ST 40

OPERATING AND MAINTENANCE MANUAL

FOR

2 x 37kW FIXED BRIDGE AQUASTAR

INSTALLED AT

CAROLE PARK WATER POLLUTION CONTROL WORKS

FOR

IPSWICH CITY COUNCIL

UNDER

CONTRACT No. 19

Aquatec-Maxcon Pty Ltd A.C.N. 002 250 482
Unit 4, 6 Byfield Street,
North Ryde, N.S.W., 2113

Telephone: 02 9888 3999
Facsimile: 02 9888 3044

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1.0 DESCRIPTION OF EQUIPMENT

The equipment supplied under this contract by Aquatec-Maxcon Pty Ltd consists of two (2) - 37 kW fixed bridge aerator assemblies.

The aerators are installed into two (2) concrete, straight walled biological reactors each approximately 440 m^3 hydraulic volume at Top Water Level (TWL). The TWL is set at around 2.5 m from the bottom of the reactor.

Each aerator is capable of delivering 48.0 kg/h of clean water oxygen under normal conditions. The aerators may be jacked up or down to deliver more or less oxygen depending on plant load

1.1 SURFACE AERATORS

Each aerator consists of a 1550 mm dia. AquaStar impeller, driven through a speed reduction gearbox by 37 kW, 4 pole electric motor. The aerators are in a fixed position and are accessed via support bridges.

The impellers are of a modern single scoop radial bladed conical design, patented by Aquatec-Maxcon and are driven at a fixed speed of about 70.4 rpm.

The impellers are driven through double reduction helical gearboxes of exceptionally robust construction. The gearboxes are of Genat & Wood design, particularly developed for aerator service, model No 7220-D225, with a reduction ratio of 20.94:1.

The gears are oil bath lubricated and all bearings are pressure lubricated by a mechanical oil pump located at the top of the gearbox and directly driven by the first reduction shaft. The one exception is the lower output shaft bearing, which is grease lubricated. Each gearbox is fitted with an oil level switch which will automatically initiate aerator shutdown on loss of lubricant or low oil level in the main body of the gearbox.

The aerator motors are of 4-pole design, flange mounted, shaft down, and fitted with thermistors and anticondensation heaters. Full load continuous rating of each is 37 kW. The motors were manufactured by Western Electric.

1.2 PRINCIPLES OF OPERATION

Low speed surface aerators perform two functions: first, they oxygenate the sewage mixed liquor, and second, they provide mixing for the lagoon contents.

Oxygen transfer is achieved by air entrainment in the mixed liquor spray thrown radially over the liquid surface by the rotating radial impeller blades.

In throwing spray outwards over the liquid surface, the impellers also create circulation in the lagoon by pumping liquid upwards under the aerator and, in consequence, radially along the lagoon floor towards the eye of the impeller.

Power draw (and thus oxygen transfer) of the aerator is dependent both on rotational speed, and on depth of impeller immersion.

Speed is fixed in this case, but power draw can be controlled over a 2:1 range by adjusting depth of immersion of the impellers from -25 to +75 mm. This is most conveniently done by jacking up or down the gearbox mounts.

The depth of immersion necessary to give the required oxygen delivery will need to be determined during commissioning trials but is expected to be (for peak transfer case) about +50 mm, i.e. the static water level above the top of the impeller top plate is 50 mm.

2.0 EQUIPMENT DATA SUMMARY

2.1 AERATORS

Manufacturer	:	Aquatec-Maxcon Pty Ltd Unit 4/6 Byfield Street NORTH RYDE NSW 2113 Phone: (02) 9888 3999 Fax: (02) 9888 3044 Aquatec-Maxcon Pty Ltd 119 Toongarra Road IPSWICH QLD 4305 Phone: (02) 3281 2299 Fax: (02) 3281 8259
Model	:	AquaStar
Type	:	Vertical shaft radial blade
Impeller Diameter	:	1550 mm
Rotational Speed	:	70.4 rpm
Immersion Range	:	-25 to +75 mm
Power Draw Range	:	26 kW approximately
Mounting	:	Fixed
Accessories	:	Access bridge

