

SECTION 11XXX
DIRECT DRIVEN
SUBMERSIBLE MIXERS

PART 1 - GENERAL

1.01. DESCRIPTION

The Installer shall furnish, install, test and place in satisfactory operation, as shown on related Plans and as specified herein ____ quantity (#) submersible direct driven mixer(s) with all appurtenances, accessories, and spare parts necessary to produce a complete and workable installation. The control system shall be furnished by others under Division ____.

1.02. RELATED WORK SPECIFIED ELSEWHERE DESCRIPTION

- A. Refer to Division ____ for supplementary requirements for guarantees, shop drawings, technical manuals, start-up, etc.
- B. Division ____ for Electrical

1.03. SUBMITTALS

A. DATA TO BE SUBMITTED

- 1. The Contractor shall submit information for the units that he proposes to supply, showing thrust (N), propeller diameter, propeller speed, brake horsepower, power input to electric drive motor for the various conditions under which the units are to operate along with descriptive data and specifications describing in detail the construction of the complete units.
- 2. The parameters thrust and power input to the drive motor shall have been measured in accordance with ISO 21630 during product development.

B. DIMENSIONAL DATA

The successful bidder may be required to submit to the Engineer or specifying authority for approval, shop drawings, showing all weights and dimensions necessary for the installation of foundations and anchor bolts.

PART 2 - MATERIALS

2.01. MANUFACTURERS

A. MANUFACTURER

Submersible mixers of a rugged, long-lasting design as manufactured by Wilo USA LLC or pre-approved equal shall be supplied.

Any manufacturer, other than specified, proposing to offer the following equipment must submit sufficient information to the Engineer to determine that the equipment complies with the requirements of these specifications. The Engineer or approving authority must receive this information not less than 14 days prior to the Bid Date. The pre-bid qualification package shall include complete mixer performance data, evidence of compliance with the installation

experience requirements of this Section and a letter from an officer of the company of the mixer manufacturer listing all exceptions to the specifications.

B. PERFORMANCE

Furnish ___ (#) submersible mixers for the ___ basin(s). The basin(s) shall contain wastewater mixed liquor of a solids concentration of not more than ___ 1% (higher concentrations available – refer to factory for ratings) total suspended solids (TSS) by weight. Each mixer shall be capable of the following performance:

Parameter	Basin Name
Number of basins	
Number of mixers per basin	
Basin dimensions, L x W x H x SWD, ft	
Model	
Minimum Propeller Diameter, in. (mm)	
Number of Propeller Blades	
Maximum Propeller Speed, rpm	
Minimum Circulation, gpm (m ³ /s)	
Minimum Thrust, lbf (N)	
Maximum Motor Speed, rpm	
Maximum Rated Motor, hp/unit	
Motor voltage, v / phase	230 or 460 / 3
Minimum Motor Reserve at rated duty, %	
Minimum Water Level above Propeller under ideal conditions, feet (mm)	1.0 (300) (TR20-1, TR30-1, TRE30) 1.64 (500) (TR40-1)
Guide rail (mast) size, mm x mm	

2.02. MIXER CONSTRUCTION

A. GENERAL

1. The mixer shall be the submersible type and shall be installed in location as shown in the plans.
2. All mating surfaces of the major castings requiring a watertight seal shall be machined and fitted with FKM (Viton®) O-rings.
3. All nuts, bolts, washers, and other fastening devices supplied with the mixer shall be AISI 316 stainless steel.

B. MIXER HOUSING

All major components of the mixing unit (i.e., stator housing and cable entry) shall be manufactured from close-grained ASTM A48 Class 35 or higher (GG25) cast iron. The output seal housing shall be investment cast AISI 316 (1.4408).

C. PROPELLER

1. Propellers shall be manufactured from investment cast AISI 316 (1.4408). No welded or metal formed propeller shall be accepted. Welded and/or non-hydraulic efficient designs are strictly prohibited. Any propeller design that require propeller shrouds or flow straitening devices are strictly prohibited due to inherent power loss and potential of collection of solids.

