SECTION 02725
LOW PRESSURE UTILITY SEWERAGE

PART 1 GENERAL

1.1 SUMMARY

A. This section is intended to provide criteria for the design, material requirements, construction, and testing of low pressure sewer (LPS) systems. This section establishes standards for sewer mains and private service lines for new LPS systems.

1.2 REFERENCES

A. American Water Works Association (AWWA):
1. C110, Ductile-Iron and Gray-Iron Fittings.
2. C153, Ductile-Iron Compact Fittings, for Water Service.
3. C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
4. C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Distribution.
5. C905, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 Inches through 48 Inches (350 mm through 1,200 mm) for Water Transmission and Distribution.
6. C906, Polyethylene (PE) Pressure Piping and Fittings, 4 in. through 63 in., for Water Distribution and Transmission.
7. C907, Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Distribution.
8. Manual M55, PE Pipe - Design and Installation

B. ASTM International (ASTM):
1. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
2. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
3. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
5. A536, Standard Specification for Ductile Iron Castings.
6. A563, Standard Specification for Carbon and Alloy Steel Nuts.
7. D638, Standard Test Method for Tensile Properties of Plastics.

8. D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
9. D2241, Standard Specification for PolyVinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
10. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
11. D2466, Standard Specification for PolyVinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
12. D2467, Standard Specification for PolyVinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
13. D2672, Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement.
14. D2855, Standard Practice for Making Solvent-Cemented Joints with PolyVinyl Chloride (PVC) Pipe and Fittings.
15. D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
16. F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
17. F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
18. F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

C. Code of Federal Regulations (CFR): Title 49 Part 192.285, Plastic Pipe: Qualifying Persons to Make Joints.

D. NSF International (NSF): 61, Drinking Water System Components - Health Effects.

E. Plastics Pipe Institute (PPI):
1. Handbook of Polyethylene Pipe.
2. Technical Note 38, Bolt Torque for Polyethylene Flanged Joints.
3. TR-33, Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.

1.3 SUBMITTALS

A. Design Requirements
1. The Owner shall require a Design Report, prepared and sealed by a Tennessee-licensed Professional Engineer, detailing the basis of design for the low pressure sewage system. The Design Report shall include at a minimum:
   a. Number of housing units, as well as any other structure(s) producing wastewater.
   b. Per capita demand (gallons/capita/day) for each unit type.
   c. Calculated Design Volumes, as the sum total of property units and their respective per capita demands.
   d. Percentage of units contributing wastewater flow at an instantaneous time.
   e. Estimated flows and respective velocities for each sewer main.

f. Range of elevations in the sewer basin, and the resultant pressures in the forcemain sewer.
g. Identification of future phases that would result in increased flow being contributed to any sewer mains. If applicable, estimate the future flows and velocities as a result of future developmental phases.
h. Main diameter shall be the largest size that supports 2-ft/s velocity at design flow.
i. Design calculations shall be prepared using Environment One's "LPS Design Assistant," latest version, for the Owner's review and approval.

B. Action Submittals
1. Shop Drawings
a. Catalog information confirming pipe, fittings, and other materials conform to requirements of this section and Section 01340.
b. Drawings of specific connection details and as otherwise required by section 01340.

C. Informational Submittals
1. As required by Section 01340.

1.4 QUALITY ASSURANCE

A. PVC Pipe (Preferred Low Pressure Sewer Main)
1. Manufacturer Qualifications, Delivery, Shipping, and Storage shall be consistent with requirements identified in Section 02722 1.04 and Section 02722 1.05.
a. Main Line work shall be warrantied by Contractor for one (1) year following the date of acceptance by Owner.

B. HDPE Pipe (Preferred Low Pressure Sewer Service)
1. Manufacturer Qualifications, Delivery, Shipping, and Storage shall be consistent with requirements identified in Section 02722 1.04 and Section 02722 1.05.
2. For Public Main Line installation, persons fusing HDPE pipe shall have 2 year(s) of experience with fusing HDPE pipe and shall have received a minimum of 8 hours of training for fusing HDPE pipe from pipe supplier or fusing equipment supplier. Training course certification shall be updated annually.
3. For Private Service Line installation, from meter box to grinder pump, persons fusing HDPE pipe shall have received a minimum of 8 hours of training for fusing HDPE pipe from pipe supplier or fusing equipment supplier. Training course certification shall be updated annually.
a. Private Service Line work shall be warrantied by Contractor for one (1) year following the date of acceptance by Owner.