2.2 GEARBOXES

Manufacturer	:	Genat & Wood Pty Ltd
Head Office & Factory	:	5-7 Mason Drive BRAESIDE VIC 3195 Phone: (03) 9580 7522 Fax: (03) 9587 2763
NSW Office	:	3/122 Bonds Road PUNCHBOWL NSW 2196 Phone: (02) 9584 1533 Fax: (02) 9534 1292

2.2 Gearboxes Cont'd...

Type	:	Double reduction, helical gear
Model	:	7220-D225
Reduction Ratio	:	20.94:1
Fittings	:	Oil level switch Input coupling: High torque, rubber cross Dipstick Oil pump
Efficiency	:	97% at full load
AGMA Ratings	:	96 kW durability, 93 kW strength

2.3 MOTORS

Manufacturer	:	Western Electric Pty Ltd
Office	:	Unit 3, 21 Binney Road MARAYONG NSW 2148 Phone: (02) 9622 1199 Fax: (02) 9622 2519
Rating	:	37 kW
No. of Poles	:	4
Speed (at MCR)	:	1465 rpm
Frame	:	D225S
Power Supply	:	415V/3ph/50Hz
Degree of Protection	:	IP56D
Mounting	:	Flange, vertical, shaft down
Insulation	:	Class F (class B rise)
Full Load Current	:	65.6 amps
Full Load Efficiency	:	92%
Full Load Power Factor	:	0.88
Starting Current	:	451 amps
Currently @ Rated Output	:	64 amps

Thermistors	:	Fitted (trip temp 140°C)
Anti-condensation Heaters	:	Fitted

For further performance details refer to Type Test Certificate in Section 6.

2.4 MIXERS

Manufacturer	:	Lightnin Mixers Pty Ltd
Office	:	Unit 5, Block C, 391 Park Road REGENTS PARK NSW 2143 Phone: (02) 9645 2999 Fax: (02) 9645 2433
Model	:	LQ220
Impeller Diameter	:	1100 mm
Rating	:	0.55 kW
No. of Poles	:	4
Rotational Speed	:	54 rpm
Power Supply	:	415 V/3 ph/50 Hz
Mounting	:	Fixed, vertical, shaft down

2.5 DISSOLVED OXYGEN PROBES

Supplier	:	Combined Instrument Systems
Office	:	4 Argent Place RINGWOOD VIC 3134 Phone: (03) 9874 6655 Fax: (03) 9874 1846
Model	:	Phox Model 640 Dissolved Oxygen Monitor & Sensor c/w float, electrode, mounting clamp, cable and junction box.

3.0 INSTALLATION AND COMMISSIONING INSTRUCTIONS

3.1 The two surface aerators supplied to Carole Park W.P.C.W. will have been installed and commissioned by Aquatec-Maxcon Pty Ltd under contract No. 19.

The following notes are therefore given for general guidance only, in case Ipswich City Council staff should find it necessary at some future date to remove and re-install any of the aerator assemblies.

3.1.1 Disconnect the aerator motor electrically and secure electrical cables safely out of the way.

3.1.2 Support load of impeller and undo fasteners between drive shaft and impeller.

3.1.3 Using shackles through the holes in the gearbox, lift the whole assembly out of the lagoon and position it where convenient to allow further dismantling or repair/refurbishment as necessary. The total mass of the assembly is about 900 kg. The motor weighs 320 kg and the gearbox including output coupling and oil fill weighs 585 kg.

3.1.4 If major components such as shaft or impeller are removed, they should be reassembled using new bolts which should be tightened to the torques shown on the drawings.

3.1.5 Reinstatement of the repaired aerator into it lagoon would involve the reverse of the above procedures, noting that once the electrical supply is reconnected the direction of rotation of the impeller should be verified as correct - refer drawing YQ.151-01.

This is an essential step because incorrect rotation direction will result in the gearbox oil pump failing to function with serious damage to the gearbox internals being the inevitable consequence.

3.2 IMMERSION PRESETTING

1. Bring static immersion to the desired level to give the appropriate power draw by jacking the gearbox assembly up or down.

   This is done by raising or lowering the gearbox/motor/impeller and shaft assembly - refer to Detail 2 on drawing YQ152-02 and -03 for construction details of the gearbox mounting and jacking screw arrangement.

