PROCESS PUMPS – GENERAL REQUIREMENTS

1. GENERAL

1.1 Description

.1 This section defines the general requirements for the supply and supervision of installation and commissioning of all pumps required for this project.

1.2 Definitions

.1 The terms in the specification generally comply with the definitions of the Hydraulic Institute.

.2 Definitions:

.1 Efficiency: Pump efficiency is calculated as the delivered hydraulic power divided by the electrical power at the inlet box of the pump. Take full account of mechanical and electrical losses.

.2 Performance Curve: The performance curve is a graph of the flow delivered (L/s, x-axis) in relation to the discharge head (metres, y-axis). It generally denotes efficiencies as isopleths and may include NPSH requirements as a function of the flow.

.3 BEP: The BEP (Best Efficiency Point) is the point in the pump performance curve where the pump operates at its highest efficiency.

.4 Rating Point: The pump rating point is the combination of discharge head and flow that the pump must satisfy. It typically is determined on the basis of all duty pumps (one or more, depending on the service) operating simultaneously against the worst system conditions (typically maximum headloss, minimum suction head, maximum discharge head, etc.). This condition is listed in the detailed pump specification and must be satisfied by the pump supplied.

.5 Low Head Point: The low head point is the combination of head and flow that corresponds to the least head the pump might operate against. It is determined on the basis of only one duty pump operating against the system conditions which would produce the least discharge pressure (typically minimum headloss, maximum suction head, minimum discharge head, etc.). The minimum system head is shown or described for each pump. The manufacturer must ensure that the pump can operate satisfactorily, without cavitation in the pump casing or over-stressing of the motor, at the intersection of the pump curve and the minimum head curve, or low head point.

.6 Low Speed Point: The minimum flow and head conditions against which a variable speed pump is expected to operate.

.7 NPSH (Net Positive Suction Head): The total pressure (atmospheric) at the pump suction. The available NPSH is the pressure available at the pump suction and is a function of site atmospheric pressure and suction piping losses. Required NPSH is the

pressure required at the pump suction to ensure cavitation due to water column separation does not occur. Required NPSH shall be defined by the pump supplier at the pump inlet connection whether that be at the casing or at the face of a suction reducer/ elbow supplied as an integral part of the pump.

.8 Minimum Diameter Passing: Solids handling pumps have listed a minimum diameter passing. A sphere of this size must be capable of passing from the pump intake to the discharge.

1.3 Submittals

.1 Shop Drawings: Submit in accordance with Section 01300 and Section 11005. For all pump shop drawings, in addition to the requirements of Section 11005, include the following specific details:

.1 Performance curve for the pumping unit(s) superimposed on the system curve for the particular pumping application. Where the system curve is not included in the specifications, request this information from the Engineer when required. With the performance curve, include efficiency isopleths and NPSHR variation with flow. Where required in the specific pump sections, the performance curve should be certified in accordance with Hydraulic Standards.

.2 Motor operating data, including motor and insulation ratings, start-up and operating current ratings, operating voltage and amperage tolerances, description of construction complete with illustrative drawings, and any other pertinent information.

.3 List of materials of construction, detailing the component parts of the pump(s), their materials of construction, and reference specifications for those materials.

.4 Required ancillary services including, but not limited to electrical, seal water, and drains. The sizes, ratings, and any other pertinent information related to these services.

.5 Installation instructions indicating assembly and mounting requirements, alignment and assembly tolerances, and points of connection for ancillary services (electrical, seal water, drains, etc.).

.6 Start-up instructions including lubricant requirements, electrical requirements, etc.

.2 Operating and Maintenance Data: Provide for incorporation in operation and maintenance manual as specified in Section 01730. Include the following:

.1 Complete description of operation

.2 General arrangement and detailed drawings

.3 Wiring diagrams for power and control schematics

.4 Parts catalogues with complete list of repair and replacement parts with section drawings, illustrating the connection and the parts manufacturer's identifying numbers.

.3 Number of weeks prior to shipment that Engineer will be required to supply final conditions of flow and head for trimming the impeller. Manufacture casings to the conditions given on the system head curves, but complete final trim of the impellers according to the flow and head supplied for this pump on or before a date agreed on between Contractor and the Engineer.

1.4 Coordination

.1 Coordinate with other Divisions to ensure there are no conflicts in the work.

1.5 Shipment, Protection and Storage

.1 Ship pre-assembled to the degree that is possible. Inform installer of any site assembly requirements.

