

SCOPE OF WORK /SPECIFICATIONS OF GOODS REQUIRED/ TERMS OF REFERENCE

1. Background

The supply, installation and commissioning of suitable submersible stainless steel mixers to create a homogenous bulk flow in three (3) lime tanks at Wiggins Waterworks. The quotation must be inclusive of all labour, tools and consumables required for all works. Service Provider to provide warranty and service support 1 year as a defects and liability period. A compulsory site briefing must be attended.

2. Description of goods/ services required

The Service Provider must:

- The mixer(s) installation should include a guide bar system rigid enough to withstand the weight and reaction forces exerted and position the mixer at an appropriate depth for optimal mixing efficiency.
- A suitably sized lifting equipment (all stainless steel) must be installed with each mixer for lifting (lowering and raising) and easy turning during maintenance operations.
- The currently existing mixers are top entry configuration. There are three (3) lime tanks must be removed and stored in at a specified location area at Wiggins WW.
- All works, tools and consumables required for the connection electrical and instruments must be provided by the Contractor
- All old removed mixer unit items to be stored at a pre-determined location on site.
- Contractor to commission and test the entire system
- All openings must be suitably blanked off or sealed
- Since there are going to be alterations on the existing mixer tanks, the awarded must provide new as-built drawings. The drawings template for UOW is also attached.

2.1 Technical Requirements

Lime tanks

NO.	ITEM	TECHNICAL DESCRIPTION
a.	Current Tank details Material: concrete Drawings supplied	Contents: lime solution Size: 3 x 3 x 3.05m deep Dosing concentration= 12 mg/l Slurry percentage = 3% Operating level - (30% -90%)
b.	Required Compact direct drive mixer data	1.5kW, 400V Material: Stainless Steel • Nominal thrust: 215N • Propeller diameter: 210mm

	Quantity of mixers required = 3 (1 per tank)	• Propeller speed: 1430 rpm • Number of blades per mixer = 3 • A total thrust of 215N needs to be produced per mixer of which 115N is required with a power uptake of 67% of max input power per mixer. • A maximum operating temperature of 155 °C with a thermal switch set to trip the mixer at 125 °C.
c.	Required Motor details	a) Motor: Squirrel-cage induction Class F insulation • Rated shaft power: 1.5 kW • Max input power: 2.1 kW • Frequency: 50Hz • Phases: 3 • Poles: 4 b) Electrical connection of mixers and e-stops c) Mixer labels to be installed inside the new MCC cubicle
d.	Instruments Scope	a) Alarm unit 24V AC/DC b) 11 pin relay socket c) Leakage Sensor to automatically detect, together with external monitoring equipment, any leakage in stator and oil housings.
e.	Civil/Mechanical Scope	a) Stainless steel square pipe 50 x 50 b) Guide bracket units (Upper and lower) c) Chain sling 9m length d) Chain sling lower chain connection e) Support unit – lower guide bar position/support f) Block and tackle to suit chain slings g) Lower guide bar position or/ support

2.1 Mixer Manufacturer Requirements

The mixer shall be equipped with a submersible cable, sized according to IEC standard, having a chlorinated polyethylene rubber jacket, and having a length suitable for the function. The mixer design and fabrication must be from a single manufacturer who shall have sole source responsibility for said equipment. The manufacturer shall have mixing equipment of this principal design and of comparable capacity in successful operation in the field for a minimum period of 10 years.

2.3 Mixer Design

The mixer shall be capable of handling raw, screened sewage. It shall be possible, with the exception for floor-mounted mixers, to easily raise and lower the mixer without the need for personnel to enter the

tank. The mixer shall be mounted on a square or rectangular guide bar system or on a fixed floor mount. A sliding guide bracket for the guide bar shall be an integral part of the mixer unit. Mixers under 2 kW may be mounted on a cantilever bar system. The mixer, with its appurtenances and cable, shall be capable of continuous submergence without loss of watertight integrity to a depth of 20 m. Parts exposed to the mixed liquid shall be made of either stainless steel AISI 304 or better or solid corrosion-resistant composite material. Nuts and bolts shall be made of stainless steel AISI 316 or better.

