prior to switch outlet installation.
- G. In locations where outlets are subject to damage, protect the devices by means of wire guards or other approved means of protection.
- H. Owner, or his Representative, reserves the right to change location of any outlet up to a distance of 10'-0" at no extra charge provided necessary instructions are given prior to roughing in of the outlet.

3.02 Junction and Pull Box Installation

- A. Provide pull boxes wherever necessary to facilitate pulling of wire and as indicated.
- B. Locate junction and pull boxes as required, concealed from finished space unless otherwise indicated. Where necessary, reroute conduits or make other arrangements for concealment as required.
- C. Covers shall be accessible.
- D. Splicing boxes for fixtures, recessed in hung ceiling, to be accessible through opening created by removal of the fixtures.

SECTION 16134

PANELBOARDS

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16110 - Conduit
- C. Section 16120 - Wiring
- D. Section 16133 - Cabinets
- E. Section 16180 - Overcurrent Protection

PART 2 - PRODUCTS

2.01 Panelboards

- A. Type: Shall be an integral part of the motor control center.
- B. Lugs: separate solderless type for each conductor.
- C. Grounding Bus: provide separate bus for green ground conductors. Isolate ground bus from neutral bus except at service entrance or unless otherwise indicated.
- D. Neutral Bus: provide full capacity neutral bus, unless otherwise indicated.
- E. Branches: bolt on type circuit breakers as herein specified. Number and size as indicated on the Drawings.
- F. Manufacturers: General Electric; Westinghouse; ITE; Square D; Federal; or equal.

PART 3 - EXECUTION

3.01 Balancing Electrical Load

- A. Care shall be exercised in connecting various electrical loads to panelboards in order to arrive at reasonable balance between loads on each phase at panelboard. It will be responsibility of the Electrical Contractor to make tests and adjust loads at panelboard to result in a reasonably balanced load condition, satisfactory to the Owner.

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16110 - Conduit
- C. Section 16120 - Electrical Wiring
- D. Section 16130 - Outlet and Junction Boxes

1.02 Standards

- A. All general use devices and related cover plates: the product of one manufacturer.

PART 2 - PRODUCTS

2.01 Switches

- A. Switches shall be UL listed, specification grade with full size toggle, Hubbell style CS1151 or equal.

2.02 Duplex Receptacles

- A. Devices shall be UL listed with impact resistant faces and automatic ground clip. Hubbell style CR151 or equal.

2.03 Key Switches (120, 20 amp)

- | | | |
|----|------------------|----------|
| A. | Arrow-Hart | 1991-L |
| B. | Bryant | 4901-L |
| C. | Hubbell | 1221-L |
| D. | Pass & Seymour | 20AC1-L |
| E. | General Electric | 5951-OLG |
| F. | Or equal | |

2.04 Receptacles (Plug-In) Strip

- A. Miniature 3 pin type receptacles mounted in surface type, snap-cover, metal raceway, spaces as indicated on the Drawings.
- B. Manufacturers: Wiremold 2000 Plugmold, or equal.

2.05 Pilot Lights (Other Than for Motor Circuits)

- A. Rectangular jewel with integral 125 volt neon lamp. Suitable for mounting in single gang or multiple gang box. Color as indicated on Drawings.
- B. Manufacturers: General Electric GE04218-0 or equal.

2.06 Weatherproof Receptacles

- A. Receptacles for weatherproof type outlets to be equipped with gasket, die-cast hinged lid and corrosion resistant type plate. UL listed for use in wet-damp locations with lift cover in the "open" position.
- B. Manufacturers: Hubbell 5205W0 or equal.

2.07 Color of Wiring Devices

- A. All wiring devices in finished areas shall be ivory plastic and ivory finished devices corresponding to catalog numbers hereinbefore specified shall be used.

2.08 Device Plates

- A. Molded nylon UL listed smooth thermoplastic plate. Hubbell "P" series; or equal.

2.09 Telephone Outlets

- A. Wall Type: Hubbell nylon P12 series or equal.

PART 3 - EXECUTION

3.01 Switches and Receptacles

- A. Install switches and receptacles of adequate rating and capacity for loads served.
- B. Install single wall plates for multiple outlet boxes.

3.02 120 Volt Receptacle Circuits

- A. Perform operational testing.
- B. Test receptacles with Woodhead 1750 tester for proper connection of ground wire, correct polarity and faults in wire.

SECTION 16170

SAFETY SWITCHES

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16180 - Overcurrent Protection

PART 2 - PRODUCTS

2.01 Safety Switches

- A. Switches shall be heavy duty UL approved quick-make, quick-break type with fuses or circuit breakers as indicated on the Drawings.
- B. Switches shall be constructed such that the blades are visible when the switch is in the OFF position and the switch door is open.
- C. Switches shall have an external operating handle with a defeatable interlocking mechanism to prevent opening the cover when the switch is in the ON position and to prevent energizing the switch with the cover open. The operating handle shall be capable of being padlocked in the OFF position.
- D. Switches to be totally enclosed. Enclosure to have NEMA rating as indicated on the Drawings.
- E. All fusible switches shall be UL listed to accept Class R fuses and shall be equipped with feature to reject all fuses except those having a Class R rating.
- F. Voltage rating to be appropriate for system where switch is used.
- G. Manufacturers: General Electric; ITE; Square D; Westinghouse; or equal.

PART 3 - EXECUTION

3.01 Safety Switch Installation

- A. Mount on Walls.
- B. Install HP rated non-fused and fused motor disconnect switch at motor locations as indicated on the drawings.
- C. Provide fourth pole in each disconnect as indicated on drawings to disconnect control circuit when motor is disconnected as indicated on drawings.

SECTION 16180

OVERCURRENT PROTECTION

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16134 - Panelboards
- C. Section 16170 - Safety Switches
- D. Section 16920 - Motor Control Centers

PART 2 - PRODUCTS

2.01 Circuit Breaker Usage

(Unless otherwise specified or shown on Drawings)

	<u>Type of Service</u>	<u>Rating (Amperes)</u>	<u>Minimum I.C. Rating</u>
A.	120/208 volt lighting and power	15-100	10,000

2.02 Fuses

- A. Rated 1/10 amp to 600 amps, 600 volts AC or less shall be UL listed Class RK1, current-limiting time delay with 200,000 amps RMS interrupting rating. Buss: Low Peak; Gould Shawmut: Amp-Trap II; or equal. All fuse sizes greater than 60 amperes to be silver link.