1.5 CONNECTION TO EXISTING SYSTEM

A. HDPE Pipe
1. Connection of New HDPE to Existing HDPE Pipe
a. Shall comply with manufacturer or distributor recommendations based on PPI TR-33 and Site Conditions.

b. Connection of New HDPE to Existing PVC Pipe see Morristown Utilities Commission standard detail.

c. Engineer shall Detail construction materials and methodology for Owner's review and approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. Pipe and Fittings
   1. Minimum pipe size for low pressure sewer mains shall be 2-inches.
   2. PVC Pipe (preferred low pressure sewer main)
      a. Polyvinyl Chloride Pipe (PVC), for pressure sewers: AWWA C-900 PC 235/C-905, PR 200, SDR 11. All pipe shall meet a minimum of 200 psi working pressure rating, and shall be marked with the manufacturer's name, nominal diameter, DR, and pressure rating.
      b. Fittings: Shall be Ductile-Iron (Protecto 401 Lined) as specified above or SDR 11 push-on fittings with Ford Uni-Flange 1360 Series restraint harness.
      c. Joints: Shall be push-on with gaskets recommended by the manufacturer for the specific application.
   3. HDPE (preferred low pressure sewer service)
      a. Pipe, Joints, Fittings, and appurtenances shall be supplied in accordance with Section 02722 1.04 and Section 02722 1.05.
      b. Pipe 4" and smaller shall be IPS size.
      c. HDPE pipe shall have a co-extruded green cover or extruded green stripes designating use for sanitary sewer. Color print lines are not an acceptable method for designation of low pressure sewer mains. Pipe with extruded green stripes shall have a minimum of three equally spaced stripes. Pipe shall have a heat indented print line containing the information required in ASTM D 3035.

B. Tracer Wire
   1. Tracer wire installation shall be required for all low pressure sewer mains and low pressure service lines.
   2. Contractor shall provide 14 gauge solid insulated cover type THHN attached to top of main and service pipelines tied off to valves and lateral kits in service meter boxes. Connecters permitting direct bury, water, and corrosion resistance shall be used.

C. Air Valves
   1. Air valves shall be located at all high points on the pipeline in accordance with the drawings, or as required by OWNER.
   2. Provide air valves in accordance with Section 02722 2.04 Air and Vacuum Valves and Morristown Utilities Commission Standard Detail

D. Isolation Valves
   1. PVC Main – 2” and larger
      a. Plug Valve Eccentric with 2" AWWA Operating Nut Model 54-4 - ANSI B16.1, class 150 Ductile iron Body ASTM A536 65-45-12. Epoxy coated, Buna-N Plug, V-Type Packing, Self Lubricating Type 316 Stainless Steel thrust bearing. As manufactured by DeZurick or Flowmatic.
      b. HDPE Service- 2” Hayward True Union Ball Valve GFPP for sewer per Morristown Utilities Commission Low Pressure Sewer Standard Details.
      c. Contractor shall provide mechanical joint adaptors to facilitate connection to SDR 17 PVC pipe as well as compression adapters and reducers for connection to 2” Hayward true union ball valve and 1-1/4” SDR 11 HDPE service line. All valves fittings, adapters are to bear same pressure rating as pipe. See Morristown Utilities Commission Low Pressure Sewer Standard Details.

E. Restraint
   1. PVC
      a. Ford Uni-Flange Series 1360 Restraint Harness to be used on all main line valves and fittings. Additional concrete thrust blocking to be installed per direction of the owner or their representative. CONTRACTOR shall install any restraint devices necessary to properly secure the pipe.
      b. Provide thrust restraint blocking in accordance with Morristown Utilities Commission Standard Details.

F. Flushing Connection
   1. Provide mid line and end-of-line flushing connections at locations indicated on the approved engineer design drawings and as directed by Owner.
   2. Install flushing assembly in accordance with Morristown Utilities Commission Low Pressure Sewer Standard Details.

