

# CHAPTER V PUMP STATIONS

## V.A PUMP STATIONS

### V.A.1 Location

(1) New facilities are to be located:

PHC 19-13-B102(d)

(A) Above the level of the one hundred year flood

(B) Where chlorine gas will not be stored or used within three hundred feet of any residence

(C) Where the facility is not likely to be subject to fires or other natural or manmade disasters.

### V.A.2 Site Protection

The station shall be

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- a. elevated to a minimum of three feet above the 100-year flood elevation, or three feet above the highest recorded flood elevation, whichever is higher, or protected to such elevations,
- b. readily accessible at all times unless permitted to be out of service for the period of inaccessibility,
- c. graded around the station so as to lead surface drainage away from the station,
- d. protected to prevent vandalism and entrance by animals or unauthorized persons.

### V.A.3 General

- (1) Well pit and/or pumphouse construction shall be designed to prevent the entrance of rodents and other small animals. All facilities shall be locked and fenced and otherwise protected and secured to prevent entrance of unauthorized persons;
- (2) Adequate drainage of all well houses and pits including the use of floor drains shall be provided as required in PHC Regulation 19-13-B51h;
- (3) Necessary electrical controls shall be installed to enable both manual and automatic operation of all pumps, motors and accessory equipment. All controls must be clearly labeled as to their function. All electrical wiring, controls and appurtenances shall be installed in conformance with the National Electrical Code;

DPUC 16-265m-8(m)

- (4) Flow meters capable of measuring totalized an instantaneous flow shall be installed to accurately measure independently each source of supply and

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(continued)

their installation shall provide for ease of meter reading, repair and/or removal. Additional meters may be required where water treatment and/or other conditions dictate.

- (5) Water treatment, when required, shall be installed in accordance with procedures established by the Department of Health Services;
- (6) Smooth end (e.g. threadless chrome) sampling taps shall be installed on the discharge line of each well and at representative point(s) off the discharge pipe(s) coming from the storage tank(s). Where treatment is used, taps before and after treatment facilities shall also be installed. Taps shall be at least 12 inches above the finished floor and any possible high water level. Taps must point downward;
- (7) Suitable over and under voltage protection shall be provided on the various electrical equipment;
- (8) The waterworks facilities shall be provided with suitable lighting, heat and ventilation. If necessary, a dehumidifier shall be used during summer operations;
- (9) The pumphouse, wells and other plant facilities should be accessible to the various maintenance vehicles.

#### **V.A.4 Design Capacity**

- Sources of supply, treatment, pumping, transmission and storage facilities of sufficient capacity shall be maintained to provide flows in excess of the maximum flows experienced in the community water system, and in individual service zones within integrated systems. Whenever peak period consumption interrupts water service to consumers under normal conditions, conservation measures that effectively reduce consumption shall be promptly instituted for the community water supply, and a program to provide sufficient supply, treatment, pumping, transmission, and storage capacity to meet existing and projected peak period consumption shall be implemented.

PHC 19-13-B102(p)

#### **V.A.5 Equipment Servicing**

Pump stations shall be provided with

- a. crane-ways, hoist beams, eyebolts, or other adequate facilities for servicing or removal of pumps, motors, or other heavy equipment,
- b. opening in floors, roofs, or wherever else needed for removal of heavy or bulky equipment,
- c. a convenient tool board, or other facilities as needed, for proper maintenance of the equipment.

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#### **V.A.6 Stairways and Ladders**

Stairways or ladders shall

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- a. be provided between all floors, and in pits or compartments which must be entered
- b. have handrails on both sides, and treads of non-slip material. Stairs are preferred in areas where there is frequent traffic or where supplies are transported by hand. They shall have risers not exceeding nine inches and treads wide enough for safety.

**V.A.7 Heating**

Provisions shall be made for adequate heating for

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- a. the comfort of the operator,
- b. the safe and efficient operation of equipment.

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

**V.A.8 Ventilation**

Ventilation shall conform to existing local and/or state codes. Adequate ventilation shall be provided for all pumping stations. Forced ventilation of at least six changes of air per hour shall be provided for:

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- a. all confined rooms, compartments, pits and other enclosures below ground floor.
- b. any area where unsafe atmosphere may develop or where excessive heat may be built up.

**V.A.9 Dehumidification**

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

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**V.A.10 Lighting**

Pump stations shall be adequately lighted throughout. All electrical work shall conform to the requirements of the National Electrical Code or to relevant state and/or local codes.

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**V.A.11 Sanitary and Other Conveniences**

All pumping stations that are manned for extended periods should be provided with potable water, lavatory and toilet facilities. Plumbing must be installed as to prevent contamination of a public water supply. Wastes shall be discharged in accordance with Section IV.M of this document.

