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 which 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 which 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 Division 01 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 Division 01. 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 efficiencies within 5% 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 with 10% 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% 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 Gauges:

.1 Supply gauges that are 60 mm diameter, 6.35 mm bottom connection, complete with shutoff cock with stainless steel movement and Bourdon tube.

.2 Use metric units of measurement (kPa or Pa), clearly indicated on the face of the gauge.

.3 Calibrate the gauges to read pressure ranges approximately as follows:

	Actual Pressure	Gauge Pressure Range
Suction	-50 kPa to 50 kPa	-50 kPa to 350 kPa
	50 kPa to 200 kPa	0 kPa to 350 kPa
	200 kPa to 700 kPa	0 kPa to 1000 kPa
Discharge	50 kPa to 350 kPa	0 kPa to 700 kPa
	350 kPa to 700 kPa	0 kPa to 1000 kPa
	700 kPa to 1500 kPa	0 kPa to 2000 kPa

.4 Acceptable manufacturers: Ashcroft, H.O. Trerice.

.7 Pressure Sensors

.1 Provide annular ring, flow through type pressure sensors, with stainless steel body, a sensing element compatible with the corrosive and abrasive nature of the fluid being measured, 25 mm diameter.

.2 Acceptable products: Red Valve Series 42 or Robbins and Myers RKL Series W.

.3 Provide stainless steel nipples extending to a tee from the pressure sensor. Mount the gauge on one leg of the tee. If a pressure indicator/transmitter/switch is shown on the drawings, mount on the other side of the tee. Otherwise, plug the tee.

.4 Supply annular type pressure sensors with their initial fill of fluid.

2.3 Pump Seals

.1 Provide double mechanical seals, as scheduled.

.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

.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 conforming with Section 11005.

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

2.7 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.

2.8 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.

2.9 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.

2.10 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.

2.11 Finishes

.1 Factory prime all pumps in accordance with Division 09. Finish coat submersible pumps in the factory in accordance with Division 09.

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%, 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%. 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

VERTICAL IN-LINE PUMPS

1. GENERAL

1.1 Description

.1 This Section specifies the supply and supervision of the installation, testing, and commissioning of centrifugal, single stage, in-line, back pullout design pumps suitable for vertical operation.

1.2 Submittals

.1 Shop Drawings: Submit in accordance with Division 01 and Section 11005.

.2 Operation and Maintenance Data: Provide data for incorporation in the Operation and Maintenance Manual as specified in Division 01. 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 Pumps for circulating and re-circulating potable water to the Plateau Subdivision.

Note: Discharge header in the Plateau Booster Station will operate at 950kPa to 1000kPa (135 – 150 psi)

2.2 Acceptable Manufacturers

.1 Design Standard

.1 Aurora Pumps (available through National Process: 780-452-4490).Alternate Manufacturers

.2 Approved equals.

2.3 Capacities and Performance

.1 Specific pumps are listed in the detailed specification at the end of the section. Required performance data is presented.

.1 P-301 / P-302 Booster Pumps: Aurora 382-BF 3 x 4 x 9 Inline

.2 P-303 / P-304 Jockey Pumps: Aurora Series 390 Model 394- 4/7.5 Inline

.3 P-310 / P-311 Recirculation Pumps: Aurora Series 382-BF 2 x 2 x 7 Inline.

2.4 Impeller

.1 Provide impeller fabricated of bronze, fully enclosed, keyed to shaft and secured with capscrew and washer.

.1 304 Stainless Steel impeller for the Jockey Pumps (P-303 / P-304).

.2 Statically and dynamically balance impeller.

2.5 Casings

.1 Provide casings fabricated of cast iron, rated for greater of 1200 kPa (175 psi) or 1.5 times actual discharge working pressure.

.1 304 Stainless Steel casing for Jockey Pumps (P-303 / P-304).

.2 Provide casings that include suction and discharge gauge ports, air vent, wear rings, seal flush connection, drain plug, and flanged suction and discharges.