G. Service Connections
   1. Connection to Existing Main(see MU standard detail)
      a. 10” long Ford 2” tapped stainless steel repair clamp shall be installed to facilitate connection of service line. Connection shall utilize a PVC nipple and Hayward true union ball valve GFPP. UL classified to ANSI/NSF Standard 61.
         1) Acceptable tapped repair clamp shall be Ford FS1-473-10-IP7 sized per main line or Owner approved equal.
   2. Connection to New Main(see MU standard detail)
   3. Install gasketed PVC SDR 17 T sized for main with 2” female threaded connection for 2” SCH 80 PVC nipple. Connect to 2” Hayward true union Ball valve GFPP, use SCH 80 PVC union to reduce down to 1-1/4” SDR 11 HDPE.
   4. Between the Low Pressure Force Main Sewer and meter box, the Low Pressure Sewer service connection shall utilize 1-1/4” diameter HDPE service pipe (PE4710 material, SDR-11) meeting requirements identified in Section 02724 High-Density Polyethylene Pipe.
   5. At the meter box, install an EONE lateral 1-1/4” lateral kit. Appurtenances shall be full port and 200-psi rated. Lateral kit to be placed upright on a concrete cap block

inside a meter box. Utilize compression fittings and be compatible with HDPE pipe (PE4710, SDR-11, IPS).

6. Meter box shall be placed at the property line, and shall contain the lateral kit and looped tracer wire. Minimum box dimensions shall be 12”x18”.
   a. Acceptable model shall be NPS Model D1800-B/O 12”x18” with NDS 12” RECT green “sewer” lid D1200-DISGSWRL.
7. On the “private” side of the meter box, the Low Pressure Sewer service connection shall utilize 1-¼” diameter HDPE service pipe (PE4710 material, SDR-11 rated) meeting requirements identified in Section 02724 High-Density Polyethylene Pipe and Fittings. Marking tape and tracer wire shall be required as previously provided for in this Section.
8. Service lines under roadway, sidewalk, or driveway shall be encased in 2-inch (min.) SDR 11 PVC pipe.

H. Grinder Pump, Control Panel, and Basin
   1. As required and specified in Section 02726 Residential Grinder Pump Stations.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Consistent with that required under Section 33 05 01.09, Section 33 05 01.10, and Contract Documents.

3.2 SEPARATION BETWEEN WATER AND SEWER

A. Sewers shall be designed with a 10-foot horizontal separation from any existing or proposed water main. If this is not practical, the sewer may be placed closer than 10 feet to a water main, provided it is laid in a separate trench and the elevation of the top of the sewer is at least 18 inches below the bottom of the water main, or as directed by ENGINEER.

B. Where a sewer crosses under a water main, the top of the sewer shall be at least 18 inches below the bottom of the water main. If the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation, or the water main shall be reconstructed with ductile iron pipe for a distance of 10 feet on each side of the sewer with a full pipe section of the water main centered over the sewer, or as directed by ENGINEER.

3.3 INSTALLATION

A. PVC Collection System
   1. Install SDR 11 force main, fittings, valves, and restraint as required in Section 02722 Sanitary Sewers, Force Mains and Appurtenances.
   2. Provide testing as required in Section 02722.

B. CONNECTION TO SYSTEM

1. Service Lines

   a. Low pressure main line, service line, grinder station, and gravity service line shall be inspected, tested, and accepted by Owner prior to backfilling the service lines or grinder pump basin. Contractor shall coordinate with Owner based on requirements set forth in the Specifications, Owner's Development Agreement, and Owner's Development Manual.

END OF SECTION

SECTION 02726
RESIDENTIAL GRINDER PUMP STATIONS

PART 1. GENERAL

1.01 GENERAL DESCRIPTION:

A. The MANUFACTURER shall furnish complete factory-built and tested grinder pump unit(s), each consisting of a grinder pump core suitably mounted on an integral stand of stainless steel, tank, electrical quick disconnect (NEMA 6P), pump removal harness, discharge assembly/shut-off valve, anti-siphon valve/check valve assembly, electrical alarm assembly and all necessary internal wiring and controls. For ease of serviceability, all pump motor/grinder units shall be of like type and horsepower throughout the system.