PART 3 - EXECUTION

3.01 Circuit Breakers

- A. Provide circuit breakers where indicated of proper sizes for loads served.
- B. Do not install 2 poles in single module.
- C. Install multiple pole breakers with single operating handle. Do not install external mechanical ties between single pole breakers.

3.02 Fuses

- A. Provide the Owner with 10% spares of each type and size with a minimum of three spare fuses for each size of fuse used in installation.

SECTION 16212

POWER GENERATION (DIESEL)

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere:

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16110 - Conduit
- C. Section 16120 - Wiring
- D. Section 16130 - Outlet and Junction Boxes

1.02 Intent of Specifications:

- A. It is the intent and purpose of these Specifications to secure, for the purchaser a diesel-generator system of the latest commercial type and design. It shall be capable of continuous duty service at rated output for the duration of any utility power failure for a period of eight (8) hours without deration. The engine/generator package shall be the product of one company; and that company, and its authorized dealer, shall have sole responsibility for the performance of the diesel engine/generator package and its accessories. It shall be a new, factory assembled and tested set. It is the further intent and purpose of these specifications to secure, for the purchaser, the necessary controls and accessories to the extent that this equipment, in conjunction with the diesel engine/generator set, will comprise a complete operating package. The engine shall be capable of operating without loss in power up to 1,000 feet elevation in an ambient temperature of 100 degrees fahrenheit.
- B. General outline of the work to be done and materials to be furnished by the contractor is given in the Specifications, but it is not intended that same is all inclusive. The contractor shall do any and all other work or operations as may be necessary to provide a complete installation in accordance with the Specifications and/or Drawings or that may be reasonably interpreted therefrom for a complete installation ready for service operation.
- C. The engine/generator system manufacturer or his authorized dealer shall submit satisfactory evidence that he maintains a fully equipped service and replacement parts organization within a reasonable proximity to the installation in order to be capable in all respects of furnishing complete service responsibility by

trained field service mechanics 24 hours a day, 7 days a week. Delegation of this service responsibility for any or all the equipment listed herein will not be considered fulfillment of these specifications.

- D. Diesel and manual transfer equipment shall comply with all requirements of current edition of NFPA 76A.

1.03 Rating:

- A. Rating of the diesel engine/generator system shall be based on operation of the set when fully equipped with all necessary operating accessories.
- B. The diesel engine/generator system shall be capable of replacing the load placed on the utility power system by producing a minimum of 50 KW at 0.8 PF, 480/277 volts continuously, for a period of eight (8) hours with no deration or time limit, at the ambient temperature and altitude indigenous to the area.
- C. Where reasonable uncertainty exists regarding the adequacy of the diesel engine/generator set, the Engineer/Owner or their appointed representative shall have the option to witness factory test for the unit. Such testing shall be performed at no additional cost to the Owner. Expenses for such trips will be paid for by the Owner.

1.04 Shop Drawings:

- A. Submit Shop Drawings on all accessories, including manual transfer switch.
- B. The contractor shall furnish information showing manufacturer's model numbers, dimensions, and weights for engine, generator and major auxiliary equipment.
- C. The contractor shall submit copies of pertinent drawings and wiring diagrams for approval.
- D. The specified standby KW shall be for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the manufacturer for the actual unit supplied. Maximum ratings or ratings above the factory certified standby rating are not acceptable.
- E. Drawings of the diesel generator system offered hereunder and its housing requirements.
- F. Certified engine horsepower curve showing manufacturer's approval of engine rating of this application.
- G. Drawings and/or literature describing auxiliary equipment to be furnished.

H. The following data in tabulated form:

1. make of engine
2. number of cylinders
3. bore, inches
4. stroke, inches
5. piston displacement, cubic inches
6. piston speed, feet per minute, at rated RPM
7. BMEP at rated KW output
8. make and type of generator
9. generator electrical rating, KVA/KW at 0.8 PF
10. exciter type
11. generator efficiency

1.05 Acceptable Package Fabricators:

- A. ONAN (Cummins Engine); McAllister Machinery (Caterpillar Engine); Clark Diesel (GM Engine) or equal.

PART 2 - PRODUCTS

2.01 Engine:

- A. The engine shall be heavy duty industrial type, water cooled, compression ignition diesel engine. It shall be a four stroke cycle, solid-injection engine of either vertical in-line or V-type and in production for a minimum of five (5) years.
- B. The engine speed shall not exceed 1800 RPM at normal full load operation. Piston speed shall not exceed 1075 feet per minute.
- C. The engine shall be capable of satisfactory performance on a commercial grade of No. 2 fuel oil. Engines that require special fuels will not be considered.
- D. An electronic solid state governing system shall be provided for precise speed control of the prime mover. The governor shall be capable of operation in a droop or constant speed system with control at any set speed to be isochronous within + or - .25%. The governing system shall comprise an electronic control module, a speed setting potentiometer, a magnetic pick-up and a hydraulic actuator with fail-safe provisions for loss of power or speed sensor signal incorporated to shutdown the prime mover. The system shall operate of starting batteries and allow automatic paralleling with one or more generator sets.
- E. As a safety measure, the prime mover shall be equipped with a separate overspeed device to prevent run-away in the event of any failure which might render the governor inoperative.

- F. The fuel oil system shall include an antisiphoning valve (if required), a 100 gallon tank minimum to be mounted under Gen-Set, fuel level control switch, low fuel level alarm contacts, test switch fuel oil level gauge. Flexible fuel lines equal to Aeroquip Type 1503 shall be supplied for connection to the engine.
- G. It shall be the responsibility of the engine/generator set supplier to familiarize himself with the Drawings and/or Specifications and supply any check valves, flexible fuel connections, etc. that may be required for proper operation of his unit in this installation.
- H. The Electrical Contractor shall supply fuel for testing of system and the initial filling of the fuel tank.
- I. The engine shall have a gear-type lubricating oil pump. Full flow oil filters with replaceable elements, conveniently located for servicing, shall be provided. Filters shall be equipped with a spring loaded bypass valve to insure oil circulation if filters are clogged. The initial fill of lube oil shall be furnished by the engine/generator supplier.
- J. The engine shall be provided with removable wet or dry type cylinder liners of close grained alloy iron.
- K. The engine shall be equipped with 12 volt or 24 volt electric starting system of sufficient capacity. For cranking at 0°F for 40 seconds continuously without the voltage dropping below 75% of the nominal rating during the period of cranking. The engine shall have an independent starting system consisting of lead calcium starting batteries rated with an ampere hour capacity. Mounted on a suitable battery rack. Maximum positive and negative lead resistance at 12V = 0,0015 OHMS.
- L. The automatic battery charger shall be of the transistor controller mag amp design, and be furnished for battery set. The battery charger shall be designed for lead calcium batteries with an output of 12 volts or 24 volts. The charger shall include + or - 10% AC line compensation, current limiting protection, voltmeter, ammeter, source suppressors and fused AC input and DC output terminals. The AC input voltage shall be 120 volts single phase. Power plug to be in weatherproof housing with 20 amp, male twin lock receptacle.
- M. The engine mounted instrument panel shall contain the following gauges for proper engine surveillance, maintenance and control:
 - 1. Engine water temperature gauge.
 - 2. Engine lube oil pressure gauge.
 - 3. Engine running hourmeter.

