

11.1.1 Pump Manufacturer Summary Table

Manufacturer	BABA Compliance	Distributor	Contact	Comments
Flygt	Yes	Electric Pump	Taylor Musselman	The Flygt submersible is BABA compliant, do not manufacture vertical turbine pumps
Cascade	No	Electric Pump	Taylor Musselman	The Cascade Pumps BABA compliant, however the motors do not meet the BABA requirements
Lane	No	WW Goetsch Associates	John Gallagher	The pump and motor combination equal 50% of the BABA requirement

EQUIPMENT: BASIC REQUIREMENTS

A. SUMMARY

1. Section Includes:
 - a. Requirements of this Section of the Special Provisions apply to all equipment provided on the Project including those found in other Divisions even if not specifically referenced in individual "Equipment" Articles of those Sections.

B. QUALITY ASSURANCE

1. Miscellaneous:
 - a. A single manufacturer of a "product" shall be selected and utilized uniformly throughout Project even if:
 - 1) More than one (1) manufacturer is listed for a given "product" in Special Provisions.
 - 2) No manufacturer is listed.
 - b. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations shown on Electrical Power Drawings and defined in the Electrical Sections of the Special Provisions.

C. PRODUCTS

1. Acceptable Manufacturers
 - a. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1) Motors:
 - a) Baldor.
 - b) General Electric.
 - c) Marathon Electric.
 - d) Siemens.
 - e) Teco-Westinghouse.
 - f) U.S. Motors.
 - g) WEG.
 - 2) Submit request for substitution in accordance with General Requirements.
2. Manufactured Units
 - a. Electric Motors:
 - 1) Where used in conjunction with adjustable speed AC or DC drives, provide motors that are fully compatible with the speed controllers.
 - 2) Design for frequent starting duty equivalent to duty service required by driven equipment.
 - 3) Design for full voltage starting.
 - 4) Design bearing life based upon actual operating load conditions imposed by driven equipment.
 - 5) Size for altitude of Project.
 - 6) Furnish with stainless steel nameplates which include all data required by NEC Article 430.

- 7) Use of manufacturer's standard motor will be permitted on integrally constructed motor driven equipment specified by model number in which a redesign of the complete unit would be required in order to provide a motor with features specified.
- 8) AC electric motors greater than 10 HP:
 - a) Three-phase, 60 Hz, designed for the supply voltage shown on the Drawings.
 - b) Oil or grease lubricated antifriction bearings conforming to ABMA standards.
 - i. Design bearing life for 90 percent survival rating at 50,000 HRS of operation for motors up to 100 HP.
 - c) For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
 - d) Thermal protective system including alarm and trip settings for motor bearing RTDs.
 - e) Thermal protective system including alarm and trip setting for motor winding thermostats.
 - f) A motor leak detection system including alarm and trip settings will be provided for submersible sump pump.
- b. NEMA Design Squirrel Cage Induction Motors:
 - 1) Provide motors designed and applied in compliance with NEMA and IEEE for the specific duty imposed by the driven equipment.
 - 2) Motors to meet NEMA MG 1 (NEMA Premium) efficiencies.
 - 3) Do not provide motors having a locked rotor kVA per HP exceeding the NEMA standard for the assigned NEMA code letter.
 - 4) For use on variable frequency type adjustable speed drives, provide:
 - a) Induction motors that are in compliance with NEMA MG a, Part 31.
 - b) Nameplate identification meeting NEMA MG 1 Part 31 requirements.
 - c) Insulated drive end bearings on all motors.
 - d) Shaft grounding rings on all motors:
 - i. Factory installed, maintenance free, circumferential, bearing protection ring with conductive microfiber shaft contacting material.
 - 5) Design motor insulation in accordance with NEMA standards for Class F insulation with Class B temperature rise above a 50 DegC ambient.
 - 6) Design motors for continuous duty.
 - 7) Size motors having a 1.0 service factor so that nameplate HP is a minimum of 15 percent greater than the maximum HP requirements of the driven equipment over its entire operating range.
 - a) As an alternative, furnish motors with a 1.15 service factor and size so that nameplate HP is at least equal to the maximum HP requirements of the driven equipment over its entire operating range.
 - 8) Motor enclosure and winding insulation application:
 - 9) The following shall apply unless modified by specific Sections of the Special Provisions:

MOTOR LOCATION	MOTOR ENCLOSURE / WINDING INSULATION
Unclassified indoors	Standard insulation.
Wet outdoor Areas	WP-II
Class I or Class II, Division 2 Areas	Explosion Proof, Approved for Division 1 Locations or TEFC with maximum external frame temperature compatible with the gas or dust in the area, Extra Dip and Bake for moisture

NOTE: Provide TENV motors in the smaller horsepower ratings where TEFC is not available.

- 10) Provide oversize conduit box complete with clamp type grounding terminals inside the conduit box.
- 11) Balance motors to ISO G2.5 level.
 - a) Submit prior to shipping to equipment manufacturer or job site.

3. Accessories

a. Guards:

- 1) Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
- 2) Interior applications:
 - a) Construct from expanded galvanized steel rolled to conform to shaft or coupling surface.
 - i. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 IN spacing.
 - ii. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.
- 3) Exterior applications:
 - a) Construct from 16 GA stainless steel or aluminum.
 - b) Construct to preclude entrance of rain, snow, or moisture.
 - c) Roll to conform to shaft or coupling surface.
 - d) Connect to equipment frame with stainless steel bolts and wing nuts.

b. Anchorage:

- 1) Cast-in-place anchorage:
 - a) Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
 - b) Configuration and number of anchor bolts shall be per manufacturer's recommendations.
 - c) Provide two (2) nuts for each bolt.
- 2) Drilled anchorage:
 - a) Adhesive anchors.
 - b) Epoxy grout.
 - c) Threaded rods same as cast-in-place.

c. Data Plate:

- 1) Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
- 2) Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.

d. Lifting Eye Bolts or Lugs:

- 1) Provide on all equipment 50 LBS or greater.

- 2) Provide on other equipment or products as specified in the narrow-scope Sections of Special Provisions.

4. Fabrication

- a. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.
- b. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.
- c. Furnish like parts of duplicate units to be interchangeable.
- d. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.
- e. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.
- f. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.
- g. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.
 - 1) Provide drain connection for 3/4 IN PVC tubing.
- h. Machine the mounting feet of rotating equipment.
- i. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that can not be properly prepared and painted.
 - 1) When such back to back fabrication can not be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.
 - 2) Where continuous welds are not practical, after painting seal the back to back surfaces from the environment.
- j. Critical Speed:
 - 1) All rotating parts accurately machined and in as near perfect rotational balance as practicable.
 - 2) Excessive vibration is sufficient cause for equipment rejection.
 - 3) Ratio of all rotative speeds to critical speed of a unit or components: Greater than 1.2.
- k. Control Panels Engineered and Provided with the Equipment by the Manufacturer:
 - 1) Manufacturer's standard design for components and control logic unless specific requirements are specified in the specific equipment Section of Special Provisions.
 - 2) NEMA or IEC rated components are acceptable, whichever is used in the manufacturer's standard engineered design, unless specific requirements are required in the specific equipment Section of Special Provisions.
 - 3) Affix entire assembly with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to delivery.
 - 4) Control panels without an affixed UL 508A label shall be rejected.

5. Shop or Factory Paint Finishes

- a. Field paint other equipment in accordance with the High-Performance Industrial Coating Specification in SP216(22).
 - 1) See the High-Performance Industrial Coating Specification in SP216(22) for factory applied primer/field paint compatibility requirements.

