SECTION 16

UTILIZATION OF SEWAGE/EFFLUENT PUMPS

The information outlined in this section shall be utilized in the design and assembly of all conventional subsurface sewage disposal systems which require the utilization of sewage/effluent pumps, related controls and alarm system, pump tanks and all piping components. Additionally, the methodology prescribed for the assembly of all aforementioned items and components, shall also apply in the construction of LPP, MLPP, Drip and Mound Systems.

A. Pump Tank

1. The pump tank, access riser and riser cover shall be watertight, structurally sound and not subject to excessive corrosion or decay.

   (a) The pump tank shall be of a single (i.e. one) compartment design. Pump tanks shall be constructed in accordance with the specifications outlined in *Section 10*.

   (b) The pump tank shall be appropriately placed so as to provide ground-level access, and the riser cover shall be visibly exposed at the ground surface.

   (c) The access riser shall have a minimum diameter of twenty-four (24) inches and extend to the finished grade or above so as to provide visible identification of said access.

   (d) The access riser shall be located at the outlet end of the tank, directly above the pump, supply line, switches and any other component or fixtures.

2. The pump tank volume shall be sized in accordance with the specifications in *Section 18*.

B. Pump

1. Pump Sizing Requirements

   (a) The minimum flow, in gallons per minute (gpm), and the proper pipe size for a pump system, shall be calculated in order to achieve a minimum scour velocity of 2.5 feet per second, in accordance with Table A13-1 in *Appendix 13*.

   (b) The total dynamic head (TDH) must be correctly calculated to ensure the proper pump selection for a particular site. The Department shall review and verify all TDH calculations for any subsurface sewage disposal system requiring the use of a pump. Since the calculations for the TDH on a site utilizing an Alternative System are made by the design engineer, they will automatically be reviewed by the Department during the Alternative System design review process.

   Where conventional systems require the use of a pump, the installer may request the Department to determine the TDH of a site, or if the installer chooses to determine the TDH for a site, they shall submit the calculations to the Department for review and approval prior to the system installation. This submitted documentation must also include the appropriate topographical information.

   (c) The TDH shall be calculated using the following information:

      (1) Elevation head (EH) is the difference in elevation from the pump and to the highest ground elevation of the disposal field area. Remember that the pump will be four (4) or five (5) feet below ground level in the pump tank.

      (2) Friction head (FH) is the loss of pressure due to friction as the effluent moves through the pipes and shall be determined using Table A13-2 in *Appendix 13* of these regulations. When estimating pipe friction, use the total length of supply line (and manifold line where applicable), but not the field lines. Add twenty (20) percent to this estimate to account for friction loss in all joints and fittings. Note that friction loss varies with pumping rate as well as with pipe length and diameter.

      (3) Pressure head (PH) is the amount of pressure desired at the distribution network and shall be a minimum of five (5) feet.

      For conventional systems, the only time pressure head (PH) should be accounted for in the total dynamic head (TDH) calculation is when a pressure distribution manifold (PDM) is utilized. Otherwise, it can be negated from the TDH calculation.

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(4) A *Safety factor (SF)*, as described below, shall be added to the sum of EH plus FH plus PH. This factor of safety shall be based upon the potential elevation head (EH) and shall be dependent upon two factors:

(i) The accuracy and exactness of the location of the proposed house and its related tanks and pump; and

(ii) The extreme potential elevation difference across the house site or building envelope.

The minimum safety factor (SF) shall be two (2) feet. If locations of the house, tanks and/or pump are exact and accurate, or if the house site or building envelope is relatively flat or level (i.e., extreme elevation change across the house site or building envelope is less than or equal to two [2] feet based on required topographical information), then the assigned SF shall be that of the minimum required (i.e., a safety factor equal to two [2] feet).

If however, the house, tank(s) and/or pump locations are only general in nature and not exact, then the SF shall be equivalent to the worst case scenario of where the pump/tank could be located, plus the minimum required safety factor. Thus, for such a case, the total safety factor shall be equal to the greatest potential elevation change across the house site or building envelope (based on the required topographical information), plus an additional two (2) feet.