2.4 Motor

The motor shall be directly connected to the propeller. The motor shall be a squirrel cage induction motor, housed in an air filled, watertight chamber. The stator windings and stator leads shall be insulated with moisture resistant Class H (180 0C) insulation. The stator shall be trickle impregnated with Class H varnish and shall be force fitted into the stator housing. Mixers under 2 kW may have Class F insulation. The motor shall be capable of up to at least 30 evenly spaced starts per hour. Thermal switches shall be embedded in the stator lead coils to monitor the temperature of each phase winding.

These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to a control panel. The combined service factor (effect of voltage, frequency and specific gravity variations) shall be at least 1.10. A motor performance chart shall on request be provided showing curves for torque, current, power factor, input power, output power, and efficiency. This chart shall also include data on starting and no-load characteristics. The power cable shall include conductors for the monitoring of thermal switches and optional protecting sensors.

2.5 Cable Entry

The cable entry seal shall consist of two cylindrical elastomer bushings without epoxies, silicones or other secondary sealing systems. The junction chamber and motor compartment shall be air-filled and separated by a terminal board which shall protect the motor interior from foreign material. Connection shall be made between the threaded compressed type binder posts thus securely affixing the cable wires to the terminal board. The terminal board housing shall be sealed off from the stator housing with two O-rings. Mixers under 2 kW are exempted from the requirements on terminal board and number of cable entry bushings.

2.6 Bearings

The mixer shaft shall rotate on three permanently lubricated bearings. The main bearing shall be an angular contact ball bearing to take up axial loads. There shall be two support bearings – one single row angular contact ball bearing to take up axial and radial loads and one cylindrical roller bearing to take radial loads. The bearings shall be pre-loaded by a bearing loading nut located at the upper end of the motor shaft in order to reduce shaft deflection and increase bearing and seal life. Mixers under 2 kW may have two permanently lubricated bearings; one deep groove main ball bearing and one single row angular contact support ball bearing.

2.7 Mechanical Seals

Each mixer shall be provided with a liquid chamber for the shaft sealing system. Each mixer shall be provided with a dual mechanical shaft seal system consisting of two independent seals assembled into one plug-in unit. The seals shall operate in a liquid reservoir that hydrodynamically lubricates the seal faces at a constant rate. The outer seal shall have rings of corrosion resistant cemented carbide (WCCR) or silicon carbide (RSiC).

Only the outer seal shall be exposed to the mixed media. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment. One face of the inner seal ring pair shall have spiral grooves laser etched in it, to provide a pumping action preventing leakage from the oil chamber to the stator housing.

2.8 Oil

The oil chamber shall be filled with a medical white oil of paraffin type. The oil shall be free from aromatic hydrocarbons and be approved according to FDA 172.878.

2.9 Mixer Shaft

Propeller shaft and motor shaft shall be the same unit, without couplings. The shaft shall be made of solid stainless steel EN 10088-3, AISI 431, or comparable.

2.10 Propeller

The propeller shall be of clogging-resistant back-swept design. The propeller shall be capable of handling solids, fibrous materials, heavy sludge, and other matter found in normal sewage applications. The fit between the propeller and the shaft shall be a sliding fit employing a single screw and washer for securing the propeller to the shaft. The propeller shall be made of AISI 316 stainless steel, duplex steel, or abrasive-resistant high-chrome alloy.

2.11 Jet Ring and Vortex Protection Shield

The mixer shall optionally incorporate a jet ring a full 360° around the propeller in order to maximize hydraulic efficiency and minimize power consumption. The mixer shall be prepared for an optional incorporation of a vortex protection shield, preventing air vortices and thereby protecting the propeller and maintaining performance.

