

**CITY OF SCOTTSDALE  
BOOSTER & WELL PUMP STATION DESIGN CRITERIA**

Last Revised: 01/18/07

**GENERAL:**

1. Pumps shall be vertical turbine type with all motors equipped with a solid shaft. Pumps shall be fitted with a mechanical seal. The pump discharge head must have enough space in seal area to remove the mechanical seal without removing or raising the motor. The discharge piping from each pump must have a flexible coupling to control vibration. Hollow shaft motors must have written approval by the department and if used be equipped with steady bearing. All pumps will be tested for vibration tolerance per manufacturer specs.
2. In general, variable frequency drives (V.F.D.) (See SPEC #7) will be required for booster stations discharging directly into the distribution system. Engineer must provide flow characteristics of the pump bowl. This report must show flow and head at the lowest, average and highest range. Bowls must be capable of moving water at 50% hertz. Air conditioning shall be provided for all V.F.D. control panels (see SPEC #5). Booster stations discharged directly to a reservoir may not require a V.F.D. Pump control valves will be required in the absence of a V.F.D. V.F.D. controlled pumps will have silent closing check valves.
3. All pump station sites shall be secured as a minimum by a wall eight-foot (8') high, with a minimum of two access points. The wall should be designed to permit installation of a roof at a later date. Access shall be provided by a 36" wide passage door and a double gate, minimum of twelve feet (12') wide for vehicular access (See Standard Detail 2165-1). Each access will be keyed to City specification: Best Lock #83K7D44CS3 with SC Key way. No equipment inside the site shall protrude above the fence line, except the emergency beacon.
4. Underground booster stations must have written approval from the Water Resources Department, and if approved, shall include the following:
  - a. All underground booster stations shall be air-conditioned. The air conditioning system will be an air-cooled split system with the evaporator installed in the pump vault and the condenser vaulted separately located above ground. Careful consideration shall be given to proper air circulation , maintenance operations and noise generated by the condenser unit.
  - b. The vault shall be equipped with a gravity drain line, 12" or more in diameter. If the vault can't be drained by gravity, an automatic drainage system must be installed large enough to handle the largest volume of water that could be released due to a break in the water lines. All the electric controls for drainage system must be located outside of the vault on a pad 6" above grade level.
  - c. Vault shall have a positive ventilating system which complies with all of the OSHA standards and regulations concerning men working inside the vault.
  - d. Vaults shall have an alarm light visible from the street and an audible signal system to signal flooding of vault.
  - e. Man-access doors shall be 2'6" x 2'6". Equipment-access doors shall be 3'0" x 3'0". Access doors shall be equipped with torsion assisted hinges. The maximum opening lift weight of the man access door will not exceed 20 pounds.
5. A minimum of three (3) sets of operation & maintenance manuals shall be prepared and provided to Water Resources Department (Operations Division) prior to final acceptance.

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6. All stations shall be equipped with a telemetry system compatible with the radio telemetry system used by the Water Department (see SPEC #8).
7. Pump motors shall be Cast-Iron, Nema Energy Spec. ISO9000 Certified. The motor shall not be loaded to use more than 90% of the rated H.P.
8. A four cycle generator shall be installed and load tested at site under full load capacity of the unit for a minimum of six hours. The fuel tank will be filled by the contractor prior to acceptance by the City. The tank will be above ground and meet all City, State and Federal regulations. The generator maximum noise level four feet (4') outside the site wall will be 65 dBA. (see spec # 10 Item C. ) To delete the generator requirement, written approval must be received from the department.
9. All stations shall have a chlorine analyzer and a chlorine facilities included (see SPEC #1 and DETAIL #2332), unless written approval to delete chlorine facilities is received from the department.
10. All electrical equipment pads will be 6" above lowest elevation of drainage from site. When concrete block openings are used, the area of drainage must be capable of draining the site when a pipe leak occurs under pressure.
11. When the engineer has determined the location of the proposed site, Water Production will perform a communication test from the site to our repeater to determine the approximate height of the antenna. The antenna height should be considered in designing the site. Should the antenna need to be painted, the COS personnel must approve the color.
12. Site signs shall be posted outside the front of the site after station is completed. (see SPEC #5 )
13. Roof mounted Air conditioners will not be allowed .
14. RTU panel will be finish painted white only - All other equipment & walls will be painted the color requested by COS personnel
15. Pump station noise guidelines ( see SPEC #10 )