RSWW 6.2.8

**V.A.12 Automatic and Remote Controlled Stations**

All automatic stations should be provided with automatic signaling apparatus which will report when the station is out of service. All remote controlled stations shall be electrically operated and controlled and shall have signaling apparatus of proven performance. Installation of electrical equipment shall conform with the applicable state and local electrical codes and the National Electrical Code.

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**V.A.13 Well Pit**

- a) The use of a well pit shall be avoided whenever practical. When used, it shall be large enough to permit ready access to equipment.
- b) A well pit and its juncture with any other structure shall be watertight, or suitably drained to insure dryness as provided in section 19-13-B51i.
- c) Every conduit or similar connection with a well pit shall be made watertight.

PHC 19-13-B51h

**V.A.14 Confined Spaces**

- *Occupational Safety and Health Standards*
- *Confined Space*

Title 29 CFR 1910

Title 29 CFR 1910.146

Confined space means a space that:

- (1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- (2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and
- (3) Is not designed for continuous employee occupancy.

Non-permit confined space means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Permit-required confined space (permit space) means a confined space that has one or more of the following characteristics:

- (1) Contains or has a potential to contain a hazardous atmosphere;
- (2) Contains a material that has the potential for engulfing an entrant;
- (3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- (4) Contains any other recognized serious safety or health hazard.

If the workplace contains permit spaces, the employer shall inform exposed employees, by posting danger signs or by any other equally effective means, of the existence and location of and the danger posed by the permit spaces.

Title 29 CFR 1910.146  
(continued)

Note: A sign reading “DANGER-PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER” or using other similar language would satisfy the requirement for a sign .

#### **V.A.15 Suction Well**

Suction wells shall

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- a. be watertight,
- b. have floors sloped to permit removal of water and entrained solids,
- c. be covered or otherwise protected against contamination,
- d. have two pumping compartments or other means to allow the suction well to be taken out of service for inspection, maintenance, or repair.

### **V.B WELL PUMPS**

#### **V.B.1 Pumps General**

- *Pumps and pumping equipment*
  - a.) Pumps and pumping equipment shall be installed in the well to make the most efficient use of well storage.
  - b.) Pumps and pumping equipment shall be located to permit convenient access for inspection, maintenance and repair.
  - c.) In the event the base plate of a pump is placed directly over the well, the base plate shall be of a type designed to form a watertight seal with the well casing or pump foundation, as provided by Section 19-13B51j of the PHC.
  - d.) The well shall be properly vented at the well head to allow for pressure changes within the well.
  - e.) The electrical wiring used in connection with the pump shall conform to specifications of the State Basic Building Code.
  - f.) Contaminated water shall not be used for the purpose of priming any pump.
- All wells shall be maintained in a proper condition to conserve and protect ground water resources, and shall not be a source or cause of contamination or pollution of the water supply of any aquifer. All materials and construction practices used in maintenance, repair, or replacement of any well shall be the same as those required for the construction of a new well. All maintenance, repair hydrofracturing, developing, and replacement work shall be done only by a registered well driller, or by a licensed plumber or electrician, as provided by Section 25-129 of the General Statutes, and Articles 5 and 6 of the regulations.
- *Pumps*

At least two pumping units shall be provided. With any pump out of service, the remaining pump or pumps shall be capable of providing the

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maximum pumping demand of the system. The pumping units shall

- a. have ample capacity to supply the peak demand against the required distribution system pressure without dangerous overloading,
- b. be driven by prime movers able to meet the maximum horsepower condition of the pumps,
- c. be provided with readily available spare parts and tools,
- d. be served by control equipment that has proper heater and overload protection for air temperature encountered.

- *Discharge Piping*

RSWW 3.2.7.3

- a. The discharge piping shall
  1. be designed so that the friction loss will be low,
  2. have control valves and appurtenances located above the purposed floor when an above-ground discharge is provided,
  3. be protected against the entrance of contamination,
  4. be equipped with a check valve, a shutoff valve, a pressure gauge , a means of measuring flow, and a smooth nosed sampling tap located at a point where positive pressure is maintained,
  5. where applicable, be equipped with an air release-vacuum relief valve located upstream from the check valve, with exhaust/relief piping terminating in a down-turned position at least 18 inches above the floor and covered with a 24 mesh corrosion resistant screen,
  6. be valved to permit test pumping and control of each well,
  7. have all exposed piping, valves and appurtenances protected against physical damage and freezing,
  8. be properly anchored to prevent movement, and
  9. be protected against surge or water hammer.
- b. The discharge piping should be provided with a means of pumping to waste, but shall not be directly connected to a sewer.

### **V.B.2 Priming**

Prime water must not be of lesser sanitary quality than that of the water being pumped. Means shall be provided to prevent either backpressure or backsiphonage backflow. When an air-operated ejector is used, the screened intake shall draw clean air from a point at least 10 feet above the ground or other source of possible contamination, unless the air is filtered by an apparatus approved by the Department. Vacuum priming may be used.