2.12 Product Testing

The manufacturer shall have the capability of acceptance testing the mixer regarding thrust and power according to ISO 21630:2007, on request. The mixer manufacturer shall perform the following inspections and tests on each mixer before shipment from the factory:

- Motor insulation test for detection of insulation defects.
- Tightness test of the assembled mixer using a vacuum method.
- Dry-run test to establish mechanical integrity and correct rotation.

- The manufacturer shall on request be able to provide a written report stating that the foregoing steps have been done for each mixer at time of shipment.

2.13 Programme

- Contractor to submit a programme indicating how long the supply and installation will take with the tender documents. No site work is to be started until a dated programme has been issued and all safety compliances have been fulfilled.
- Contractor's program to accommodate or cause minimum disruptions to the plant's normal operations necessary to treat the water
- Once the works commence on site, the Contractor must continue communicating/making arrangements to negotiate with the plant operations staff about work packages on specific items.
- Once work starts on site there must be continuity of work till all site work is completed.

2.14 Guarantee

All items supplied and workmanship to be issued with a 12 months guarantee from date of commissioning.

2.15 General Specifications and Safety Requirements

- a) Before site work starts the contractor / sub contractor to have undergone a safety induction course. See site safety officer and arrange course and for safety requirements. Contact site safety officer Sibongile Mngwengwe – 031 – 203 3000 before tendering to establish exact safety requirements.
- b) Contractor to provide all equipment, insurance, safety equipment, rigging, scaffolding, transport, labour and any other item/s that will be required to fulfil this contract.
- c) All equipment used by the contractor to be safe and checked and signed off on a register to be supplied by the contractor. All power tools and or scaffolding that will be required on site to be certified safe for use.
- d) Contractors staff / vehicles may and can be searched when entering or leaving site.
- e) Staff to report to the site control room whenever entering or leaving site.
- f) Contractor's staff to be under supervision at all times and are not to loiter around the site.
- g) Site to be in a clean and tidy state at all times. Any damaged plant and or surroundings caused by contractor to be made good as per existing. All waste to be disposed of by the contractor daily.
- h) Work on site to be between 7.30 AM and 4.00 PM Monday to Friday.
- i) All work to comply with the OHSA No 85 of 1993 and general good engineering practices. If there is any conflict of specifications the more stringent to apply.

2.16 Work Quality and Safety

- a) Fastener threads not to protrude more than ten threads beyond nuts and not less than two threads beyond nuts. Packing or additional nuts, washers will not be accepted.
- b) All fasteners to be graded SABS and strength according to the application, to be determined by the contractor. (SABS or equivalent) Fasteners may not be cut.
- c) If work is stopped on site due to any unsafe practices Umgeni Water will not entertain any claims due to lost productivity or material.
- d) When working on site suitable protection to be placed around our equipment and waterways, to prevent damage and contamination of water.
- e) All pages of this document to be signed and returned with the tender documents.
- f) All items supplied and installed to be checked and signed off by the contractor and client to confirm items are supplied as per specifications and tender document. Control sheets / copies to be inserted into manuals. All documentation to be supplied by the contractor.

2.17 Commissioning, handing over and payment

- a) After contractor has installed and checked that the unit is ready for running, after the electrics have been completed they are to arrange with the plant operations and maintenance staff a commissioning and handover session.
- b) All drawings and specified mixer information sheets etc. to be included in the manuals. The contractor is to supply manuals and as built drawings giving all details of installation. All drawings as per Umgeni water specifications.
- c) Three sets of manuals to be provided. (Manuals to be lever arc files white plastic)

Title. On front cover.

Wiggins. W.W.

Lime tank mixers

Manuals to have details of all mixers, as well as electrical, instruments and civil specifications and copies of drawings. Name and details of equipment supply, details of installer. Maintenance inspection requirements for the equipment to be included in the manuals