

SECTION 11308 - PROGRESSING CAVITY GRINDER PUMP STATION

SUMMARY

Section Includes: Work shall be providing complete, ready-to-operate grinder pump stations. Work shall include furnishing and installing factory-assembled units with pump(s), check valves, tank and controls, providing electrical equipment, wire and conduit, providing concrete anchor, assistance in locating station, excavating, backfilling, dewatering, disposing of excess material, restoring site, cleaning and testing.

Related Construction Work Specified Elsewhere.

Section	02140	Dewatering
Section	02210	Excavation and Backfill (Sewers and Water Main)
Section	03315	Concrete Work (Sewers)

REFERENCES

Reference Standards. Performance and material requirements shall meet specific Reference Standards referred to hereinafter under individual items.

SYSTEM DESCRIPTION

Performance Requirements. Each progressing cavity grinder pump station shall consist of a factory-built basin, progressing cavity grinder pump(s), discharge piping and valves, and electrical controls. These components shall be part of a standard system supplied by the same manufacturer. The station shall be Simplex (one pump) or Duplex (two pumps) with basin size as designated on the Drawings, or listed in the Schedule.

The completely assembled and wired grinder pump in its tank shall be listed by Underwriters Laboratories, Inc. The grinder pump shall bear the National Sanitation Foundation seal of approval.

The pump station 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.

The grinder shall be constructed to eliminate clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following items in conjunction with the grinder tank pump:

1. The grinder shall be positioned in such a way that solids are fed in an up-flow direction.
2. The inlet shroud opening shall have a diameter no less than 5 inches.
3. At maximum flow, the average inlet velocity should not exceed 0.2 feet per second.
4. The cutter bars shall extend above the impeller disc 0.200 to 0.250 inch.
5. The impeller disc shall rotate at a nominal speed of 1725 rpm.

The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4-inch diameter discharge pipe.

SUBMITTALS

Shop Drawings and Guarantees. Furnish Shop Drawings and Warranties covering the items included under this Section of the Work.

Operation and Maintenance Instructions. Supplier shall submit to ENGINEER, four copies of a manual giving operation and maintenance instructions.

Installation Check. A qualified factory representative from Supplier shall place each station in operation, make necessary adjustments, conduct a complete functional check, including pump performance tests, and, upon completion of this final installation check, furnish ENGINEER a start-up report signed by a factory representative.

QUALITY ASSURANCE

Standards. Equipment furnished and installed under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with detail Drawings, Specifications, engineering data, instructions and recommendations of the equipment manufacturers as approved by ENGINEER.

Codes, Ordinances and Industrial Standards. The design, testing, assembly, and methods of installation of the wiring materials, electrical equipment and accessories proposed under this Contract shall conform to the National Electrical Code and applicable State and local requirements. UL listing and labeling shall be adhered to under this Contract. Any equipment that does not have a UL, FM, CSA or other listed testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that the equipment furnished has been manufactured in accordance with the National Electrical Code and OSHA requirements.

EXTENDED WARRANTY

Supplier shall warrant the equipment from the time of on-site checkout of the station. The warranty shall pay for parts-and-labor for pump core assembly, basin, wiring and panel, including diagnostic time, beginning at start-up, prorated according to the following schedule.

<u>Year</u>	
1	100 Percent Required Warranty
2	100 Percent Required Warranty
3	100 Percent Extended Warranty
4	87.5 Percent Extended Warranty
5	75 Percent Extended Warranty
6	62.5 Percent Extended Warranty
7	50 Percent Extended Warranty
8	37.5 Percent Extended Warranty
9	25 Percent Extended Warranty
10	12.5 Percent Extended Warranty

POST-CONTRACT COST LIMITATIONS

Supplier shall place on the Equipment Evaluation list in the Bid Form, the base price guaranteed by the manufacturer for furnishing in the future a standard simplex grinder pump station (FOB factory) as specified herein. To this base price, the manufacturer agrees to add a charge no greater than an amount calculated by multiplying the base price by the percent increase in Producer's Price Index for pumps and pumping equipment between the date of future sale and bid date for up to five years following the Bid date.