4. Safety shutdown controls for high engine temperature, low oil pressure, starting battery failure, overspeed and overcrank with restart lockout, plus 5 minute unloaded running time.

- N. The engine cooling system shall have sufficient capacity for cooling the engine when the diesel generator system is delivered full rated load in the ambient temperature stated in Section 1.02.
- O. The engine shall be equipped with an engine driven, centrifugal type water circulating pump and thermostatic valve to maintain the engine at recommended temperature level. The cooling system shall be filled with 50% solution of permanent type antifreeze.
- P. A unit mounted radiator shall be provided, and rated at 100 degrees fahrenheit with a 50% solution of ethylene glycol. Protective guards shall be included.
- Q. The engine shall be provided with one or more dry type air replaceable cleaners.
- R. The engine, generator with Nema 3R enclosure and fuel tank shall be mounted on a portable trailer. The base shall maintain rigid alignment of the engine/generator unit. Vibration isolator base shall be provided. The "over-the-road" trailer shall have two 8-ply tires, adjustable hitch leveler with both ball hitch and pirtle eye, rear stabilizer jacks, front 2000 lb. leveler jack, fenders and lights.

2.02 Generator:

- A. The generator rating shall be in accordance with NEMA Class F temperature rise.
- B. The generator shall be revolving field type, coupled directly to the engine flywheel through a flexible driving disc for positive alignment. The generator housing shall bolt directly to the engine flywheel housing. The rotor shall be dynamically balanced up to 25% overspeed.
- C. The generator shall be built to NEMA MGI-22.40 test performance standards. Insulation shall be rated for 130 degrees centigrade rise by resistance above a 40 degrees centigrade ambient at the rated KW specified under continuous duty conditions. The field shall be equipped with full armortisseur windings.
- D. Generator field excitation shall be performed by either a solid state static exciter or a rotating diode system.

- E. The voltage regulator shall be of the static magnetic amplifier type with silicon diode control. It shall be mounted on the top or side of the generator and enclosed in a NEMA drip-proof enclosure. A built-in voltage adjusting rheostat shall provide + or - 5% voltage adjustment.
- F. The generator shall be capable of supporting 300% rated current for 10 seconds (current boost) for selective tripping of downline protective devices when a short circuit occurs.

2.03 Generator Set Performance:

- A. The voltage regulation from no load to rated load shall be within a band of + or - 1% of rated voltage. The steady state voltage stability shall remain within a 0.5% band of rated voltage. Steady state voltage modulation shall not exceed one cycle per second.
- B. For any addition of load up to and including 90% of rated load, the voltage dip shall not exceed 15% of rated voltage. The voltage shall recover to, and remain within the steady band, in not more than 1.5 seconds.
- C. The frequency regulation from no load to rated load shall be in accordance with that defined by the engine governor performance. For any single step load up to 90% of rated load, the frequency shall recover to the steady state frequency band within five seconds.

2.04 Control Equipment and Accessories:

A. Generator Control Panel

- 1. The generator control panel shall be unit mounted and shall contain:

AC Ammeter, 2%, 3-1/2" face
AC Voltmeter, 2%, 3-1/2" face
Frequency Meter, dial type, 3-1/2" face
Ammeter/Voltmeter phase selector switch
Current and Potential Transformers, as required

B. Generator Mounted Main Line Circuit Breaker

- 1. One generator main line molded case circuit breaker of adequate capacity shall be installed as a load circuit interrupting and protective device which shall operate both manually for normal switching functions and automatically during overload and short circuit conditions. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit conditions. Generator exciter field circuit breakers are not acceptable.

2.05 Manual Load Transfer Switch:

- A. Provide and install one manual transfer switch in a NEMA 3R enclosure to be mounted on exterior of building and main lift station control panel.
 - 1. The rating of the load transfer switch shall be 100 ampere, 480/277 volts and shall have 3 poles and overlapping neutral transfer contacts.
 - 2. The transfer switch shall be mechanically held and lockable on both the emergency and the normal side, and rated for continuous duty in an unventilated enclosure. The switch shall be double throw with the main contacts rigidly and mechanically interlocked to insure only two possible positions: Normal or emergency. A manual operator must be provided to enable one hand manual operation.
 - 3. The transfer switch shall be listed under UL 1008, NEMA 3R enclosure.
 - 4. Accessories for transfer switch: the load transfer switch specified above shall include the following accessories:
 - a. Female plug for three leg wire, neutral and ground, mounted as shown on drawings in transfer switch.
 - b. Isolated (underground) neutral bus. Grounding lug from male plug or cable.
 - c. Grounding plate for connection of grounding cable from generator set.

2.06 Support Equipment:

- A. Labels for all components safety and warning labels.
- B. Gen-set shall have weather protective Nema 3R housing with adequate cooling ventilation and factory mounted critical silencer.
- C. Grounding bond jumper to tie together all metal parts of generator set.

PART 3 - EXECUTION

3.01 Installation of Electric Generating Plant:

- A. Provide operation instruction period for Owner.
- B. Unit to be fully lubricated and ready for operation.
- C. Test engine and transfer switch in presence of Owner. State and Fire Marshal test shall conform to manufacturer's testing recommendations.

SECTION 16420

ELECTRIC SERVICE AND ENTRANCE

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16110 - Conduit
- C. Section 16120 - Wiring
- D. Section 16450 - Grounding
- E. Section 16180 - Overcurrent Protection

1.02 Entire Service Entrance

- A. Shall comply with NEC and utility company's requirements.

1.03 Coordination With Utility Company

- A. Coordinate with the utility company and verify the limits of responsibility with respect to metering, terminations and the like.
- B. In such cases these Specifications do not conform with the utility company's requirements, the latter shall govern the work.
- C. Under no circumstances shall the Contractor be reimbursed for changes in the service installation brought about due to the failure of the Contractor to verify all the details with the utility company.