(5) Thus, the TDH is determined by the following formula:

TDH = EH + FH + PH + SF

IMPORTANT NOTE: The minimum assigned total dynamic head shall be ten (10) feet

(6) Additional headloss must be accounted for and included in the TDH calculations when miscellaneous components and fittings are included in the system design. Examples of such components that require additional headloss calculations include, but are not limited to, multi-zone valves, in-line pressure filters, air-relief valves, pressure regulators, flow meters, and drip system filters and headwork assemblies, etc.

2. Pump Selection

(a) The submersible pump shall be of a type that has been specifically designed for use and application in the septic tank/sewage environment, and shall be of sufficient quality so as not to be corroded by sewage. No other type of pumps (e.g. sump pumps, water pumps, grinder pumps, well pumps, etc.) shall be approved nor allowed for this use. The pump shall be located in the pump tank.

(b) The pump shall be of sufficient size so as to meet and/or exceed the design capacity (i.e. the flow requirement and the total dynamic head requirement) stipulated for the specific system and site it is intended to serve.

(c) The Department retains the authority to mandate the use of a different pump (i.e. regarding size, horsepower, pumping capacity, etc.), for a site/installation, in lieu of any previously specified or installed pump, as deemed necessary.

IMPORTANT NOTE: The pump shall meet all provisions outlined in Appendix 12.

C. Pump Controls

1. All float switches shall be of a sufficient quality and material so as to perform under turbulent conditions and be resistant to the corrosive nature of the effluent.

2. The controls shall be sealed to prevent the entry of corrosive and explosive gases from the effluent, and shall have NEMA (National Electrical Manufacturing Association) approval.

3. The pump controls shall be either sealed mercury float switches or sealed, self-contained mechanically-activated float switches.

(a) Mercury switches are activated by a sealed float which contains a tube of mercury in contact with power leads.

(b) The only approved mechanically-activated type switches shall be of the same design principle as that of the mercury-type switches. In lieu of a tube of mercury, the mechanical switches employ a steel ball to activate the electrical contacts.

(c) Diaphragm-type switches or vertically rising mechanical-type float switches are not acceptable and shall not be utilized.

4. For demand dosing, the pump control system may employ either a single float switch or a dual float switch arrangement, operating in series, to control pump operation.

5. For time dosing, the pump control system shall employ a minimum three float set-up to control pump operation; consisting of a timer enable/low level cutout float, a timer override float and an alarm float. An optional fourth float, a redundant off float, may also be used.

D. Alarm System

1. A high water alarm system shall be required on all pump installations.

2. The alarm system shall emit an audible and visual signal.

3. The alarm system shall be located in the electrical control panel in accordance with the specifications outlined in Subsection F.

4. For demand dose systems, the alarm float control shall be placed so as to be activated when the pump tank water level rises above the *pump on* float control. For time dose systems, the alarm float control may be installed either above or below the timer override float, depending on the specific situation and application.

E. Piping and All Related Components (Excluding Electrical Components)

1. All piping materials (i.e. pipe, fittings, etc.) shall be pressure-rated Schedule 40 PVC and shall conform to the provisions as set forth in *Appendix 12*.

2. All PVC fittings shall be pressure-rated and shall conform to the provisions as set forth in *Appendix 12*.

3. All check valves shall be constructed of either PVC, brass or bronze and shall conform to the provisions as set forth in *Appendix 12*.

4. All threaded unions shall be PVC and shall conform to the provisions as set forth in *Appendix 12*. In lieu of PVC threaded unions, other similar connecting devices may be utilized, as approved by the Department on an individual basis.

5. All pre-manufactured discharge assemblies associated with vertical turbine pumps shall conform to the provisions as set forth in *Appendix 12*.

6. All gate or ball valve(s), where a Pressure Distribution Manifold is being utilized, or in any other instance where the Department has determined that such valve(s) are required, shall be brass or bronze and shall conform to the provisions as set forth in *Appendix 12*.

F. Electrical Components

This Subsection shall address all Department requirements regarding the proper setup and connection of the electrical components associated with the use of sewage/effluent pumps. Thus, since all alternative systems (i.e. LPP systems, MLPP systems and Mound systems) require the use of sewage/effluent pumps, as do a percentage of conventional systems, those particular types of septic systems shall be considered as *Electrically Assisted Systems* (*EAS*). Therefore, the provisions of this *Subsection* shall apply to all subsurface sewage disposal systems which employ the use of sewage/effluent pumps.