2.6 Shaft

.1 Provide shaft fabricated of stainless steel or carbon steel with bronze or stainless steel sleeve through seal chamber.

.2 Fit to impeller with impeller key.

.3 Pump shaft to be suitably stress relieved and turned to final dimensions.

.4 Pump shaft extension to be "O" ring sealed from pumped liquid.

.5 Design shaft such that the dynamic deflection does not exceed 0.05 mm at the operating conditions for the given pump.

.6 Calculate bearing loads based on the maximum hydraulic thrust encountered through the full operating range of the pump in the process fluid as well as any mechanical loading as applied by shaft weight.

2.7 Seals

.1 Provide Carbon with Ni-Resist mechanical seal with 303 stainless steel and metal parts, and Buna N flexible elastomers.

.1 Mechanical seal with EPDM elastomers for Jockey pumps.

2.8 Couplings

.1 For pumps 3.7 kW and larger, provide split spacer couplings.

2.9 Bearings

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

.2 Minimum B-10 life of 25,000 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 an average bearing life of 125,000 hours.

2.10 Motors

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

.1 Motors to be NEMA standard, 3 ph TEFC electric motors.

.2 Provide motors that comply with the provisions of Section 11035.

2.11 Protective Coatings

.1 Factory prime and finish in accordance with Division 15.

2.12 Spare Parts

.1 Provide the spare parts listed in Section 11300 for each size of pump.Execution

2.13 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.

2.14 Testing

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

.2 Refer to Section 11300 for testing requirements.

3. EXCUTION

3.1 Commissioning

.1 Conform to the requirements of Division 01.

VERTICAL IN-LINE PUMPS

	P-301 / P-302	P-303 / P-304	P-310 / P-311
Pump Name	Booster Pumps	Jockey Pumps	Recirculating Pump
Type	Vertical Inline	Multi-Stage Vertical Inline	Vertical Inline
Quantity	2	2	2
Operating Conditions			
Duty	Continuous	Continuous	Continuous
Drive	Variable Frequency	Variable Frequency	-
Ambient Environment	Indoors	Indoors	Indoors
Fluid Service	Treated Water	Treated Water	Treated Water
Fluid Temperature	0.5°C - 10°C	0.5°C - 10°C	0.5°C - 10°C
Fluid pH Range	6.0 – 8.5	6.0 – 8.5	6.0 – 8.5
Fluid Specific Gravity	1.0	1.0	1.0
Fluid Viscosity	1.72 to 1.3097	1.72 to 1.3097 centipoises	1.72 to 1.3097
Project Site Elevation	38 m ASL	38 m above ASL	38 m above ASL
Min. NPSHa	6.2 m	4.5 m	2.1 m
Performance Requirements			
Design Flow Capacity	1500 LPM	450 LPM	4.5 L/s
Design Flow Pump Head	49 m	49 m	7 m
Low Flow Operating Capacity	400 LPM	70 LPM	-
Low Flow Pump Speed	2800 RPM	2700 RPM	-
Maximum Pump Speed	3500 RPM	3450 RPM	1750 RPM
Maximum Motor Speed	3600 RPM	3600 RPM	1800 RPM
Minimum Motor Size	25 hp	7.5 hp	1 hp
Motor Type	3ph TEFC inverter duty motor	3ph TEFC inverter duty motor	3 ph inverter duty motor
PumpDimension / Limits			
Discharge Outlet	(75 mm) 3 inch	(50 mm) 2 inch	(50 mm) 2 inch
Suction Inlet	(100 mm) 4 inch	(50mm) 2 inch	(50 mm) 2 inch
Max. Case Working Pressure	(1200 kPa)175psi	(2480 kPa) 360psi	(1200 kPa) 175psi
Flange Discharge Rating	125 #	250#	125 #

END OF SECTION

SAMPLE PUMP / HOLDING TANK EQUIPMENT

1. GENERAL

1.1 Description

.1 This Section specifies the supply and installation, and testing of the Rotary Vane Sample Pump and motor, and holding tank assembly.