**MECHANICAL:**

1. All piping and equipment sized correctly - pressure and load.
2. All check valves shall be silent closing type.
3. All control sensors and pressure gauges will be sized to operate in the mid-range of scale and shall be isolated from the system with snubbers and shut-off. All control sensors will be protected from freezing in a heated panel.
4. Booster and Well stations shall be equipped with water meters which register and totalize in U.S. gallons. All electrical components for the meter except the register head will be located in the electrical panel and not in the meter vault. See SPEC #2.
5. A properly designed relief valve shall be mounted on top of all hydro-pneumatic tanks. Relief valves shall be a minimum of two inches (2") and installed with an isolation valve.
6. See SPEC #3 for pump control, pressure relief,, pressure reducing, and/or pressure sustaining valves.
7. Sensing lines shall be protected from freezing.

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8. Air compressor discharge line must have flexible coupling. Air compressor will be mounted on pad beside pressure tank.
9. Control valve proper operation - required on all pumps that are not controlled by a V.F.D. Pump starts when valve is in closed position; valve slowly opens and stays open until demand is met; valve then starts closing until completely shut, causing pump to shut down. The valve will have actuator and switch assembly - including 1 switch for control operator and 1 switch for valve status to the RTU.
10. Water sample valve on discharge header.
11. Champion mechanical seals for boosters. See SPEC #4.
12. Air release on header discharge (lever action).
13. Pressure recorder - Dickson 4 inch, 24 hours. See SPEC #9.
14. Pressure switch - mercoid type with visible calibration. See SPEC #6. Mercoid switches to be mounted in separate cabinet, with heater. Each mercoid switches will be labeled to signify its operation. All pump stations will include a mercoid panel as a backup system for the RTU, unless the system is pumping into a reservoir. In that case a 24 hr. time clock will be used as a backup devise.
15. Probe bottle, 2 1/2" in diameter, for sensing psi, water level, etc., shall be mounted on the end of the hydro-pneumatic tank with the isolation valves. Sight glass to be mounted on this assembly.
16. Hydro tank required at all booster stations and nozzle in tank must be of proper size based on pump flow.
17. Hydro-pneumatic sight glass shall have isolation valves, and to be mounted on probe bottle assembly.
18. Hydro-pneumatic tanks must have valves to isolate the tank from the system.
19. Pump discharge head must have register for Nema base motors.
20. Passage door shall be keyed to water operations specs.
21. Rotating shafts must be shielded on all pump bases.
22. Head-shaft coupling not permitted in pump discharge head.
23. Maximum line shaft bearing spacing is five (5) feet.
24. Bowl suction case to have four webs to support lower bowl bearing. The suction for each pump will have a Stainless steel strainer with Anti-Vortex blades.
25. Pump cans and pump manifold piping shall be coated, per AWWA approved method.
26. Gear operated butterfly valves will be used only in above ground application at booster station. If the psi is above 150 pounds, an RW gate valve may be required.
27. Pumps will be designed to reach max. speed at 1750 RPM.
28. Pressure transducers will have a isolation valve with the capabilities to shut off the transducer and a separate valve to drain the line pressure ( for calibration purposes).