1.04 Description of System

- A. Provide Electrical Service to wastewater treatment facility.
- B. Provide electric service to main lift station.

1.05 Primary Characteristics

- A. 3 phase, 4 wire, grounded, 7200/12,400 volts, wye connected, 60 hertz, alternating current.

1.06 Source

- A. Utility company's transformer bank located approximately as indicated on the Drawings.

1.07 Secondary Characteristics

- A. Treatment Plant: Lighting - 3 phase, 4 wire, 120/208 volts;
 Power - 3 phase, 4 wire, 277/480V.
- B. Main Lift Station: Power - 3 phase, 4 wire, 240V.

PART 2 - PRODUCTS

2.01 Primary Entrance Cable

- A. Furnished and installed by the utility company.

2.02 Secondary Service Feeders

- A. Conductor
 - 1. By the Utility Company to main disconnect.

2.03 Terminations

- A. Terminations at transformers by utility company.

2.04 Trenching and Backfilling

- A. Secondary
 - 1. By Utility Company

2.05 Metering

- A. Furnished by the Utility Company. Meter base by Utility Company,
 installed by Electrical Contractor. Final connections to base
 line side by Utility Company. Meter set by Utility Company.

PART 3 - EXECUTION

3.01 General

- A. It shall be the responsibility of the Electrical Contractor to
 coordinate all service entrance items required for this project
 with the local utility company.
- B. The Electrical Contractor shall rope tie the cables connected to
 the switches in the service equipment in the manner specified in
 UL 891 to maintain the switchboard short circuit rating.
- C. The Electrical Contractor shall install the grounding as required
 by NEC and as indicated on the drawings.

SECTION 16450

GROUNDING

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16110 - Conduit
- C. Section 16120 - Wiring
- D. Section 16140 - Service Entrance

PART 2 - PRODUCTS

2.01 General

- A. Grounding electrode conductors (service grounding) may be insulated or bare and if insulated may be any color other than white, gray or green.

2.02 Equipment Ground

- A. Equipment grounding conductors (receptacles, outlet boxes, enclosures, etc.) may be insulated or bare and if insulated shall be green in color.

PART 3 - EXECUTION

3.01 General

- A. Entire installation to be grounded in accordance with requirements of NEC.
- B. Pull separate green grounding conductor in all new raceways.
- C. An equipment bonding jumper shall be used to connect the grounding terminal of a grounding-type receptacle to a grounded box.
- D. All grounding type receptacles are to have grounding slot connected to outlet box.
- E. Service entrance neutral shall be grounded in accordance with Article 250-94 NEC. The Electrical Contractor shall provide a grounding rod as indicated on drawings, that is in direct contact with the earth.

- F. Test resistance to ground of ground system or grounding network at point where equipment, raceways, and conductors are to be connected. Measurement shall be made with vibro-ground instrument manufactured by Associated Research or equal. Value of this resistance to ground shall not exceed 5.0 ohms and shall be measured from ground being tested to system neutral.
- G. Ground system tests shall be performed by contractor equipped to certify tests. All test shall be in the presence of Owner/Engineer.

SECTION 16460

DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16110 - Conduit
- C. Section 16120 - Wiring
- D. Section 16450 - Grounding

PART 2 - PRODUCTS

2.01 Three Phase Transformers (30 KVA and Above)

- A. Dry Type, air insulated and air-cooled.
- B. Insulation: Class H or better having 150 degree C rise, average maximum over 40 degree C ambient temperature.
- C. Cores: high grade, non-aging, sheet silicon steel laminations having coreplating insulation on both sides of each lamination.
- D. Terminal Boards: to be provided on all units.
- E. Connections: 480V - 120/208V (delta-wye).
- F. Taps: two 2-1/2% full capacity above and two 2-1/2% full capacity below rated primary volts.
- G. Overload Capacity: not less than 10% for intermittent operation.
- H. Size: KVA as indicated on the Drawings.
- I. Sound Rating: not greater than 50 db up to and including 150 KVA.
- J. Cabinets: shall be included as an integral part of the motor control center.
- K. Nameplate: all transformers to have metal or plastic nameplate listing manufacturer's name, serial number, type, class, KVA, voltage, frequency and showing an internal wiring diagram.
- L. Manufacturer: General Electric; Hevi-Duty; Jefferson; Precision; Westinghouse; Sorgel; ITE; or equal.

PART 3 - EXECUTION

3.01 Transformer Installation

- A. Shall be mounted inside Motor Control Center.
- B. Conduit connections to transformers shall be liquid-tight flexible.

SECTION 16510

ELECTRICAL LIGHT FIXTURES

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16110 - Conduit
- C. Section 16120 - Wiring
- D. Section 16130 - Outlet Boxes
- E. Section 16551 - Lamps
- F. Section 16552 - Ballast

PART 2 - PRODUCTS

2.01 Fluorescent Lighting Fixtures

- A. Construction: constructed sheet steel, die-formed to provide structural strength. Louvers to be constructed of spring steel (22 MGS minimum).
- B. Painting: fixtures to be properly treated for acceptance for finish coats. Finishes to be baked white high reflectance enamel or porcelain enamel.
- C. Shielding: plaster shielding media shall be color stabilized 100% virgin acrylic plastic, glass or vinyl, as indicated on the Drawings, not less than .187" thick.
- D. Lens Panel Frames: lens panels for surface bos type fixtures and for recessed troffers shall be framed, hinge and latch. Frames and louvers shall be equipped with retaining means to support frame during relamping.
- E. Fixture Gasketing: all gasketing material shall be neoprene, vinyl or other non-aging type as approved by the Engineer.
- F. Lampholders: porcelain, turret type for industrial fixtures, tombstone type for commercial fixtures.
- G. Weatherproof Fixtures: to be constructed of aluminum, stainless steel or non-ferrous material and equipped with neoprene gasketing.

- H. Fixtures Mounting: recessed fixtures shall be suitable for mounting in type of ceiling to be furnished.
- I. Louver and Frame Supports: all louvers, baffles, shielding panels, etc., shall be equipped with some retaining means such as hinges, clips, chains or other approved device to support louver or panel during relamping or cleaning.
- J. Wires: heat resisting type in accordance with NEC.
- K. Ballast Mounting: fixtures to be designed in such manner that case temperature of ballast does not exceed 90 degrees C. All ballast mounting studs to be welded or bolted to fixture. (Snap in ballast is not acceptable.)