.2 Securely fasten heavy wood blanks to the pump flanges. Use blanks that are larger diameter than the flange. Protect machined surfaces against rusting. Protect threaded connections with threaded plugs or caps. Protect open, plain pipe ends with caps.

.3 Where pumps are to be stored on-site for any period of time exceeding one week, instruct site staff of specific requirements to ensure there is no uneven wear or distortion of pump component parts.

.4 Identify any special storage requirements.

2. PRODUCTS

2.1 Pump Performance Requirements

.1 Provide pumps that are suitable for continuous duty.

.2 Select impellers for fixed speed pumps that permit operation at an efficiency within 5 percent of the efficiency at the Best Efficiency Point.

.3 For variable speed pumps, select pump speed and impeller diameter which allow operation from the Rating Point to the Low Speed Point at efficiencies within 10 percent of efficiency at the Best Efficiency Point.

.4 Ensure that motors are sufficiently sized to drive pumps at a maximum speed when the head is as defined for the low head point.

.5 Provide pumps capable of operating at 30 percent of the flow at the rated capacity with good efficiency without exceeding the motor horsepower, and capable of operating at any point on

its characteristic curve, to where that curve intersects the low head point, without exceeding motor power rating.

2.2 Pressure Sensing

.1 Supply a means of measuring inlet and outlet pressure with each pump, except as noted.

.2 For centrifugal pumps handling clean water, provide gauges for the inlet and outlet of each pump. Mount on the connections described for equipment in Section 11005.

.3 For submersible pumps, provide only one gauge for mounting on the discharge of the pump on a weldolet installed outside, but within 2 metres of the wetwell.

.4 For centrifugal pumps handling sewage, sludge, grit, or effluent water, provide one pressure sensor and one gauge for each pump. Refer to standard details for mounting requirements.

.5 For positive displacement pumps (diaphragm, piston, etc.), provide full pipe diameter annular ring pressure sensor for both the suction and discharge, complete with gauges and connections for instrumentation devices.

.6 Refer to Division 17 for instrument specifications for gauges and pressure sensors.

2.3 Pump Seals

.1 Provide double mechanical seals, as scheduled, unless otherwise noted in the pump data sheets.

.2 Provide non-destructive, self-aligning seals of the stationary design with require no wearing sleeve for the shaft.

.3 Material of construction:

Type of Service	Metal Parts	Spring(s)	O-Rings	Faces
Potable water	316 or 317L Stainless Steel	316 or Hastelloy C	Buna-N or Viton	Silicon Carbide on Carbon
Sewage	316 or 317L Stainless Steel	316 or Hastelloy C	Viton	Sintered Silicon Carbide on Carbon
Secondary Sludge (RAS), WAS, TWAS, and SUB	316 or 317L Stainless Steel	316 or Hastelloy C	Viton	Tungsten Carbide on Sintered Silicon Carbide
Primary Sludge	316 or 317L Stainless Steel	316 or Hastelloy C	Viton	Tungsten Carbide on Sintered Silicon Carbide

.4 Approved manufacturers are:

.1 Durametalic
.2 John Crane
.3 Chesterton

2.4 Bearings

.1 Refer to Section 11005.

2.5 Protective Guards

.1 Provide a protective guard for all couplings and keys, drive belts, or other exposed rotating devices. As a minimum, conform to the requirements of Section 11005.

2.6 Couplings

.1 For all pumps other than submersible and where noted otherwise in the detailed specifications, provide flexible, double disc, spacer type couplings between the pump shaft and driver shaft conforming with Section 11005.

.2 Design couplings so that the pump unit can be disassembled without disturbing face piping.

2.7 Pipeline Couplings

.1 Where shown on the drawings, provide single arch flexible couplings at the suction and discharge of pumps. Refer to Section 15053, Clause 2.2.5.

2.8 Shafts

.1 Design shafts to absorb 1.15 times the rated power of the motors required to drive the pumps when the pump is fitted with maximum size impellers.

2.9 V-Belt Drives

.1 Do not use V-belt drives unless specified or shown on the drawings.

.2 Conform to the requirements of Section 11005.

2.10 Spare Parts

.1 For each pump, provide for one spare mechanical seal or packing kit (as applicable) and one set of pump bearings.

.2 For each centrifugal pump type and size, provide a single impeller, wear plate, suction ring (if replaceable), one pump shaft, and nut.

.3 Meet additional spare parts requirements as stated in detailed equipment specification sections.

2.11 Factory Performance Testing

.1 Where required for specific pumps, as noted in the sections related to those pumps, factory performance test all pumps.