IMPORTANT NOTE: All electrical installations shall be installed to meet the current wiring methods of the current edition of the National Electric Code (NEC).

1. Permitting of EAS Subsurface Sewage Disposal Systems

   Where the Department has specified that a property shall require the use of an EAS, the Department shall refuse to issue a Construction Permit for that property until the permit applicant has first procured a separate electrical permit for the inspection of the electrical service and its related components for the EAS.

2. Obtaining the Required EAS Electrical Permit

   Such permits are to be procured from the State of Tennessee, Department of Commerce and Insurance or one of their authorized issuing agents.

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IMPORTANT NOTE: The electrical wiring permit, for a structure, does not include the permit for the wiring of an EAS. Separate permits for an EAS are required and the Williamson County Department of Sewage Disposal Management shall not issue any Construction Permit for an EAS in the absence of proof of a proper electrical wiring permit for said system.

Additionally, the Department shall refuse to sign any *Certificate of Occupancy*, nor will the department grant final approval to any EAS where the electrical inspector has found deficiencies and has not granted approval to the EAS electrical service and its related components. Valid proof of the EAS electrical service approval and serviceability from the electrical inspector's office shall be required before final installation approvals shall be granted or before any *Certificate of Occupancy* will be released.

3. Control Panel and Electrical Requirements

(a) Securing Control Panel

(1) Where the electrical control panel is mounted on the pump tank the following specifications shall apply:

(i) It shall be mounted via a two (2) inch diameter galvanized steel standpipe permanently affixed to the top of the pump tank. A pass-through hole (2 inch minimum diameter) shall be bored through the tank top to allow for passage of the pump wiring and controls. The stand-pipe shall be anchored to the tank top via a permanently affixed flange centered over the pass-through hole to allow the wiring to exit the tank and enter the control panel through the stand pipe. Explosion proof seals (with approved seal compound) shall be required at the tank/stand-pipe connection and the stand-pipe/control panel connection in order to prevent gases from exiting the pump tank and entering the electrical control panel.

(ii) There shall be no splices of any wiring between the pump and the control panel.

(iii) There shall be a Ground Fault Interrupt (GFI) receptacle installed at the control panel if the distance from said control panel to the house or structure is more than twenty-five (25) feet.

(iv) All wiring conduit and associated strapping connectors shall be of the rigid type, in accordance with the NEC requirements.

(v) Two (2) inch conduit shall have plastic bushings, with the appropriate lock nut, in accordance with the NEC.

(vi) All materials exposed to the sewage/effluent/wastewater and/or its related gases, shall have inherent corrosion protection.

(vii) All exterior steel surfaces shall be suitably protected against corrosion.

(viii) The electrical control panel shall be mounted a minimum of two (2) feet above the finished grade of the ground surface.

(ix) The panel front shall be oriented so that it can be observed from the pump access portal of the pump tank.

(2) Where the electrical control panel is mounted immediately adjacent to the pump tank the following specifications shall apply:

(i) The panel shall be mounted on a pressure treated post (pressure treated post grade shall be specified as meeting the .40 retention, Ground Contact Application standard) having the dimensions of six (6) inches by six (6) inches.

(ii) The post shall be installed a minimum of thirty-six (36) inches deep into undisturbed earth; a lesser minimum depth of eighteen (18) inches may be permitted, provided it is reinforced with concrete.

(iii) The post shall be located within two (2) feet of the front of the pump tank.

(iv) The control panel front shall be oriented so that it may be observed from the pump access portal of the pump tank.

(v) The electrical control panel shall be mounted a minimum of two (2) feet above the finished grade of the ground surface.

(vi) The electrical control panel shall be firmly affixed to the six (6) inch by six (6) inch post with screws specifically approved for use with electrical installations.

(vii) A two (2) inch minimum diameter pass-through hole shall be bored through the side of the pump tank (i.e. on the same end of the tank as the pump) to provide for passage of the pump wiring and controls. Said pass-through hole shall be located so as to be centered within the required tank air-space (i.e. air-space as in accordance with the provisions in *Section 10*).

(viii) A two (2) inch minimum diameter conduit shall be permanently affixed over the pass-through hole to allow the wiring to exit the tank and enter the control panel through the conduit.

