Guidance for *R309-540. Facility Design and Operation: Pump Stations.*

R309-540-5. Pumping Facilities.

Location.

- *Subsurface pits or pump rooms and inaccessible installations should be avoided.*

Pumping Stations - Stairways and Ladders.

- *Ramps are preferred in areas where there is frequent traffic or where supplies are transported by hand. Where ramps are not possible, stairs are preferred to ladders.*

Pumping Stations - Heating.

- *In pump houses not occupied by personnel, only enough heat need be provided to prevent freezing of equipment or treatment process.*

Pumping Stations – Ventilation.

- *In areas where excess moisture could cause hazards to safety or damage to equipment, means for dehumidification should be provided.*

Booster Pumps - Individual Home Booster Pumps.

- *Refer to Guidance found in R309-550-11(3)*

Automatic and Remote-controlled Stations – Signaling Apparatus.

- *All automatic stations should be provided with automatic signaling apparatus which will report when the station is out of service.*

Appurtenances - Gauges and Meters.

- *Larger pumping stations should have a means for measuring the discharge. The station should have indicating, totalizing, and recording metering of the total water pumped.*

R309-540-6. Hydropneumatic Systems.

Location.

- *It is preferred that pressure tanks and appurtenances be located above ground and be protected.*

Pressure Tanks – Disinfection CT.

- *Sizing of hydropneumatic storage tanks should consider the need for disinfectant contact time.*

Pressure Tanks – Access Opening for a Large Tank.

- *For larger pressure tanks, the access manhole should be a minimum 24 inches in diameter.*

Pressure Tanks – Minimum Volume.

- *Volume (min) > = S + CX/4W*
  where the following values are used in the equation above:
  C = minutes per operating cycle, four minutes to meet the requirements of R309-540-6(5) above or preferably six minutes, and is equal to pump ON time plus pump OFF time.
  X = output capacity rating of the pump(s) at the high pressure condition in the tank(s), in gpm.
  W = percent of volume withdrawn during a given drop in tank pressure: specifically, between P_h and P_l. W = 100(P_h- P_l)/P_h where P_h = high pressure in tank in psia (high absolute pressure) and P_l = low pressure in tank is psia (low absolute pressure). Values of W range typically from 0.26 to 0.31 for pressure differentials of 15 to 30 psi and high system pressures of 45 to 85 psi at elevations of approximately 5,000 feet.
  S = water seal volume in gallons, the volume of inactive water remaining in tank at low pressure condition.
- *As a rule-of-thumb the minimum volume of the hydropneumatic tank should be at least five times the capacity of the pump(s), rated in gpm. For example, a 200 gpm pump or combination of pumps should have a 1,000 gallon pressure tank.*

Water Seal – Pressure Tanks without Internal Diaphragm.

- *To prevent the formation of a vortex, a covering baffle may be installed over a vertical bottom outlet large enough to limit the peripheral velocity of approach to the baffle to 0.5 ft/sec of less. At low absolute pressure the depth of water over the top of the baffle should be about one outlet pipe velocity head or greater. For either horizontal or vertical outlets, the pipe outlet itself should be large enough to limit the maximum axial velocity in the pipe to 4.0 ft/sec or less. The use of anti-swirl vanes is always desirable.*