D. EXECUTION

1. Installation

- a. Install equipment as shown on Drawings and in accordance with manufacturer's written instructions, and in accordance with Laws and Regulations. Where the Contract Documents, manufacturer's written instructions, or Laws and Regulations conflict, obtain interpretation or clarification from engineer before proceeding.
- b. Utilize templates for anchorage placement for slab-mounted equipment.
 - 1) For equipment having drainage requirements such as seal water, provide 3/4 IN PVC or clear plastic tubing from equipment base to nearest floor or equipment drain.
 - 2) Route clear of major traffic areas and as approved by Engineer.
- c. DO NOT construct foundations until major equipment supports are approved.
- d. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings from closest operating floor level.
- e. Equipment Base:
 - 1) Construct level in both directions.
 - 2) Take particular care at anchor bolt locations so these areas are flat and level.
- f. Machine Base:
 - 1) Mount machine base of rotating equipment on equipment base.
 - 2) Level in both directions, using a machinist level, according to machined surfaces on base.
- g. Level machine base on equipment base and align couplings between driver and driven unit using steel blocks and shims.
 - 1) Size blocks and shims to provide solid support at each mounting bolt location.
- h. Provide area size of blocks and shims approximately 1-1/2 times area support surface at each mounting bolt point.
 - 1) Provide blocks and shims at each mounting bolt.
 - 2) Furnish blocks and shims that are square shape with "U" cut out to allow blocks and shims to be centered on mounting bolts.
 - 3) After all leveling and alignment has been completed and before grouting, tighten mounting bolts to proper torque value.
 - i. Rotating equipment Couplings:
 - 4) Align in the annular and parallel positions.
 - a) For equipment rotating at 1200 rpm or less, align both annular and parallel within 0.001 IN tolerance for couplings 4 IN size and smaller.
 - b) Couplings larger than 4 IN size: Increase tolerance 0.0005 IN per inches of coupling diameter, i.e., allow 6 IN coupling 0.002 IN tolerance, and allow a 10 IN coupling 0.004 IN tolerance.
 - c) For equipment rotating at speeds greater than 1200 rpm allow both annular and parallel positions within a tolerance rate of 0.00025 IN per inch coupling diameter.
 - 5) If equipment is delivered as a mounted unit from factory, verify factory alignment on site after installation and realigned if necessary.
 - 6) Check surfaces for runout before attempting to trim or align units.
- j. Grouting:
 - 1) After machine base has been shimmed, leveled onto equipment base, couplings aligned and mounting bolts tightened to correct torque value, place a dam or formwork around base to contain grouting between equipment base and equipment support pad.

- a) Extend dam or formwork to cover leveling shims and blocks.
 - b) Do not use nuts below the machine base to level the unit.
 - 2) Saturate top of roughened concrete subbase with water before grouting.
 - a) Add grout until entire space under machine base is filled to the top of the base underside.
 - b) Puddle grout by working a stiff wire through the grout and vent holes to work grout in place and release any entrained air in the grout or base cavity.
 - 3) When the grout has sufficiently hardened, remove dam or formwork and finish the exposed grout surface to fine, smooth surface.
 - a) Cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too rapid evaporation of water from the grout.
 - b) When the grout has fully hardened (after a minimum of seven (7) days) tighten all anchor bolts to engage equipment base to grout, shims, and equipment support pad.
 - c) Recheck driver-driven unit for proper alignment.
- 2. Installation Checks
 - a. For all equipment specifically required in detailed sections of the Special Provisions secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.
 - 1) In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.
 - b. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
 - 1) Has been properly installed and lubricated.
 - 2) Is in accurate alignment.
 - 3) Is free from any undue stress imposed by connecting piping or anchor bolts.
 - 4) Has been operated under full load conditions and that it operated satisfactorily.
 - a) Secure and deliver a field written report to Owner immediately prior to leaving jobsite.
 - c. No separate payment shall be made for installation checks.
 - 1) All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.
- 3. Identification of Equipment and Hazard Warning Signs
- 4. Field High Performance Industrial Coatings
 - a. For required field High Performance Industrial Coatings, comply with High-Performance Industrial Coating Specification in SP216(22).
- 5. Wiring Connections and Termination
 - a. Clean wires before installing lugs and connectors.
 - b. Terminate motor circuit conductors with copper lugs bolted to motor leads.
 - c. Tape stripped ends of conductors and associated connectors with electrical tape.
 - 1) Wrapping thickness shall be 150 percent of the conductor insulation thickness.
 - d. Connections to carry full ampacity of conductors without temperature rise.
 - e. Terminate spare conductors with electrical tape.