2. The propeller shall be of a true hydrofoil design and have a swept-back profile and at least three (3) blades. The propeller blades shall be thicker on the leading edge than the trailing edge and thicker towards the hub than at the tip to allow the propeller to free itself from rags as it turns. The blades shall be smooth, finished throughout, and shall be free from sharp edges.
3. Propellers shall be statically and dynamically balanced. The propeller hub shall be constructed of AISI 316 (1.4408) stainless steel.
4. The propeller shall have a hollow shaft-shaped base. Propeller base shall feature a reverse helix where rotation of the propeller results in a pumping action of the vanes of the helix where any debris is pumped away from the mechanical seal area. Additionally, the base shall cover and protect the mechanical seal. Designs without such protection are prohibited.
5. The propeller shall be slip fit and securely held to the shaft by a stainless steel washer and bolt assembly. The output shaft end shall be keyed to mate with a matching key recess on the hub of the propeller.

D. BEARINGS

1. Each mixer shall be furnished with two (2) sets of bearings spaced to minimize shaft deflection to offer maximum bearing life.
2. Mixer shaft overhang and bearing design shall provide a minimum B10 life of 100,000 minimum throughout the design operating range.
3. Bearings shall be sealed, permanently grease lubricated and maintenance-free.

E. MECHANICAL SEALS

1. Each submersible mixer shall be provided with a separate and isolated seal chamber.
2. The seal chamber shall be provided with an independent mechanical seal.
3. Each mechanical seal shall be provided with solid sintered silicon carbide seal face material on both the stationary and rotating components. Other materials, such as tungsten carbide or ceramic, are prohibited.
4. The seal chamber shall be constructed of AISI 316 stainless steel.
5. A moisture sensor probe shall be furnished in the seal chamber of each mixer. The sensor shall be wired to the control panel and shall activate an alarm light upon moisture intrusion.
6. The seal sensor probe shall be externally located and accessible for maintenance without the need to disassemble the mixer for service or replacement.

2.03. MOTORS

A. SUBMERSIBLE MOTORS

1. Each mixer shall be furnished with a squirrel cage, induction motor enclosed in a watertight housing suitable for use and compatible with all variable frequency drive systems. The air-filled motor design shall be liberally sized for efficient heat transfer via the motor housing to dissipate within the fluid surrounding the mixer unit during normal operation. All mixer motors shall be rated for continuous operation.

2. The motors shall be air-filled and constructed of moisture resistant NEMA Class H insulation and Class H slot liners and constructed to NEMA B design standards. The copper wound stator shall be dipped in epoxy enamel and hardened to withstand a temperature of 180 degrees Centigrade as defined in NEMA Standard MG-1. Each winding phase or layer shall be laced with Class H glass lined paper. The use of cable ties to restrain windings shall not be allowed. The rotor shall be statically and dynamically balanced after fabrication. The rotor shall utilize aluminum amortisseur bars and short circuit rings. The constructed motor shall be certified for continuous duty with a service factor of 1.10 on sine wave power.
3. Motors shall be capable of sustaining 15 starts per hour (unlimited starts with VFD) at an ambient temperature of 40°C.
4. Motors shall be capable of uninterrupted operation with a voltage drop of 10%.
5. Thermal switches shall be furnished to monitor stator temperatures. The stator shall be equipped with two (2) thermal switches. Thermal switches shall automatically de-energize the motor when its temperature exceeds a preset limit as recommended by the manufacturer.
6. The motor shall bear the FM (Factory Mutual) explosion-proof label certifying its use in a Class 1, Division 1, Groups C & D hazardous location.
7. The manufacturer's nameplates shall be engraved, laser etched or stamped on stainless steel and fastened to the motor casing.

B. SHAFTS

1. Motor shafts shall be AISI 420 (1.4021) stainless steel. Carbon steel shafts or shafts with sleeves of any type are not acceptable. The shaft shall be one-piece construction without joints or stubs attached.