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### **V.B.3 Suction Lift**

Suction lift shall

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- a. be avoided, if possible,
- b. be within allowable limits, preferably less than 15 feet.

If suction lift is necessary, provision shall be made for priming the pumps.

#### **V.B.4 Submersible Pumps**

- Where a submersible pump is used
  - a. the top of the casing shall be effectively sealed against the entrance of water under all conditions of vibration or movement of conductors or cables, and
  - b. the electrical cable shall be firmly attached to the riser pipe at 20 foot intervals or less.
- Submersible pumps should conform to AWWA standard E01-88 Verticle Turbine Pumps – Line Shaft and Submersible Types, most current revision.

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#### **V.B.5 Turbine**

- The foundation for a reciprocating pump shall be constructed with sufficient clearance around the well casing and the base of the power head to permit the assembly in place of a watertight well top seal. The well casing shall extend at least six inches above the floor.
- Turbine pumps should conform to AWWA standard E01-88 Verticle Turbine Pumps – Line Shaft and Submersible Types, most current revision.

PHC 19-13-B51(j)c

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#### **V.B.6 Hand Pumps**

A hand pump shall be constructed so that a stuffing box or other arrangement prevents entrance of contamination around the pump rod. The pump spout shall be of covered type. The base shall be of the one-piece flange type. Provision shall be made for leading waste water away from the top of the well. A hand pump shall be frost-proof and shall not require priming. A hand pump shall be mounted:

PHC 19-13-B51j(e)

- (1) When a well is cased with iron pipe, upon a base flange which is attached rigid and watertight to the well casing;
- (2) on a concrete platform or similar structure when a well is not cased with iron pipe. A metal sleeve shall be used through the concrete platform or cover slab and extend above the slab into the pump base; or
- (3) by other sanitary method approved by the commissioner of health.

#### **V.B.7 Line Shaft Pumps**

- Wells equipped with line shaft pumps shall
  - a. have the casing firmly connected to the pump structure or have the casing inserted into a recess extending at least one-half inch into the pump base,

RSWW 3.2.7.1

- b. have the pump foundation and base designed to prevent water from coming into contact with the joint, and
- c. avoid the use of oil lubrication at pump settings less than 400 feet.
- Line shaft pumps should conform to AWWA standard E01-88 Verticle Turbine Pumps – Line Shaft and Submersible Types, most current revision.

AWWA

**V.C BOOSTER/TRANSFER PUMPS**

**V.C.1 Pumps Size and Capacity**

- Hydropneumatic tank and transfer pumps:
  - (A) A hydropneumatic tank and transfer pump arrangement, used in tandem with the atmospheric tank, shall be sized to accommodate the peak hour demand. A minimum of two (2) transfer pumps shall be installed to operate alternately, each capable of providing water to the system at the peak hour demand rate;
  - (B) The transfer pumps shall be installed between the atmospheric tank and the hydropneumatic tank;
  - (C) The required gross volume of the hydropneumatic storage tank shall be calculated using the following equations:

DPUC 16-262m-8(g)3

$$\text{Usable Volume} = 5 \text{ minutes} \times \text{largest transfer pump capacity (gpm)}$$

$$\text{Gross Volume} = \frac{100\% \times \text{Usable Volume}}{\% \text{ Usable Volume}}$$

- (D) Transfer pumps shall be protected by low water level shutoff controls in the storage tank.
- Booster pumps shall be located or controlled so that
  - a. they will not produce negative pressure in their suction lines,
  - b. the intake pressure shall be at least 20 psi (140 kPa) when the pump is in normal operation,
  - c. automatic cutoff or low pressure controller shall maintain at least 10 psi (70 kPa) in the suction line under all operating conditions,
  - d. automatic or remote control devices shall have a range between the start and cutoff pressure which will prevent excessive cycling,
  - e. a bypass is available.

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**V.C.2 Inline Booster Pumps**

In addition to the other requirements of this section, inline booster pumps shall be accessible for servicing and repairs.

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**V.C.3 Individual Home Boosters**

- Customer Booster Pumps: No community water system shall be designed

DPUC 16-262m-8(i)7

to furnish water service to any customer who must utilize a booster pump to pump water from the utility's water main into the customer's plumbing facilities in order to maintain a minimum 35 psi pressure service, except in extreme circumstances and when authorized by the Department of Public Utility Control. The system's gradient shall be designed to preclude this need under reasonable foreseeable conditions for the ultimate service area. Consideration shall be given both to deteriorating pipe conditions leading to increases in pressure losses in the mains and also to any potential hazard which might be created if contamination should be introduced into the system through a cross-connection when a negative pressure is induced in the water main by a customer's booster pump;

- Individual home booster pumps shall not be allowed for any individual service from the public water supply main without the approval of the Department, and shall conform with Water Supplies Recommended Procedure titled "Home Booster Pumps", in Appendix B.