1.02 SUBMITTALS:

A. After receipt of notice to proceed, the MANUFACTURER shall furnish a minimum of six sets of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction. The ENGINEER shall promptly review this data, and return two copies as accepted, or with requested modifications. Upon receipt of accepted shop drawings, the MANUFACTURER shall proceed immediately with fabrication of the equipment.

1.03 MANUFACTURER:

A. Grinder pump stations, complete with all appurtenances, form an integral system, and as such, shall be supplied by one grinder pump station manufacturer. The CONTRACTOR shall be responsible for the satisfactory operation of the entire system. The equipment specified shall be a product of a company experienced in the design and manufacture of grinder pumps for specific use in low pressure sewage systems. The company shall submit detailed installation and user instructions for its product.

B. The MANUFACTURER of the grinder pump station shall be Environment One Corporation. Preferred model DH071-61.

1.04 OPERATING CONDITIONS:

A. The pumps shall be capable of delivering 15 GPM against a rated total dynamic head of 0 feet (0 PSIG), 11 GPM against a rated total dynamic head of 92 feet (40 PSIG), and 7.8 GPM against a rated total dynamic head of 185 feet (80 PSIG). The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

1.05 WARRANTY:

A. The grinder pump MANUFACTURER shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to, the panel for a period of

60 months after notice of OWNER'S acceptance, but no greater than 66 months after receipt of shipment. Any manufacturing defects found during the warranty period will be reported to the MANUFACTURER by the OWNER and will be corrected by the MANUFACTURER at no cost to the OWNER.

PART 2. PRODUCTS

2.01 PUMP:

A. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

2.02 GRINDER:

A. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque.
B. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:
    1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
    2. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second.
    3. The inlet shroud shall have a diameter of no less than 5 inches.

4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

C. The grinder shall be capable of reducing all components in normal domestic sewage to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter discharge piping.

2.03 ELECTRIC MOTOR

A. As a maximum, the motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, air-cooled induction type with Class F installation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. The motor shall be press-fit into the casting for better heat transfer and longer winding life. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application. The wet portion of the motor armature must be 300 Series stainless.

2.04 MECHANICAL SEAL

A. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.05 TANK

A. High Density Polyethylene Construction (HDPE). The tank shall be a wetwell design made of high density polyethylene of a grade selected for environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. Corrugations of the outside wall are to be of a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be a minimum .250 inch thick. All seams created during tank construction are to be thermally welded and factory tested for leak tightness. Tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to maximum external soil and hydrostatic pressure.

B. The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD (4" DWV or SCH 40) inlet pipe.

C. The tank shall include a lockable cover assembly providing low profile mounting and watertight capability. The cover shall be high density polyethylene, green in color, with a load rating of 150 lbs per square foot. The cover assembly shall also include an integral 2-inch vent to prevent sewage gases from accumulating in the tank. The accessway design and construction shall facilitate field adjustment of station height in increments of 3" or less without the use of any adhesives or sealants requiring cure time before installation can be completed.

D. The power and control cable shall connect to the pump by means of the provided NEMA 6P Electrical Quick Disconnect (EQD) and shall enter the tank through a factory installed watertight strain relief connector. An electrical junction box shall not be permitted in the tank.
E. Tank heights shall be as shown on the Standard Drawings.
F. The station shall have all necessary penetrations factory sealed and tested. No field penetrations shall be acceptable.

2.06 DISCHARGE HOSE AND DISCONNECT/VALVE

A. All discharge piping shall be constructed of 304 stainless steel. The discharge shall terminate outside the accessway bulkhead with a stainless steel 1-1/4-inch female NPT fitting to facilitate connection to service forcemain. The discharge piping shall include a stainless steel ball valve rated for 235-psi WOG. The bulkhead penetration shall be factory installed and warrantied by the manufacturer to be watertight.