6. Field Quality Control

a. General

- 1) Furnish equipment manufacturer's field quality control services and testing as specified in the individual equipment Specification Sections.
- 2) Execute pre-demonstration requirements in accordance with General Requirements.
- 3) Perform and report on all tests required by the equipment manufacturer's Operation and Maintenance Manual.
- 4) Provide testing of electrical equipment and connections in accordance with the Electrical Section of the Special Provisions.
- 5) Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
 - a) Contract Drawings and Special Provisions.
 - b) Related construction change documentation.
 - c) Approved Shop Drawings.
 - d) Approved Operation and Maintenance Manuals.
 - e) Other pertinent information as required.

b. Equipment Monitoring and Testing Plans:

- 1) Approved in accordance with Working Drawings submittal schedule.
- 2) Included as a minimum:
 - a) Qualifications of firm, field personnel, and analysis personnel doing the Work.
 - b) List and description of testing and analysis equipment to be utilized.
 - c) List of all equipment to be testing, including:
 - i. Name and tag numbers identified in the Contract Documents.
 - ii. Manufacturer's serial numbers.
 - iii. Other pertinent manufacturer identification,

c. Testing and Monitoring Program Documentation:

- 1) Provide reports with tabbed sections for each piece of equipment tested.
- 2) Include all testing results associated with each piece of equipment under that equipment's tabbed section.

d. Include legible copies of all forms used to record field test information.

- 1) Prior to start of testing, submit one (1) copy of preliminary report format for Engineer review and comment
- 2) Include data gathering and sample test report forms that will be utilized.
- 3) In the final report, include as a minimum, the following information for all equipment tested:
- 4) Equipment identification, including:
 - a) Name and tag numbers identified in the Contract Documents.
 - b) Manufacturer's serial numbers.
 - c) Other pertinent manufacturer identification,
 - d) Date and time of each test.
 - e) Ambient conditions including temperature, humidity, and precipitation.
 - f) Visual inspection report.
 - g) Description of test and referenced standards, if any, followed while conducting tests.
 - h) Results of initial and all retesting.
 - i) Acceptance criteria.
 - j) "As found" and "as left" conditions.

- k) Corrective action, if required, taken to meet acceptance.
- 5) Verification of corrective action signed by the Contractor, equipment supplier, and Owner's representative.
- 6) Instrument calibration dates of all instruments used in testing.
- 7) Provide three (3) bound final reports prior to Project final completion.

7. DEMONSTRATION

- a. Demonstrate equipment in accordance with General Requirements
- b. Provide baseline vibration testing of motor and pump units.

END OF SECTION

PUMPING EQUIPMENT: BASIC REQUIREMENTS

A. SUMMARY

1. Section Includes:
 - a. Pumping equipment.
2. Related Sections of the Special Provisions include but are not necessarily limited to:

B. QUALITY ASSURANCE

1. Fully coordinate all mechanical seal systems specified to ensure pump and seal compatibility.
2. Pump/motor coordination: See Section Equipment: Basic Requirements.

C. DEFINITIONS

1. The abbreviations are defined as follows:
 - a. IPS: Iron Pipe Size.
 - b. NPSHR: Net Positive Suction Head Required.
 - c. TDH: Total Dynamic Head.
 - d. TEFC: Totally Enclosed Fan Cooled.
2. Pump Service Category: Pump or pumps having identical names (not tag numbers) used for specific pumping service.

D. SUBMITTALS

1. Shop Drawings:
 - a. See General Conditions for requirements for the mechanics and administration of the submittal process.
 - b. See Section Equipment Basic Requirements.
 - c. Product technical data including:
 - 1) Performance data and curves with flow (gpm), head (FT), horsepower, efficiency, NPSH requirements, submergence requirement.
 - 2) Pump accessory data.
 - 3) Bearing supports, shafting details and lubrication provisions.
 - a) Bearing life calculations.
 - b) Critical speed calculations.
 - 4) Solids passage information.
 - 5) Lubrication system.
 - 6) Pump Control Panel components, instruments, fabrication, and detailed wiring diagram.
 - 7) Instruments, level transmitter, and float switches.
 - 8) Certifications:
 - a) Certified pump performance curves as described in the SOURCE QUALITY CONTROL Article.
 - 9) Test reports:
 - a) Factory hydrostatic test.
2. Contract Closeout Information:
 - a. Operation and Maintenance Data:

- 1) See General Requirements for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
 3. Informational Submittals:
 - a. Certifications:
 - 1) Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.
- E. PRODUCTS
1. Centrifugal Pump Design
 - a. Provide units with increasing head characteristics from the end run out portion of the curve to shut-off condition.
 2. Accessories
 - a. See Section Equipment: Basic Requirements.
 - b. Each Unit:
 - 1) Lifting eye bolts or lugs.
 - 2) Tapped and plugged openings for casing and bearing housing vents and drains.
 - 3) Fittings for properly adding flushing lubricant.
 - 4) Pressure relief fittings for grease lubrication.
 3. Fabrication
 - a. Pump Support:
 - 1) Design base to support weight of drive, shafting and pump.
 - 2) Comply with HI vibration limitations.
 - 3) Mount horizontal pump, motor and coupling on single piece drip lip type baseplate.
 - 4) Mount vertical pumps on single piece pedestal baseplate.
 - 5) Fabricate to withstand all operating loads transmitted from the pump and drive.
 4. Source Quality Control
 - a. Factory hydrostatic test all pumps at 150 percent of shut-off head for a minimum of 5 minutes.
 - b. If specifically required in the individual pump sections of these Special Provisions, provide factory tests:
 - 1) All units:
 - a) Conduct tests in accordance with HI.
 - i. Shut-off head and design condition: Positive unilateral performance tolerance meeting Grade 1U per HI 14.6 for Rotodynamic Pumps.
 - 2) Constant speed units:
 - a) Head (FT) versus flow (gpm) pump curves:
 - i. Efficiencies along curve.
 - ii. Brake horsepower along each curve.
 - 3) Results certified by a registered professional engineer.
 - c. Statically and dynamically balance each pump per HI standards.
 - 1) If specifically required in the individual pump sections of these Special Provisions or in Section Equipment: Basic Requirements, field vibration test pumps:

- a) To meet requirements of HI 9.6.4 for Rotodynamic Pumps at any point on the pumps and motor.

F. EXECUTION

1. Installation

- a. See Section Equipment: Basic Requirements.
- b. Floor or Pad-Mounted Units:
 - 1) Align vertically and horizontally level, wedge and plumb units to match piping interfaces.
 - 2) Assure no unnecessary stresses are transmitted to equipment flanges.
 - 3) Tighten flange bolts at uniform rate and manufacturer's recommended torque for uniform gasket compression.
 - 4) Support and match flange faces to uniform contact over entire face area prior to bolting pipe flange and equipment.
 - 5) Permit piping connecting to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
 - 6) Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
 - 7) Assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
- c. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
- d. Realign as necessary, install flange bolts and make equipment connection.
 - 1) Field paint units as defined in the High Performance Industrial Coatings Section of these Special Provisions.
 - 2) Provide pressure gage on discharge of all pumps and on suction and discharge of all non-submersible units.

2. Field Quality Control

- a. Provide baseline vibration testing of completed pump and motor assemblies.
- b. Provide services of equipment manufacturer's field service representative(s) to:
 - 1) Inspect equipment covered by this Section.
 - 2) Supervise pre-start adjustments and installation checks.
 - 3) Conduct initial start-up of equipment and perform operational checks.
 - 4) Instruct Owner's personnel for the specified minimum number of hours at jobsite per on operation and maintenance of each of following pumping equipment:
 - a) Pumping Equipment: Propeller, 8 HRS
 - b) Pumping Equipment: Sump, 2 HRS.

END OF SECTION

PUMPING EQUIPMENT: PROPELLER

A. SYSTEM DESCRIPTION

1. Storm Water pumps utilizing Variable Frequency Drives.
2. Provide single source coordination responsibility through the pump manufacturer for the entire system including but not limited to the following:
 - a. Pumps.
 - b. Motors.
 - c. Accessories.