1.2 Submittals

.1 Shop Drawings: Submit in accordance with Division 01 and Section 11005.

.2 Operation and Maintenance Data: Provide data for incorporation in the Operation and Maintenance Manual as specified in Division 01. 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, motors, tanks as specified.

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 Pump for returning potable water to the suction side of the booster system. This water was drawn from the system by the turbidity and chlorine analyzers.

.2 Holding Tank Assembly (see drawings for details)

.1 Covered tank for water from the analyzers

.2 Foot valve on suction line

.3 Hi / lo level switches

.4 Tank exhaust / over flow complete with carbon air filter (to fit pipe).

2.2 Manufacturers

.1 Design Standard

.1 Procon Pumps [contact (450) 665-1560].

.2 FABCO 330-1, 200L (45 gallon) tank complete with lid.

.2 Alternate Manufacturers

.1 Approved equals.

2.3 Pump Capacity and Performance

.1 Specific pump listed in the detailed specification sheets on the previous page. Required performance data is presented.

.1 P-300 Sample Pump: Procon 2507 XH Pump, complete with optional brass solid relief valve set at 650 kPa (95psi)

.1 Self-priming

.2 Brass housing

.3 Lovejoy coupler PP-54710, bracket PP-54720

.4 Buna N sealing parts.

2.4 Motors

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

.2 Design Standard: NEMA 56C bolt on Marathon Motor 1800 RPM M-605-10C3550 575 V, 3-Phase.

.3 Provide motors that comply with the provisions of Section 11035.

2.5 Protective Coatings

.1 Factory prime and finish in accordance with Division 15.

2.6 Spare Parts

.1 Provide the spare parts listed in Section 11300 for each size of pump.

3. EXECUTION

3.1 Installation

.1 Install pumps as per manufacturer's recommendations.

.2 Install holding tank assembly as per drawings.

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

3.2 Testing

.1 Ensure that each pump and holding tank assembly including all component parts operate as intended.

.2 Refer to Section 11300 for testing requirements.

3.3 Commissioning

.1 Conform to the requirements of Division 01.

SAMPLE PUMP / HOLDING TANK EQUIPMENT

	P-300
Pump Name	Sample Pump
Type	Rotary Vane
Quantity	1
Operating Conditions	
Duty	Intermittent
Drive	-
Ambient Environment	Indoors
Fluid Service	Treated Water
Fluid Temperature	0.5°C - 10°C
Fluid pH Range	6.0 – 8.5
Fluid Specific Gravity	1.0
Fluid Viscosity	1.72 to 1.3097 centipoises
Project Site Elevation	38 m above ASL
Min. NPSHa	-
Performance Requirements	
Design Flow Capacity	15 LPM
Design Flow Pump Head	56 m
Low Flow Operating Capacity	
Low Flow Pump Speed	
Maximum Pump Speed	1725 RPM
Maximum Motor Speed	1800 RPM
Minimum Motor Size	1 hp
PumpDimension / Limits	
Discharge Outlet	(12.5 mm) ½ inch
Relief Valve Setting	(655 kPa) 95 psi
Max. Discharge Pressure	(1720 kPa) 250 psi

END OF SECTION

FIRE PUMPING EQUIPMENT

1. GENERAL

1.1 Scope of Work

.1 This section refers to the supply, assembly, installation, startup and commissioning of pumping and engine drive equipment. Documentation for design standard pump following this section.

1.2 Inspection of Equipment

.1 Upon delivery inspect for damage and omissions. Immediately advise the supplier of any discrepancies.

1.3 Unloading of Equipment

.1 Unload and store the equipment in accordance with the manufacturer's recommendations.

1.4 Shop Drawings

.1 Obtain and submit complete shop drawings in accordance with the requirements of Division 01 of these specifications.

1.5 Maintenance Data

.1 Provide maintenance data for incorporation into maintenance manual specified in Division 01.