.2 Conduct factory performance testing in compliance with the Hydraulic Institute Standards.

.3 Inform the Engineer at least three weeks prior to the factory testing to allow for the Engineer's attendance.

.4 Certify test results and summarize findings in a short report. Submit report within three weeks of completing factory tests.

.5 Where the pump(s) does not satisfy the specified performance requirements within the tolerances specified by the Hydraulics Institute, redesign, modify, and retest the pump(s), all at no additional cost.

.6 Do not ship the pump(s) until the test result report has been submitted to the Engineer.

2.12 Protective Coatings

.1 Factory prime all pumps in accordance with Section 09905. Finish coat submersible pumps in the factory in accordance with Section 09905.

3. EXECUTION

3.1 General

.1 Comply with the requirements of the specific sections for the pumps to be provided.

3.2 Installation

.1 Comply with the requirements of Section 11020 and any special requirements listed in the specific sections related to each pump.

3.3 Testing

.1 Field test all pumps greater than or equal to 3.7 kW, and smaller units where noted, to verify performance.

.2 Provide temporary connections, flow monitoring, pressure monitoring, ammeters, and temporary tankage required for the performance of the tests.

.3 Flow Metering

.1 Where possible, use fill and draw techniques to determine the amount of flow conveyed during the test period. Ensure that the volumes are sufficient for at least 5 minutes of pump operation at the flows that are to be tested, other than run-out.

.2 Where permanent flow meters are installed on the downstream piping, they may be used to measure the flow during testing when accepted by the Engineer. Ensure that the

permanent flow meters are calibrated to within five percent of the rated flow of the pump to be tested prior to testing.

.3 Temporary metering may be used if accepted by the Engineer. Temporary meters must have an accuracy of plus or minus 5 percent, at the rated flow of the pump, to be acceptable.

.4 Where other methods are not possible or where directed, use dye testing to determine the flow during the test periods. Dye testing is to be conducted by an agency acceptable to the Engineer. Measured flows during the testing will be certified by a qualified Engineer to be within five percent of the actual flows.

.4 Pressure Monitoring

.1 Do not use permanent gauges for pressure monitoring during tests. Temporary test gauges can be connected to the permanent gauge taps.

.2 Use gauges with sufficient accuracy to measure anticipated pressures on pump discharges within 2.5 percent. Where pump suction draws from an open tank or wet well, test gauge must be capable of measuring pressure at pump suction within 1.0 kPa.

.3 Provide evidence of pressure gauge calibration within 3 months of conducting tests.

.5 Test pump(s) at a minimum of three flow conditions, typically corresponding to the rating point flow, 75% of that flow, and 120% of that flow. At each test point, measure flow, pressure, and amperage. In addition, verify run-out conditions.

.6 For variable speed pumps, conduct the tests at two speeds, typically 100% of the design speed and 30% of the design speed.

.7 Field Test Report

.1 Compile field test results into a report for submittal to the Engineer.

.2 Describe test set-up and measurement devices used to conduct the tests.

.3 For each pump, list the specified performance requirements and field test results. Show field test results (flow, pressure, power draw) superimposed on the performance curve provided with the submission.

.8 Where field tests do not verify compliance with specified performance requirements, investigate cause for noncompliance, undertake remedial work as required to bring pump into compliance, or replace the pump and all necessary ancillaries, and retest to prove compliance. All work required to bring the pump into compliance is the responsibility of the Contractors.

END OF SECTION

HORIZONTAL, AXIAL PROPELLER MIXERS

1. GENERAL

1.1 Work Included

.1 This Section specifies the supply and supervision of the installation, testing, and commissioning of horizontally mounted, submersible, axial flow impeller mixers with submersible motors and all associated appurtenances.

1.2 Submittals

.1 Submit in accordance with Section 11300.

1.3 Coordination

.1 For mixers requiring VFDs, coordinate design, supply and installation of mixers and motors with VFD manufacturer.

1.4 Shipment, Protection, and Storage

.1 Identify any special storage requirements. Store on site until ready for incorporation into the work using methods recommended by the manufacturer to prevent damage, undue stress or weathering.

2. PRODUCTS

2.1 Description

.1 Use these mixers for mixing large volumes of water or dilute sludge (total suspended solids less than 10,000 mg/L).

.2 Include a specially designed propeller, mounted horizontally with a jet ring. Make the motor in-line with the propeller shaft, submerged in the fluid. Provide a guide bar lifting system to allow removal and replacement of the mixer.

.3 Ensure the mixer is easily removed for inspection or service without the need for personnel to enter the tank.