2.07 ELECTRICAL QUICK DISCONNECT

A. The grinder pump core shall include a factory-installed NEMA 6P electrical quick disconnect (EQD) for all power and control functions. The EQD will be supplied with 32', 25' of useable, electrical supply cable (ESC) to connect to the alarm panel. The EQD shall require no tools for assembly, seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque. Plug-type connections of the power cable onto the pump housing will not be acceptable. Junction boxes are not acceptable. The EQD shall be so designed to be conducive to field wiring as required.

2.08 CHECK VALVE

A. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Moving parts will be made of a 300 Series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure. The valve body shall be an injection molded part made of an engineered thermoplastic resin. The valve shall be rated for continuous operating pressure of 235 psi.

2.09 ANTI-SIPHON VALVE

A. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the discharge piping. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an

integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure. The valve body shall be injection-molded from an engineered thermoplastic resin. Holes or ports in the discharge piping are not accepted. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

2.10 CORE UNIT

A. The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, electrical quick disconnect and wiring. The watertight integrity of the core unit shall be established by a 100% factory test at a minimum of 5 PSIG.

2.11 CONTROLS

A. All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners. Wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. Level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. Level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation, etc. Level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermoplastic elastomer.
B. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater and with excellent impact resistance. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be radial sealed with redundant O-rings. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.
C. All fasteners throughout the assembly shall be 300 Series stainless steel. High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices and their tendency to malfunction because of incorrect wiring, tangling, grease buildup, and mechanical cord fatigue. To assure reliable operation of the pressure switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes. Tube or piping runs outside of the station tank or into tank-mounted junction boxes providing pressure switch equalization will not be permitted due to their susceptibility to condensation, kinking, pinching, and insect infestation. The grinder

pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a FACTORY INSTALLED NEMA 6P EQD half attached to it.

2.12 ALARM PANEL

A. Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel.

B. The alarm panel shall contain one 15-amp, double-pole circuit breaker for the pump core's power circuit and one 15-amp single-pole circuit breaker for the alarm circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.

C. The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability. The alarm sequence is to be as follows when the pump and alarm breakers are on:
   1. When liquid level in the sewage wet-well rises above the alarm level, the contacts on the alarm pressure switch activate, audible and visual alarms are activated, and the redundant pump starting system is energized.
   2. The audible alarm may be silenced by means of the externally mounted, push-to-silence button.
   3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.

D. The visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5" H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).

E. The entire alarm panel, as manufactured and including any of the following options shall be listed by Underwriters Laboratories, Inc.

F. Panel shall be modified to include E-One's "Sentry Simplex Protect" features, including:
   1. Low Voltage (Brownout) Protection – A lockout cycle will prevent the motor from operating and will illuminate an LED if:
      a. The incoming AC Mains voltage drops below a predetermined minimum, typically 12% of nameplate (211 volts for a 240 volt system) for 2 to 3 seconds, regardless of whether the motor is running.
      b. the lockout cycle will end if the incoming AC Mains voltage returns to a predetermined value, typically 10% of nameplate (216 volts for a 240 volt system).
   2. The system continues to retest the voltage every second indefinitely. If the lockout cycle has been initiated and the voltage comes back above the predetermined

starting voltage, the system will function normally. The LED remains illuminated during a Brownout condition and remains latched until the pump breaker is turned off and then on again (reset). The audible and visual alarm will not be activated unless there is a high wastewater level in the tank.

3. Run Dry Protection – A 20-minute lockout cycle will prevent the motor from operating and will illuminate an LED when the wastewater level in the tank is below the pump inlet level. The condition is rechecked every 20 minutes. If the lockout cycle has been initiated and the condition is satisfied, the pump is not allowed to cycle normally but the LED remains latched. The LED will remain latched until the pump breaker is turned off and then on again (reset). If the condition is not satisfied after 3 consecutive attempts, the visual alarm will be activated until the pump breaker is turned off and on (reset) or until there is one cycle of normal operation. If a high level condition is presented at any time, a pump run cycle will be activated.
4. High System Pressure Protection – A 20-minute lockout cycle will prevent the motor from operating and will illuminate an LED when the pressure in the discharge line is atypically high (closed valve or abnormal line plug). The condition is rechecked every 20 minutes. If the condition is satisfied, the pump is allowed to cycle normally but the LED remains latched. If the condition is not satisfied after 3 consecutive attempts, the pump is locked out indefinitely until the condition is removed and power is reset. The LED will remain latched until the pump breaker is turned off and then on again (reset). The audible and visual alarm will be activated.
5. In all of the above cases, if more than one error condition is presented, the LED depicting the most recent error condition will be displayed.
6. Other features shall include:
   a. Alarm Activated Dry Contacts – Normally open relay contact closes upon alarm activation.
   b. Alarm Activated Contacts for Remote Indoor Alarm Module – Will work with or without power to the alarm panel and is designed to work with E/One's Remote Sentry
   c. Includes Inner Door Dead Front
   d. Separate LED's for each condition