2.02 High Intensity Discharge Lighting Fixtures

- A. Mounting: units to be furnished complete with all mounting accessories required, prewired unless otherwise noted or indicated.
- B. Wiring: high temperature wiring in accordance with NEC.
- C. Lampholders: mogul base porcelain type.
- D. Shielding media shall be color stabilized plastic, glass, vinyl or mylar as indicated on Drawings.
- E. Fixture to carry UL rating of 55 degree C ambient temperature.
- F. Reflector to be constructed of spun aluminum. Adjustment shall be provided in reflector position or lamp position to allow changes in fixture distribution characteristics. Reflector to have safety latch to prevent reflector from separating from remainder of fixture.
- G. Ballast to be enclosed within case to allow proper heat dissipation for cool operation.
- H. Weatherproof Fixtures: constructed of aluminum or stainless steel with complete gasketing.

PART 3 - EXECUTION

3.01 Light Fixture Installation

- A. All fixtures to be equipped with lamps of proper size and type, as scheduled or recommended by the manufacturer.
- B. Tandem fixtures may be used in continuous rows provided that finished appearance conforms to the appearance of the individual units.

- C. All rows of light fixtures to be properly aligned, plumbed and square with adjacent walls.
- D. Schedule of Lighting Fixtures on the Drawings contains a written description of fixture and manufacturer's catalog numbers. Numbers provided are intended to indicated design and quality desired. Fixtures must meet requirements of this Specification and of the description contained in the Schedule.
- E. If outlet does not have fixture symbol, install fixture of same type used in similar locations elsewhere on the Drawings.
- F. Provide additional trim as required for neat mounting of recessed fluorescent lights mounted in patterns.
- G. Light fixtures shall be supported from structure with suspension wires or rods of sufficient strength to support weight of light fixtures. It is the responsibility of the Electrical Contractor to insure that adequate supports are furnished.
- H. Light fixtures must be suitable for mounting in or on the type of ceiling to be furnished. The Contractor must verify the type of ceiling and provide appropriate fixtures and mounting hardware prior to ordering.
- I. Coordinate with other trades so lights are properly aligned with diffusers, grilles, speakers, etc. If necessary, relocate lights as directed so there will be no conflict with the other trades' equipment.
- J. Adjust all adjustable fixtures to the satisfaction of the Engineer and the Owner. All adjustable exterior lighting fixtures, such as floodlights, shall be adjusted under cover of darkness.
- K. Remove all conspicuous trade labels.
- L. All permanent fixtures used for temporary lighting shall be cleaned and relamped in order to insure that the time of Owner's acceptance all lamps will be new.

SECTION 16551

ELECTRIC LAMPS

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16510 - Lighting Fixtures
- C. Section 16552 - Ballasts

PART 2 - PRODUCTS

2.01 Fluorescent Lamps

- A. Type: rapid start, T-12 bi-pin type, unless otherwise specified or indicated on the Drawings.
- B. Color: standard cool white, unless otherwise indicated on Drawings.
- C. Manufacturer: General Electric; Westinghouse; Sylvania; or equal.

2.02 High Pressure Sodium Vapor Lamps

- A. Type: diffuse coated mogul base. Size and voltage as specified or indicated on Drawings or Schedule.
- B. Manufacturers: General Electric; Westinghouse; Sylvania; or equal.

PART 3 - EXECUTION

3.01 General

- A. Install proper number, type and size lamp in light fixture as indicated on the Drawings.
- B. Replace all burned out lamps at the time of acceptance of the project by the Owner.

SECTION 16552

BALLASTS

PART 1 - GENERAL

1.01 Related Work Specified Elsewhere

- A. Section 16010 - Basic Electrical Requirements
- B. Section 16510 - Lighting Fixtures
- C. Section 16551 - Electric Lamps

PART 2 - PRODUCTS

2.01 Fluorescent Ballasts

- A. Quality: certified ballasts, ETL approved, energy efficient high power factor rapid start type.
- B. Voltage: suitable for use on 120 volt, 1 phase, supply, unless otherwise specified or indicated on the Drawings.
- C. Noise Rating: B or better.
- D. One lamp or two lamp ballasts only to be used. Three lamp ballasts not permitted.
- E. All ballasts to be P rated, thermally operated, automatic reset type.
- F. Manufacturer: Advance; Jefferson; Westinghouse; General Electric; or equal.
- G. Provide individual fuse protection for each ballast.

2.02 High Pressure Sodium Lamp Ballasts

- A. Ballasts for high pressure sodium lamps to be as follows unless otherwise specified or indicated on the Drawings or Schedule.
 - 1. Quality: ETL approved, 90% power factor or better, auto regulator type designed to meet ANSI "Trapezoid" specification.
 - 2. Enclosures: enclosed when mounted in dry interior locations. Moistureproof when mounted in moist locations. Weatherproof for exterior locations.
- B. Voltage: as specified on Drawings or Schedule.
- C. Insulation: Class H.

- C. A vertical wireway with minimum of 35 square inches of cross sectional area shall be adjacent to each vertical unit and shall be covered by a hinged door. Wireways shall contain steel rod cable supports.

2.03 Bus Arrangement

- A. Each structure shall contain a main horizontal copper or aluminum bus, with minimum capacity of 600 amperes. Vertical busses feeding unit compartments shall be securely bolted to the horizontal main bus. All joints shall be front accessible for ease of maintenance. The vertical bus shall have a minimum rating of 300 amperes for front mounted units.
- B. The vertical bus shall be completely isolated and insulated by means of a labyrinth design barrier. it shall effectively isolate the vertical busses to prevent any fault generated gasses to pass from one phase to another. In addition, a shutter mechanism shall close the stab openings upon removal of unit and shall automatically open upon reinsertion of the unit. busses shall be braced for (42,000) amperes symmetrical.
- C. Provide 1/2 capacity neutral bus, unless otherwise indicated.
- D. Provide separate grounding bus full length of motor control center for green ground conductors. Isolate ground bus from neutral bus unless otherwise indicated.