PART 2 - PRODUCTS

MANUFACTURERS

Progressing Cavity Grinder Pump Stations shall be the product of one of the following manufacturers. Others will not be accepted.

Environment One Corporation

Low Voltage Field-Mounted Devices shall be the product of one of the following manufacturers, or equal:

Allen Bradley	Siemens, Inc.
Crouse Hinds	Square 'D' Co.
Cutler Hammer	Westinghouse
General Electric	Hoffman

Low Voltage Molded Case Circuit Breakers shall be the product of one of the following manufacturers, or equal:

Crouse Hinds	Siemens, Inc.
Cutler-Hammer	Square 'D' Co.
General Electric	Westinghouse

Coating Thread Paint for conduits shall be the product of one of the following manufacturers, or equal:

ZRC Chemical Products Co.
CRC Chemicals USA
Sherwin-Williams
Brady
3M Company

Trench Marking Tape shall be the product of one of the following manufacturers, or equal:

Brady
3M Company

MATERIALS

Conduit. The following types of conduit shall be installed in outdoor areas as defined in this Section or as shown on the Drawings.

Exposed: PVC externally coated rigid steel conduit and fittings.

Underground: As indicated, PVC externally coated rigid steel, fiberglass reinforced conduit, or rigid non-metallic conduit, concrete encased or not concrete encased.

Trench Marking. Direct-buried conduit installed in trenches shall be marked by a 1-inch-thick concrete ribbon or a strip of marking tape. The concrete ribbon shall be painted with a stripe 6 inches wide. The tape shall be highly acid- and alkali-resistant polyethylene film 0.004-inch thick, 6 inches wide with lengthwise and crosswise shear strength of 1500 psi minimum. The tape shall read: CAUTION BURIED ELECTRICAL LINE. The wording shall repeat every 12 to 18 inches minimum.

Grounding Materials.

General. Equipment and system grounding shall be provided in accordance with the National Electrical Code as a minimum.

Ground rods shall be solid cylindrical rods of copper clad steel, tinned at the top connection. Dimension shall be as shown on the Drawings.

Grounding cable shall be bare soft-drawn copper. It shall be sized as shown on the Drawings. Where equipment grounding conductors are required, they shall be sized according to Article 250 of the National Electrical Code, minimum. Equipment grounding conductors shall be provided even when not shown on the Drawings when they are required by the National Electrical Code or other applicable codes. Grounding cable shall be insulated when run in a conduit with power wires. The insulation on grounding wires in conduit shall be RHW, THHN, or XHHW. The insulation on grounding wires shall be impregnated green color or green with yellow stripes over its entire length.

Low Voltage Field-Mounted Devices.

General. Where required use load-break, heavy-duty, quick-make, quick-break switches. Switches shall be gang-operated by an insulated steel cross-bar. Switch I^2t rating shall be equal to or greater than the fuse let-through with which it is used when fusible. Where the switch is unfused, the I^2t rating shall be equal to or exceed that I^2t let-through of the nearest upstream protective device in its circuit.

Disconnect Switch. Service entrance disconnect switches shall be approved for service-entrance switching applications.

Switch Enclosures. When enclosures are required, they shall be NEMA 4X or galvanized NEMA 3R with interlocked cover so that the switch may not be closed with the cover open or the cover opened with the switch closed. A defeat mechanism shall be provided to operate when the enclosure is open to bypass the interlock. External operating handle shall be lockable in the open and closed position.

Molded Case Circuit Breakers. Where molded case circuit breakers are required for panel boards, they shall be dual-element thermal-magnetic protective devices assembled into an enclosing housing of insulating, inorganic material. The trip rating shall be shown on the Drawings. Unless otherwise noted, they shall be one-pole devices. All breakers shall be ambient compensated for enclosure mounting.

Molded case circuit breakers shall operate both manually for normal switching functions and automatically to open when over current conditions exist. Poles of a multi-pole breaker shall open and close simultaneously. Unless otherwise noted, the breakers shall have a nonadjustable, instantaneous magnetic element and a long-time thermal element. The thermal element shall have an inverse time-current characteristic. The breakers shall have an over-center type, quick-make, quick-break mechanism. When the breaker has automatically tripped, the handle shall assume a center tripped position. Lighting breakers for 15-100 amp services shall have 10,000 Ampere Interrupting Rating.