(ix) Explosion proof seals (with approved seal compound) shall be required at the tank/conduit connection and at the conduit/electrical control panel connection in order to prevent gases from exiting the pump tank and entering the electrical control panel.

(x) There shall be no splices of any wiring between the pump and the control panel.

(3) Where the electrical control panel and electrical disconnect switch is mounted on an outside wall of the house or structure, the following specifications shall be met:

(i) All wiring splices shall be housed within a NEMA 4X, UL listed junction box located within and affixed to the pump tank access riser located directly above the pump.

(ii) Explosion proof seals, with approved seal compound, shall be installed at the conduit entrance and exit of the junction box and additionally at the conduit entrance to the pump electrical control panel in order to prevent gases from exiting the pump tank and entering the electrical control panel.

(iii) The electrical wiring leaving the junction box (located within the pump tank access riser) shall be encased in its entirety in one and one-half (1½) inch minimum diameter conduit from the exit of the junction box to the entrance of the electrical control panel (located on the outside wall of the structure). At the installer's discretion, the electrical wiring between the junction box and the electrical control panel may be housed in separate conduits. Where separate conduits are utilized, one half (½) inch minimum diameter conduit shall be required. All conduit and related connections shall be watertight.

(iv) All electrical wiring from the electrical service equipment panel of the house or structure to the pump electrical control panel shall be encased in one and one-half (1½) inch minimum diameter conduit. Said conduit shall extend between the electrical service equipment panel of the house or structure and the electrical disconnect switch (which must be housed in a lockable NEMA 4X watertight enclosure) located on the outside wall of the house or structure. Said conduit shall also extend between the electrical disconnect switch housing and the pump electrical control panel (also located on the outside wall of the house or structure).

(v) All wiring (both pump electrical service and controls) shall meet the minimum rating for conductor size and amp capacity rating as established by the current edition of the National Electrical Code.

(vi) The conduit housing the electrical service wiring from the pump electrical control panel (located on the outside wall of the house or structure) to the NEMA 4X junction box (located within the pump tank access riser) shall be buried in accordance with the following conduit-type use:

a. A minimum of six (6) inches below what will be the finish graded ground surface level, where Intermediate Metal Conduit (IMC) or rigid conduit is utilized.

b. A minimum of eighteen (18) inches below what will be the finished graded ground surface level, where PVC conduit is utilized.

(vii) All grounding apparatus and methodology shall be in accordance with the NEC, in addition to any local electrical codes that may apply.

IMPORTANT NOTE: All electrical work shall be inspected prior to back-filling tank hole and all associated ditches containing electrical conduits.

(b) Electrical Control Panel Requirements

Any and all electrical control panels utilized on subsurface sewage disposal systems shall contain, but shall not be limited to, the following features:

(1) Shall be Underwriters Laboratory (UL®) listed.

(2) Shall be National Electric Manufacturers Association (NEMA) 4X watertight enclosure with lockable hasp.

(3) Shall contain an alarm horn (83-85 decibel rating).

(4) Shall contain a top-mounted, visual, red-lighted beacon providing for a 360° visual check of the alarm condition.

(5) Shall contain an exterior horn silence switch.

(6) Shall contain an exterior alarm test switch.

(7) Shall contain an exterior green pump run indicator light.

(8) Shall contain a Hands Off and Auto (HOA) switch for manual pump operation.

(9) Shall contain a terminal strip, mounted in the box, clearly marked for easy identification and installation of alarm, pump and pump control wiring.

(10) Shall contain a circuit breaker.

(11) Shall contain a wiring diagram integral within the electrical control panel.

(12) Shall have a lockable hasp on the panel door.

(13) Shall be fastened with proper screws, specifically approved for use with electrical installations.

(14) Conductors shall be sized to NEC requirements for electrical and breakers.

(c) Additional Requirements for EAS

The following procedures shall apply to all of the electrical components starting from the house or structure electrical service panel to the pump electrical control panel.

(1) The electrical service line to the pump electrical control panel shall be on a separately dedicated and clearly identified circuit. That section of the pump electrical control panel which controls the alarm shall require a separate wire feed. This wire shall be connected to a commonly used household circuit breaker which is located in the house or structure electrical service panel. This is required so as to provide notice to the homeowner when the alarm has been tripped.