2.04 Unit Construction

- A. All full voltage starter units shall be of the drawout type. Drawout provisions shall include a positive guide rail system and stab shrouds to absolutely ensure alignment of stabs with the vertical bus. Drawout units shall have a tin-plated stab assembly for connection to the vertical bus. No wiring to these stabs shall extend into the bus compartment. Interior of all units shall be painted white for increased visibility. Units shall be equipped with side-mounted (pull-apart) terminal blocks rated 300 volts. Knockouts shall be provided for the addition of future terminal blocks.
- B. All drawout units shall be secured by a spring loaded quarter turn indicating type fastening device located at the top front of the unit. Each unit compartment shall be provided with an individual front door.
- C. An operating mechanism shall be mounted on the primary disconnect of each starter unit. It shall be mechanically interlocked with the unit door to prevent access unless the disconnect is in the OFF position. A defeater shall be provided to bypass this interlock. With the door open, an interlock shall be provided to

prevent inadvertent closing of the disconnect. A second interlock shall be provided to prevent removal or reinsertion of the unit while in the ON position. Padlocking facilities shall be provided to positively lock the disconnect in the OFF position with from one to three padlocks with the door open or closed. In addition means shall be provided to padlock the unit in a partially withdrawn position with the stabs free of the vertical bus.

- D. Combination starter units shall be full voltage non-reversing circuit breakers. The combination shall safely interrupt 22,000 amperes of short current.
- E. Line starters shall be electrically operated, electrically held, three pole assemblies with arc extinguishing characteristics and shall have silver-to-silver renewable contacts. They shall have provisions for a total of eight N/O electrical interlocks. The overload relay assembly shall be of the thermal bimetallic type. Overload relays shall be reset from outside the enclosure by means of an insulated button.
- F. Each starter shall be equipped with a fused control power transformer, indicating lights, push buttons, selector switches and two normally open contacts, as shown on the drawings. Device panel to have space to accommodate six oil-tite pilot-control devices.
- G. Individual feeder breakers shall be of the thermal magnetic type with an interrupting capacity of 22,000 amps I.C. at rated voltage.

2.05 Finish

- A. The control center is to be given a phosphatize pretreatment. Then a coat of baked-on enamel shall be applied. Manufacturer's standard color shall be used.

2.06 Nameplates

- A. Each unit shall have nameplate. Black letter on white background.

2.07 Approved Manufacturer

- A. All major components shall be by the same manufacturer as the motor control center.
- B. Manufacturers: I.T.E. or equal.

APPENDIX
SOIL BORING DATA



ALT & WITZIG ENGINEERING, INC.


Project Name Grover Hill Project No. N-7032
Site Grover Hill, Ohio
Boring SB-1 Surface Elevation _____ Driller Sikora
Date Started 11/24/87 Groundwater Level _____
Date Completed 11/24/87 16.0' ft. on completion
Weather Cloudy _____ ft. at _____ hrs.
Boring Method Hollow Stem Auger _____ ft. at 24 hrs.

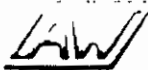
Description	Depth (ft.)	Sample	Blow Count 3-6" incr.	Recov. %	Remarks
Brown Silty CLAY w/Organics 0.8		1SS	2-4-5-6	100	
		2SS	6-10-14-16	100	
	5	3SS	10-14-23-21	80	
		4SS	10-15-18-31	85	
Brown to Gray Silty CLAY with some Sand (CL)	10	5SS	11-20-25-32	100	
		6SS	11-20-30-34	95	
		7SS	10-19-27-33	90	Vertical Cracks
	15	8SS	13-24-24-32	100	▽ on Completion Showing Calcium & Iron Deposits
		9SS	13-22-24-32	100	
Gray Clayey SILT (CL-ML)	20	10SS	12-21-24-23	90	
		11SS	13-13-15-25		
Gray Wet Fine to Coarse SAND with a trace of Gravel (Visual) (SP-SM)	21.5	12SS	10-35-50-0		Auger Refusal @ 23'
Auger Refusal at 23.5 feet.					



ALT & WITZIG ENGINEERING, INC.


Project Name Grover Hill Project No. N-7032
 Site Grover Hill, Ohio
 Boring WB-1 Surface Elevation _____ Driller Schwartzkopf
 Date Started 12/1/87 Groundwater Level _____
 Date Completed 12/1/87 _____ ft. on completion
 Weather Cloudy _____ ft. at _____ hrs.
 Boring Method Hollow Stem Auger _____ ft. at 24 hrs.

Description	Depth (ft.)	Sample	Blow Count 3-6" incr.	Recov. %	Remarks
Brown Silty CLAY w/Organics 0.5					
Brown CLAY (CL)		1SS	3-4-3-4	100	
2.0		2SS	7-7-8-15	100	
	5	3SS	6-18-22-27		
		4SS	12-18-25-22	100	
		1ST		80	
Brown & Gray Silty CLAY with some Sand (CL)	10				
		5SS	18-23-29-50/.4	100	
		6SS	20-22-28-50/.4	100	
15.0	15	7SS	18-28-40-43	100	
Gray Silty CLAY with some Sand (CL)		8SS	22-32-37-45	100	
		9SS	20-30-37-40	100	 On Completion.
21.8	20	10SS	20-26-30-30	100	
Gray Clayey SILT (CL-ML)					
Auger Refusal at 22.3 feet.					



ALT & WITZIG ENGINEERING, INC.

Project Name Grover Hill Project No. N-7032
Site Grover Hill, Ohio
Boring CB-2 Surface Elevation _____ Driller Schwartzkopf
Date Started 12/1/87 Groundwater Level _____
Date Completed 12/1/87 _____ ft. on completion
Weather Cloudy _____ ft. at _____ hrs.
Boring Method Hollow Stem Auger _____ ft. at 24 hrs.

Description	Depth (ft.)	Sample	Blow Count 3-6" incr.	Recov. %	Remarks
Brown Clayey SILT w/Organics 0.4					
		1SS	10-9-10-19	100	
	5	2SS	12-23-40-63	100	
		3SS	22-23-50/.4	100	
Brown & Gray Silty CLAY with some Sand (CL)	10	1ST		0	
		4SS	32-35-70/.4	100	
		5SS	25-36-40-50/.4	100	
15.0	15	6SS	27-37-42-50/.4	100	 On Completion.
Gray Silty CLAY with some Sand (CL)		7SS	23-25-37-50		
17.5		8SS	23-23-45-50/.4	100	
Gray Clayey SILT (CL-ML)	20				
Auger Refusal at 21.5 feet.					



ALT & WITZIG ENGINEERING, INC.

Project Name Grover Hill Project No. N-7032
 Site Grover Hill, Ohio
 Boring CB-3 Surface Elevation _____ Driller Sikora
 Date Started 11/24/87 Groundwater Level _____
 Date Completed 11/24/87 14.0' ft. on completion
 Weather Cloudy _____ ft. at _____ hrs.
 Boring Method Hollow Stem Auger _____ ft. at 24 hrs.