B. SUBMITTALS

1. Shop Drawings:
 - a. Source quality control test reports.
 - b. Provide shop drawing submittals for pumps and all ancillary components, including but not limited to the following:
 - 1) Lubrication system.
 - 2) Instrumentation.
 - c. Operation and Maintenance Manuals:

C. ACCEPTABLE MANUFACTURERS

1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - a. Propeller pumps.
 - 1) Cascade.
 - 2) Prime.
 - b. Submit request for substitution in accordance with General Conditions.

D. MATERIALS

1. All Pumps, Enclosed Line Shaft, Axial or Mixed Flow:
 - a. Pump shaft: 416 stainless steel, ASTM A582 (416).
 - b. Bowls: Cast iron, ASTM A48, Class 30.
 - c. Bowl bearings: Bronze B584, ASTM B505 (932).
 - d. Propeller: Bronze, ASTM B584 (836).
 - e. Suction bell: Cast iron, ASTM A48, Class 30.
 - f. Suction bell bearing: Bronze, ASTM B505 (932).
 - g. Connector bearing: Bronze, ASTM B505 (932).
 - h. Bowl liner: 316 Stainless Steel.
 - i. Column coupling-threaded: Steel, ASTM A53, Grade B.
 - j. Column and flanges: Steel, ASTM A53, Grade B.
 - k. Shaft coupling: 416 stainless steel.
 - l. Lineshaft: 416 stainless steel.
 - m. Discharge head: Steel, ASTM A53, Grade B.
 - n. Baseplate: Steel with motor support stand.
 - o. Bolts and nuts: ASTM F593, Type 316 stainless steel.
2. Enclosed Line Shaft:
 - a. Shaft bearing: Bronze, ASTM B505 (932).
 - b. Enclosing tube: Steel, ASTM A53.

- c. Tube stabilizer: Rubber, natural.
- d. Enclosing tube tension nut: Bronze, ASTM B584 (836).

E. EQUIPMENT

- 1. Performance and Configuration Requirements:
 - a. Storm Water Pumps:
 - 1) Design condition: 5,200 gpm at 36.5 FT TDH with minimum bowl efficiency of 78 percent.
 - 2) Minimum Operating Water Surface: EL 806.92.
 - 3) Maximum Operating Water Surface: EL 835.00
 - 4) Pump configuration: Enclosed line shaft.
 - 5) Maximum pump speed: 1800 rpm.
 - 6) Nameplate driver horsepower: 75 HP.
 - 7) Drive type: Variable Frequency Drive.
 - 8) Minimum solids passage: 2 IN.
 - 9) Net positive suction head available (NPSHA): 36 FT.
 - 10) Column and discharge diameter: 14 IN.
 - 11) Discharge head: Surface.
 - 12) Provide all pump components and accessories rated for outdoor, cold climate installation.

F. ACCESSORIES

- 1. Lubrication system:
 - a. Provide automatic solenoid operated drip feed oil lubrication system for lineshaft bearings and discharge bowl bushings.
 - 1) Reservoir capacity: 1 GAL.
 - 2) Normally closed solenoid valve.
 - 3) Manually adjustable needle valve dripper.
 - 4) Operate from a 110-115V, 1-Phase power supply.
 - b. Provide clear dripper so that lubrication operation can be verified by sight.
 - c. Provide grease packing lubrication for the suction bowl bushing.
 - d. Lubrication system shall provide a fixed volume lubrication to the pump line shaft bearings before initial start and at programmed run hours for the duration of the run cycle.
 - e. Unit must be fully automatic and programmable to match the lubrication requirements set forth by the pump manufacturer.
 - f. Lubrication piping shall be welded stainless steel and rated for 5000 psi.
 - g. Rated for outdoor service in cold climates.
- 2. Provide 316 stainless steel clip on type basket strainer.
 - a. Pump manufacturer shall provide basket strainer.
 - b. Provide 2 IN x 3 IN rectangular openings in the strainer.
 - c. Pump capacity shall take into account losses through strainer.
- 3. Provide flanged connection of the pump discharge to the discharge pipe.

