

[DRINKING WATER MASTER SPECIFICATION] SUBMERSIBLE MIXER [PROJECT TITLE] SECTION 11220

PART 1 – GENERAL

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, a nozzle mounted on a submersible stainless-steel casing, and a non-submersible control center that houses all control electronics.

1.2 THE REQUIREMENT

- A. CONTRACTOR shall furnish a PWM150 PAX Mixer with an optional SCADA Interface or PCC155 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 115VAC Single Phase voltage based on System configuration. Depending on the configuration, the following needs to be installed:
 - 1. A 20 Amp non-GFCI circuit breaker up to the point of installation of the mixing system utilizing a PAX control center.
 - 2. A 20 Amp GFCI 300mA trip level circuit breaker up to the point of installation of the 115VAC single phase mixing system when no PAX control center is installed.
- 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, trouble-shooting, 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 shall be measured and validated after installation by operators with the help of mixer manufacturer with readily-available tools such as temperature probes and total chlorine grab samplers.
 1. Temperature Uniformity

For tanks up to 750,000 gallons in volume: All temperatures shall converge to within 0.50°C within 24 hours after mixer is installed and activated.
 2. Disinfectant Residual Uniformity

For tanks up to 750,000 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, disinfectant residual will converge to within 0.20 ppm at least once every 24 hours.

2.2 GENERAL

- A. Mixing system consists of a nozzle mounted in a submersible stainless-steel casing. System is lowered to the tank floor and creates a vertical flow pattern inside the tank. Devices with an externally mounted pump shall not be acceptable. Mixer operation shall be independent of tank drain and fill cycles to ensure constant mixing. Mixer shall weigh less than 45 pounds (~20 kg) and 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 inlet shall be elevated at a minimum of 6" 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. Mixers shall include a buoyancy mechanism to keep nozzle pointing upright no matter the angle of the tank floor
- E. Mixers shall include integrated power cable as a lowering mechanism for simplicity
- F. Mixer provider must have more than 1000 installation of similar equipment in potable water tanks or reservoirs.
- G. Mixers shall have no oil-filled parts
- H. All wet-side mixer components shall be certified by NSF to the NSF/ANSI Standard 61
- I. Dry-side mixer components shall include sine filter to prolong motor life and reduce noise level.
- J. Power source for mixer shall be 115VAC single phase grid power to allow unit to continue 24/7 operation.
- K. No regular, periodic maintenance required on the wet-side components in typical potable water application
- L. No passive mixing system allowed.

2.3 CONSTRUCTION

- A. Components – wet-side: shall be certified by NSF to the NSF/ANSI Standard 61.
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" x12" or larger. UTILITY may prefer to puncture sidewall or ceiling of tank (in place of penetrating the hatchway) to allow motor cable entry into the tank and protection against freezing/ice damage.

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

1. Nozzle
 - AISI Type 316 Stainless Steel
2. Nozzle housing
 - AISI Type 316 Stainless Steel
 - Brush finish to minimize surface corrosion
 - Buoyancy mechanism to keep nozzle pointing upright no matter the angle of the tank floor
 - Chlorine/chloramine resistant rubber foot pad to avoid scratching tank floor
 - Integrated power cable and lowering mechanism for simplicity
3. Motor
 - Stainless Steel 304 body
 - Chlorine/Chloramine resistant rubber seals
 - Fully submersible

Please select one of the two dry-side options below for control mechanism

- B. Option 1: for Single Phase 115VAC configurations: Component – On/Off Safety Disconnect Switch with indicator light and SCADA Interface.
(Note: This is optional and not required for the operation of the mixer):
 1. Enclosure
 - Type 3R
 - Lockable

Weather Resistant
 Indicator light showing Mixer run status
 Manual On/Off Switch
 SCADA Interface: Digital output indicating motor running (Output contacts are SPDT,
 UL/CUR File E44211 Approved Contact Ratings)

C. Option 2: for a Three Phase motor configuration: Components – dry-side: Each 115VAC 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

115VAC, single-phase, with a 300mA trip level GFCI included inside control center

4. Branch Circuit Protection

Panel equipped with a 115VAC 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

Any other controls shown on electrical and instrumentation drawings

2.5 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 45 pounds (~20 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 below a hatch opening in a full tank utilizing the Mixer power cord.
 - 2. Installation by personnel with confined space training while the tank is drained and empty.
 - 3. Installation by tank manufacturer personnel during tank manufacture.
- 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 optional SCADA interface or control center shall be installed in accordance with approved procedures submitted and Manufacturer's instruction 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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