Description	Depth (ft.)	Sample	Blow Count 3-6" incr.	Recov. %	Remarks
Brown Silty CLAY w/Organics	0.8				
		1SS	12-17-23	60	
	5	2SS	11-17-22	75	
Brown Silty CLAY with some Sand (CL)		3SS	12-17-21	80	Vertical Fracture with Calcium Deposit
	10	1ST		30	
		4SS	8-15-20-33	100	
	12.8				
		5SS	16-30-30-40	100	▽ On Completion.
	15	6SS	13-25-25-40	100	
		7SS	19-21-27-35	85	
Gray Silty CLAY with some Sand (CL)		8SS	16-20-28-34		
	20				
Auger refusal at 23.5 feet.					

MSDS DATE: 3/16/90
CHANGE NO.: 7557For Assistance, Contact:
Regulatory Affairs Dept.
PO Box 907 Ames, IA 50010
(800) 227-4224HACH COMPANY
PO BOX 907
AMES, IA 50010Emergency Telephone #
Rocky Mountain Poison Ctr.
(303) 623-5716**I. PRODUCT IDENTIFICATION**CATALOG NO.: 14160 PRODUCT NAME: BOD Nutrient Buffer Pillows
CAS NO.: NA CHEMICAL NAME: Not applicable
FORMULA: Not applicable CHEMICAL FAMILY: Not applicable**II. INGREDIENTS**

Potassium Phosphate, Dibasic, Anhydrous

PCT: <5 CAS NO.: 7758-11-4 SARA: NOT LISTED
TLV: Not established PEL: Not established
HAZARD: Moderately toxic; may cause irritation

Magnesium Sulfate Heptahydrate

PCT: <5 CAS NO.: 10034-99-8 SARA: NOT LISTED
TLV: Not established PEL: Not established
HAZARD: Moderately toxic; may cause irritation

Calcium Chloride Dihydrate

PCT: <5 CAS NO.: 10035-04-8 SARA: NOT LISTED
TLV: Not established PEL: Not established
HAZARD: Moderately toxic; may cause irritation

Other components, each

PCT: <1 CAS NO.: NA SARA: NOT LISTED
TLV: Not applicable PEL: Not applicable
HAZARD: Not applicable

Demineralized Water

PCT: to 100 CAS NO.: 7732-18-5 SARA: NOT LISTED
TLV: Not applicable PEL: Not applicable
HAZARD: None

Any component of this mixture not specifically listed (eg. "other components") is not considered to present a carcinogen hazard.

III. PHYSICAL DATASTATE: liquid APPEARANCE: Turbid, white ODOR: None
SOLUBILITY IN: WATER: Slightly soluble ACID: Not determined
OTHER: Not determined BOILING POINT: 100C MELTING PT.: NA
SPEC GRAVITY: 1.045 pH: 7.1 to 7.6 VAPOR PRESSURE: Not determined
VAPOR DENSITY (air=1): ND EVAPORATION RATE: 1.79
METAL CORROSIVITY - ALUMINUM: None STEEL: None STABILITY: Stable
STORAGE PRECAUTIONS: No special storage precautions are required.**IV. FIRE, EXPLOSION HAZARD AND REACTIVITY DATA**FLASH PT.: Not applicable METHOD: NA
FLAMMABILITY LIMITS - LOWER: NA UPPER: NA
SUSCEPTIBILITY TO SPONTANEOUS HEATING: None
SHOCK SENSITIVITY: None AUTOIGNITION PT.: NA
EXTINGUISHING MEDIA: Not applicable
FIRE/EXPLOSION HAZARDS: Not applicable
HAZARDOUS DECOMP. PRODUCTS: None reported
OXIDIZER: No NFPA Codes: Health: 0 Flammability: 0 Reactivity: 0
CONDITIONS TO AVOID: None Known**V. HEALTH HAZARD DATA**

THIS PRODUCT MAY BE: irritating to eyes.

ACUTE TOXICITY: Practically non-toxic

ROUTES OF EXPOSURE: Not applicable

TARGET ORGANS: Not applicable

CHRONIC TOXICITY: Practically non-toxic

ROUTES OF EXPOSURE: Not applicable

TARGET ORGANS: Not applicable

CANCER INFORMATION: Not applicable

ROUTES OF EXPOSURE: Not applicable

TARGET ORGANS: Not applicable

OVEREXPOSURE: May cause irritation

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None reported

VI. PRECAUTIONARY MEASURES

Wash thoroughly after handling.

Avoid contact with eyes, skin and clothing.

PROTECTIVE EQUIPMENT: safety glasses, adequate ventilation

VII. FIRST AID

EYE AND SKIN CONTACT: Flush with plenty of water.

INGESTION: Give large quantities of water or milk. Call physician immediately.

INHALATION: Not applicable

VIII. SPILL AND DISPOSAL PROCEDURES

IN CASE OF SPILL OR RELEASE: Dilute with water. Pour down the drain with excess water.

DISPOSE OF IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL REGULATIONS.

IX. TRANSPORTATION DATAD.O.T. PROPER SHIPPING NAME: Not Currently Regulated
HAZARD CLASS: Not applicable ID: NAI.C.A.O. PROPER SHIPPING NAME: Not Currently Regulated
HAZARD CLASS: NA ID: NA GROUP: NAI.M.O. PROPER SHIPPING NAME: Not Currently Regulated
HAZARD CLASS: NA ID: NA GROUP: NA**X. REFERENCES**

- 1) TLV's Threshold Limit Values and Biological Exposure Indices for 1980-1989. American Conference of Governmental Industrial Hygienists, 1988.
- 2) 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor)
- 3) In-house information
- 4) Technical judgment

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

PRODUCT DATA

Oxford™
Chemicals, Inc.

Box 80202/Atlanta, Georgia 30366
Toll Free Number: (800) 451-6996

OXFORD SOLV-AWAY

Floating Degreaser

PURPOSE

Aids in the elimination of grease and scum in lift stations, pumping stations and wet wells by forming a thin water insoluble film that dissolves grease and scum on the surface.

WHERE USED

Municipal and industrial treatment plants — lift stations, pumping stations, wet wells and other areas where grease and scum are a problem.

SURFACES APPLICABLE

Safe to use on all metals, well bonded painted surfaces, concrete, glass and wood. Also can be used on organic substrates such as rubber and some plastics provided that contact time is controlled.

PROPERTIES

Clear, straw-colored mobile liquid, with a mild aromatic odor containing a balanced blend of powerful solvents for effectively dissolving grease and scum.

