

Equipment and Operational Checklist

Wastewater Pumping Stations

Site and Building:

- ☐ Paved access road, minimum width = 12 feet
- ☐ Wetwell location accessible by vector truck
- ☐ Wetwell typically 8 feet diameter minimum
- ☐ Building constructed of low-maintenance, aesthetically pleasing materials matching surrounding community (i.e. brick or split face block)
- ☐ Building dimensions sufficient to allow 36" minimum clearance between equipment and interior walls or cabinets (minimum 8' x 10')
- ☐ Building located adjacent to wet well. No buildings located over wet well due to H₂S corrosion.
- ☐ Typical building will have metal roof.
- ☐ Fencing (Consistent with adjacent property fencing)
- ☐ HVAC must be installed
- ☐ As-built station construction plans stored in PVC tube at station
- ☐ Electronic O&M manual submitted in MSWord or PDF format

Force Main:

- ☐ 6-inch minimum. A 4-inch FM may be considered if required to maintain minimum flushing velocity.
- ☐ 90 degree bends should be minimized due to need for jet nozzle accessibility
- ☐ Force main access points on all FMs exceeding 1,500 feet in length
- ☐ Station bypass pumping pit w/ plug valve (see attached sketch)
- ☐ Air Relief Valves must be constructed of 316 stainless steel components (Approved Manufacturer: ARI).

Vault Construction:

- ☐ All hatches to be constructed of durable, lightweight metal (i.e. aluminum)
- ☐ All hatches to provide sufficient lighting in vaults
- ☐ All hatches to provide sufficient ingress/egress into vaults. Vaults with insufficient head clearance to be fully accessible.
- ☐ Vaults to have drains or sump pumps

Equipment:

- ☐ Submersible pumps w/ 5-year warranty (Approved Manufacturers: Flygt, Fairbanks Morse)
- ☐ If equipment size exceeds 50 HP, provide dry-pit submersible pump configuration
- ☐ Submersible pumps to include pneumatic recirculation nozzle mounted on the pump volute (Flygt Model # 5565101 Mix Flush valve or approved equal)
- ☐ All stations to include one redundant pump
- ☐ Stainless steel required for all materials, components, or equipment that will be exposed to wastewater and/or H₂S (i.e. guide rails, cable, bolts, well piping, etc.)
- ☐ An on-site electric hoist capable of pulling 2x the weight of the submersible pumps will be required if sufficient wetwell access is not available

- ☐ Discharge check valves accessible in a dry pit
- ☐ Influent plug valve (if applicable)

Electrical and Telemetry:

- ☐ All electrical and telemetry components located inside a building, with 30-inch doorway (minimum)
- ☐ Mag-meter (Approved Manufacturers: Krohne, ABB, Toshiba)
- ☐ Y-fitting in valve vault (no 90 degree fittings with tee)
- ☐ Auto-transfer switch to generator power (Approved manufacturer: ASCO)
- ☐ Generator (Diesel Backup power) – Generator to be sized based on electrical service(e.g. a 200 amp electrical service would be the basis for sizing instead of the equipment load)
- ☐ Ultrasonic depth sensor or submersible pressure transducer(Approved Manufacturer: Milltronics HydroRanger, Siemens A1000)
- ☐ Standard Telemetry package (MDS iNet II radio, Modicon M340 RTU/PLC etc.) Available from Border States Electric @ 615-255-4161.

Vibration Monitoring System:

- ☐ Flygt vibration monitoring system (available on Flygt pumps only)