2.2 Acceptable Manufacturers

.1 Supply products, modified as necessary by the manufacturer to provide the specified features and to meet the specified operating conditions. Refer to Section 11005.

.2 Design Standard:

.1 Flygt

2.3 Capacities and Performance

.1 Specific mixers are listed in the detailed specification sheets at the end of this section.

2.4 Materials

.1 Fabricate propellers of corrosion- and abrasion-resistant stainless steel.

.2 Fabricate casings of solid stainless steel.

.3 Fabricate shafts of 420 or 329 stainless steel conforming to ASTM A276.

.4 All stainless steel components must be pickled and passivated in accordance with Sections 15050 and 05500.

2.5 Propeller

.1 Provide three-blade propellers with fixed blade angles. Backward curve the leading edges to allow shedding of fibrous material.

.2 Provide propeller assembly with a jet ring.

2.6 Shaft

.1 Connect the motor directly to the shaft.

.2 Design the shaft with sufficient strength and diameter to withstand whip and deflection.

2.7 Motor

.1 Provide submersible motors and the associated shafts, bearings, and seals in accordance with Section 11207.

.2 Provide variable speed drives and controllers in accordance with Division 16.

2.8 Gear Drives

.1 For designs that employ gear drives to achieve the appropriate propeller speed, design to AGMA standards for continuous heavy duty service.

.2 Seal gear drives in watertight enclosures and provide permanent oil lubrication.

.3 Use bearings with AFBMA B10 bearing life of 100,000 hours.

2.9 Accessories

.1 Provide single 50 mm wide guide bar for each mixer, complete with all mounting brackets and fasteners. Fabricate all components of stainless steel.

.2 Provide a stainless steel cable, shackle, and hook for each mixer.

.3 Provide power cable.

2.10 Spare Parts

.1 Provide one shelf spare horizontal axial propeller mixer.

.2 Other spare parts are not required for this Contract.

3. EXECUTION

3.1 Manufacturer's Representative

.1 Arrange for a technically qualified Manufacturer's Representative to attend the installation work, certify correct installation, train operating and maintenance staff and undertake the testing of the system for sufficient periods, to ensure the equipment is installed, operated, and maintained in accordance with the manufacturer's recommended procedures.

3.2 Installation

.1 Verify satisfactory delivery of the equipment by completing Form 100, illustrated in Section 01650.

.2 Ensure that each mixer is installed in accordance with Section 11020 as required to provide satisfactory service.

.3 Instruct installer in the methods and precautions to be followed in the installation of the equipment. Certify the installer's understanding by completing Form 101, illustrated in Section 01650.

.4 Cooperate with the installer to fulfill the requirements for a successful installation as documented by Form 102, illustrated in Section 01650.

3.3 Startup and Testing

.1 Ensure that each mixer, including all component parts, operates as intended.

.2 Cooperate with the installer to fulfill the requirements for successful testing of the equipment as documented by Form 103, illustrated in Section 01650.

.3 Refer to Section 11300 for testing requirements.

3.4 Commissioning

.1 Attend during commissioning of the process system which includes the mixer specified in this section to ensure that the mixer functions as intended in the process system.

3.5 Training

.1 Provide the services of factory trained instructors for the purpose of training the Owner's personnel in the proper operation and maintenance of the equipment. Provide not less than two sessions of at least 2 hours training each. Conform to the requirements of Section 01664.

END OF SECTION

EarthTech
A Tyco International Ltd. Company

Iqaluit WWTP Conversion and Expansion

Axial Propeller Mixer

Data Sheet # DS-MXR-220

Equipment Name
Aeration Mixer

Tag Numbers
MXR-220, MXR-221

Specification Section
11314A

Location	Designer
Bioreactors -Aeration Cell 3	MJW

P&ID	General Arrangement	Commodity	Project No
I3-02	P3-01, P3-03	Mixed Liquor	75360

ENVIRONMENTAL CONDITIONS	Hazardous and/or Corrosive Area				Slightly corrosive						
	Inside/Outside/Undercover/Submerged				Submerged, inside, under				Elevation (m geodetic)		8
	Ambient Temp.	°C	Max	35	Min	-40			Ambient Pressure	kPaA	102
PROCESS MECHANICAL	Impeller Type		Axial Propeller			Variable Speed	(Y/N)	No			
	Impeller Diameter	mm	BM	Belt Drive	(Y/N)	No			Direct Coupled	(Y/N)	Yes
	Base Plate Dim.	mm	(L) BM		(W) BM		Overall (H)			BM	
	Weight	kg	(pump) BM		(motor) BM		(base) BM				
	NPSH	m	(req'd) BM		(avail) N/A						