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**ELECTRICAL:**

1. Three-phase/230 - 480 volt power is a requirement.
2. Field prints shall include all electrical information.
3. Phase protection shall be provided for all three-phase motors and pumps.
4. Pump failure indicator lights shall be included on the control panel.
5. Failure indicating lights with manual/remote reset for all failures.
6. An hour meter shall be provided for each pump.
7. Low suction pressure safety cut-off/high discharge pressure cut-off.
8. Area lights are to be wall-mounted with at least one operated by an electric eye and a light switch at walk-in door.
9. All stations shall have a main power disconnect switch (fused or breaker).
10. Panels properly anchored to pad.
11. Motors must have overload protection on all phases.
12. Control wiring labeled correctly.
13. Indicating lights labeled correctly.
14. Conductance actuated liquid level control will be series 1 style only (Warrick).
15. Conduit sealed in chlorine cabinet to MCC.
16. Low level reservoir safety shut-off, if applicable.
17. See SPEC #9 for radio telemetry information.
18. Watt hour meters for each pump - Ohio Semitronics Model #WH50 or equal. Or unit that will encompass all loads on main buss.
19. Solid State motor starters will be capable of start ramp, and stop ramp, and include bypass contactor that will energize when starter reaches full speed.
20. Lightning and surge protection to be mounted in its own can (container) away from the motor control center and meeting UL 1449 and ANSI/IEEE C62.1, C62.41, C62.45, CA & A, B, C. Standards
21. Outlets mounted by control valves and all pump pads to power heat tapes
22. VFD panel to have lighting fixture.
23. Submersible style pressure transducers such as "Druck" are to be used to transmit level information from reservoir to RTU using 4-20 mA output.

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24. Pressure transducers to operate at 60% of full range under normal site operations.
25. Motors will be 1750 RPM, 60 cycle Max. speed.
26. All electric panels will be cleaned and vacuumed at the time of final walk-through.
27. PLC's will not be used for control logic. The RTU will be used for control logic.
28. Instrumentation to have surge suppression modules mounted by transducers, providing a path to ground for all surges and lightning strikes, such as manufactured by Joslyn Inc., or approved equal.
29. All boosters will have individual high pressure mercoids installed in discharge line, between pump and discharge valve, to allow local control of pumps, and high pressure C.O. in case of valve closure.

NOTE: It is required that designers coordinate their booster station design with the Water Resources Department prior to plan preparation (See the water system design procedures and criteria.)

**SPECIFICATIONS FOR CHLORINATION EQUIPMENT**

1. Equipment shall be manufactured by WALLACE & TIERNAN:
2. Model #V100 A1 Unit                      Includes master control unit and the injector. The rotometer size and the type of tailpiece and nozzles required will depend on the size of the station and the operating pressures.
3. Model V-500 A-1 Compound Loop Controlled Unit                      A V-500 A-1 compound loop controlled unit with automatic switchover will be used when flow is monitored.
4. Model #200C                              150# Cylinder Automatic Switchover Unit.
5. Model #50-125                              Leak Detector Unit with two separate dry contact outputs.
6. Model #50-345                              Two Cylinder Scale
7. Model Micro 2000                              Residual Analyzer

**SPECIFICATION FOR PRESSURE PUMP WHEN USED ON CHLORINATION INJECTION SYSTEM**

1. Goulds Model HB 710-HPI Booster Pump, or equal
  - a. Suction bracket - cast iron with support foot
  - b. Mechanical seal - carbon/ceramic, buna
  - c. Motor - 3 phase or single phase (where applicable)
  - d. Motor to have sealed bearings

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**WATER METER SPECIFICATIONS**

1. Magnetic Meters shall be: Endress+Hauser ProMag 53, or Water Specialties Model UM06-R. Call Water Operations for detail specifications.
2. The Mag meter must comply with the applicable provisions of AWWA C704-70.
3. Totalizer will feature a digital indicator-totalizer and solid state construction transmitter. The totalizer-transmitter will provide a 4-20 mA current signal proportional to the rate of flow.
4. The totalizer will have an EPROM memory to prevent memory loss during battery change out. The battery will have a one year life expectancy.
5. Meter shall be installed per manufacturer's specs concerning pipe diameters before and after meter.
6. Meter shall be sized to accurately determine flow at both high and low ends of system's operating range verified by manufacturer.
7. Meter must have Empty Pipe Detection that uses no external devices to operate.

