**[DRINKING WATER MASTER SPECIFICATION]**

**Submersible Mixer**

**[PROJECT TITLE]**

**SECTION XXXXX**

**PART 1 – GENERAL**

1.1 SCOPE

This section covers the submersible reservoir/tank mixing systems up to 1.5 HP in size intended for continuous use while submersed in potable water storage tanks. Mixer will operate 24 hours a day, 7 days per week. Each mixer shall consist of a water-lubricated submersible motor, an impeller, and a non-submersible control center that houses all controller electronics.

1.2 THE REQUIREMENT

A. CONTRACTOR shall furnish a Big Wave Water Technologies Tidal Wave Mixer with a control center and install mixer together with control center and accessories necessary for operable system.

B. UTILITY shall furnish electrical conduit with either 115 VAC or 230 VAC 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. Classified UL Water Quality NSF/ANSI 61, NSF/ANSI 372

B. Underwriters Laboratories Inc., UL 508A

C. NEMA Type 3R, 4, and 12

D. CSA Type 3R, 4, and 12

1.4 CONTRACTOR SUBMITTALS

1. NSF Certification

Copy of the NSF-61 certified listing for reservoir mixer material being placed inside the tank.

1. Installation, O&Ms shall be obtained from the equipment manufacturer
2. General equipment specifications and data sheets
3. Installation, startup, operation, and maintenance instructions
4. Factory-recommended maintenance schedule
5. Wiring diagram

1.5 QUALITY ASSURANCE

A. Each reservoir mixer shall be tested prior to shipment.

B. Complete mixing system is NSF/ANSI Standard 61 certified.

* 1. WARRANTY

For the period of time beginning with shipment to buyer and ending at the timeframe listed below, the reservoir mixer is warranted to be free from shortcomings in material and workmanship and to conform to manufacturer’s specifications.

1. Three (3) years on all supplied parts
2. One full year labor
3. Lifetime warranty on impeller

**PART 2 – PRODUCTS**

2.1 PERFORMANCE

Reservoir mixer 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.

A. 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.

B. 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. Reservoir mixer consists of an impeller mounted on a submersible motor and supported thirty (30) inches 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. Wetside of mixer shall weigh less than 40 pounds and dry-side shall weigh less than 20 pounds for safety of installation. Both wet-side and dry-side shall be able to be hoisted, installed, and/or removed by on-site personnel without additional equipment needed 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. Reservoir mixer active components shall be elevated at a minimum of 30 inches above tank floor to avoid disturbing accumulated tank sediment or entraining particles and causing accelerated wear of moving parts. Tripod configurations shall not be acceptable.

C. Mixers using submersible pump with slit or “water sheet” or horizontal motor mounting designs are not acceptable.

D. The use of an unstable tripod as a base shall not be used to assure no damage to tank coatings.

E. Mixer shall produce 35 lbs. of downward thrust while mixing.

F. Oil-filled motors shall not be acceptable.

G. All wet-side mixer components shall be certified by NSF to the NSF/ANSI Standard 61. .

H. Power for mixer shall be 120 VAC single-phase grid power.

I. No maintenance shall be required on the wet-side components in typical potable water application.

J. Passive mixing system shall not be acceptable.

K. Pumped water or jet mixers shall not be acceptable.

L. Mixer shall utilize VFD control center to maximize mixing efficiency. Constant speed mixers shall be modified to accommodate this feature.

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 any 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 24-inch x 24-inch or larger. UTILITY may prefer to penetrate side wall or ceiling of tank (in place of penetrating the hatch) 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
   1. Balanced to within 0.5 gram-inches
   2. Not more than 1.5 inches in overall height
   3. Not more than 5.2 inches in diameter
   4. Not more than .5 lbs. in weight
   5. Shall not create cavitation at any rotational speed up to 3,450 RPM
2. Motor
   1. AISI Type 304 stainless steel body
   2. Chlorine/chloramine resistant rubber seals
   3. Fully submersible
   4. Low power (1.5 HP maximum)
   5. Water-lubricated motor
3. Mounting
   1. Mixer frame shall be constructed of high-density polyethylene
   2. Attachments secure motor cable away from impeller
   3. Overall weight of wet-side unit not to exceed 40 lbs. for ease of installation and operator safety when installing
   4. Overall height of unit shall not exceed 42 inches, including lifting arm

B. Components (dry-side): Each 120 VAC control center shall consist of the following components:

1. Enclosure
2. Type (NEMA 3R) lockable
3. Weather resistant
4. Overall weight of control center not to exceed 40 lbs.
5. Green and red LED indicator lights show motor status
6. Cooling fan
7. Power switch located inside of panel
8. Motor Controller/VFD
   1. Rated to 1.5 HP
   2. Operating temperature range -4 ºF to 131 ºF (-20 ºC to 55 ºC)
   3. Start/stop switch mounted internally
   4. Manual speed control
   5. Built-in thermal shut-off protection
   6. Built-in current overload protection
   7. SCADA outputs included:
      1. Digital output signal indicating motor running
      2. 4-20 mA signal
9. Branch Circuit Protection

Panel equipped with a 120 VAC 20-amp main breaker

2.4 CONTROLS

Each unit shall be equipped with all necessary controls, inter-wired, to provide the following minimum functions:

A. On/off switch to control power to mixer

B. Alarm dry contact to indicate mixer running

C. 4-20 mA signal to indicate mixer current draw

2.5 ACCEPTABLE MANUFACTURERS

Big Wave Water Technologies Model TWM15-230-33-V3R050-3. no approved equals.

**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, operations, and maintenance requirements for the type of equipment installed under these specifications. Mixer must be able to be installed through a   
24” x 24” 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 40 pounds and dry-side shall weigh less than 42 pounds. Both wet-side and dry-side shall able to be hoisted, installed, and/or removed by on-site personnel without additional equipment needed 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 side wall.

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. A water-tight penetration may be installed under the water line

C. Installation of the in-tank 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 below a hatch opening in a full tank

D. Installation of the outside-of-tank components may be performed by:

1. Third party representatives or CONTRACTORS according to the manual provided
2. UTILITY personnel according to the manual provided
3. Safety disconnect provided by others

E. The mixer and control center shall be installed in accordance with approved procedures submitted and as shown, unless otherwise approved in writing.

3.2 TRAINING

Big Wave Water Technologies personnel (or representative) will direct designated personnel in the correct operation of the reservoir mixer. This instruction will cite the operations manual provided with equipment and show how to check for correct operation of the equipment.