Nozzles	Size (mm)	Rating	Facing
Inlet	N/A	N/A	N/A
Outlet	N/A	N/A	N/A

		Minimum	Normal	Maximum
Capacity	L/s	N/A		N/A
TDH	m	N/A		N/A
Discharge Head	m			
Suction Head	m			
Fluid Temp	°C	10	15	25
Vapour Pressure	kPaA	1.2	1.7	5
Solids Conc'n	%	0.3		0.5
Viscosity	cP		2	
Density	kg/m³		1000	
Pump Efficiency	%	BM	BM	BM

Max Empty Pipe Start Head (m)	N/A
Corrosivity/Abrasiveness/Erosion/Hazard	N/A

Utilities	Y/N	Inlet P (kPag)	Inlet Temp (°C)	Consumption
Seal Water	N	N/A	N/A	N/A
Instrument Air	N	N/A	N/A	N/A
Service Air	N	N/A	N/A	N/A
Other	N	N/A	N/A	N/A

ELECTRICAL	Power	kW	(calculated)	1.1		(name plate)	2.3
	Motor Speed	rpm	BM	Max. Operating Speed	rpm	1660	
	Voltage	V	600				
	Phase		3				
	Frequency	Hz	60	(high)	N/A	(low)	
	Enclosure		Submersible				

Electrical		Comments
Class: 1	Division: 2	Classified under cover of bioreactor cells

CONSTRUCTION	**Material**	Impeller	Stainless Steel 12S8011SP
		Shaft	420 (per Flygt) or 329 Stainless Steel, ASTM A276
		Casing	316 Stainless Steel
		Base	BM
		Wear Ring	BM
			Refer to Specifications
	Packing (Y/N)	No	Seal (Y/N) Y — Type: Tandem double mechanical

ACCESSORIES	Cable: 20 cable
	Guide Bar: 50 mm dia., 316 Stainless Steel - System 4 Guide Bar
	Lifting Cable: 6 mm x 12.2 m long, 9.7 m lift, 316 Stainless Steel, with hook and shackle
	Davit/Base: N/A
	Winch: N/A
	VFD: N/A
	Flange Adaptor: N/A

ACCEPTABLE PRODUCTS	Design Standard	Flygt	Model	4620
	Alternate	KSB	Model	
	Alternate	Landia	Model	

NOTES

Provide minimum 230 N thrust. Tank dimensions are 6m x 4.93m x 4.1 m water depth. Upstream screening <10 mm and primary treatment.
Objective is to keep biological solids entrained during periods of low oxygen demand. Average mixing velocity 0.25 m/s.
Mount approximately 1 m off the tank bottom. Ensure aeration diffusers are not directly in path of mixer flow

Revision Date:	October 14, 2004	Printed:	October 15, 2004
Revision	A		

1. GENERAL

1.1 Description

.1 This Section specifies the supply and supervision of the installation, testing, and commissioning of horizontally mounted, screw impeller, centrifugal pumps.

1.2 Submittals

.1 Shop Drawings: Submit in accordance with Section 01300 and Section 11005.

.2 Operation and Maintenance Data: Provide data for incorporation in the Operation and Maintenance Manual as specified in Section 01730. Include complete operation description together with general arrangement and detailed drawings, wiring diagrams for power and control schematics, parts catalogue with complete list of repair and replacement parts with Section drawings illustrating the connections and identifying numbers.

1.3 Coordination

.1 Coordinate design, supply and installation of pumps and motors.

1.4 Shipment, Protection, and Storage

.1 Ship pre-assembled to the degree that is practical.

.2 Identify special storage requirements. Store on site until ready for incorporation into the work using methods recommended by the manufacturer to prevent damage, undue stress or weathering.

2. PRODUCTS

2.1 Description

.1 Use these pumps for sludge that has total suspended solids concentrations less than 25,000 mg/L, with minimal abrasive material.

2.2 Acceptable Manufacturers

.1 Hayward Gordon
.2 Wemco/Hidrostal
.3 ITT A-C Pump
.4 Morris

2.3 Capacities and Performance

.1 Specific pumps are listed in the detailed specification sheets at the end of this section. Required performance data and system curves are presented.

2.4 Materials

.1 Fabricate impeller of hardened high chrome iron, ASTM A532, with minimum Brinnell hardness of 550.