2. PRODUCTS

2.1 Engine Driven Fire Pumps

.1 Supply, deliver, install and commission one diesel fuelled engine driven horizontal split case pump.

2.2 Fire Pump Performance

.1 Pump duty point 10 000 L/min at TDH of 66 meters. (2650 USGPM at 216 feet)

2.3 Fire Pumps

.1 Type: Horizontal split case, single stage, double suction pump to operate at maximum speed 1800 RPM with a pump curve continuously rising from runout to shut off head.

.2 Casing: Bronze fitted cast iron, split, with (1720 kPa) 250 psi working pressure and twin bearing housings, 125# flat face suction flanges integrally cast to lower half of the casing.

.3 Impellor: Bronze enclosed type double suction impeller, bronze wear rings (case and impeller), dynamically balanced and fastened to shift by key and screw locked sleeves.

.4 Shaft: Alloy steel (SAE 1045 or better) shaft with bronze shaft sleeves, locked and threaded. Buna o-rings must be provided between the impellor hub and the shaft sleeves to prevent pump liquid from corroding the shaft.

.5 Seals: Stuffing boxes shall be on both sides of the pump centerline to seal the pump shaft.

.6 Bearings: The rotating element shall be mounted in heavy duty grease lubricated ball bearings and be equipped with water slingers on side next to pump glands. The bearing housing shall be furnished with regreasable bearing for both radial and thrust loads. Shaft bearings minimum 250,000 hours B10 life, air release valve for pump bowl.

.7 Driver: CAT Diesel engine driven with power take-off coupling and coupling guard. Coupling to be a flexible type and shaft to be equipped with a removable guard.

.8 Acceptable Manufacturers

.1 Design Standard: Aurora Series 411-BF 8x10x17B Horizontal Split Case Pump

.2 Alternate Manufacturers: Approved equals.

2.4 Pump Diesel Engine

.1 Pump and engine to be based mounted on a rigid steel frame for mounting on a concrete floor with a concrete house keeping pad for a foundation. Frame to be designed for removal of crankcase pan without removal of engine from the mounting frame, and include piping and valve to drain crank case from outside the frame.

.2 Diesel engine size will be continuous rated at 2200 RPM with sufficient torque and horsepower to operate the pump through the speeds of zero to 2200 RPM with a minimum reserve torque/horsepower 10% more than required by the pump at any speed up to 2200 RPM and at any point on the curve from S.O.H. to runout.

.3 Engine cooling by a heat exchanger system.

.4 Double wall heat exchanger to be shell and tube type with cross flow pattern. The engine coolant (non toxic, AWWA approved for potable water application) will flow between the shell tubes and the potable water (PW) will flow in the tubes. Tubes shall be stainless steel. The end of heat exchanger to be removable to allow for cleaning of the tubes. The heat exchanger to be sized to adequately cool the engine coolant with the cooling water (PW) entering the heat exchanger at a temperature of 20°C or less and exiting at a temperature of 50°C or less. The cooling water will flow upon engine start-up and shut off upon engine shut down by use of a normally closed solenoid switch (slow close 12 V DC, water tight enclosure, ASCO 8221 Type 3R enclosure).

.5 Two CSA approved jacket water heaters with thermostatic control to maintain engine temperature at a sufficient level to maintain normal engine starting temperatures.

.6 Engine exhaust system with insulated exhaust manifold, expanded mesh protective cover over stainless steel flexible connection to manifold and Cowl TXS-SL critical class muffler and exhaust piping and insulation by Division 15.

.7 Engine start system to be minimum Positive shift, gear engaging starter 12 or 24 V d. Cranking limiter to provide 6 cranking periods of 10 s duration, each separated by 5 s rest. Lead acid, 12 or 24 V storage battery with sufficient capacity to crank engine for 1 min. at 0°C without using more than 25% of ampere hour capacity.