   The procedure to raise or lower the assembly is as follows:

   A. Ease bolts item 25, loosen the studs and nuts (item 16 & 17) holding the gearbox height adjustment brackets to the gearbox mounting angle, and raise (or lower) the whole assembly to the desired immersion.

B. As a variation to the above procedure, once the nuts item 17 are loosened, a simple hydraulic or screw jack can be placed under the angle cross member at each end of the gearbox mounting angle and the raising or lowering effected by operating the jack.

C. Once the impeller is at the desired level all bolts and nuts shall be securely tightened.

3.3 PRE-START CHECKS

1. Check gearbox oil level.
2. Check that motor bearings and gearbox lower bearings are charged with grease.
3. Check motor electrical connections.
4. Megger motor for evidence of dampness or other faults.
5. Check that the hinge pins at both ends of the pivoting bridge are not binding and move freely.

3.4 INITIAL START-UP

3.4.1 Start the aerator from the switchboard, under manual control, run for 1 or 2 seconds only and ensure that the sense of rotation is as indicated by the rotating arrow on the gearbox casing and as shown on drawing YQ151-01. This is most important for reasons given in 3.1.5.

3.4.2 If the sense of rotation is correct, continue running for one hour, checking current draw for steadiness and correct value on the switchboard ammeter. Note that the current draw will always be higher for about the 10-15 minutes of operation while hydraulic equilibrium is being established in the tank, i.e. until the contents of the tank are all circulating there is slightly greater power draw and hence higher current.

3.4.3 Stop the aerator after this period and check for any evidence of oil leaks or any other malfunction.

3.4.4 Re-start with one person on the aerator platform. This person should check for satisfactory general operation and freedom from excessive vibration, noise or pitching.

4.0 OPERATING INSTRUCTIONS

Following initial commissioning and testing, the aerators can be run either continuously or intermittently as appropriate to perform best the aeration duty desired of them.

Aerator starting and stopping is controlled by electrical switchboard equipment provided under another contract (i.e. not by Aquatec-Maxcon). There are no operating procedures specifically associated with the aerators themselves, other than occasional levelling and immersion adjustment.

For general operation instructions regarding the aeration system as a whole, please refer to the overall Sewage Treatment Plant Operating Manual.

4.1 AERATOR IMMERSION ADJUSTMENT

From time to time, it may be necessary to increase or decrease aerator impeller immersion in order to optimise system performance, or because one aerator has to be stopped for an extended period for maintenance or overhaul.

Instructions for immersion adjustment are given in the previous Section (3.0). Remember that static immersion measurements will always be 50- mm less than the dynamic values because of the absence of dynamic down thrust effects. Also, the weight of any personnel on the aerator platform will increase immersion by a further 50-60 mm above the normal running value.

5.0 MAINTENANCE INSTRUCTIONS

Only items requiring regular maintenance on the equipment supplied under this contract are the aerator gearboxes and electric motors.

Detailed maintenance instructions for the gearboxes (Genat & Wood) and motors (Western Electric) are included in Section 7 of this manual. However, for convenience, a summary of the main requirements is set out below:

In general, the gearboxes and motors have been designed for a very long service life (gearbox B10 bearing life in excess of 100,000 hours, for example) and no parts replacements are envisaged as being necessary for at least 5 years of normal operation.

5.1 GEARBOX LUBRICATION

All bearings (except the output shaft bearing) and gears are oil lubricated, with the upper bearing receiving a pumped oil supply. The oil pump is located on the top of the gearbox, and is direct driven by an extension of the intermediate shaft. The lower (output shaft) bearing is lubricated with Titan 303 multipurpose EPMP grade grease, with only occasional attention being required as per the detailed instructions of the manufacturer.

The gearboxes have been given an initial charge of oil (18 litres each gearbox) by Aquatec-Maxcon, but this must be replaced after the first 800 hours of normal running. At Carole Park this may approximate to 2 months if the aerators are run 12 hour per day.

Thereafter, the gearbox manufacturer's recommendation is that oil changes should be made at intervals of 4000 hours, depending on severity of the operating conditions. At Carole Park this is expected to approximate to 12 months, but the Council specialist maintenance personnel may modify this requirement, in consultation with the gearbox manufacturer, after examining characteristics of the oil drained from the gearbox.