OXFORD SOLV-AWAY is completely miscible with most common aliphatic and aromatic solvents. OXFORD SOLV-AWAY is insoluble in water, weighs 7.7 pounds per gallon and hence will float on the surface of water. OXFORD SOLV-AWAY features a controlled evaporation rate.

HOW USED

Lift stations, pumping stations, wet wells: spray undiluted on walls of lift stations. Pour approximately 1 gallon into lift station wet well and allow water level to rise. This treatment will start dissolving grease within 30 minutes after application in most cases.

Loosening floating digester covers: spray undiluted around perimeter of cover. Pressure spray dissolved matter with water hose.

HANDLING

See Product Label

ADVANTAGES

- Effectively reduces grease and scum blankets.
- Easy and simple to use.
- Effective and economical — because of floating property and controlled evaporation rate, large areas may be treated at low costs.

Solv-Away

Floating Degreaser

DIRECTIONS

LIFT STATIONS, PUMPING STATIONS, WET WELLS: Spray undiluted on walls of lift stations. Pour approximately 1 gallon into lift station wet well and allow water level to rise. This treatment will start dissolving grease within 30 minutes after application in most cases.

LOOSENING FLOATING DIGESTOR COVERS: Spray undiluted around perimeter of cover. Pressure spray dissolved matter with water hose.

DANGER: HARMFUL OR FATAL IF SWALLOWED • COMBUSTIBLE • CONTAINS PETROLEUM DISTILLATES

Do not take internally. Use with adequate ventilation. Avoid breathing vapor. Remove or extinguish all possible sources of excessive heat, sparks, or open flames when using product to avoid accidental combustion of vapors. Place used rags in approved safety waste receptacle or wash with soap and water and discard to avoid potential fire hazard. **FIRST AID:** (INTERNAL)— (1) Do **not** induce vomiting. (2) Give a glass of water. Do not give large amounts of water as this may cause vomiting. (3) Call physician immediately. (EYES)— Flush immediately with water for 15 minutes. If irritation persists, call physician. (EXTERNAL)— Wash with soap and water.

CONTAINER DISPOSAL: Triple rinse with cold water, then dispose of in accordance with Federal, State and local regulations.

KEEP OUT OF REACH OF CHILDREN

Industrial Strength Product

NET CONTENTS _____ GALLONS

D-7A87
DC-63

I.C.C.: Compound, Cleaning, Liquid

MATERIAL SAFETY DATA SHEET

I. PRODUCT IDENTIFICATION

MANUFACTURER'S NAME: Oxford Chemicals, Inc.
ADDRESS: P. O. Box 80202, Atlanta, GA 30366

TELEPHONE NO.: (404) 452-1100
CHEMTREC EMERGENCY NO.: (800)424-930

PRODUCT NAME: Solv-Away

D.O.T. SHIPPING NAME: I.C.C.: Compound, Cleaning, Liquid

II. HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	CAS NO.	% \pm 5%
Aeromatic Hydrocarbon (TLV: None established)	68477-31-6	95

III. PHYSICAL DATA

BOILING POINT, 760 MM HG (°F.): 370
SPECIFIC GRAVITY (H₂O = 1): 0.96
VAPOR DENSITY (AIR = 1): N/A
% VOLATILES BY VOL.: 1-10%
APPEARANCE AND ODOR: Aromatic odor.

pH (AS IS): N/A
pH (1% SOLN.): N/A
VAPOR PRESSURE: N/A
SOLUBILITY IN H₂O: Negligible
EVAPORATION RATE (WATER = 1): N/A

IV. FIRE AND EXPLOSION DATA

FLASH POINT (TEST METHOD): 180°F (T.C.C.)
FLAMMABLE LIMITS IN AIR, % BY VOL.: 1.9 in air at 135°C (Lower)
EXTINGUISHING MEDIA: Regular foam, water fog, carbon dioxide and dry chemical.
SPECIAL FIRE FIGHTING PROCEDURES: Self-contained breathing apparatus with a full facepiece operated in pressure demand or other positive pressure mode, approved by MESA-NIOSH.
UNUSUAL FIRE AND EXPLOSION HAZARD: None

AUTOIGNITION TEMPERATURE: 910°F
LOWER: UPPER:

V. HEALTH HAZARD INFORMATION

EFFECTS OF OVEREXPOSURE: Vapor harmful. May cause eye and skin irritation.

EMERGENCY AND FIRST AID PROCEDURES:

EYES: Flush immediately with water for 15 minutes. If irritation persists, call physician.

SKIN: Avoid contact with skin. Wash exposed skin with soap and water.

INGESTION: Do not induce vomiting. Keep person warm, quiet and get medical attention immediately.

INHALATION: Remove individual to fresh air. If symptoms persist, call physician immediately.

NOTES TO PHYSICIAN: Aspiration of material into lungs due to vomiting can cause chemical pneumonitis.

VI. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: Stable

CHEMICAL INCOMPATIBILITY: Strong oxidizing agents.

HAZARDOUS THERMAL DECOMPOSITION PRODUCTS: None

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION: Will not occur.

VII. DISPOSAL, SPILL OR LEAK PROCEDURES

WASTE DISPOSAL METHOD: Controlled incineration or sanitary landfill unless directed otherwise by Federal, State, or local regulations.

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Small spills: Use absorbent and transfer to hood. Allow volatile portion to evaporate in hood. Allow sufficient time for vapors to completely clear hood duct work. Large Spills: Eliminate all ignition sources. Wear protective equipment. Dike area. Pump liquid to salvage tank. Remaining liquid taken up on absorbent material. Shovel absorbent into approved container.

VIII. SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS: Local exhaust.

RESPIRATORY (SPECIFY IN DETAIL):

EYE: Safety glasses/goggles.

GLOVES: Resistant nitrile rubber gloves.

OTHER CLOTHING AND EQUIPMENT: Wear impervious clothing and boots.

IX. SPECIAL HANDLING AND STORAGE PRECAUTIONS

PRECAUTIONARY STATEMENTS: Keep out of reach of children. Combustible. May cause eye and skin irritation.

OTHER HANDLING AND STORAGE REQUIREMENTS: Keep away from heat and open flame. Avoid breathing vapor or mist. Avoid prolonged or repeated skin contact.

PREPARED BY: Eugene Schaffstall
TITLE: Technical Director
COMPANY: Oxford Chemicals, Inc.
REVISION DATE: July 24, 1987

PRODUCT CODE: DC-63