G. FABRICATION

- 1. General:
 - a. Furnish units consisting of a vertical shaft pump, direct connected to a vertical hollow shaft motor.

- b. Design unit with non-reversing ratchets.
 - c. Weight of revolving parts of pump including unbalanced hydraulic thrust of impeller is carried by thrust bearing in driver.
 - d. Make provision at driver shaft for adjusting propeller.
2. Column:
- a. Construct discharge column pipe of steel and supply with connections.
 - b. Provide top and bottom sections of column pipes to 5 FT lengths.
 - c. Provide intermediate column sections not exceeding 10 FT in length.
3. Line Shaft:
- a. Construct line shaft from 416 stainless steel, Rolled and ground.
 - b. Maximum length: 10 FT.
 - c. Enclose line shaft in tub constructed of extra-heavy steel pipe in sections also not to exceed 10 FT in length.
 - d. Provide bronze line shaft bearings at each column connection.
 - 1) Furnish tension bearing assembly to provide tension on shaft enclosing tube and to serve as line shaft bearing. Construct bearing portion of assembly from bronze and assure it is designed not to "freeze" to shaft enclosing tube.
 - e. Sized to have first critical speed 50 percent above maximum operating speed.
4. Pump Bowl and Suction Bell:
- a. Provide bowl and suction bell constructed of close grained cast iron, free from imperfections and accurately machined and fitted.
 - b. Coat pump bowl water passages with an abrasion-resistant baked enamel, phenolic or epoxy.
 - c. Design to ensure easy removal of bearings and propeller.
 - d. Furnish suction bell with flared end to reduce entrance losses and with a sufficient number of vanes to support lower guide bearings and weight of propeller and pump shaft when dismantling pump.
 - e. Bowl Assembly shall be equipped with a replaceable 316SS bowl liner at the wearing surface of the suction bell, installed to not interfere with impeller or water flow, and to be used as a reference surface to set the optimum impeller lateral clearance of 0.030".
5. Bearings:
- a. Provide units with sleeve bearings in bowl and in suction bell.
 - b. In bowl, provide main bronze bearing immediately above propeller.
 - c. Furnish suction bell bearing having minimum length equal to five shaft diameters.
 - d. Ensure bell bearing is permanently packed type with packing to be a nonsoluble grease.
 - e. Provide SAE 40 bronze collar for bell bearing to prevent abrasives from entering bearing.
 - f. Maximum 5 FT spacing for lineshaft bearings.
6. Pump Shaft and Propeller:
- a. Provide pump unit shaft constructed of rolled and ground stainless steel.
 - b. Furnish propeller constructed of bronze and securely attached to propeller shaft.
 - c. Ensure propeller is accurately fitted and statically and dynamically balanced after it is securely locked on the shaft.
 - d. Propeller is to be free from abrupt transitions, projections or cavities.

- e. Adjust propeller to provide proper angle of inclination to achieve specified performance.
- 7. Discharge Head Assemblies:
 - a. Design discharge head assembly for 40 psi working pressure.
 - b. Provide discharge head for above ground mounting constructed of fabricated steel.
 - c. Mount discharge head on fabricated steel base plate which is of sufficient size to span opening in support structure.
 - d. Provide 416 stainless steel shaft at top section of line shaft where it passes through stuffing box.
 - 1) Provide bronze upper shaft bearing directly below stuffing box, in the head, to eliminate any shaft whip which could damage the seal.
- 8. Pedestal:
 - a. Design to support motor and complete pump assembly without distortion.
 - b. Provide suitable openings for access to stuffing box.
 - c. Provide registered connection between motor and pedestal.
 - d. Include tap and pipe for pedestal drain.
 - e. Cylindrical with diameter larger than motor base, mount reinforcing ribs inside pedestal.
 - f. Mount brass or stainless steel nameplate with manufacturer's name and pertinent design and identification information.
 - g. Provide positive means to adjust shaft and propeller without disturbing stuffing box.
- 9. Baseplate:
 - a. Provide rigid baseplate and soleplate to support pedestal and pumping unit.
 - b. Design to support motor and complete pump assembly without distortion.
 - c. Supply base plate with lifting lugs capable of supporting weight of entire unit.
 - d. Rounded corners.
 - e. Opening large enough to pass discharge flange.
 - f. Tapped for pedestal drain connection.
- 10. Motor:
 - a. 460 V, 3 PH, 60 Hz, 1.15 SF.
 - b. Vertical hollow shaft.
 - 1) Bird screen on motor fan guard.
- 11. Balance:
 - a. All rotating parts accurately machined and in as near perfect rotational balance as practicable.
 - b. Excessive vibration is sufficient cause for equipment rejection.
 - c. Unit mass and distribution such that resonance is avoided.
 - d. Maximum shaft vibration: Per HI standards.
 - e. Ratio of rotative speed to critical speed of a unit or components thereof: Less than 0.8 or more than 1.3.
- 12. Data Plates:
 - a. Provide stainless steel data plate securely attached to pump.