(2) All electrical service wiring and related conduits and appurtenances shall be in accordance with the NEC, in addition to any local codes that apply.

(3) The electrical service wiring shall be encased in one and one-half (1½) inch minimum diameter conduit from the house or structure to the pump electrical control panel. The conduit shall be water-tight.

(4) A suitable disconnect, in accordance with the NEC, shall be installed on either the pressure treated post (where applicable) or the pump electrical control panel stand-pipe to provide for power shut off independent of the house or structure electrical service panel.

(5) The disconnect shall be housed in a NEMA 4X water-tight enclosure with lockable hasp.

(6) The disconnect shall be connected to the pump electrical control panel via conduit. Explosion proof seals (with approved seal compound) shall be installed over the conduit entrance into the pump electrical control panel.

(7) All grounding apparatus and methodology shall be in accordance with the NEC, in addition to any local electrical codes that may apply.

(8) The conduit housing the electrical service wiring from the house or structure to the pump electrical control panel shall be buried, in accordance with the following conduit-type use:

(i) A minimum of six (6) inches below what will be the finished graded ground surface level, where Intermediate Metal Conduit (IMC) or rigid conduit is utilized.

(ii) A minimum of eighteen (18) inches below what will be the finished graded ground surface level, where PVC conduit is utilized.

(9) At the installer's discretion, the electrical wiring between the pump electrical control panel and the junction box may be housed in separate conduits. Where separate conduits are utilized, one half (½) inch minimum diameter conduit shall be required. All other requirements pertaining to explosion proof seals, connectors and conduit usage shall apply as specified in these regulations.

IMPORTANT NOTE: ALL ELECTRICAL WORK SHALL BE INSPECTED PRIOR TO BACKFILLING TANK HOLE AND ALL ASSOCIATED DITCHES CONTAINING ELECTRICAL CONDUITS.

G. Assembly and Setup of Components

1. Assembly

(a) The pump tank shall be set in such a manner so that the inlet to the pump tank is a minimum of four (4) inches lower in elevation than the outlet of the septic tank.

(b) The pump tank shall have all of its additional components assembled in order to meet all provisions of Subsection A of this Section.

(c) The pump shall be placed at the end opposite of the pump tank inlet.

(d) Unless housed in an approved filter vault, the pump shall be set to ensure that the intake is a minimum of eight (8) inches above the bottom of the pump tank. A solid base or platform shall be provided for the pump to set upon. An acceptable practice is to utilize standard eight (8) inch concrete blocks (typically two blocks placed side by side for stability). See *Appendix 14* design detail.

(e) All electrical control cables (i.e. wiring of any type) shall be routed through conduit installed through the tank in accordance with the provisions of *Subsection F of this Section*.

(f) The controls and conduit (i.e. the end of the conduit inside the tank) shall be sealed in accordance with the provisions of *Subsection F of this Section*.

(g) The conduit/tank interface shall be constructed in accordance with the provisions of *Subsection F of this Section*.

(h) The controls shall be adjustable and properly secured to the stand pipe by ~~plastic cable ties~~ non-corrodible clamps or brackets. Pre-manufactured float tree assemblies may be used.

(i) The ~~cable tie~~ clamps and brackets shall be arranged around the stand pipe in such a manner so as to ensure against slippage, up or down the pipe. See *Appendix 14* for design detail.

(j) The pump outlet pipe shall be connected to the supply line with a threaded union, or similar device, to allow for easy and quick removal of the pump. See *Appendix 14* design detail.

(k) A gate valve shall be installed in the supply line, on the outlet side of the union or similar disconnecting device (*i.e.*, between the union and where the discharge pipe exits the pump tank), to allow pipe shutoff for pump removal/replacement. See *Appendix 14* for design detail.

(l) Where a check valve is required, it shall be installed with threaded fittings in the pump tank, between the gate valve and the union, to provide easy access for maintenance.

(m) The supply line shall be designed and installed so as to drain after each use, unless system design requires a check valve. Should a check valve be required, See *Part 2, subpart (c) "Pumping Uphill", of this Subsection*.

(n) Where the use of a check valve has been specified by the Department, a supply line pipe shall be buried a minimum of twelve (12) inches below the existing ground surface. Thus, the supply line trench shall be excavated to sufficient depth so as to ensure that the crown of said pipe lies twelve (12) inches below the ground surface throughout the entire length of the supply line to prevent freezing of the effluent held in said supply line.