Oil level in the gearboxes should be checked at about weekly intervals, and additional oil added as necessary to maintain level between the maximum and minimum markings shown on the dipstick. The oil recommended by the manufacturer and initially in the gearbox is Alpha Syn T320 by Castrol Australia.

Alternative brands are available and may be used as long as type and viscosity remain equivalent.

5.2 MOTOR BEARINGS LUBRICATION

The bearings of the Western Electric squirrel cage motors are of a rolling type. The bearing size is 6312. They have been greased prior to despatch from the manufacturer's works. They should be re-greased every 4000 hours using Shell Alvania R3 grease or equivalent. The quantity of grease should be 20 grams in each bearing. Excessive grease would cause overheating.

5.3 MAINTENANCE SCHEDULE

Daily

a. Check switchboard ammeter readings to verify power draws are normal.

b. Visually observe aerator operation to check equal spray pattern and stable operation of each.

Weekly

a. Inspect oil level in gearboxes, and check for any evidence of oil leaks.

b. Check, and clean if necessary, oil breather in gearboxes.

Every Two Months

a. Check motor and gearboxes during running (with one person on aerator platform) for abnormal noise or any other sign of incipient operating problems.

b. Inspect pivoting bridge hinges for wear or loose nuts and bolts and tighten/replace as necessary.

Every Six Months

a. Re-grease motor bearing if it appears that 4000 hours/year operation is likely to be exceeded.

b. Inspect aerator assembly as a whole for any loose connections.

Every Twelve Months

a. Change gearbox oil (see also 5.1).

b. Inspect aerator assembly as a whole for paintwork defects, and touch up as necessary.

c. Regrease motor bearings.

6.0 MANUFACTURERS' MANUALS AND DATA

This section contains documentation provided by the manufacturers, Genat & Wood Pty Ltd and Western Electric Australia Pty Ltd as listed below.

Genat & Wood Gearboxes

- Installation, operating, lubrication manual.
- Gearbox dimension drawing A96, Sht 32.
- Parts drg. SP96, Sht 27.
- Spare parts list.

Western Electric Motors

- Installation and Maintenance Procedures.
- Type Test Certificate.
- Motor outline dimensions drg. No. 2003483

Lightnin Mixers Mixers

- Installation, Operation & Maintenance Instructions.

Combined Instruments D.O. Probes

- ELE International Ltd
- Wall Mounted D.O. Monitor, Operating Instructions

7.0 LISTING OF AS-BUILT DRAWINGS

Drawing No.	Title
YQ151-01	General Arrangement
YQ151-02	Aerator Assembly (Stage 1) Reactor
YQ.151-03	Aerator Assembly (Stage 2) Reactor

Matt,

Find attached a copy of the O&M manual for the original installation of the surface aerators. This and the budget price is about all the useful information available.

Regards,

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>>> Jose Castineyra 3/02/2011 10:18 am >>>
Peter,
This project has been reclassified as maintenance, therefore it will be delivered by Mat Dellaway.
Could you please send him all the information you have gathered so far.
Thank you for your help.
Regards
Jose

>>> Peter Bailey 1/02/2011 7:56 am >>>
Jose,

Find below budget price to complete the impeller & shaft replacement. The indicative price for the impeller & shaft alone is $8,000. Ray mentioned, to replace one unit is $16,000, and two units would be approx. $24,000 because the contract admin / drawings etc would not be applied twice.

How would you like me to proceed with the budget submission?

Regards, Peter.

>>> "Raymond Janowicz" <rayj@aquatecmaxcon.com.au> 31/01/2011 3:49 pm >>>
Peter

As discussed this afternoon, the budget cost to draft, check, manufacture, deliver and install one 37kW AquaStar Impeller and Shaft is:
$16,000 excluding GST.

This includes sourcing and checking the drawing, site inspection, site crane hire and re-commissioning (checking power draw and minimal adjustment).

We trust this is helpful.

Best regards

Raymond Janowicz, RFD
Project Manager, Product Manager Vertical Shaft Aerators
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