

# [DRINKING WATER MASTER SPECIFICATION]

## SUBMERSIBLE MIXER

### [PROJECT TITLE]

## SECTION 11220

### PART 1 – GENERAL

#### 1.1 SCOPE

- A. This section covers submersible tank mixing systems up to 0.5 HP in size intended for continuous use while submersed in potable water storage tanks. Each mixer shall have the ability to function continuously on a year-round basis, regardless of drain and fill cycles. Each mixer shall consist of a water-filled submersible motor, an impeller and a non-submersible control center that houses all control electronics.

#### 1.2 THE REQUIREMENT

- A. CONTRACTOR shall furnish a PWM400V3 PAX Water Mixer with a PCC405V3 PAX Control Center and install submersible mixing system together with controls and accessories necessary for a complete and operable system.
- B. UTILITY shall furnish electrical conduit with either 230VAC Single Phase voltage based on System configuration, a Safety disconnect switch and a 20 Amp non-GFCI circuit breaker up to the point of installation of the mixing system control center.
- C. UTILITY shall also provide conduit from control center to tank penetration for submersible motor cable and penetration through tank for same cable.

#### 1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Comply with the applicable reference specifications as specified in the General Requirements
- B. Occupational Safety and Health Administration, OSHA
- C. NSF/ ANSI Standard 61
- D. Underwriters Laboratories Inc., UL 508

#### 1.4 CONTRACTOR SUBMITTALS

- A. NSF Certification
  - 1. Copies of the NSF-61 certified listing for all submersible mixer material being placed inside the tank and headspace, including the motor and power cable.
- B. Installation, Operations, and Maintenance Manuals shall be obtained from the equipment manufacturer and submitted. The following sections shall be included:
  - 1. General equipment specifications and data sheets
  - 2. Installation, start-up, operation, and maintenance instructions
  - 3. Factory-recommended maintenance schedule
  - 4. Wiring diagrams specifying what electrical wiring needs to be done onsite during and prior to the installation, and by which responsible party
  - 5. List of equipment or tooling necessary for diagnostics, troubleshooting, repair or general maintenance

#### 1.5 QUALITY ASSURANCE

- A. Each mixing system shall be tested prior to deployment according to the manufacturer's standard factory testing practices at the factory testing facilities.
- B. Complete mixing system is NSF/ANSI Standard 61 certified by NSF

#### 1.6 WARRANTY

- A. For the period beginning with installation or 3 months after shipment to Buyer, whichever is earlier and ending 60 months

thereafter, the mixer, including its associated controller, is warranted to be free from defects in material and workmanship and to conform to Seller's specification applicable to the product –

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE

- A. Mixing system shall completely mix reservoir according to the following minimum performance requirements. These requirements can be measured and validated after installation by operators with readily available tools such as temperature probes and total chlorine grab samplers.
  - 1. Temperature Uniformity  
For tanks up to 4,000,000 gallons in volume: All temperatures shall converge to within 0.50°C (0.9°F) within 24 hours after mixer is installed and activated.
  - 2. Disinfectant Residual Uniformity  
For tanks up to 4,000,000 gallons in volume: Disinfectant residual within top five feet of tank and bottom five feet of tank will converge to within 0.20 ppm within 24 hours after mixer is installed and activated. During continuous operation of the mixer, under normal disinfectant dosing parameters, disinfectant residual will converge to within 0.20 ppm at least once every 24 hours.

### 2.2 GENERAL

- A. Mixing system consists of an impeller mounted on a submersible motor and supported approximately three feet in height from the tank floor in order for it to launch a jet of water from the bottom of the tank up toward the surface of the water. Mixer control and operation shall be independent of tank drain and fill cycles to ensure constant mixing. Wet-side of Mixer shall weigh less than 75 pounds (~34 kg) and dry-side shall weigh less than 56 pounds (~25 kg). Both wet-side and dry-side shall be able to be hoisted, installed, and/or removed by on-site personnel without additional equipment needed, and so that there is no crush hazard or entanglement hazard present, and so that weight of mixer on tank floor does not cause damage to interior coating.
- B. Mixing system active components shall be elevated at a minimum of 18 inches above tank floor to avoid disturbing accumulated tank sediment or entraining particles and causing accelerated wear of moving parts.
- C. Mixers using submersible pump with slit or "water sheet" or horizontal motor mounting designs are not acceptable.
- D. Mixer provider must have more than 1000 installation of similar equipment in potable water tanks or reservoirs.
- E. Mixers shall have no oil-filled parts
- F. All wet-side mixer components shall be certified by NSF to the NSF/ANSI Standard 61
- G. Dry-side mixer components shall include sine filter to prolong motor life and reduce noise level.
- H. Power source for mixer shall be 230VAC single phase grid power to allow unit to continue 24/7 operation where necessary.
- I. No regular, periodic maintenance required on the wet-side components in typical potable water application
- J. No passive mixing system allowed.