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#### **V.C.4 Multiple Pumps**

Each booster pumping station should contain not less than two pumps with capacities such that peak demand can be satisfied with the largest pump out of service.

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### **V.D APPURTENANCES**

#### **V.D.1 Valves**

Essential water supply valves shall be maintained in operating conditions.

PHC 19-13-B102(q)

##### **V.D.1.a *Isolation Valves***

Pumps shall be adequately valved to permit satisfactory operation, maintenance and repair of the equipment. If foot valves are necessary, they shall have a net valve area of at least 2.5 times the area of the suction pipe and they shall be screened. Each pump shall have a positive-acting check valve on the discharge side between the pump and the shut-off valve.

RSWW 6.6.1

##### **V.D.1.b *Air Relief Valves***

- At high points in water mains where air can accumulate provisions shall be made to remove the air by means of air relief valves. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.
- Air relief valves when provided, shall conform with AWWA standard C512-92, Air Release, Air/Vacuum, and Combination Air Valves or Waterworks Service, most current revision.

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### **V.D.2 Piping**

In general, piping shall

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- a. be designed so that the friction losses will be minimized,
- b. not be subjected to contamination,
- c. have watertight joints,
- d. be protected against surge or water hammer and provided with suitable restraints where necessary,
- e. be such that each pump has an individual suction line or that the lines shall be so manifolded that they will insure similar hydraulic and operating conditions.

### **V.D.3 Gauges and Meters**

Each pump

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- a. shall have a standard pressure gauge on its discharge line,
- b. shall have a compound gauge on its suction line,
- c. shall have recording gauges in the larger stations,
- d. should have means for measuring the discharge.

The station should have indicating, totalizing, and recording metering of the total water pumped

### **V.D.4 Water Seals**

Water seals shall not be supplied with water of a lesser sanitary quality than that of the water being pumped. Where pumps are sealed with potable water and are pumping water of lesser sanitary quality, the seal shall

RSWW 6.6.4

- a. be provided with either an approved reduced pressure principle backflow preventor or a break tank open to atmospheric pressure.
- b. where a break tank is provided, have an air gap of at least six inches or two pipe diameters, whichever is greater, between the feeder line and the flood rim of the tank.

### **V.D.5 Controls**

Pumps, their prime movers and accessories, shall be controlled in such a manner that they will operate at rated capacity without dangerous overload. Where two or more pumps are installed, provision shall be made for alternation. Provision shall be made to prevent energizing the motor in the event of a backspin cycle. Electrical controls shall be located above grade. Equipment shall be provided or other arrangements made to prevent surge pressures from activating controls which switch on pumps or activate other equipment outside the normal design cycle of operation.

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**V.D.6 Sampling Taps**

- Smooth end (e.g. threadless chrome) sampling taps shall be installed on the discharge line of each well and at a representative point(s) off the discharge pipe(s) coming from the storage tank(s). Where treatment is used, taps before and after treatment facilities shall also be installed. Taps shall be at least 12 inches above the finished floor and any possible high water level. Taps must point downward;
  
- Sampling taps shall be provided so that water samples can be obtained from each water source and from appropriate locations in each unit operation of treatment. Taps shall be consistent with sampling needs and shall not be of the petcock type. Taps used for obtaining samples for bacteriological analysis shall be of the smooth-nosed type without interior or exterior threads, shall not be of the mixing type, and shall not have a screen, aerator, or other such appurtenance.

DPUC 16-262m-8(m)(6)

RSWW 2.10

**V.D.7 Standby Power**

- (1) Where possible, there shall be included on-site a permanently installed gasoline, propane-fueled, diesel, natural gas or oil fired generator capable of supporting at least the largest well pump, one transfer pump, any high service booster stations and all treatment systems simultaneously in the event of an electrical outage. Portable generators may be considered acceptable as an alternate to an on-site generator;
  
- (2) Fuel storage shall be above ground, and provided with a containment area capable of holding the full volume of the fuel tank.
  
- a. To ensure continuous service when the primary power has been interrupted, a standby power supply shall be provided through
  1. connection to at least two independent public power sources, or
  2. portable or in-place auxiliary power.
  
- b. When automatic pre-lubrication of pump bearings is necessary, and an auxiliary power supply is provided, the pre-lubrication line shall be provided with a valved by-pass around the automatic control, or the automatic control shall be wired to the emergency power source.

DPUC 16-262m-8(h)

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**V.D.8 Metering of Flow**

All booster pumping stations should contain a totalizer meter.

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