C. POWER AND CONTROL CABLES

1. Power and control cables shall be furnished in lengths to run un-spliced from the mixer to the control panel or disconnect as shown on the Contract Drawings and as specified herein (40-ft). Cables shall terminate with conductor sleeves that bundle the entire group of strands of each phase to improve termination at the pump control panel. The sleeves shall be provided to confirm that all strands of each conductor are terminated properly.
2. Cables shall be of the "NSSHOU" type and shall be approved by the MSHA for use in hazardous locations and shall conform to industry standards for loads, resistance under submersion against sewage, and be of stranded construction. The cables shall enter the mixer motor through a heavy duty galvanized cast iron entry assembly that shall be provided with an external clamp assembly to protect against tension once secured providing a strain relief function as part of standard construction.
3. The cables for each mixer motor shall pass through the galvanized cast iron strain relief component and then through a series of stainless steel disks and Buna-n grommet that is sandwiched between the disks to control compression of the grommet. The cable entry design shall be of the type recommended in the Factory Mutual Research Corporation specifications for Explosion Proof Certification. The entry shall be comprised of the cast iron fitting that will include the Buna-N strain relief grommet coupled with a poured conductor section. In the poured section, only Factory Mutual approved sealant shall be used to wick into each conductor strand that has the insulation removed in this area to provide a positively leak proof seal for the power and sensor cords.

2.04. REMOVAL SYSTEM**A. GUIDE RAIL (MAST) SYSTEM**

1. Where called for on the drawings and to accommodate ease of removal, a guide rail of AISI 304SS shall be used to mount each mixer during operation and to guide the units during installation and removal for service. The system shall consist of a bottom assembly, mixer support assembly, guide rail, upper support, and positioning device. The system is to be fixed at the bottom of the tank in a pivot that shall allow horizontal rotation of the mast through not less than 120 degrees. All brackets shall be constructed of AISI 316 stainless steel. The mast bearings shall be constructed of Hostaform (POM). Power/control cable holders shall be provided per manufacturer's recommendation.
2. The bottom assembly shall be bolted to the floor of the tank, and provide support for the guide rail. It shall also include a hole to accept the guide pipe bottom plug.
3. The assembly shall be strong enough to support the weight of the mixer, the guide rail and the mixer preload force. The assembly shall be positioned in such a manner to prevent the mixer blade tips from hitting the basin floor.
4. The upper guide holder assembly shall secure the system to the tank edge or platform. It shall also provide the lateral support for the guide rail. The assembly shall contain a location to secure the electrical motor cable holder.
5. Mixer support frame (including angular adjustment brackets) shall be manufactured from AISI 316Ti stainless steel.

B. HOIST (CRANE) ASSEMBLY (If Required)

A hoist system shall be used for lifting and lowering of the mixer on the guide rail during installation and maintenance. The system shall be capable of 360 degree-rotation. Each hoist assembly shall be rated at a minimum of 250-kg (550-lb). The crane boom and mast shall be constructed of AISI 304 stainless steel. The winch shall be constructed of AISI 304 stainless steel. The compatible lifting cable shall be constructed of AISI 316SS. The sleeves and the bearings in the receiving box shall be constructed of Nylon (PA).

2.05. SHOP PAINTING**A. Primer and Finish Paint-Shop apply to all exterior ferrous surfaces of the mixer and motor.**

1. Solids by volume: 97%
2. Type: Solvent-free ceramic coating, impregnated with aluminum oxides
3. Total Dry Film Thickness: 400 microns (15 mils) minimum
4. Minimum Adhesion: 15 Newtons per square millimeter (2,030 psi) per ISO 4624.
5. Minimum Hardness: 110 on Buchholz Indentation scale
6. Resistance: Level 1 (continuous duty) for sewage with pH of 6-11, Level 1 for saltwater, Level 3 (not recommended) for 10% hydrochloric acid.

- B. Surface Preparation-Prepare all surfaces to receive coating system.
1. Method: Blasting per ISO 12944-4
 2. Standard Cleanliness Grade: 2.5
 3. Minimum Peak to Valley Height: 70 microns (2.75 mils)

PART 3 - EXECUTION

3.01. WARRANTY

The municipal-use submersible mixers and their motors shall be covered by a non-prorated two (2) year warranty against defects in materials and workmanship that shall include 100% parts and labor. This warranty shall not be limited by hours of running time or operation from variable speed drives.

3.02. FIELD QUALITY CONTROL

The manufacturer shall provide the services of a factory trained service technician to inspect the installation, assist in the successful start-up of the mixers, and instruct the Owner in proper operation and maintenance of the equipment for a period of not less than ____ (#) eight (8) hour days.

3.03. SPARE PARTS

- A. The manufacturer shall furnish one set of the following spare parts: _____

(TBD by specifier)

+ +END OF SECTION + +