## 2.3 CONSTRUCTION

### A. Components – wet-side: shall be NSF/ANSI Standard 61 certified.

Equipment entering tank shall not adhere to, scratch or otherwise cause damage to internal tank coating or put undue stress on the materials of the tank construction. Equipment shall fit through a standard hatch of size 12-inch x 12-inch or larger. UTILITY may prefer to puncture sidewall or ceiling of tank (in place of puncturing the hatchway) to allow motor cable entry into the tank for ease of installation and protection against freezing/ice damage.

Each submersible mixer shall consist of the following components, regardless of the power source selected:

1. Impeller
  - AISI Type 316 Stainless Steel
  - Balanced to within 0.5 gram-inches
  - Passivated per ASTM A380 to minimize corrosion
  - Not more than 8 inches in overall height
  - Not more than 4.7 inches in diameter
  - Not more than 2.4 lbs. in weight
  - Shall not create cavitation at any rotational speed up to 2500 RPM
2. Motor
  - AISI Type 304 Stainless Steel body
  - Chlorine/Chloramine resistant rubber seals
  - Fully submersible
  - Low power (0.5 HP maximum)
  - Water-filled motor
  - Water-lubricated motor
3. Mounting
  - AISI Type 316 Stainless Steel
  - Three detachable legs or pedestal mount
  - NSF/ANSI Standard 61 certified EPDM rubber, non-skid, non-scratch feet or insulating pad
  - Attachments secure motor cable away from impeller
  - Overall weight of wet-side unit not to exceed 75 lbs. to avoid damaging tank floor
  - Overall height of unit not to exceed 5 ft.

### B. Components – dry-side: Each 230VAC control center shall consist of the following components:

1. Enclosure
  - Type 4 (NEMA 4) Lockable
  - Weather Resistant
  - Overall weight of control center not to exceed 50 lbs.
  - Green and Red LED Indicator lights show motor status
  - White Power Indicator Led
  - Cooling Fan
2. Motor Controller/VFD
  - Rated to 1.0 HP
  - Operating temperature range -4 °F to 129 °F (-20 °C to 54 °C)
  - HOA Switch
  - Manual speed control
  - Thermal shut-off protection built-in
  - Current overload protection built-in
  - SCADA outputs included:
    - Digital Output signal indicating motor running
    - Digital Output signal indicating fault
    - Digital Input/output signal allowing remote motor on/off
    - RS-485 or Dry Contact connections
    - 4-20mA Signal
3. GFCI-protection
  - 230VAC, single-phase, with a 300mA trip level GFCI included inside control center

4. Branch Circuit Protection  
Panel equipped with a 230VAC 20-Amp main breaker
5. Sine Filter

#### 2.4 CONTROLS

- A. Each unit shall be equipped with all necessary controls, inter-wired, to provide the following minimum functions:
  1. On/Off switch to control power to mixer.
  2. Automatically activated motor shut-off if water level drops below motor height in tank.
  3. Sine filter
  4. Any other controls shown on electrical and instrumentation drawings.

#### 1.5 ACCEPTABLE MANUFACTURERS:

- A. PAX Water Technologies (Milpitas, California)

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The CONTRACTOR shall furnish services of a factory-trained installation contractor or crew having experience with installation procedures and operation and maintenance requirements for the type of equipment installed under these specifications. Mixer must be able to be installed through a 12"x12" hatch. Mixer must be able to be installed without draining tank or taking tank out of service. Wet-side of Mixer shall weigh less than 75 pounds (~34 kg) and dry-side shall weigh less than 55 pounds (~25 kg). Both wet-side and dry-side shall be able to be hoisted, installed, and/or removed by on-site personnel without additional equipment needed, and so that there is no crush hazard or entanglement hazard present, and so that weight of mixer on tank floor does not cause damage to interior coating.
- B. Tank penetration is recommended to be above tank water line, typically through the hatch sidewall.
  1. Fitting will prevent moisture intrusion into tank and ideally be horizontally oriented.
  2. Fitting shall be 1" diameter fitting to allow cable to pass through.
  3. Strain relief for power cable shall be part of the contractor-supplied fitting for tanks more than 30' in depth.
  4. For tanks more than 70' in depth, or at customer's discretion, a water-tight penetration may be installed under the water-line.
- C. Installation of the in-tank ("wet-side") components may be performed in any of the following ways:
  1. Installation by a factory-trained and drinking-water-certified potable water tank diver.
  2. Installation by personnel with confined space training while the tank is drained and empty.
  3. Installation by tank manufacturer personnel during tank manufacture.
  4. Installation below a hatch opening in a full tank utilizing a chain.
- D. Installation of the outside-of-tank ("dry-side") components may be performed by:
  1. Third party representatives or CONTRACTORS according to the manual provided.
  2. UTILITY personnel according to the manual provided
- E. The mixer and control center shall be installed in accordance with approved procedures submitted and Manufacturer's instructions supplied, unless otherwise approved in writing from the Manufacturer.

### 3.2 TRAINING

- A. PAX Water Technologies staff (or their representatives) will instruct designated UTILITY personnel in the safe and proper operation of the PAX Water Mixer. This training will reference the operations manual provided with equipment and show how to check for proper functioning of the equipment.

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