

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Waste Management And Disposal.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 01 91 13 – General Commissioning (CX) Requirements.
- .5 Section 03 30 00 - Cast-in-Place Concrete.
- .6 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .7 Section 33 05 13 - Manholes, Catch Basin and Utility Structures.

1.2 REFERENCES

- .1 1809-300/2004 BNQ (R2007) Construction work - Clauses General - water and sewer lines technical.

1.3 SYSTEM DESCRIPTION

- .1 Reinforced concrete enclosure. Pumping system to be factory assembled and disassembled for shipment with mating components clearly identified. Principal items of equipment to include 2 identical submersible sewage pumping units, all internal piping and valves, liquid level controls, lifting chains, guide bars, vents complete with screens, access frame and cover, electrical wiring, control panel with circuit breakers and motor starters.
 - .2 Equipment and installation to include following:
 - .1 Excavation for sewage lift station.
 - .2 Placement of granular base.
 - .3 Connection of power to control panel as indicated.
 - .4 Connections to sanitary sewers and force mains.
 - .5 Supply and installation of packaged sewage lift station in accordance with manufacturer's instructions.
 - .6 Backfill as indicated.
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- .3 Wet well sewage lift station:
 - .1 Fully automatic, consisting of duplex submersible pumps mounted on rail system. Control to be by series of liquid level switches.
 - .2 Pumps to alternate as lead pump on each cycle.
 - .3 Incorporate time delay relays in control circuits to allow continuation of pump for pre-set time after normal pump shut down signal is received.
 - .4 Operate both pumps when lag pump "on" water level is reached in wet well. Lag pump to shut off when water level drops to pump "off" water level. Refer to Civil drawings for pumps sequence of operation.
 - .5 Locate control system mounted above lift station cover plate.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for civil, structural, hydraulic, mechanical and electrical elements.
- .3 Indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
 - .2 Wiring and schematic diagrams.
 - .3 Dimensions and recommended installation.
 - .4 Pump performance and efficiency curves.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Data to include:
 - .1 Manufacturers name, type, model year, capacity and serial number.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list with names and addresses.
 - .4 System description.
 - .5 Design parameters, system hydraulics, design calculations, and system curves.
 - .6 Related civil, mechanical, and electrical drawings.
 - .7 Manufacturer's operation instructions.
 - .8 Name, address, and telephone number of equipment suppliers.
 - .9 Information on guarantees and warranties.
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- .10 Spare parts list comprising a complete schedule clearly identified to facilitate re-ordering.

PART 2 - PRODUCTS

2.1 PUMP STATION

- .1 Pre-assembled duplex station including pumps and motors, quick disconnect rail system, check valves, plug valves, junction boxes, start-stop level controls, motor high temperature and leakage shutoff, high water alarm, all internal wiring terminating into a junction boxes, shut off valve and discharge piping and fittings, external pump control and alarm panel with indicating light to be provided and mounted on supporting structure provided in this Contract.

2.2 WET WELL STRUCTURE

- .1 Structure: leak free, precast reinforced concrete with access opening, ladder and service platform and designed for following forces:
 - .1 Hydrostatic uplift forces.
 - .2 Horizontal earth loading and full hydrostatic pressure assuming water at ground elevation.
 - .3 Dead load of station and components and soil forces.
- .2 Materials:
 - .1 Precast concrete to ASTM C 478M CAN/CSA-A257.
 - .2 Cast-in-place concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete.
 - .3 Sheet membrane waterproofing
 - .1 Acceptable Materials
 - .1 Blueskin WP200 by Bakor.
 - .2 Bituthene 3000 by W.R. Grace.
 - .3 Colphene 1500 by Soprema.
 - .4 Carlisle QSC-701 by Carlisle Synetc.
 - .5 Aquabarrier FP by IKO Industries.
 - .2 Primer: as recommended by and supplied by the sheet membrane manufacturer.