.2 Fabricate casing of cast iron, ASTM A48, with no less than 3 percent nickel.

.3 Fabricate suction liner of Ni-hard or hardened high chrome iron, ASTM A532, with minimum Brinnell hardness of 550

.4 Fabricate shaft of steel, ASTM A108, Grade 1141 or 1045

.5 Fabricate shaft sleeve of stainless steel, ASTM A276, Type 416 or 420, Brinnell Hardness of 450, minimum

.6 Manufacture pump bases of cast iron or fabricated steel.

2.5 Impellers

.1 Provide spiral screw type impeller combining the action of positive displacement screw and a single vane centrifugal impeller.

.2 Provide conical geometry of the impeller and suction pieces to maintain optimum running clearances along the entire length of the impeller.

.3 Statically and dynamically balance impellers.

.4 Secure impeller to shaft with an impeller bolt, formed to shed stringy material.

2.6 Casings

.1 Provide casings of two piece construction consisting of volute and suction cone, with an end suction and that discharge vertically upwards.

.2 Provide suction cone internal profile with a straight sided cone to allow axial adjustment to maintain running clearances between the impeller and suction cones.

.3 Provide back pull out design to permit withdrawal of the impeller without disturbing the discharge or suction piping.

.4 Provide self-centering backhead and with back pull-out.

.5 Provide casing with a tapped and plugged connection at the discharge nozzle for a pressure gauge, a vent on top of the case, and a drain on the bottom of the case.

.6 Design the casing so that it is capable of passing solid spheres of the following sizes:

.1 100 mm or less casing connections: 50 mm sphere

.2 150 mm casing connections: 75 mm sphere

.3 Greater than 150 mm casing connections: 100 mm sphere

.7 Pressure test casings at 1.5 times the pressure developed by the pump at shut off head.

.8 Solidly foot-mount casings to allow easy access to pump interior.

.9 Provide suction and discharge connections that are flanged, faced, and drilled to conform to ASTM B16.5, Class 125.

2.7 Inlet Nozzle

.1 Provide inlet nozzle with an eccentric reduction to the connection at the casing.

.2 The top of the nozzle is horizontal and parallel to the pump shaft with no pockets or discontinuities which might trap air.

2.8 Suction Liner

.1 To facilitate adjustment of clearances between the suction cone and impeller, provide replaceable and externally adjustable suction liner.

.2 Provide adjustment for the suction liner by means of not more than three external screws, located equidistant around the circumference of the suction cone.

.3 Ensure adjusting screws are capable of advancing or retracting the suction liner and are capable of locking the position of the suction liner.

2.9 Cleanouts

.1 Supply each pump with a hand sized cleanout either integral with the casing or on a suction spool piece attached to the casing.

2.10 Shafts

.1 Fit to impeller with impeller key.

.2 Make the shaft of sufficient diameter to assure rigid support of the impeller and to transmit loads without slip, vibration or undue deflection at operating loads. Where L = impeller overhang and D = shaft diameter, maintain $L^3/D^4<80$.

.3 Provide shaft manufactured of heat-treated high strength steel, turned, ground and polished of proportions suitable for use in constant speed or variable speed pumping applications.

.4 Provide reduced diameter section for sleeves.

.5 Each shaft is of sufficient section to limit deflection at the outer seal face to not more than 0.10 mm when pump is operating at continuous duty point defined by the operating conditions.

2.11 Bearings

.1 Oil or grease lubricated duplex thrust angular contact and roller bearings.

.2 Minimum B-10 life of 100,000 hours at maximum efficiency as specified in Section 11005.

.3 Design radial and thrust bearings for the worst combination of loading developed at all operating conditions for a bearing life of 100,000 hours.

2.12 Motors

.1 Motor types, voltages, service conditions and power ratings are indicated in the detailed pump specification sheets.

.2 Provide motors that comply with the provisions of Section 11205.

.3 Variable speed drives are specified in Division 16. Certify compatibility between pump motor and drive manufacturers as specified in Section 11205.

2.13 Bases

.1 Provide bases with grouting holes, a minimum of one at the centre and one at each corner, of sufficient size to allow for the pouring of grout into the annular space.

.2 Ensure bases have square corners in all three directions, with parallel surfaces.

.3 Provide motor mounting blocks so that one size greater motor frame may be accommodated by replacing the mounting blocks.

2.14 Protective Coatings

.1 Factory prime and finish in accordance with Section 09905.

2.15 Spare Parts

.1 In addition to the spare parts required in Section 11300, provide the following:

.1 One bearing set per pump.