.8 Battery Charger: constant voltage, solid state, two stage from trickle charge at standby to boost charge after use. Regulation: plus or minus 2% output for plus or minus 10% input variation. Equipped with dc voltmeter, dc ammeter, and on-off switch. Minimum charger capacity: 7 A.

.9 Engine mounted panel to include, engine run light, mechanical tachometer and hour meter, oil pressure (wet and dry side for engine controller), water temperature (wet and dry side for engine controller) and ammeter gauges, and a manual start and kill switch all mounted on a common instrument panel on the engine.

.10 Engine speed control to include a manual aircraft type throttle with locking capability, and fully enclosed mechanical self lubricating governor capable of controlling the set speed within 5% from no load over the entire engine speed.

.11 Engine control panel to be wall mounted with manual, off, automatic (MOA) switch. In manual mode a single manual initiated push button will start the automatic start cycle of crank/rest and disconnect battery charge circuit on the engine run start initiation. The automatic mode position will be initiated by low pressure sensed locally or remotely by a pressure switch and contacts are required in the panel for a remote start signal.

.12 A torsional vibration analysis will be completed on each component of the pumping equipment prior to delivery to ensure that all components are torsionally compatible with each other at all operating conditions up to and including shut off head, correcting any undue vibration problems that may develop through the use of vibrationally incompatible components.

The report will identify the RPM range where the unit should be operated.

.13 Approved Manufacturer (no substitutions)

.1 CAT 3208 DIT Diesel Engine, heat exchanger cooled , 12v starter/alternator, safety shutdowns, auto start/stop, gauge panel, muffler c/w flex

3. EXECUTION

3.1 Installation

.1 Assemble and/or install all pumping equipment in strict accordance with manufacturer's and supplier's instructions.

.2 Any damage resulting from either failure to observe the installation instructions or as a result of proceeding with the work without complete knowledge of how it is to be done will be the Contractor's responsibility.

.3 Make equipment installation and connections by a qualified journeyman to the best standard.

.1 Carry out work to produce a neat, accurate, secure, functional installation.

.2 Repair at own expense, any damage done to the installation or materials while carrying out the work.

3.2 Field Testing

.1 Complete installation to the requirements of the equipment manufacturer.

.2 Provide all testing equipment required to measure the following:

.1 Engine RPM.

.2 Vibration amplitudes.

.3 Shaft runout.

.4 Surface temperatures.

.3 Operate and adjust the equipment and take readings, of the pump/engine operating characteristics at:

.1 Shutoff head.

.2 Full rated capacity.

.3 One intermediate point.

.4 Use only personnel who have taken an active part in the actual installation of the system. Do not designate a subtrade as representative at any time during construction prior to final inspection. Pump and engine manufacturer representative to be on site for testing and certify equipment meets their requirements for warranty.

3.3 Final Inspection

.1 See Division 01.

.2 Final inspection will be made by the Engineer only after the Contractor has advised that the equipment installation is in order and that the system has been operated.

.3 The Engineer will request that the equipment be operated to demonstrate that it will perform as specified. The Engineer will note deficiencies, and if possible, the deficiency will be corrected immediately by the Contractor. All deficiencies that cannot be corrected at the time of inspection will be noted by the Engineer who will advise the Contractor of these deficiencies in writing. Correct the deficiencies as soon as possible and advise the Engineer of their correction.

	P-305
Pump Name	Fire Pump
Type	Horizontal Split Case
Quantity	1
Operating Conditions	
Duty	Intermittent
Drive	-
Ambient Environment	Indoors
Fluid Service	Treated Water
Fluid Temperature	0.5°C - 10°C
Fluid pH Range	6.0 – 8.5
Fluid Specific Gravity	1.0
Fluid Viscosity	1.72 to 1.3097 centipoises
Project Site Elevation	38 m ASL
Min. NPSHa	4.2 m
Performance Requirements	
Design Flow Capacity	10 000 LPM
Design Flow Pump Head	66 m
Maximum Pump Speed	1775 RPM
Maximum Motor Speed	2200 RPM
Minimum Motor Size	215 hp
Pump Dimensions / Limits	
Discharge Outlet	
Case Working Pressure	(1720 kPa) 250 psi g
Flange Discharge Rating	125#
Discharge Outlet	(200 mm) 8 inch
Suction Inlet	(250 mm) 10 inch

END OF SECTION

IDENTIFICATION

1. GENERAL

1.1 Work Included

.1 Identification of equipment, motors, vessels, valves, ferrous, non-ferrous, and insulated piping.