**PUMP CONTROL, PRESSURE REDUCING, PRESSURE SUSTAINING VALVE SPECIFICATIONS**

1. Model number and sizing of valve shall be in accordance with manufacturer's specifications; Bermad or approved equal will be accepted.
2. All Valves will have stainless steel control lines. Pump control valve shall be a Bermad Model 740-Q-03-U or Cla Val Model 60-73 with extra limit switch for RTU valve status.
3. Provide valve position indicator for all of the above control valves.

**BOOSTER SEALS**

1. Champion Style 401 316-SS, Hastelloy "C" springs alpha silicon carbide face material, rated at operating pressure 450 psi.
2. One spare seal for every size pump and one spare seal for every four pumps

**PRESSURE SWITCHES**

1. External adjustment
2. Visible calibrated dial
3. Visible On-Off operation
4. Mercury switch operation
5. Working pressure 0-300 psi or (as needed)
6. Watertight Nema 4

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7. Flange for surface mount
8. Bourdon tube operated

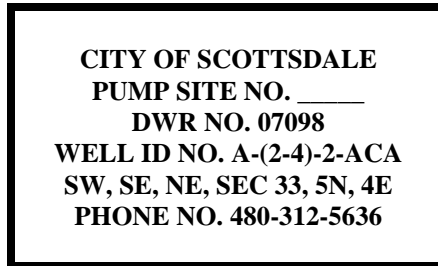
**PUMP SITE SIGN**

1. The sign will have a green background with 2” white reflective lettering and will be made of aluminum. The sign will read:...City of Scottsdale, Pump Site No., Emergency phone No. Well Sites will have Legal Description and the DWR # on the sign, as required by County Health.

2. **Booster Station Example**



- Well Site Example**



**VARIABLE FREQUENCY DRIVE UNIT**

1. Following is a list of acceptable makes (equals will be considered):
  - a. Toshiba AFDs  
G2+ series inverters.  
H2+ series inverters.
  - b. Allen Bradley AFDs  
1336+ series inverters.  
1336 Force series inverters.
  - c. Safetronics IGBT series AFD by Yosgawa
2. Recommended spare parts for the drive unit will be include, at minimum:
  - a. (3) Main Power fuses
  - b. (2) DC Bus fuses
  - c. (3) Control fuses
  - d. (3) Inverter modules
  - e. (3) Converter modules
  - f. (1) CPU Main control card

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- g. (1) Base Driver card.
- 3. Air conditioning units will be sized to keep the VFD unit 15 degrees below maximum temperature allowed by the manufacturer when the ambient temperature is 110 degrees.

**TELEMETRY**

- 1. All sites will be equipped with a telemetry system compatible to the City of Scottsdale’s system. The Remote Terminal Unit (RTU) for the telemetry system will be used also as the programmable controller for the site. Requirements of the RTU are site specific. Specifications for the RTU will be furnished by Water Operations when the size and function of the site has been determined.
- 2. The communication radio for the telemetry system shall be a Microwave Data Systems (MDS) 2310 Md “smart” data transceiver TX on 928,18125 Mhz, RX on 952.18125 Mhz, 12V DC input, 4800 baud asynch digital interface modem RS
- 3. 232 interface - direct, type “N” female antenna connector with loopback option. Antenna shall be a SCALA TY 900 Yagi, N female connector, Lightning arrestor - polyphaser IS-50NX-C2.