2.3 PUMPS

- .1 Two vertical, single stage, bottom suction, non-clog, heavy duty, totally submersible centrifugal pumps, direct connected to motor by solid stainless steel shaft and fitted with thrust bearings, duplex operation.
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- .2 Characteristics:
 - .1 Capacity: 1.33 L/s.
 - .2 Total dynamic head: 7.8 m.
 - .3 Maximum static discharge head: 6.22 m.
- .3 Volute casing: cast iron, close coupled.
- .4 Impeller: bronze, in static and dynamic balance. All fasteners to be stainless steel.
Size: as required.
- .5 Capable of passing 75 mm solid sphere.

2.4 PUMP SHAFT AND SEALS

- .1 Pump shaft: AISI 400 series stainless steel. Provide each pump with a tandem mechanical shaft seal system.
- .2 The upper of the tandem set of seals operates in an oil chamber. This set contains one stationary tungsten-carbide ring and one positively driven rotating carbon ring. The seals function as an independently secondary barrier between the pumped liquid and the stator housing.
- .3 The lower of the tandem set of seals shall function as the primary barrier between the pumpage and the stator housing. This set shall consist of a stationary ring and a positively driven rotating ring, both to be solid tungsten carbide, silicone carbide or carbon ceramic.

2.5 ACCESS COVER

- .1 Access Cover to be a one piece, solid cover constructed of non-skid, checkered plate aluminum with a minimum thickness of 6mm, complete with locking mechanism and hold open brackets.
 - .2 Top of the access cover to be flush with top of wetwell.
 - .3 A bilingual confined space warning label to be clearly displayed on the underside of the cover.
 - .4 Cover shall have safety grating.
 - .5 Hatches and grating to open such that 3 sides of opening are protected.
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2.6 PUMP LIFTING SYSTEM

- .1 Pumps to be complete with sliding guide and brackets, chains and quick leak-proof disconnect to discharge piping, all allowing for withdrawal of pumps.
- .2 Provide galvanized lifting chain or stainless steel cable for each pump accessible from roof access hatches.
- .3 Provide two vertical guide bars with each pump to ensure correct alignment of pump with automatic discharge connection.
- .4 For each pump, guide bars to consist of Schedule 40 galvanized pipe or Stainless Steel.
- .5 Extend guide bars from discharge connection toward base level to be securely fixed by a galvanized or equivalent bracket. Upper guide bar holder to be anchored to the roof of the basin.

2.7 SUBMERSIBLE MOTORS

- .1 Motors:
 - .1 The pump motor: 200V, 1 ph, 60Hz, housed in a watertight chamber of maximum efficiency and durability. Design motor for continuous duty capable of sustaining a maximum of (8) starts per hour. Motor speed and electrical considerations as indicated in Project Documents. Motor with integral cable approved for Class I, Zone 2, Gr. IIA & IIB, T3 hazardous location and suitable for corrosive environment.
 - .2 Motor stator: directly shrink fitted into the stator housing. Insulate stator winding and leads with moisture-resistant varnish capable of withstanding a temperature of 155 degrees C or the motors maximum temperature rise, whichever is greater. Dip and bake stator three (3) times in Class F varnish.
 - .3 Rotor bars and short-circuit rings to be made of aluminum. Use thermal sensors to monitor stator temperatures on all pumps. Equip stator with not less than two (2) thermal switches embedded in the end coils of the stator windings (one switch per phase to protect the motor against surcharges and high temperature). Use these in conjunction with, and supplemental to, external motor overload protection, and wired to the control panel.
 - .4 Equip motor housing with a moisture detector and the winding thermal switches.
 - .5 Accomplish control of the moisture detector and the winding thermal switches by using a control/indicator relay(s) which will be installed and wired inside the control panel to stop the pump unit upon a fault signal.

- .6 Motors to be air cooled or oil cooled to manufacturer's standard.
 - .7 Capable of operating pump at any point on selected curve without exceeding motor nominal rating.
 - .8 Fully overload protected.
 - .9 Assembly capable of operating continuously in air without overheating.
 - .10 Complete with NEMA approved winding temperature sensor.
 - .11 Supervisory and Indication Relay:
 - .1 Supply loose for mounting and wiring to the Pump Controller.
 - .2 Relay unit to monitor pump moisture detector and the winding thermal switches. On over-temperature the unit will act to turn pump off and lock it out. On detection of leakage, after a 10 second delay an alarm will be activated. An output relay enables stop of pump if required.
 - .3 Provide individual LED's for indication of power, leak and over-temperature conditions.
 - .4 Provide one per submersible pump.