PART 2.

2.13 SERVICEABILITY:

A. The grinder pump core, including level sensor assembly, shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy core removal when necessary. The level sensor assembly must be easily removed from the pump assembly for service or replacement. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation. Each EQD half must include a water-tight cover to protect the internal electrical pins while the EQD is unplugged. A pump push-to-run feature will be provided for field trouble shooting. The push-to-run feature must operate the pump even if the level sensor assembly has been

removed from the pump assembly. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.14 OSHA CONFINED SPACE

A. All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station (as per OSHA 1910.146 Permit-required confined spaces). *"Entry means the action by which a person passes through an opening into a permit- required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space."*

2.15 SAFETY

A. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use.
B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International.

PART 3. EXECUTION

3.01 FACTORY TEST

A. Each grinder pump shall be submerged and operated for 1.5 minutes (minimum). Included in this procedure will be the testing of all ancillary components such as, the anti- siphon valve, check valve, discharge assembly and each unit's dedicated level controls and motor controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. Certified test results shall be available, upon request, showing the operation of each grinder pump at two different points on its curve. Additional validation tests include: integral level control performance, continuity to ground and acoustic tests of the rotating components.
B. All HDPE basins shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings and cable connectors shall be included in this test along with their respective sealing means (grommets, gaskets etc.).

3.02 DELIVERY

A. All grinder pump core units, including level controls, will be delivered to the job site 100 percent completely assembled, including testing, ready for installation. Grinder pump

cores will be shipped separately from the tanks. Installing the cores and discharge piping/hose into the tanks is the only assembly step required and allowed due to the workmanship issues associated with other on-site assembly. Grinder pump cores must be boxed for ease of handling.

3.03 INSTALLATION

A. Earth excavation and backfill are specified under Section 02221 Trenching, Backfilling, and Compacting, but are also to be done as a part of the work under this section, including any necessary sheeting and bracing.
B. The CONTRACTOR shall be responsible for handling ground water to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding.
C. The grinder pump stations must be approved by the Morristown Utilities Commission representative/inspector prior to excavation. The grinder pump station shall not be set into the excavation until the installation procedures and excavation have been approved by a Morristown Utilities Commission Representative/ Inspector.
D. Remove packing material. User instructions MUST be given to the OWNER. Hardware supplied with the unit, if required, will be used at installation. The basin will be supplied with a standard 4" inlet grommet (4.50" OD) for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled or laid on its side for any reason.
E. Installation shall be accomplished so that 1" to 4" of accessway, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavated hole must be large enough to allow for the concrete anchor.
F. A 6" inch (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8" or more than 3/4" shall be used as bedding material under each unit.
G. A concrete anti-flotation collar, as detailed on the drawings, and sized according to the manufacturer's instructions, shall be required and shall be pre-cast to the grinder pump or poured in place. Each grinder pump station with its pre-cast anti-flotation collar shall have a minimum of three lifting eyes for loading and unloading purposes.
H. If the concrete is poured in place, the unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8" sleeve is required over the inlet prior to the concrete being poured.
I. The CONTRACTOR will provide and install a 4-foot piece of 4-inch SCH 40 PVC pipe with water tight cap, to stub-out the inlet for the property owners' installation contractor, as depicted on the Morristown Utilities Commission standard details and manufacturer's installation guide. Installation shall include tracer wire, consistent with the requirements identified in Section 02726 2.1 B. The CONTRACTOR shall provide full depth stone backfill from the excavation limits to the bottom of the inlet piping and around the basin.
J. The electrical enclosure shall be furnished, installed and wired to the grinder pump station by the CONTRACTOR. An alarm device is required on every installation, there shall be NO EXCEPTIONS.