Electrical Controls.

General. Controls shall be integral with the grinder pump and shall be located in the top housing of the core unit inside a waterproof access cover. The cover shall be attached with stainless steel, tamper-proof fasteners.

Non-fouling wastewater level detection for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral, air-bell level sensor connected through airtight tubing to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater.

Overflow sensing shall be accomplished by separate air-bell sensor of the same type.

Each level control shall have its own built-in fail-safe design which will prevent the entrance of moisture into the controls in case of switch diaphragm failure.

To ensure reliable operation of pressure-sensitive switches, each core shall be equipped with a quick-disconnect breather assembly, complete with check valve to prevent accidental entry of water into motor compartment in the event of access way flooding.

The electrical control panel enclosure shall be NEMA 3R or 4X for mounting on the exterior of a building. The enclosure shall be constructed of thermoplastic or fiberglass to ensure corrosion resistance. The enclosure shall have a hinged, pad-lockable access cover. The electrical control panel enclosure shall provide a secured dead front and access knockouts. The enclosure shall not exceed 7.50-inch W by 8.75-inch H by 3.75-inch D.

The panel shall contain a separate 15 amp double-pole breaker for the power circuit and a 15 amp single-pole breaker for the control circuit. The panel shall contain finger-safe terminal blocks, integral power bus and a complete alarm circuit.

Alarm circuit shall consist of alarm relay circuit board, weather-proof/corrosion resistant NEMA 4X alarm light/alarm beacon, audible alarm and an exterior-mounted "push-to-silence" button. Alarm sequence shall be as follows: When liquid level in sewage wet well rises to alarm level, visual alarm will light and audible alarm will sound. Audible alarm may be silenced by pushing the push-to-silence button. Visual alarm will remain lighted until alarm condition subsides.

Audible alarm must be rated by manufacturer to have a sound output of no less than 60 dB at 2 feet. Visual alarm shall be a red fluted lens at least 2-5/8 inches in diameter and 1-11/16 inches in height. Alarm light shall be mounted on the top of the panel enclosure in such a manner as to maintain the rainproof integrity of the panel enclosure.

Cable. Supplier shall furnish a watertight NEMA 4X quick-disconnect and 12 gauge, 6 conductor, SJOW cable for connecting the stations to the control panel. The cable and electric quick disconnect shall be rated for 1 phase, 240 volt, 60 Hertz power supply and meet UL requirements. Cable shall be supplied in bulk reels, the total length of which shall be equal to the total number of stations to be supplied multiplied by the average length of cable listed in the Schedule.

Installer shall install the length of cable necessary to connect the control panel to the pump station. Installer shall make all necessary connections to the quick-disconnect and control panel.

MANUFACTURED UNITS

Basin. The tank for simplex stations shall be made of high-density polyethylene. Corrugated sections are to be made of a double-wall section with the interior wall being generally smooth. The exterior wall shall have corrugations with 1-1/2-inch minimum amplitude. All seams shall be thermally welded and factory tested for

water tightness. Tank shall be designed to withstand bearing pressure from fully saturated soil at the maximum bury depth.

The tank for duplex stations shall be custom-molded of fiberglass-reinforced polyester resin. Tanks of 120-gallon capacity shall have a nominal wall thickness of 1/4 inch, and larger capacity tanks shall have a nominal thickness of 1/2 inch.

The basin capacities shall be as stated in the Schedule.

Installer shall connect to the inlet hub a 1-foot minimum piece of Schedule 40 PVC pipe with plug or cap. The tank for the two-pump station shall be made divided into two equal volumes by a center baffle.

Tanks shall be furnished with EPDM grommet fittings to accept DWV inlet pipes.

The lower portion of the basin shall contain the pump and grinder unit. The upper portion shall be sealed from the lower wet well portion of the basin by an intermediate floor and flanged connection of the core pump unit.