 - .2 Motor speed: maximum 1800 rpm.
 - .3 Motor enclosure and seal housing: corrosion resistant, completely watertight, cast iron.
 - .4 Bearing: anti-friction type, greasable, with lubrication lines and fittings, minimum 50,000 hours, B-10 life.
 - .5 Terminal box: watertight, with waterproof cable entry glands mounted at motor.
 - .6 Protect all surfaces coming into contact with sewage, other than stainless steel or brass, by an approved, sewage resistant coating.
 - .7 Shaft seals: double mechanical seals with tungsten/carbide faces.
 - .8 Motor leads and power cords to be sealed and locked in place using strain bushings. All cables to be waterproof.
 - .9 Pump and motor close-coupled, integral design.
 - .10 Power and control cable(s): SOW type sized to handle electrical code requirements. Cable to be neoprene-jacketed and CSA approved. Cable shall have surplus length that will allow it to be cut 3 times for servicing without being replaced.
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2.8 PUMP CONTROL SYSTEM

- .1 Liquid level switches: shock-proof switches enclosed in leak-proof polypropylene body approved for Class I, Zone 2, Gr. IIA & IIB, T3 hazardous location.
- .2 Provide following independently adjustable control levels:
 - .1 Lead pump start level.
 - .2 Lead pump stop level.
 - .3 Lag pump start level.
 - .4 Lag pump stop level.
 - .5 High water alarm.
- .3 Lead pump and lag pump controls to include alternator relay to provide automatic pump alteration for each pumping cycle when pump sequence selection switch is on automatic.

2.9 PIPING AND VALVES

- .1 PVC, fitting and joints: to CSA-B137: size 50 mm.
 - .2 Wall pieces: wall pieces to have slip-on flanges, welded to pipe and located in center of the wall. Exterior wall pieces to be cement-lined ductile iron, flanged inside and plain end outside. Exterior connections to PVC forcemain to be by suitable dresser style coupling.
 - .3 Discharge line for pump: ASTM A 53, electric resistance-weld steel pipe with forged fittings, A181. Install non-clog ball check valves and ballcentric plug valves in each pump discharge line. Each valve to have a throughway size equal to the pump discharge pipe size to ensure full, free-flow operation.
 - .4 Plug valves:
 - .1 Body/Plug/Stem/Cap: Cast iron, ASTMA-126, Class B with nickel seat.
 - .2 Bronze impregnated bearing.
 - .3 Full round port.
 - .4 Blue enamel finish.
 - .5 3 mm thick Red rubber gasket.
 - .6 Nut operated with removable lever handle.
 - .7 Plug coating: Buna-N.
 - .8 Operating pressure: 1207 KPa.
 - .9 Flanged Ends in accordance with ANSI B16.1.
 - .10 Dimensions in accordance with ANSI B16.10.
 - .11 Provide minimum (2) wrench head lever handles sized for largest valve.
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- .5 Ball check valve:
 - .1 Body: Nodular cast iron, zinc phosphate primer finish.
 - .2 Ball: Metal core with nitride rubber vulcanized coating.
 - .3 Gasket: 3 mm thick Red rubber.
 - .4 Flanged connections drilled to ANSI B16.1, Class 125.
 - .5 Working pressure up to 1000 KPa.
 - .6 Working temp. up to 27 degrees C.
 - .7 Valve to be installed horizontally.