1.2 Submittals

.1 Submit list of plates for review prior to engraving.

.2 Submit colour board for approval, a minimum of three weeks prior to painting.

2. PRODUCTS

2.1 Equipment Nameplates

.1 Provide metal equipment nameplates on each piece of manufacturer's equipment, mechanically fastened, with raised or recessed letters.

.2 Provide Underwriters' Laboratories and/or CSA registration plates, as required by respective agency.

.3 Provide manufacturer's nameplates indicating size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.2 Equipment - Project Identification

.1 Supply and install black laminated identification plates with 12 mm high white letters on all equipment installed under this contract. Include the unit name and tag number.

2.3 Valving

.1 Provide all valves with a 32 mm diameter brass tag with 12 mm black engraved numbers complete with non-ferrous chains or 'S' hooks.

.2 Consecutively number valves in distinct systems in accordance with piping and instrumentation drawings.

.3 Furnish a directory consisting of a typewritten valve list showing the tag number, valve location, and its use. The directory may be made up in sections to suit the respective plant area or system.

2.4 Piping

.1 Paint all piping installed under this Contract, with identifying pipe markers designating the pipe service and the direction of flow, except for stainless steel pipe and aluminum recovered pipe which shall be banded and identified. Refer to Section 09905.

.2 Either paint or self adhesive decals are acceptable pipe markers.

.3 Direction arrows are to be 150 mm long by 70 mm wide for piping with an outer diameter 75 mm or larger, including insulation. Use 100 mm long by 20 mm wide for smaller diameters. Abbreviations for names of the pipe service are provided in the drawings.

2.5 Colour Coding

.1 Apply the colour coded system identification on the following items:

.1 All uninsulated piping and valves.

.2 All canvas and cotton insulated coverings.

.3 All pumps – coat pumps with the colour identifying the material being pumped.

.4 Paint all motors blue.

.2 Identification consists of the following.

.1 Full coating of non-stainless steel pipes and valves to the colour designated for the commodities being conveyed.

.2 Coat non-submerged process equipment to match the colour code of the material being processed.

.3 Paint valve handles, chain wheels, and similar appurtenances black.

.3 Identification colours shall be as directed by the Engineer and shall match existing, whenever possible. For factory finished equipment, the identification colours shall be identified by the Engineer during the shop drawing submission stage.

.4 Piping, ductwork, conduit and support identification colours and description shall match the existing schedule. Original colours indicated are from the Mobil Chemical line of products.

IDENTIFICAITON/ DESCRIPTION LEGEND	COLOUR	ABBREVIATIONS USED ON DRAWINGS
Portable Water	Blue	TW TWS TWR
Drain	Black 28-J-5	DR

3. EXECUTION

3.1 Nameplates

.1 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

3.2 Fasteners

.1 Attach plates to the equipment with sheet metal screws or nuts and bolts (adhesive is not acceptable).

.2 Fasten plates in conspicuous locations. On hot or cold surfaces where plates cannot be mounted, provide standoffs.

3.3 Piping

.1 On completion of protective coatings or finish painting, neatly stencil on yellow, green or white backgrounds, as appropriate, directional flow arrows and the pipe service or attach pipe marking labels.

.2 Provide pipe identification in readily visible locations. Identify pipes at each of the following locations:

.1 At each valve

.2 On both sides of wall penetrations

.3 At floor and roof penetrations

.4 On each leg of branches

.5 Every 10 m along continuous runs.

END OF SECTION