**CHART RECORDER (NO LONGER REQUIRED)**

- 1. ~~Recorder measures and records pressure variation on a 4”, #26, 24 hour chart.~~
- 2. ~~0-200 psi range for systems up to 175 psi, range must be 15% over maximum designed pressure.~~
- 3. ~~Battery operated.~~
- 4. ~~+/- 2% scale guaranteed accuracy.~~

**SOUND LEVEL LIMITS**

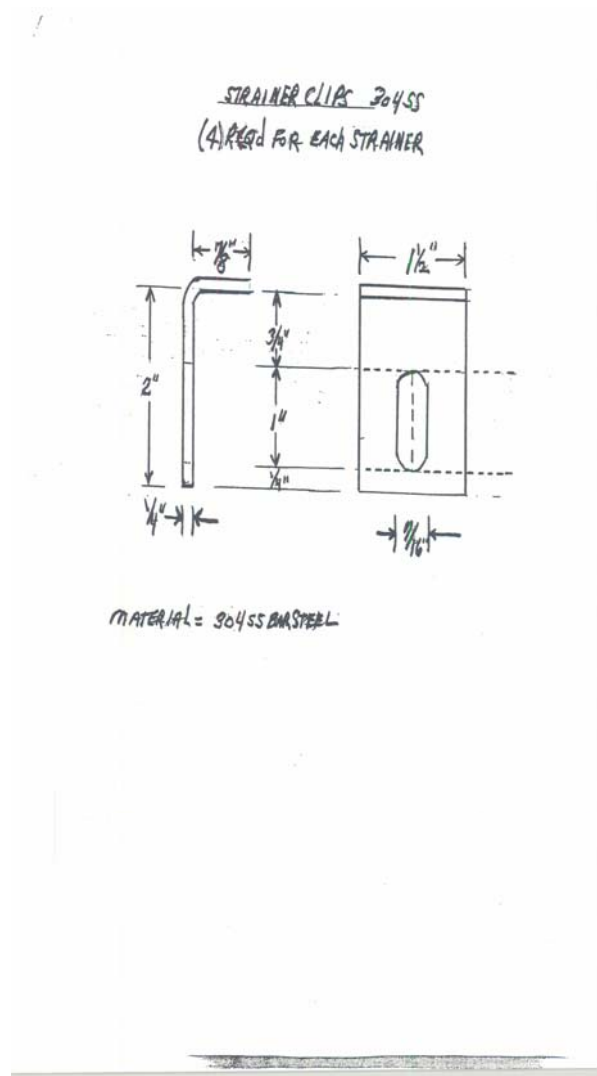
- 1. It shall be unacceptable for any pump station to cause noise by any means to the extent that any fifteen (15) minute period average sound level exceed the applicable limit given in the following table, at any location in the City of Scottsdale on or beyond the boundaries of the property line of the pump station facility. The noise subject to these limits is that part of the total noise at the specified location that is due solely to the action of said pump station.

<b>TABLE OF APPLICABLE LIMITS</b>	
<b>Land Use Zone</b>	<b>Fifteen-Minute Average Sound Level (decibels)</b>
<b>Residential</b>	<b>45</b>
<b>Commercial</b>	<b>60</b>

- 2. Average sound level measurements will consist of  $L_{eq}$  (15) measurements performed with an ANSI-S1.4-1971 Type 1 or Type 2 Sound Level Meter using the A-weighting network. Instrument response shall be “slow”.  $L_{eq}$  means the constant sound level that, in a given situation and time period, conveys the same sound energy as the actual time-varying A-weighted sound. Measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

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3. The location for measuring exterior sound levels shall be at the property line of the pump station facility and four to five feet (4' to 5') above ground level and at least four feet (4') from walls and other reflective surfaces. If a wall is closer than the required four feet (4') to the property line, move the required distance outside the property line. An exception occurs when the pump station shares a boundary with an affected property. In this case the location for measuring exterior sound levels shall be at least one foot (1') inside the property line of the affected property and four to five feet (4' to 5') above ground level and at least four feet (4') from walls and other reflective surfaces.
  
4. Alternative sound level measurements:  
Compliance with these guidelines can be demonstrated if the maximum sound level caused by the operation of the pump station does not exceed the average sound level limits set forth in Section A, when tested at the locations prescribed in Section C.



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