2.10 ELECTRICAL CONTROL PANEL AND WIRING

- .1 All components to be CSA approved.
 - .2 Electrical equipment in station wet well to requirement for Hazardous Locations, Class 1, Zone 2, Gr. IIA & IIB, T3.
 - .3 Panel enclosure to CSA Type 4X of fabricated stainless steel suitably braced, door equipped with locking device, suitable for surface mounting.
 - .4 Panel to be complete with required components including but not limited to:
 - .1 1 main circuit breaker with thermal magnetic trip and suitable current rating for station load.
 - .2 Surge protective device suitable for service entrance.
 - .3 1 motor circuit protector with toggle handle for each pump motor with adjustable instantaneous trip.
 - .4 1 magnetic full voltage starter with 120 volts coils and overload relays for each pump.
 - .5 1 time delay-relay, 2-50 second range, 10 amp minimum resistive contacts to prevent concurrent starting of pumps after power restoration.
 - .6 Dry contacts, normally open, on high water alarm relay for remote indication.
 - .7 Convenience 120 V power outlet and enclosure lighting.
 - .8 Elapsed time meters, one for each pump.
 - .9 Anti-condensation heater and enclosure fan.
 - .10 Control relays and modules required to achieve intended operation.
 - .11 Ground fault relay for each pump to provide ground fault protection.
 - .12 Space for future SCADA RTU with communication module.
 - .5 Mount following switches and instrumentation on door of panel:
 - .1 Pump mode selector switches for hands-off-automatic operation of each pump.
 - .2 Pump sequence selector switch to permit override of automatic pump alteration and selection of either pump to run as lead pump.
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- .3 1 high level alarm complete with alarm relay and flashing red light on top of panel. Provide signal and connection point to allow the high level alarm to be transmitted to a BAS system in the new building.
- .4 Indicating LED lights for pump "RUN, STOPPED" and "MOTOR FAULT".
- .6 Terminals in circuit of start float switch of lag pump.
- .7 Ground connection lug.
- .8 Labels: all components on and inside panel to indicate operating routine. Labels to be anodized aluminum with 5 mm minimum letters.
- .9 Schematic wiring diagram: mounted inside panel door, varnish protected.
- .10 Conductors: copper.
- .11 Control wiring: minimum number 14 AWG, stranded type TEW.
- .12 Power wire: minimum number 12 AWG, type RW 90.
- .13 Wire:
 - .1 Numbered with printed permanent indelible identifying plastic tapes to correspond to schematic diagram.
 - .2 Terminated for external control connections by tubular screw type terminal blocks with barrier and labels.
 - .3 Equipped with grommet and shields for mechanical protection.
 - .4 Adequately supported and installed to approval of Departmental Representative.
- .14 Refer to Division 26 specifications for electrical components additional requirements.

2.11 VENTILATION

- .1 Provide external blower heater capable of delivering 12 air changers per hour. Fan to be on schedule 40 galvanized pipe and shall be powered with direct current (DC). Fan to be two speed, the higher speed activated when access door is opened. Fan construction to be suitable for outdoor use, and specifically designed for sewage application. Approved for Class I, Zone 2, Gr. IIA & IIB, T3 hazardous location.
 - .2 Provide 150 dia galvanized steel gravity ventilation pipe opposite ventilation fan.
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2.12 PACKAGE SYSTEM

- .1 Provide precast concrete enclosure complete with all components specified herein.

2.13 INSPECTION, TESTING AND SHIPMENT

- .1 Inspection and Testing
 - .1 Test pump proper operation at rated power supply values and for electrical and mechanical integrity prior to shipment. Pump supplier to have adequate test facilities to at least provide a single-point performance test or a complete performance curve at an accuracy of +/- 1%. Check level regulators for correct operation.
 - .2 Pump/motor assembly to be CSA approved as one, integral unit, as per CSA standard CAN/CSA-C22.2.108-M89, Liquid Pumps. Proof of this approval to be submitted by the pump manufacturer together with the approval drawings. An approval of the motor unit only shall not be acceptable. Cable to be CSA approved, SOW type, neoprene-jacketed, with a 90 degree rating.
 - .3 The supplier grants the right of inspection of the pumping station to any authorized representative of the purchaser before shipment from factory. If inspection is requested give 48 hours notice in advance of the time when the equipment will be ready for inspection at the factory.
 - .4 Any equipment in the pumping station that may have been provided by another supplier shall have been tested by the original supplier.
 - .5 Pump manufacturer to perform the following inspections and tests on each pump before shipment.
 - .1 Check impeller, rotor rating, and electrical connections for compliance to the customer's purchase order.
 - .2 A motor and cable insulation test for moisture content and/or insulation defects.
 - .3 Prior to submergence, run the pump dry to establish mechanical integrity and free rotation.
 - .4 Run pump for 30 minutes, submerged 2 m minimum depth.
 - .5 Repeat after operational test number 4, the insulation test, number 2.
 - .6 Check oil housing for any leakage of water by the lower seal.
 - .7 Inspect motor housing and junction box for any water leakage.