The access way shall be an integral extension of the tank made with dual-wall corrugated HDPE. It shall have an access opening at the top to accept a lockable cover. The basin top and access way shall include the following factory-supplied items: Series 304 stainless steel discharge piping with a surface-operable, positive-sealing, quick-disconnect coupling and a 200 psi stainless steel valve terminating in a factory-warranted watertight bulkhead penetration with external stainless steel 1-1/4-inch female pipe thread fitting. Internal wiring shall terminate in a NEMA 4X electrical quick-disconnect.

To prevent flotation, the basin shall be properly anchored by Installer in accordance with Supplier's written instructions.

Pump And Grinder Core Assembly. The pump station shall have cartridge-type, easily removable core assemblies containing pump, motor, grinder, controls, check valve, anti-siphon valve and wiring. In the duplex stations, two complete assemblies shall be provided, with the necessary piping interconnections on the discharge lines.

The pump shall be a custom-designed, integral, vertical rotor, motor-driven, solids handling pump of the progressing cavity type with mechanical seal. The rotor shall be through-hardened, highly polished, precipitation-hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. The 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, good aging properties, and outstanding wear resistance.

The pump shall be equipped with a factory-installed, gravity-operated, flapper-type integral check valve built into the discharge pipe. This valve will provide a full-port passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. A non-metallic hinge shall be an integral part of the flapper assembly, providing maximum degrees of freedom for assured seating even at a very low backpressure. The valve body shall be made of PVC.

The pump shall be constructed with a positively primed flooded suction configuration. As added assurance that the pump cannot lose prime even under negative pressure conditions in the discharge piping system, the pump shall be equipped with an integral antisiphoning, air relief valve in the discharge piping just below the main check valve. This valve will automatically close when the pump is running and open when the pump is off.

The grinder shall be positioned immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft. The grinder will be of the rotating type with a stationary hardened and ground chrome steel shredding ring spaced in accurate close annular alignment to the driven impeller assembly, which shall carry two hardened type 400 series stainless steel cutter bars. This assembly shall operate without objectionable noise or vibration over the entire range of recommended operating pressures.

The motor shall be a 1 hp, 1725 rpm, capacitor start, ball bearing, squirrel cage induction type with a starting current not to exceed 30 amperes and maximum starting torque of 8.4 foot-pounds.

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

CABLE SPLICE

Supplier shall furnish NEMA 4 cable splice for safe connection of standard length SJOW cable to SJOW cable to be used as extension.

ETM/EC Diagnostic Device. Supplier shall furnish ETM/EC Diagnostic Device. The device shall be a portable unit supplied by the grinder pump manufacturer. The device shall contain an elapsed time meter, ENM Company Model T12C62B, or equal, and an event counter, Diversified Electronics, Inc., Model CMG-0100-20, or equal. These devices shall be enclosed in a NEMA 4X enclosure equipped and designed to be placed temporarily in service using the grinder pump electrical quick disconnects. The grinder pump station must remain fully operational while diagnostic unit is in place.

Portable Auxiliary Power Cable System. Supplier shall furnish an ancillary power cable system consisting of NEMA 4X electrical quick-disconnect, five feet of 12-6 SJOW cable, a control panel (E-One Model 250-1), 100 feet of power cable on a reel, and a male adapter plug compatible with small portable generator. The components shall be connected to safely provide power from a portable generator to a grinder pump and also provide control of the grinder pump station.

SOURCE QUALITY CONTROL

Factory Test. Each grinder pump shall be submerged and operated for five minutes (minimum). Included in this procedure will be the testing of all ancillary components such as the anti-siphon valve, check valve, discharge piping, level sensors, each unit's dedicated controls, respective alarm/disconnect panel, etc. All factory tests shall incorporate each of the above-listed items. Actual appurtenances and motor controls which will be installed in the field shall be particular to the tested pump only; a common set of appurtenances and motor controls for all pumps will not be acceptable. Certified test results with dates, serial number and signature shall be supplied showing the operation of each grinder pump at two (2) different points on its curve, with the maximum pressure no less than 60 psi.

PART 3 - EXECUTION

EXAMINATION

Site Verification of Conditions. Installer shall be an active participant in the process of determining pump station locations. Installer shall confer with each property owner and ENGINEER to discuss functional requirements of the systems, construction concerns, construction methods, and property OWNER's site preferences. Installer shall request information on underground facilities the property owner has such as yard lighting, satellite cable, sprinkler pipes, drainage pipes or drain fields. ENGINEER shall use information gathered to establish the pump station location.