NOTE: Where any impediment, in attaining this minimum depth, is encountered during the excavation of the supply line trench (e.g. encountering bedrock, etc.) and the specified depth cannot be maintained, those portions of the trench being less than the required depth shall be bedded with a minimum of six (6) inches of an approved (i.e. by the Department) insulating material (e.g. clay, saw-dust, crushed disposal field gravel media, etc.) on which the supply line pipe shall rest. The remaining depth of backfill or cover shall consist of imported soil fill material. This material shall be of sufficient depth so as to provide the minimum of twelve (12) inches of cover, and said depth shall extend to a distance of eighteen (18) inches to either side of the pipe.

(o) *IMPORTANT:* A check valve shall always be installed on any conventional subsurface sewage disposal system, utilizing a sewage/effluent pump setup, where the installation of an Effluent Brake Device has been specified by the Department. Thus, the provisions outlined in *Part 2, subpart (c) "Pumping Uphill", of this Subsection* do not apply in this situation.

(p) All PVC connections shall be primed with purple PVC primer and glued with PVC solvent cement. See *Appendix 12.*

(q) As a means to remove the pump from the pump tank, a material of sufficient strength and durability (*i.e.*, a non-corrodible material) shall be secured to the pump, pump outlet pipe and access riser. An acceptable practice is to utilize nylon rope or a heavy-duty plastic chain capable of supporting the weight of the pump and pipe. See *Appendix 14* design detail.

(r) All line connections to the pressure distribution manifold shall be accomplished via PVC tees and/or crosses. No screw-in or tapping arrangements into the pressure distribution manifold shall be allowed. See *Appendix 11* for design detail on Pressure Distribution Manifold Construction.

2. Setup

(a) Dosing Volume

For demand dosing to conventional, LPP/MLPP and Mound systems, the dosing volume shall be between one-fourth and one-half daily flow, except in those situations where the minimum dose exceeds one-half daily flow, then the calculated minimum dose shall be the dosing volume. For time dosing to Drip systems, the dosing volume shall be in accordance with the guidelines outlined in *Section 39*.

(b) Float Controls

(1) The pump control shall be positioned so the *pump off* switch is slightly above the top of the pump and the *pump on* switch is at the desired dosing depth. The *pump off* switch for pumps specifically designed to operate with the pump motor casing exposed to air, may be located at a lower elevation provided an adequate depth of wastewater is maintained above the pump intake to insure that the pump intake will not draw in air. See *Appendix 14* design detail.

Note: Care shall be taken to ensure that the floats are properly secured to prevent them from becoming fouled or entangled by other components such as the electrical power cord to the pump or the pump lifting rope.

(2) It may be necessary for the system installer to make adjustments to the float controls after a system has been installed and in use. Should this be necessary, the installer shall notify the Department and provide information on where such work was required, the date it was completed and the reason for the adjustment.

(c) Pumping Uphill

When pumping uphill, a check valve shall be utilized if the volume of effluent which will flow back into the tank exceeds one-fourth of the daily flow.

When a check valve is utilized, a vent hole shall be drilled in the discharge pipe below the check valve, inside the pump tank, to purge the pump of trapped air (*This practice is also recommended by the Sump & Sewage Pump Manufacturers Association - SSPMA*).

(1) The vent hole size shall be in accordance with the pump installation instructions provided by the pump manufacturer.

(2) An extra two (2) gallons per minute (gpm) shall be added to the pumping rate to compensate for flow through the vent hole.

Example:
For a system with 36 gpm flow rate and a vent hole.
Total flow rate = 36 gpm + 2 gpm = 38 gpm

(d) Pumping Downhill

For systems where the absorption field is at a lower elevation than the pump, a 1/4-inch siphon-breaker hole must be drilled in the supply line inside the pump tank. This hole will prevent inadvertent siphoning of the contents of the pump tank into the field. An extra two (2) gallons per minute (gpm) must be added to the pumping rate to compensate for flow through the siphon-breaker hole.

Example:
For a system with 36 gpm flow rate and a siphon-breaker hole.
Total flow rate = 36 gpm + 2 gpm = 38 gpm