- .6 Supply upon request, a written report stating that the above tests have been performed with each pump at the time of shipment.
- .7 Seal pump cable end with a high quality protective covering to make it impervious to moisture and/or water seepage, prior to shipping to job site and electrical installation.
- .8 Ship station assembled to the greatest extent possible to reduce installation and start-up costs. Shipped separately from the wetwell to be the pumps, the controls including the regulators, and a container of miscellaneous connecting hardware, etc.

2.14 LABELS

- .1 Suitable nameplates to be permanently affixed onto the pumps, control components, and other operating components to indicate the purpose of the component or operating routine and parameters applying to the component. The lift station pumps and control equipment are CSA approved and the CSA logo appears on the nameplates of these components.

PART 3 - EXECUTION

3.1 EXCAVATION BACKFILLING AND COMPACTION

- .1 Excavate, backfill and compact in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling and as indicated.

3.2 CONCRETE

- .1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete and Section 33 05 13 - Manholes and Catch Basin Structures.
- .2 Apply waterproofing membrane to all underground portions of wet well, following manufacturer's instructions and recommendations.

3.3 EQUIPMENT INSTALLATION

- .1 Install equipment, piping and controls in accordance with manufacturers' recommendations.
 - .2 Verify all layouts, dimensions, elevations and other pertinent data prior to proceeding with the work.
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- .3 Backprime all metal surfaces being mounted directly against concrete surfaces with bitumastic paint with the exception of surfaces that will be grouted in.
- .4 Examine all components to be incorporated into the Work for cracks, pits, blow holes, finishes, and any other defects. Do not incorporate any defective materials into the Work. Remove any defective materials from the site immediately and replace defective materials with new materials.

Inspect all materials and remove all dirt and other debris.
- .5 Install all components in strict accordance with each manufacturer's instructions, recommendations and the approved shop drawings for the various materials to be incorporated in the work.
- .6 Install pumps, pipe, fittings, valves, accessories and appurtenances using skilled workers experienced in the tasks required.
- .7 Handle all components carefully taking care not to damage the surface finish on these components. Make good any damage or supply new components as appropriate.
- .8 Install isolation bushings between stainless steel anchors and other dissimilar materials.
- .9 Install stainless steel washers when installing anchors for pump discharge base elbows. Washers to have a stick-on plastic film on the side contacting the base elbows. Use stainless steel shims similarly protected when shimming base elbows.
- .10 Arrange for start-up, testing and commissioning by the equipment manufacturer's representatives in presence of the Owner's representatives after the installation has been completed and is ready for start-up and commissioning.

3.4 PIPING

- .1 Cut piping to length using equipment designed for the cutting of pipe within the maximum allowable tolerance from square cut ends in accordance with groove and shoulder type coupling. Roll groove galvanized pipe slowly so as not to damage the galvanized coating. Discard pipe if galvanized coating is damaged and redo procedure with a new piece of pipe.
 - .2 Lubricate pipe and gaskets with lubricate before installing gaskets on pipe and completing joint.
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- .3 Install piping straight, parallel to walls and in such a manner so as to prevent straining during jointing procedures. Install galvanized pipe supports where shown or required.
- .4 Prior to assembling flanged joints, thoroughly clean flanges. Use a gasket lubricant to ease gasket installation. Tighten diametrically opposed bolts simultaneously.
- .5 Do not correct misalignment using fasteners or other means to pull flanges into alignment. Correct so that no eccentric loads are placed on flanges.