Installer shall also assist ENGINEER in determining the station depth and need for installing access way extensions. Three measurements shall be made to determine depth: the distance for the pump station location to the building sewer at the building line, the elevation of the lowest floor served by a sanitary drain, and the ground surface elevation at the pump station.

The pump station inlet centerline elevation shall be calculated by subtracting 2 feet from the lowest floor elevation and 1/4-inch per foot of distance to the station. The distance between surface elevation and inlet center line elevation is the depth.

INSTALLATION

Install anti-flotation ballast or concrete anchor onto the pump station prior to installation of the grinder pump station. Install the grinder pump station as shown on the Drawings.

Trench and lay wires for pump to building within five (5) working days of installing pump station and service lateral to minimize disruption to property owners. The Installer shall install the underground wiring while installing the underground piping.

Install direct-buried cable 2 feet, 6 inches below grade, marked by ribbon or tape a minimum of 12 inches below grade and cover with sand and gravel as shown on the Drawings.

Make buried conduit joints watertight by coating threaded portions with a brush-on type paint containing 90 percent minimum by weight of metallic zinc powder in the dried film. Spray-can type paint will not be permitted. First clean field-threaded conduit of cutting oil, using the zinc-bearing paint manufacturer's recommended solvent before applying the zinc-bearing paint to the threaded length of the conduit. The conduit is then screwed into the mating threads. Paint threads whether field-threaded or factory threaded.

Mandrel each conduit bend. Run a non-metallic mandrel not more than 0.25-inch smaller than the inside diameter of the conduit through conduit and follow by a wire brush. A swab shall be run through to clean out any loose dirt or other foreign material.

Use conduit bushings on conduit terminated by double locknuts. Permanently fix a thermosetting insulating insert to the interior surface of the bushings. Grounding bushings are required on conduit entering enclosures without hubs or without double locknuts fastening the conduit to the enclosure.

Provide equipment grounding conductors for feeder circuits even if such feeder circuits are contained in grounded steel raceways. Attach equipment grounding conductors for feeder circuits continuously from ground bus to ground bus at each piece of equipment.

FIELD QUALITY CONTROL

Testing and Start-up. ENGINEER shall coordinate testing of pump stations. Installer shall provide portable power generators (if needed) and testing water for on-site checkout by Supplier's representative.

Supplier shall provide the services of qualified factory-trained technician(s) who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the OWNER's personnel in the operation and maintenance of the equipment before the stations are accepted.

The services of a trained factory-authorized technician shall be provided by CONTRACTOR at a rate of one (1) four (4)-day week for each 100 grinder pump station supplied. Each day shall be ten (10) person hours long.

Upon completion of the installation, the authorized factory technicians will perform the following test on each station:

1. Make certain the discharge shutoff valve is fully open. In some installations, there may be a valve(s) at the street main that must also be open.
2. Turn ON the alarm power circuit.
3. The installer shall fill the wet well with water to a depth sufficient to allow the technician to verify that the high level alarm is operating.
4. Turn ON pump power circuit. Initiate pump operation to verify that automatic "on/off" controls are operative. Pump should immediately turn ON. Verify that alarm light will turn OFF as liquid level falls below alarm point. Verify pump shuts OFF at proper liquid level.

Prior to pump operation acceptance and operation, furnish ENGINEER with a start-up report signed by Supplier's representative for each station.

CLEANING

Remove sand and gravel within basin prior to placing station in operation.

PROGRESSING CAVITY GRINDER PUMPING STATION SCHEDULE

Simplex Pump Stations:

Size:	70 gallon (minimum storage basin)
Type:	Progressing Cavity, 1 core per unit
Motor:	240 volt, 1 phase, 1 Hp
Pump:	7.8 gpm at 184.8-ft TDH 11 gpm at 92.4-ft. TDH 15 gpm at 0-ft. TDH
Influent Pipe Size:	4 inches
Exterior Power Cable:	30 LF per unit, SJOW type

END OF SECTION 11308