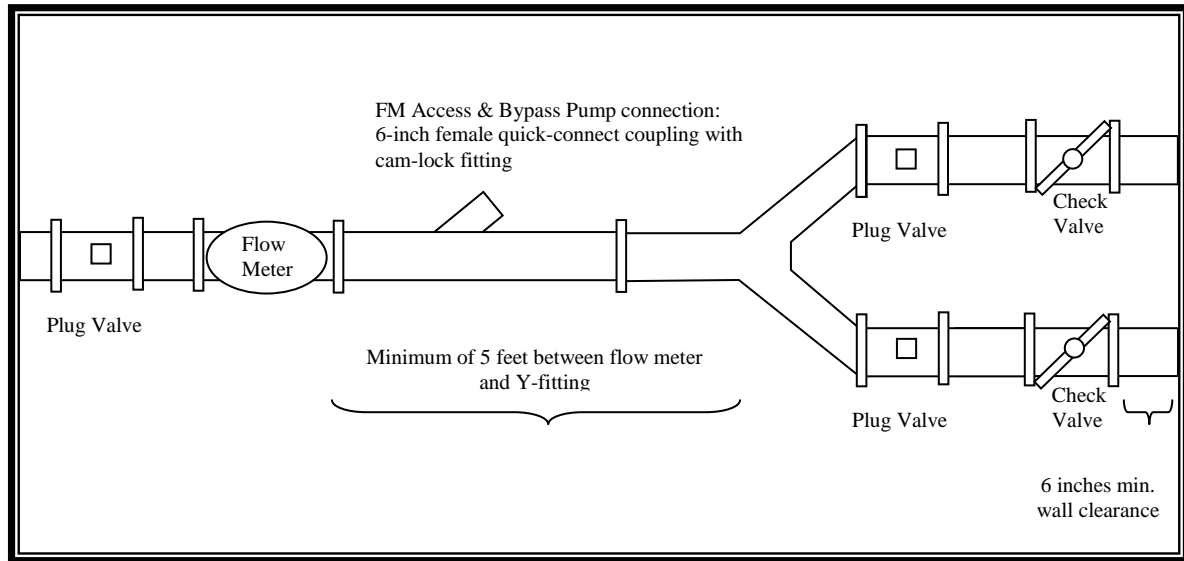
OR

- ☐ Industrial vibration sensor, 4-20 mA output, 0 to 1 in/sec pk, 3 to 1k Hz, top exit, 2 pin connection. IMI part no. 640B01
- ☐ Indicator/controller (for use w/ 4 to 20 mA sensors) w/retransmit option. IMI part no. 683A001000
- ☐ 2-socket 106 style composite connector kit, field installable. IMI part no. CF
- ☐ Twisted/shielded pair, polyurethane jacket cable (+250 deg. F/121 deg. C). IMI part no. 052BZ1000BZ

Utilities:

- ☐ City water required. Type K Copper service line.
- ☐ Backflow preventer (located inside building or hotbox)
- ☐ Freeze-proof yard hydrant or water hose connection at building

Flow Meter and Valve Pit Layout



Meter/Valve vault will require a gravity drain to the wet well (with check valve) or a small sump pump.

Vibration and Alignment Specifications

- Metro Water Services will conduct all vibration and alignment acceptance tests. Contractor must be present during vibration and alignment acceptance test. Vibration shall not exceed the stated limits when readings are taken in three orthogonal positions at each bearing. Metro Water Services will notify the Contractor of the results of the acceptance test. It is the Contractor's responsibility to identify and eliminate the source of any vibration that exceeds the tolerances stated below. It is the Contractor's responsibility to correct any misalignment or softfoot condition that exceeds the tolerances stated below.

Motor Unloaded:

- Overall digital vibration shall not exceed 0.15 in./sec. peak velocity over a frequency range of 2-1500 Hz.
- Vibration due to imbalance shall not exceed 0.1 in./sec. peak velocity.
- Vibration at the Ball Pass Outer Race frequency shall not exceed 0.03 in./sec. peak velocity and shall not create impacting greater than 0.5 g's acceleration in the waveform. Vibration at the Ball Pass Outer Race frequency that exceeds these limits will be cause for rejection of the equipment. The presence of any other bearing fault frequencies will be cause for rejection of the equipment.
- All other discrete vibrations shall not exceed 0.1 in./sec. peak velocity.
- Any indications of material defects (i.e., bearing misalignment, bent shaft, air gap eccentricity, and electrical anomalies) will be cause for rejection of the equipment.

Driven Equipment and Motor (Loaded):

- Overall digital vibration shall not exceed 0.3 in./sec. peak velocity radially and 0.15 in./sec. peak velocity axially over a frequency range of 2-1500 Hz.
- Vibration due to imbalance shall not exceed 0.2 in./sec. peak velocity.
- Vibration at the Ball Pass Outer Race frequency shall not exceed 0.03 in./sec. peak velocity and shall not create impacting greater than 0.5 g's acceleration in the waveform. Vibration at the Ball Pass Outer Race frequency that exceeds these limits will be cause for rejection of the equipment. The presence of any other bearing fault frequencies will be cause for rejection of the equipment.
- All other discrete vibrations shall not exceed 0.1 in./sec. peak velocity.
- Any indication of material defects will be cause for rejection of the equipment.

Dry Well Submersible Pumps (Loaded):

- Overall digital vibration shall not exceed 0.2 in./sec. peak velocity radially and 0.15 in./sec. peak velocity axially over a frequency range of 2-1500 Hz.
- Vibration due to imbalance shall not exceed 0.1 in./sec. peak velocity.
- Vibration at the vane pass frequency shall not exceed 0.15 in./sec. peak velocity.
- Vibration at the Ball Pass Outer Race frequency shall not exceed 0.03 in./sec. peak velocity and shall not create impacting greater than 0.5 g's acceleration in the wave form. Vibration at the Ball Pass Outer Race frequency that exceeds these limits will be cause for rejection of the equipment. The presence of any other bearing fault frequencies will be cause for rejection of the equipment.
- All other discrete vibrations shall not exceed 0.1 in./sec. peak velocity.
- Any vibration caused by material defects will be cause for rejection of the equipment.

Equipment Subject to Variable Speed Operation:

- A coast down test will be conducted on all equipment subject to variable speed operation. Any resonant condition within the operating range of the equipment that produces vibration in excess of the tolerances stated above must be eliminated prior to acceptance of equipment. External bracing will not be an acceptable method for controlling vibration due to resonance. Any VFD harmonics that produce vibration in excess of the tolerances stated above must be eliminated prior to acceptance of the equipment.

Pump Cavitation:

- Random vibration and noise caused by recirculation and cavitations that generates an overall nonsynchronous vibration in excess of 0.1 in./sec. peak velocity over a frequency range of 1 times run speed at 3 times vane pass frequency, or an overall subsynchronous vibration in excess of 0.1 in./sec. peak velocity, will be cause for rejection of equipment.

Alignment:

- Rotating equipment will be aligned within the manufacturer's tolerance for the driven component of the system, as measured by laser alignment instrumentation. In the absence of a manufacturer's tolerance for the driven component of the system, the motor and driven component shafts will be aligned within 0.5 mils./in. angularity and 2 mils offset in all planes. The presence of softfoot in excess of 4 mils must be corrected prior to acceptance of the equipment. Any misalignment in excess of the tolerances stated above must be corrected prior to acceptance of the equipment.