- b. Include manufacturer's name, pump size and type, serial number, speed, propeller diameter, capacity and head rating, and other pertinent data.
- 13. Anchor bolts:
 - a. Complete with nuts, pipe sleeves, and plates for proper installation.
 - b. Long enough to pass through its sleeve to the bottom of the slots or beam and be secured at this point by a bearing plate.
 - c. Nuts: Hexagonal cap nuts with rounded tops where exposed to view.
 - d. Sleeve internal diameter: Anchor bolt diameter plus 1-1/2 IN.
 - e. Stainless steel.
- 14. Shop Painting:
 - a. Sandblast and finish paint all iron and steel parts below baseplate, including pump column inside in accordance with submerged metal.
 - b. Surfaces above baseplate: Shop prime with epoxy coating.
- 15. Design pumps to operate without damage from reverse rotation due to return of water through column.
- 16. Piping:
 - a. Fabricate discharge head with long sweep elbow with minimum of three or four welded segments.

H. SOURCE QUALITY CONTROL

- 1. Factory test all pumps.

I. MAINTENANCE MATERIALS

- 1. Extra Materials:
 - a. Furnish Owner following spare parts for each pump service category.
 - 1) Bearing: One (1) set.
 - 2) All gaskets: One (1) set.

J. FIELD QUALITY CONTROL

- 1. Provide Special Services by Manufacturer's authorized and qualified field service representative(s) to assist the Contractor with the following:
 - 1) Installation
 - 2) Inspect equipment covered by this Section of the Special Provisions.
 - 3) Supervise adjustments and installation checks.
- a. During startup:
 - 1) Assist Contractor in startup of equipment and perform operation checks.
 - 2) On-site startup service to be available with 24 HR notification.
 - 3) Contractor shall provide an acceptable testing agency specializing in the field of baseline vibration testing and machinery condition diagnosis on pumps, including drives.
- b. During demonstration period:
 - 1) Assist Contractor during the demonstration period to prove the functional integrity of the mechanical and electrical equipment components and the control interfaces of the equipment and components as evidence of substantial completion.
 - 2) Perform final operational checks.
- c. Personnel training:

- 1) On-site training of Owner's personnel.
- d. Provide Contractor with written statement that equipment has been installed properly, started up and is ready for operation by Owner's personnel.
- e. To accomplish the above Special Services, the Manufacturer's representative shall plan a minimum of trips to the site as follows:
 - 1) One (1) trip will be dedicated to assist the Contractor and witness pump assembly and installation procedures throughout the Project (8 HRS total on-site per pump).
 - 2) One (1) trip will be dedicated to startup activities, assist the Contractor during the demonstration period, perform final operational and provide Owner's personnel training (16 HRS total on-site).
 - 3) Provide manufacturer's one year warranty. Warranty shall begin on the project's substantial completion date.
- f. All costs for utilities, supplies and chemicals used during startup and demonstration shall be the responsibility of the Contractor.
- g. Contractor shall provide Manufacturer with a minimum of 30-days notice prior to each scheduled activity listed in Paragraph J.1. above.

END OF SECTION