K. The CONTRACTOR shall mount the alarm device in a conspicuous location, as per national and local codes. The alarm panel will be connected to the grinder pump station by a length of 6-conductor type TC cable as shown on the contract drawings. The power and alarm circuits must be on separate power circuits. The grinder pump stations will be provided with 32'of useable, electrical supply cable to connect the station to the alarm panel. This cable shall be supplied with a FACTORY INSTALLED EQD half to connect to the mating EQD half on the core.

3.04 BACKFILL REQUIREMENTS

A. Proper backfill is essential to the long-term reliability of any underground structure. Several methods of backfill are available to produce favorable results with different native soil conditions. The most highly recommended method of backfilling is to surround the unit to grade using Class I or Class II backfill material as defined in ASTM 2321. Class 1A and Class 1B are recommended where frost heave is a concern; Class 1B is a better choice when the native soil is sand or if a high, fluctuating water table is expected. Class 1, angular crushed stone, offers an added benefit in that it doesn't need to be compacted.

B. Class II, naturally rounded stone, may require more compactive effort, or tamping, to achieve the proper density. If the native soil condition consists of clean compactible soil, with less than 12% fines, free of ice, rocks, roots and organic material, it may be an acceptable backfill. Soil must be compacted in lifts not to exceed one foot to reach a final Proctor Density of not less than 90%. Heavy, non-compactible clays and silts are not suitable.

C. Another option is the use of a flowable fill (i.e., low slump concrete). This is particularly attractive when installing grinder pump stations in augured holes where tight clearances make it difficult to assure proper backfilling and compaction with dry materials. Flowable fills should not be dropped more than four feet from the discharge to the bottom of the hole to avoid separation of the constituent materials.

D. Backfill of clean, native earth, free of rocks, roots, and foreign objects, shall be thoroughly compacted in lifts not exceeding 12" to a final Proctor Density of not less than 85%. Improper backfilling may result in damaged accessways. The grinder pump station shall be installed at a minimum depth from grade to the top of the 1 1/4" discharge line, to assure maximum frost protection. The finish grade line shall be 1" to 4" below the bottom of the lid, and final grade shall slope away from the grinder pump station.

E. All restoration will be the responsibility of the CONTRACTOR. Per unit costs for this item shall be included in the CONTRACTOR'S bid price for the individual grinder pump station. The properties shall be restored to their original condition in all respects, including, but not limited to, curb and sidewalk replacement, landscaping, loaming and seeding, and restoration of the traveled ways, as directed by the ENGINEER.

3.05 START-UP AND FIELD TESTING

A. The OWNER shall inspect the placement and installation of the basin and service line, as required by this Section, Section 02726, and Morristown Utilities Commission E-One Installation Guidance document.

B. The OWNER shall inspect the placement and wiring of each station, perform field tests as specified herein, and evaluate the installed equipment before the stations are accepted by the OWNER. The pump shall not be installed until the basin and service lines have been accepted, and water and electric service are active.
C. All equipment and materials necessary to perform testing shall be the responsibility of the CONTRACTOR. This includes, as a minimum, electrical service connection per OWNER requirements, water service, and opening of all valves in the system. These steps shall be completed prior to the Morristown Utilities Commission Representative/ Inspector.
D. The services of Morristown Utilities Commission Representative/Inspector are required for each installation.
E. Upon completion of the installation, the Morristown Utilities Commission Representative/ Inspector will perform the following test on each station:
    1. Make certain the discharge shut-off valve in the station is fully open.
    2. Turn ON the alarm power circuit and verify the alarm is functioning properly.
    3. Turn ON the pump power circuit. Initiate the pump operation to verify automatic "on/off" controls are operative. The pump should immediately turn ON.
    4. Consult the Manufacturer's Service Manual for detailed start-up procedures.
F. Upon completion of the start-up and testing, the OWNER shall issue acceptance to the CONTRACTOR and/or property owner. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed and any installation deficiencies corrected.

END OF SECTION