3.5 VALVES

- .1 Ensure that the valves are installed in the proper orientation with respect to flow direction. Install isolation valves with the seat side down.
- .2 Ensure that the isolation valves are positioned so that the handles are easily accessible from a ladder inserted through the lift station cover openings and do not interfere with the removal of the pumps when the handles are in the closed or open positions.

3.6 PUMPS AND APPURTENANCES

- .1 Locate, align, level, adjust and install pump discharge base elbows. The pumps and discharge base elbows to be located so that the pumps can be easily removed through the openings in the lift station without requiring the removal of any station equipment. Ensure that sufficient clearance is present to permit easy pump removal when a flush valve is installed on the designated pump.
- .2 Install upper guide bar holders and guide bars in accordance with the pump and anchor manufacturer's instructions, so that the guide bars are true, plumb and in the proper location and alignment so that the pumps can be easily removed through the openings in the lift station cover.
- .3 Take particular care to protect the finish on the pumps, pipe, fittings, valves and appurtenances from scratches and other damage. Repair any damage to the surface finishes.

3.7 ACCESSORIES

- .1 Backprime the level regulator hanger with bitumastic paint and mount in the position indicated or as directed if not shown, mount in a location where they will not be affected by flow from the inlet piping or prevent removal of the pumps,
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including a pump if fitted with a flush valve, all in accordance with the pump and anchor manufacturer's instructions.

- .2 Backprime and mount each galvanized chain hook in the area shown and located so that the chain can be reached conveniently and such that the hook does not interfere with pump removal from the lift station. Install isolation bushings between galvanized steel and 316 stainless steel anchors. Install hooks in accordance with pump and anchor manufacturer's instructions.
- .3 Supply and install backprimed galvanized pipe supports and install with medium duty, 316 stainless steel, wedge anchors using isolation bushings all in accordance with the anchor manufacturer's instructions.
- .4 Connect the stainless steel chain to the dust plug and the handle of the female camlock coupler after installation has been completed.
- .5 Following installation of the stainless steel anchors that can use studs instead of bolts, cut the studs off level with the top of the nut.

3.8 TESTING

- .1 Prior to starting the pumps, remove the plug or cap from the forcemain in the manhole.
- .2 After pumps and piping have been installed, test pumps with the material they are to pump, or with water, operate and pump for a duration of time sufficient to satisfy that the complete installation has been properly installed and aligned and that the pumps run free from heating, rubbing or vibration and meet the requirements of these Specifications, and that the pumps and piping are free and clear of debris and obstructions.
- .3 Demonstrate that each pump can be easily removed from the lift station without obstruction or removal of any station equipment. Make any adjustments necessary to carry out pump removal in this manner.
- .4 Demonstrate the operation of all valves and make any adjustments necessary to permit the valves to be operated smoothly without obstruction and allow the pumps to be removed with the valves in an open or closed position.

3.9 FIELD QUALITY CONTROL

- .1 Check power supply.
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- .2 Check starter protective devices.
- .3 Start up, check for proper and safe operation.
- .4 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.
- .5 Adjust flow from water-cooled bearings.
- .6 Adjust impeller shaft stuffing boxes, packing glands.

3.10 FIELD QUALITY CONTROL

- .1 After completion of installation, demonstrate functional operation of systems, including sequence of operation, to approval of Departmental Representative.
- .2 Test in presence of Departmental Representative and representative from equipment supplier.
- .3 Provide labour and ancillary equipment necessary to fulfill tests.
- .4 Test to demonstrate that:
 - .1 Pumps and equipment run free from heating, or vibration.
 - .2 Operation meets requirements of these specifications.
 - .3 Pumps and pumping are free and clear of debris and obstructions.
- .5 Replace equipment found defective. Repeat test until equipment is accepted by Departmental Representative.

3.11 DEMONSTRATION

- .1 Operating Personnel Training
 - .1 Provide on site training by qualified personnel for designated operating personnel prior to final commissioning. Training to be in accordance with training plan approved by Departmental Representative.
 - .2 Provide training for 3 designated personnel on all routine maintenance procedures, minor repairs, replacement of parts, including disassembly of major components.
 - .3 Provide safety precaution procedures for all systems.