.2 One seal per pump

.3 Two suction cones for each size of pump.

3. EXECUTION

3.1 Installation

.1 Install pumps as per manufacturer's recommendations.

.2 Ensure that each pump is installed in accordance with Section 11020 as required to provide satisfactory service.

.3 Installer to certify the understanding by completing Form 101, illustrated in Section 01650.

.4 Installer to fulfill the requirements for a successful installation as documented by Form 102, illustrated in Section 01650.

3.2 Testing

.1 Ensure that each pump, including all component parts, operates as intended.

.2 Fulfill the requirements for successful testing of the equipment as documented by Form 103, illustrated in Section 01650.

.3 Refer to Section 11300 for testing requirements.

3.3 Commissioning

.1 Conform to the requirements of Section 01735

END OF SECTION

DETAILED PUMP SPECIFICATION

Description: RAS Pumps

Tag Number: P-305, P-306, P-307

Design Conditions :

Liquid:	Return Activated Sludge
Liquid temperature:	10 to 20°C
Solids content:	0 to 15,000 mg/L
Atmospheric pressure:	101 kPa
Solids passing:	50 mm

Rating Point:

Rating Point Design Flow	22 L/s
Rating Point TDH (Nominal)	2.7 m

Construction:

Suction Connection:	100 mm
Discharge Connection:	100 mm
Flange Rating:	Class 125
Seals:	Single Mechanical
Impeller Type:	Two or three vane
Impeller Material:	Hardened High Chrome Iron, 450 BHN
Casing Material:	Cast Iron, ASTM A48 Class 30

Driver:

Drive Type:	Belt Drive and Variable Speed Motor
Motor Type:	TEFC
Voltage/Phase/Frequency:	600 V/3-phase/60 Hz
Motor Size:	2.25 kW (3 hp)
Motor Synchronous Speed:	1740 RPM
Maximum Pump Speed:	1740 RPM

Accessories:

None

Design Standard:

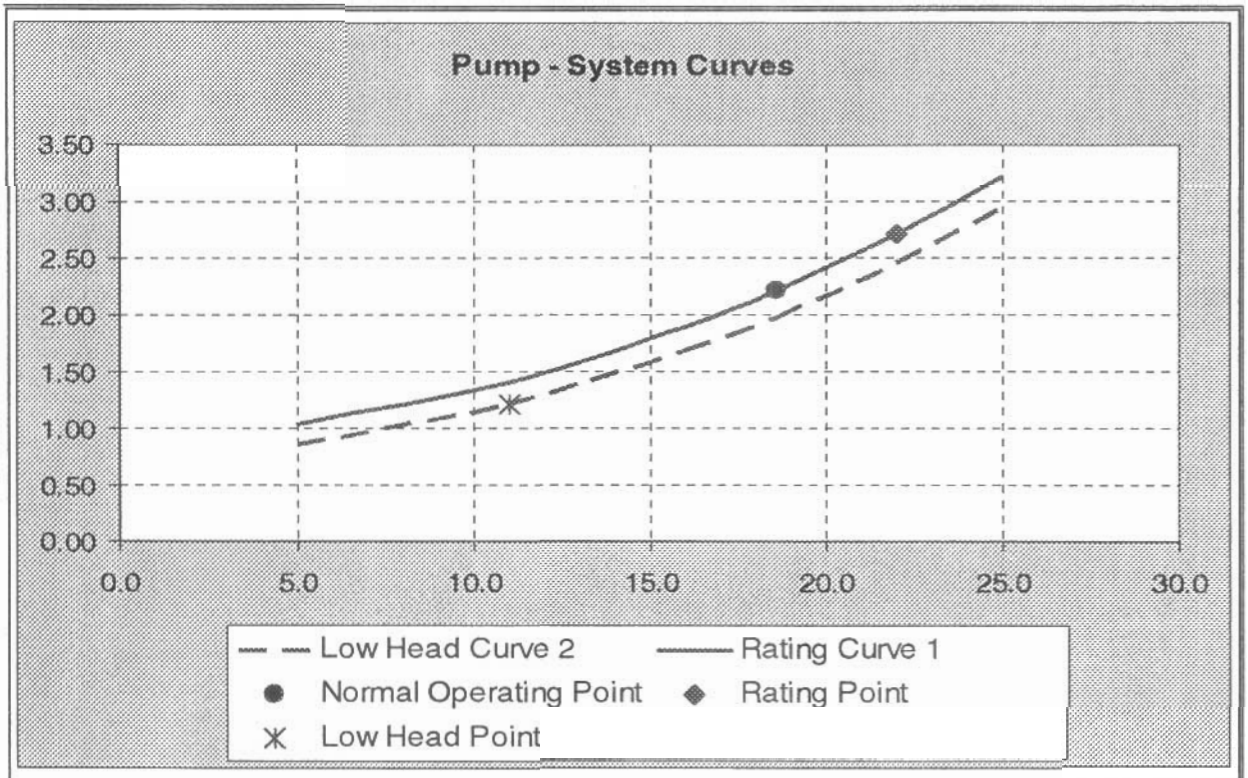
Hayward Gordon-Model XCS4C

Acceptable Products:

DETAILED PUMP SPECIFICATION

ITT-A-C, Wemco/Hidrostal, Morris

System Curve: RAS Pumps



Flow (L/s)	Rating Curve 1 TDH (m)	Low Head Curve 2 TDH (m)	Comments
5.0	1.03	0.86	
11.0	1.40	1.21	Low Head Point
16.0	1.89	1.68	
18.6	2.22	1.97	
22.0	2.71	2.45	Rating Point
25.0	3.21	2.93	
18.6	2.22		Normal Operating Point

Tag Numbers
P-305, P-306, P-307

Notes:
1. Pumps to operate as duty.
2. Pumps deliver to Anoxic Zone of Bioreactors.
3. Pump selected must be able to handle all conditions within operating range of 11 to 22 L/s, via VFD.

END OF SECTION

1. GENERAL

1.1 Work Included

This section specifies the supply and supervision of installation, testing and commissioning of submersible raw sewage pumps, complete with electric motors and all specified appurtenances.

.1 Submersible pumps are heavy duty submersible centrifugal non-clog type pumps specifically designed for pumping raw sewage.

1.2 Submittals

.1 Shop Drawings: Submit in accordance with Section 01300 and Section 11005. In addition to the requirements of Section 11005, submit the following:

.1 Mill certificates confirming hardness of casings, suction pieces, rotors, stator and shaft sleeves.

.2 Operation and Maintenance Data: Provide data for incorporation in the Operation and Maintenance Manual as specified in Section 01730. Include complete operation description together with general arrangement and detailed drawings, wiring diagrams for power and control schematics, parts catalogue with complete list of repair and replacement parts with Section drawings illustrating the connections and identifying numbers.

1.3 Coordination

.1 Coordinate design, supply and installation of pumps and motors.

1.4 Shipment, Protection, and Storage

.1 Ship pre-assembled to the degree that is practical.

.2 Identify special storage requirements. Store on site until ready for incorporation into the work using methods recommended by the manufacturer to prevent damage, undue stress or weathering.

2. PRODUCTS

2.1 Description

.1 Use these pumps for raw sewage that has total suspended solids concentrations between 0 and 500 mg/L, with abrasive material.

.2 Select and design submersible pumps specifically for continuous and intermittent duty pumping of and suitable for exposure to raw, unscreened sewage, process wastewater and floor washdown containing grit and other abrasive and fibrous materials.

.2 All pumps are to be supplied from a single manufacturer.

2.2 Acceptable Manufacturers

.1 FLYGT
.2 KSB
.3 Barnes

2.3 Capacities and Performance

.1 Specific pumps are listed in the detailed specification sheets at the end of this section. Required performance data and system curves are presented.

2.4 Impeller

.1 Provide a cast iron, dynamically balanced, multi-vane non-clogging impeller, having a long throughlet without acute turns.

.2 The impeller shall be capable of pumping fibrous materials, heavy sludges, and solids as defined by the minimum size passing listed in the detailed specification sheets.

.3 Firmly affix the impeller directly to the motor shaft through a keyed and bolted connection. Design the connection to minimize solids capture.

2.5 Pump Shaft

.1 Fabricate the shaft of C1035 carbon steel.

.2 Pump and motor shaft shall be one unit. Couplings are not acceptable.

.3 Provide a shaft of sufficient diameter to assure rigid support of the impeller and to transmit loads without slip, vibration, or undue deflection at all operating speeds.

.4 Completely isolate the shaft from the pumped liquid.

2.6 Pump Volute

.1 Cast iron, Class 30, to ASTM A48.

.2 Single piece, non-concentric design.

.3 Fit a stainless steel wear ring to the volute inlet to provide efficient sealing between the volute and the impeller.

2.7 Motors

.1 Motors to conform to the requirements of Sections 11205 and 11207. In addition, motors shall conform to the following: