



LAKE HAVASU CITY, ARIZONA

ADDENDUM NO. 1

Lake Havasu City Booster Station 5A Improvements
PROJECT NO. 108020

Date Issued: March 28, 2022

Bid Date: April 12, 2023, 3:00 p.m., Arizona Time

To: All Planholders of Record

This addendum forms a part of the Solicitation described above. The original Solicitation Documents in full force and effect are modified by the following changes. Addendum No. 1 will take precedence over any conflicting provisions in the prior documents.

In accordance with the Information for Bidders, Section 00100 -16, Addenda and Interpretations, the following revisions to the Plans and Specifications shall become a part of the Contract Documents and each bidder shall acknowledge receipt thereof on page 00300-1 of the Bid Proposal and by attaching this Addendum to its bid.

The following changes are to be made and become part of the Bid/Contract Documents. Attention is called to the following changes, additions, clarifications and/or deletions to the original solicitation and they shall be taken into account in preparing submissions:

Item 1:

Bid Due Date shall be REVISED to: no later than 3:00 p.m., Arizona Time, April 12th, 2023, at the City Clerk's Office, 2330 McCulloch Blvd. N., Lake Havasu City, AZ 86403.

Item 2:

Item 7 on the Bid Schedule Waterline and Back-flow Preventer - Delete the works "and backflow preventer" as this item is only for the connection to the existing City waterline shown on plans.

Item 3:

Delete Section 11219 – Vertical Multi-Stage Centrifugal Pumps in its entirety and replace with the revised specification attached with this addendum.

Item 4:

Answers from Questions Received.

1. Question: Regarding the pumps, do they accept equal pressures and volume?

Answer: Yes

The booster pump station operates based on pressure. The four booster pumps BPS-5A-1, BPS-5A-2, BPS-5A-3 and BPS-5A-4 and the two hydropneumatic tanks, operate to meet the required domestic and fire flow demands. During normal operating conditions, one booster pump (BPS-5A-3 or BPS-5A-4) and hydropneumatic tank operate to meet system domestic demands. When the system pressure drops below 60 psi, the hydropneumatic tanks operate to meet low usage demands and maintain 85-95 psi. If the hydropneumatic tanks require more domestic demand (and the level falls), pump (BPS-5A-3 or BPS-5A-4) will operate to fill the tanks to meet the system demands. If fire flow demands are needed, and pressures drop further (below 40 psi – adjustable), the fire flow pumps (BPS-5A-1 or BPS-5A-2) will operate to meet high flow demands.

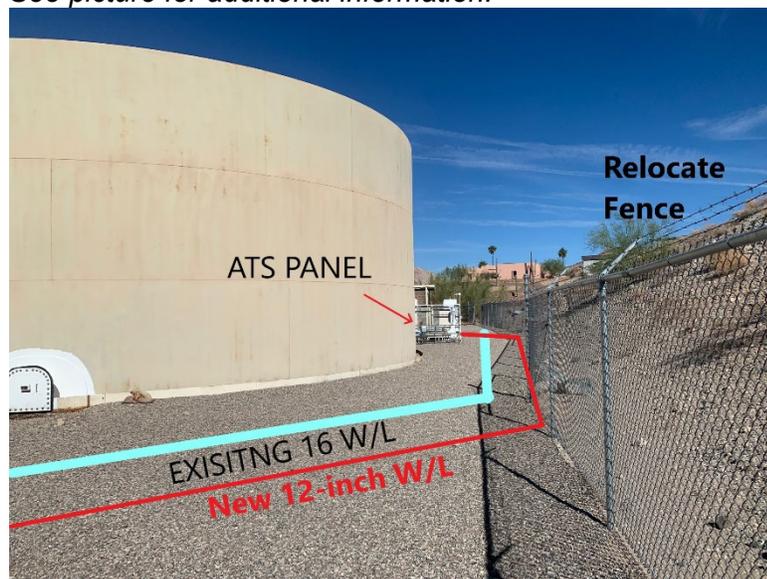
2. Question: Do the City have any “Buy American” or “Prevailing Wages” stipulations?

Answer: No

3. Question: Is any dirt removal anticipated for fence relocation?

Answer: It is not anticipated. The fence will need to be relocated in close proximity to the existing fence line.

See picture for additional information.



4. Question: Regarding the hydropneumatic tanks, why are there back-to-back valves?

Answer: To isolate each tank as close as possible to the tank. The City will verify the valve locations.

5. Question: Can 300 days be extended dependent on the procurement of equipment and supply chain delays?

Answer: The City will be flexible with the contractor when it comes to dealing with supply chain issues. Once the Contract is awarded the City will provide separate NTPs for equipment and construction to address equipment delays.

- 6. Question: Is there a tie-in plan to minimize downtime when switching over to the new system?**

Answer: Contractor must make provisions to maintain pressure and minimize down time. Tie-ins shall be coordinated with the OWNER and shall be scheduled as to minimize the disruption of services. CONTRACTOR shall provide a written proposed maintenance of plant operation (MOPO) for tie-in activities and shutdowns for review by the OWNER.

- 7. Question: What is the current working pressure?**

Answer: 85 to 95 PSI.

- 8. Question: Will "Equal" equipment be considered?**

Answer: "Equal" equipment will be considered with written approval from Lake Havasu City prior to Contractor purchase.

- 9. Question: Spec calls for vertical turning line shaft pumps typical for well applications, there is not wet well in this case, can you clarify what type of pump is needed?**

Answer: Please refer to revised pump specification attached to this addendum.

- 10. Question: There are (2) design points listed in the spec, is Design Point 1 to be applied to the larger pumps and Design Point 2 to be applied to the smaller jockey pumps?**

Answer: Please refer to revised pump specification attached to this addendum.

- 11. Question: Spec calls for 100 PSI. but also 43' of head. 43' of head is roughly equivalent to 18 PSI, we assume 100 PSI is the design point, can you confirm?**

Answer: Please refer to revised pump specification attached to this addendum.

- 12. Question: Item 7 on the Bid Schedule Waterline and Back-flow Preventer - Please give more detail on the scope of that work.**

Answer: Please delete the reference to the backflow preventer as it is a typo and this item is only for the connection to the existing City waterline shown on plans. This is clarified in the Addendum.

- 13. Question: Standard details i.e. TYP/105 where are these to be found at? It does not look like they are part of the Lake Havasu Engineering Dept standards.**

Answer: These are part of the Engineers standard details on sheet S-01, M06, and M-07.

- 14. Question: Is the generator slab thickness called out anywhere or is this determined by the generator manufacturer?**

Answer: these are part of the Engineers standard details on sheet S-01.

15. Question: Do we need to pre approve a surge tank supplier before the bid if it is not Smyth? Spec section 11405-3.

Answer: See Response to question 8.

16. Question: Does spec section 01520 indicate the requirement of the GC to maintain a field office for the duration of the project?

Answer: Contractor shall mee the requirements of Section 1520.

SECTION 11219

VERTICAL MULTI-STAGE CENTRIFUGAL PUMPS **REVISED PER ADDENDUM 1**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope: CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install four (4) vertical multi-stage centrifugal pumps (Tag I.D.s: BPS-5A-1, BPS-5A-2, BPS-5A-3, and BPS-5A-4) complete and operational with motors, Soft start motor controls, control equipment, and appurtenances. Anchor bolts are included in this Section.
- B. Related Sections: CONTRACTOR shall coordinate the requirements of the Work in this Section along with the requirements of the Sections listed below which includes, but is not necessarily limited to, Work that is directly related to this Section.
 - 1. Section 01600 - Product Delivery, Storage, and Handling.
 - 2. Section 01340 - Technical Submittal.
 - 3. Section 05052 - Anchor Bolts, Toggle Bolts, and Concrete Inserts.
 - 4. Section 09900 - Special Coatings.
 - 5. Division 15, as applicable.
 - 6. Division 16, as applicable.
- C. See Drawings
- D. In order to centralize responsibility, it is required that all equipment and services provided under this Section be furnished by a single supplier or manufacturer who shall assume full responsibility for the completeness of the system. CONTRACTOR shall guarantee and be the source of information on all equipment furnished regardless of the manufacturing source of that equipment.

1.02 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Manufacturer shall have a minimum of five years' experience of producing substantially similar equipment, and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
- B. Component Supply and Compatibility:
 - 1. Obtain all equipment included in this section regardless of the component manufacturer from a single pump manufacturer or supplier. The pump shall arrive complete to the jobsite, including OEM discharge lead, column pipe and bowl assembly.

2. The pump manufacturer or supplier shall review and approve or shall prepare all Shop Drawings and other submittals for all components furnished under this Section.
 3. All components shall be specifically designed for pumping service and shall be integrated into the overall equipment design by the pump manufacturer or supplier.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. National Electrical Code.
 2. Standards of National Electrical Manufacturers Association.
 3. Institute of Electrical and Electronic Engineers.
 4. American Gear Manufacturers Association.
 5. American National Standards Institute.
 6. Anti-Friction Bearing Manufacturer's Association.
 7. Standards of the Hydraulic Institute.
 8. Standards of the American Water Works Association.
 9. National Sanitation Foundation.
 10. ASTM A 48, Specification for Gray Iron Castings.
 11. ASTM A 53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 12. ASTM A 276, Specification for Stainless Steel Bars and Shapes.
 13. ASTM B 584, Specification for Copper Alloy Sand Castings for General Applications.
- D. Shop Tests:
1. All pumps shall be shop performance tested.
 2. All tests shall be witnessed by a Registered Professional Engineer, who may be an employee of the manufacturer. The Registered Professional Engineer shall sign and seal all copies of curves and shall certify that hydrostatic tests were performed. The State of registration, registration number and the name on the seal shall be clearly legible. Tests shall be conducted in conformance with the methods described in Section A6 of AWWA E101.
 3. Hydrostatic Test: All pump discharge heads, columns, and bowl assemblies shall be hydrostatically tested to twice the total head or one and half times the shutoff head, whichever is greater.
 4. Performance Test Requirements:
 - a. Pump bowl assembly shall be operated from zero to maximum capacity as shown on the approved curve. Results of the test shall be shown in a plot of test curves showing head, flow, horsepower, efficiency and current drawn. Readings shall be taken at a minimum of seven evenly spaced capacity points including shutoff, design point and 125 percent of flow at best efficiency point. Tests shall be conducted in conformance with applicable methods and standards of Section A6 of AWWA E101.
 - b. Curves shall be corrected for column and discharge head losses, shaft friction loss, and operating speed to show the anticipated field performance of the complete pump assembly.

- c. Performance of the pumping units shall be within the tolerances specified in the Hydraulics Institute Standard, latest revision, when operated at design speed and capacity.
 - d. Should the test results indicate that the pumping unit does not meet the above requirements, it shall be modified at no additional cost to the OWNER and retested until full compliance with specified performance can be demonstrated.
5. If manufacturer cannot run tests at full speed because of limitations in manufacturer's testing facilities, reduced speed tests, acceptable to ENGINEER, may be utilized and the results corrected to design conditions by means of accepted hydraulic computations.
 6. The complete pumping unit shall conform to the vibration requirements set forth in Section 9.6.4 of the 2018 edition of the Hydraulic Institute Standards.
 7. All test measurements shall be taken with properly calibrated instruments and all procedures shall conform to the test code of the Hydraulics Institute, unless modified herein. Acceptance criteria shall be Grade 1U as defined by table 14.6.3.4 in Hydraulic Institute Standards 14.6 - 2011.
 8. Pumps shall not be shipped until the ENGINEER has approved the test reports and test curves.
- E. Witness Tests: OWNER and ENGINEER shall be permitted to witness the certified pump performance factory test. CONTRACTOR shall provide two weeks minimum written notice prior to scheduling shop tests to allow OWNER time to make travel arrangements. Cost of lodging, meals and travel shall not be CONTRACTOR'S responsibility. However, if the witness shop tests are not run on the date agreed upon because of CONTRACTOR'S or the supplier's fault, the cost of the excess travel, lodging, meals, and time for the OWNER may be deducted from the money due CONTRACTOR.

1.03 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Manufacturer's literature, illustrations, paint certification, specifications and engineering data including: dimensions, materials, size, and weight.
 2. Performance data and curves showing overall pump efficiencies, required net positive suction head, allowable suction lift, flow rate, head, brake horsepower, motor horsepower, speed, and shut off head. Supply data on pump head losses to include entrance, column, pump, discharge head and valve losses.
 3. Shop Drawings showing fabrication methods, assembly, accessories, and installation details and wiring diagrams.
 4. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
 5. Three copies of certified pump performance test results and hydrostatic test.
 6. Three copies of motor test results and data.
 7. List of all deviations from the Contract Documents.

- B. Operation and Maintenance Manuals:
 - 1. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation and spare parts information.
 - 2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01340 - Technical Submittals.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast in place concrete in ample time not to delay that Work.
- B. All boxes, crates, and packages shall be inspected by CONTRACTOR upon delivery to the site. CONTRACTOR shall notify ENGINEER of any loss or damage to equipment or components. Replace losses and repair damage to new condition, in accordance with manufacturer's instructions.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, and other supports. Protect steel members and packaged materials from corrosion and deterioration.
- D. Store all mechanical equipment in covered storage off the ground and prevent condensation.

PART 2 - PRODUCTS

2.01 PRODUCT MANUFACTURER

- A. Pumps shall be:
 - 1. Grundfos Fire Pump: Grundfos CR 185-2-2, 1000 gpm @100psi
 - 2. Grundfos Domestic Pump: Grundfos CR 45-3-21, 250 gpm @ 100psi
 - 3. Approved equal
- B. Provide motors as manufactured by one of the following:
 - 1. U.S. Motors
 - 2. Baldor

2.02 SERVICE CONDITIONS

- A. Pumps shall be vertical multi-stage centrifugal type pumps to be run on VFDs to meet various flow and pressure conditions.
- B. The characteristic curve of the pump shall rise from minimum head condition to shut off without dips. The complete pumping unit consisting of the pump and respective motor shall be suitable in all respects for continuous and stable performance without cavitation and in

accordance with the vibration criteria specified in Hydraulic Institute Standards.

- C. Each complete pumping unit, including the motor, shall be capable of safely operating at up to 125% of full load speed in reverse rotation without sustaining damage.
- D. Materials in Contact with Potable Water:
 - 1. All surfaces, including coatings which will be in contact with water that will become potable following additional treatment, shall under both pump operating and non-operating (stagnant) conditions:
 - a. Not impart taste or odor to water nor produce an organic or inorganic content in the water in excess of the maximum level established by applicable laws or regulations.
 - b. Be listed by the National Sanitation Foundation as being suitable for contact with potable water, as applicable.
- E. Pumps shall be specially designed, constructed, and installed for the service intended and shall comply with the following minimum conditions. The requirements in this section shall govern for pump performance compliance. (Hydraulic Institute’s tolerance for testing and hydraulic efficiency are not applicable):

Fire Flow Pump Parameters	Value
Number of Pumps Required	2
Number of Soft starters	2
Number of Stages on Each Pump (Minimum)	2
Flow Rate (for Each Pump), gpm	1000
Head (for Each Pump), psi	100
Minimum Efficiency , %	81
Min. Shutoff Head, ft	160
Design Point 2 for Each Pump, gpm	1200
Design Point 2 for Each Pump, psi (min)	70
Maximum Operating Speed, rpm	3,546
Impeller Diameter, inches	8 inch
Liquid type	Water
Drive Type	Variable Speed
Max Water Temperature, Deg F	68
Motor HP, Each (Maximum)	75

Domestic Flow Pump Parameters	Value
Number of Pumps Required	2
Number of Soft starters	2
Number of Stages on Each Pump (Minimum)	3
Flow Rate (for Each Pump), gpm	250
Head (for Each Pump), psi	100 psi
Minimum Efficiency, %	76

Min. Shutoff Head, psi	145
Design Point 2 for Each Pump, gpm	300
Design Point 2 for Each Pump, psi (min)	80
Maximum Operating Speed, rpm	3,521
Impeller Diameter, inches	Varies
Liquid type	Water
Drive Type	Variable Speed
Max Water Temperature, Deg F	68
Motor HP, Each (Maximum)	25

1. Based on the given flow and pressure conditions, either one or two pumps shall be running at a time. One of the three pumps shall be a standby pump (unless demand is high). Pumps shall be run alternately each time Booster Pump Station (BPS) comes online, this will allow rotation among the two pumps.

2.03 DETAILS OF CONSTRUCTION

A. Pump Materials and Construction:

1. Inlet Bell and Bowl Assembly: The castings shall be of close-grained cast iron, ASTM A 48, Class 30 or ductile iron, having a minimum tensile strength of 30,000 pounds per square inch, free from blow holes, and sand holes. The inlet bell shall provide conservative entrance velocities and direct the flow to the impeller. The inner surfaces of the bell shall be smooth and free of sharp projections or cavities which might cause turbulence or cavitation. A streamlined housing, centered and held in the bell by means of rigid vanes, shall be provided to properly direct the flow to the impeller. The bowl shall be designed for a flanged, indexed fit to the inlet bell and discharge column to provide proper bearing alignment. The interior surfaces shall be smooth and free of sharp projections, transitions, and cavities which might incite turbulence and undesirable vibration. The contours of the bowl shall be designed to closely match the shape of the impeller's vanes and to provide a smooth conversion of kinetic to potential energy. A bearing housing, centered in the bowl by rigid vanes shall be positioned immediately above the impeller to ensure minimum shaft deflection at all conditions of service. Bowls shall be fitted with a replaceable bronze bowl wearing rings. Bowl fasteners shall be Type 316 stainless steel. Bowl suction case shall have four webs to support lower bowl bearing. Bowl inlet shall have a stainless steel strainer with anti-vortex blades
2. Impellers: Provide enclosed impellers of one piece, constructed of NSF 61 approved Type 316 Stainless Steel or nickel aluminum bronze. Provide impellers with vanes of uniform spacing, rounded inlet edges, and smooth water passages. Provide removable bronze wear rings at the inlet end of the impeller and at the casing, secured by a positive mechanical method to prevent loosening in any operating mode. Secure impeller to the shaft by a stainless steel key and locknut or locking collar so that it cannot unscrew or become loose due to torque or rotation in either direction.
3. Bowl shaft: The bowl shaft shall be ASTM A 276, Type 416 stainless steel, turned, ground, and polished. Shafts shall be sized as recommended by the manufacturer.

4. ~~Strainer: The strainer shall be constructed of 18-8 stainless steel. Net inlet area shall be equal to four times the net impeller inlet area. Maximum inlet area shall be not more than 75 percent of the minimum opening of the water passage through the bowl or impeller.~~
5. ~~Support the bowl shaft by no less than two bearings. Support line shaft bearings by rigid spiders spacers at a maximum spacing of 5 ft apart. Provide fully machined shafts of sufficient diameter to transmit torsional and axial loads under all specified operating conditions, diameter per pump manufacturer recommendations. Provide shafts made of 410 or 416 stainless steel at a maximum length of 10 ft. The shafting shall be coupled with Type 316 stainless steel couplings, designed with a safety factor of one and half times the shaft safety factor and shall be left hand thread to tighten during pump operation. Provide shaft sleeves of Type 416 stainless steel hardened to 250-400 BHN at each intermediate line shaft bearing and at the seal box. Secure the sleeves to the shaft by a positive mechanical method which prevents the sleeve from rotating on the shaft."~~
6. Booster Pump Column: The pump column shall be fabricated steel with welded steel flanges capable of supporting the bowl assembly. Limit the column sections to a maximum length of 10-ft and connected with isolated 316 stainless steel hardware. Column sections shall be rated for the maximum pressure on the pump curve.
7. Discharge Head Assembly: The discharge head assembly shall be fabricated steel, accurately machined with a rabbet fit for mounting the driver and supporting the pump assembly and with above ground discharge flange machined and drilled to ANSI standards for 250 lb pressure rating. The discharge head shall be manufactured by the pump manufacturer and shall be a fabricated steel fitting that mounts to the pump can flange. Cast iron discharge heads are not allowed. The Discharge flange shall match the pressure rating of the booster station piping. Prior to machining, the discharge head shall be stress relieved by a thermal process. A flanged four piece adjustable spacer type coupling shall be provided with a coupling guard for seal removal. An air release valve shall be provided on the discharge head base to relieve air in the suction barrel. Provide taps and penetrations on the discharge head required for the mechanical seal drain and air release valve. The discharge head and flanges shall be rated for the maximum pressure on the pump curve.
8. Mechanical Seal: The mechanical seal must be removable without removing or raising motor and must include a seal drain. Champion mechanical seals 401 316-SS, Hastelloy "C" springs alpha silicon carbide face material rated at 450 psi. Provide one spare seal for each pump.
9. Provide removable, adjustable water slinger fitted to pump shaft to prevent pressurized leakage from the stuffing box from entering the motor enclosure. The stuffing box shall be bronze, ASTM B 584 or cast iron, ASTM A 48.
10. Type 316 stainless steel anchor bolts and inserts shall be furnished under this Section and shall be sized and installed in accordance with the manufacturer's recommendations
11. All bolts, nuts and cap screws shall have hexagon heads, and be Type 316 stainless steel.
12. Stainless steel nameplates giving the manufacturer's model and serial number, rated capacity, head, speed and all other pertinent data shall be attached to the pump.
13. A suitable gasket shall be provided to prevent leakage at the mounting flange.

14. As the motor shall be vertical solid shaft, impeller adjustment shall be made through the use of a space type rigid coupling offering a removable spacer for easy maintenance of the pump and an adjusting nut assembly, whereby the required vertical clearance in between the bowls and the impeller is attained. Coupling spacer shall be of sufficient length to remove both the seal cartridge and the seal retainer without disturbing the motor.
15. Pump base: Each pump motor, discharge assembly, and column pipe shall be mounted on the concrete base as shown on the Drawings. The pump manufacturer shall provide anchor bolts, vibration isolation soleplate and installation instructions.
16. Booster Suction Barrel: The suction barrel shall be welded steel with a mounting flange and side suction nozzle/flange. Suction barrels shall be manufactured by the pump manufacturer. Wall thickness as determined by Section VIII of the ASME code based on 0.125 corrosion allowance and the pump rated head, but in no case less than 0.375 inch thick. Do not install baffles inside suction barrels. Vortex suppression fittings shall be installed on the pump bowls. All barrels shall be placed on a concrete leveling pad.
17. Booster Bearings: Bowl bearings shall be Bismuth Tin Bronze UNS C89835 or other NSF 61 approved bronze material. Provide suitable lubrication grooves to adequately pass water through the bearings and distribute lubrication evenly. Pack the suction bell bearing with a water resistant grease approved for use in potable water. The bearings shall be located at intervals of no more than five (5) feet and as recommended by the pump system manufacturer. Bearing spacing shall be provided in distances as recommended by the manufacturer to avoid natural frequency effects. Provide a protecting collar made of bronze to exclude solids or foreign matter from entering the bearing.

B. Motors:

1. Motors shall operate on 460 volts, 60 Hz, 3 phase electric power. It shall be 50 HP minimum. It shall be able to run on VFD. It shall be supplied with non-reverse ratchet mechanism.
2. Motors shall be in accordance with all current applicable standards of NEMA, IEEE, AFBMA, NEC, HI, ASTM, ANSI, and AWWA.
3. Motors shall be Weather Protected Type-One with NEMA P-base. Motors shall be vertical solid shaft type.
4. Service Conditions:
 - a. Suitable for serving indoor in a clean environment.
 - b. Voltage variation of $\pm 10\%$.
 - c. Frequency variation of $\pm 5\%$.
5. Enclosure shall be NEMA Weather Protected Type One.
6. Motors shall be Totally Enclosed Fan Cooled (TEFC), squirrel cage induction type, 460 volt, 60 Hz, 3 phase electric power. Motors shall be cast iron, Nema Energy Spec ISO9000 certified. Provide air cooled anti-friction guides, oil lubricated thrust bearings, and reverse rotation ratchets. Motor shall have a stainless steel plate indicating all essential lubricating information. The motor shall not be loaded more than 90% of rated horsepower.
7. Motors shall be Division One explosion proof, as defined by UL, meeting the Class and Group as required by the hazard.

8. Motors shall be of the full voltage starting, squirrel cage induction type, of sufficient size so that there will be no overload on the motor above rated nameplate horsepower under any condition of operation from shut off to zero head, unless otherwise specifically permitted in this Section.
9. Insulation system shall be rated minimum Class F (155oC). Magnet wire shall be copper and rate Class H (180oC) or better. Magnet wire shall be classified Pulse Endurance, suitable for variable frequency applications. Varnish shall be 100% polyester. Water borne varnish is not acceptable.
10. Provide T-stat for motor over temperature protection built into windings. It shall protect against overload, high ambient temperature, too frequent starting, abnormal voltage, ventilation failure, and single phase condition.
11. Motors shall be capable of carrying full load current continuously without injurious temperature rise in an ambient temperature of 60°C.
12. Motors shall be provided with a service factor of 1.15.
13. Motors shall be premium efficiency in accordance with “NEMA PREMIUM” value for horsepower, speed, and enclosure.
14. Motors applied to variable frequency drives shall adhere to NEMA MG-1 Part 31 and shall be nameplated accordingly.
15. Provide each motor with air-cooled anti-friction guide and thrust bearings. Thrust bearings shall be oil lubricated; guide bearings shall be oil or grease lubricated. All bearings shall have a minimum L-10 or B-10 life of 100,000 hours as defined by the Anti-Friction Bearing Manufacturer's Association. Thrust bearings shall be angular contact ball or roller type rated for continuous operation and a total load consisting of the weight of the motor rotor, pump impellers and lineshafting plus the hydraulic thrust imposed by the pump at rated operating conditions. Thrust bearings shall have adequate capacity to carry the upthrust at starting and the combined downthrust at shutoff. The use of tandem or series bearings will not be acceptable. Thrust bearings for each motor shall be provided with a visual indicator for lubricant level and readily accessible connections for adding and draining lubricant. The lubricating system shall be designed to provide the correct amount of oil to the bearing with a minimum of foaming or aeration. Each motor shall be supplied with a stainless steel information plate indicating all essential information such as, type of lubricant, viscosity, and other pertinent data.
16. Lubrication of motor bearings shall be as recommended by the manufacturer.
17. Each motor shall have a stainless steel nameplate which shall provide the following: Type, frame, insulation, class, HP, full load current, RPM, centigrade degrees rise, manufacturers name and serial no., model, voltage, locked rotor KVA code, bearing numbers and a connection diagram. The motor terminal box shall be oversized to provide adequate space for connections. The motor terminal box shall be of cast iron or fabricated steel, neoprene gasketed and bolted, and oversized to provide adequate space for connections. The motor leads shall be permanently marked in agreement with the connection diagram.
18. Motors shall be high efficiency design type. Efficiencies shall be determined in accordance with NEMA Standard MGI-12.53a and IEEE Standard 112, Test Method B. Nominal and guaranteed efficiencies shall be included on motor nameplates in compliance with NEMA Standard MGI-12 53b.
19. Ratchets: Pumps shall be supplied with non-reverse mechanism in the motor.

20. Vibrations shall not exceed 0.08 inches per second, peak to peak.
21. Noise level shall not exceed 85 dbA at 1 meter.
22. Motors shall have permanent lifting lugs capable of a safety factor of 10.

- C. Variable Frequency Drives: Use soft starters.
- D. Provide control panel and accessories as per Division 16.

2.04 CONTROLS

- A. All Controls and Instrumentation per Drawings and Specifications.
- B. Pressure Gauge:
 1. Provide indicating gauge on the discharge piping as shown on Drawings. Gauges shall be furnished with diaphragm seals (with flush connection) and gauge cocks. Range of the pressure gauge shall be 0 to 250 psi.

2.05 ANCHOR BOLTS

- A. Furnish anchor bolts and nuts of ample size and strength for the purpose intended, sized by the equipment manufacturer. Anchor bolt materials shall be Type 316 stainless steel and shall conform to the requirements of Section 05052, Anchor Bolts, Toggle Bolts and Concrete Inserts.

2.06 TOOLS, SPARE PARTS AND MAINTENANCE MATERIALS

- A. Each pump shall be furnished with a manufacturers repair kit which shall include as a minimum the following:
 1. Two sets of special tools required for maintenance and operation.
 2. One set of sleeve bearings for shafting.
 3. Wear rings, one for each impeller.
 4. A complete set of all fasteners, bolts, nuts, pins, keys, washers and the like which are not of standard manufacture.
 5. All bearing grease, and any other lubricants required for initial operation, properly labeled and boxed.
 6. One complete mechanical seal kit.
 7. Complete set of gaskets.
- B. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the OWNER at the conclusion of the Project.

2.07 SURFACE PREPARATION AND SHOP PAINTING

- A. Pumps, motors, and appurtenances shall receive shop primer and shop finish coating conforming to requirements of Section 09800 - Special Coatings. If any damage to the paint system occurs, the equipment shall be repainted as directed by the ENGINEER. The interior surfaces of the pump, suction bell and discharge column pipes, and the interior surfaces of

the pump head and suction barrel shall be cleaned with a Near White Metal Sandblast (SSP-SP10), and coated with an NSF approved paint. Approved coating manufacturer: TNEMEC

- B. All gears, bearing surfaces, machined surfaces, and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspection:
 - 1. Inspect and verify that structures or surfaces on which the equipment will be installed have no defects which will adversely affect installation.
 - 2. Inspect all equipment prior to installation.
 - 3. Promptly report defects which may affect the Work to the ENGINEER.

3.02 INSTALLATION

- A. Install the pump equipment in a manner and to the tolerances recommended by the equipment manufacturer. CONTRACTOR shall arrange for a qualified service representative from each manufacturer of equipment to assist in the installation of the equipment, to check the equipment before it is placed into operation, and to provide start-up service.
- B. Lubricants: Install products recommended by equipment manufacturer for initial operation.
- C. Install pumping units on concrete bases and secure with anchor bolts in accordance with the manufacturer's recommendations and as shown on the Drawings. The concrete bases shall be poured as per the Drawings. Concrete work and grout are specified in Division 3, Concrete. The base with the equipment mounted thereon, or the soleplate, shall then be accurately shimmed to grade and the spaces between filled with an approved non-shrink grout. After the grout has reached its initial set, exposed edges shall be cut back 1/2-inch and the edges neatly finished with one to two cement mortar.
- D. Support piping independent of the pump.
- E. Check and align all pump, motor, and flexible shafting.

3.03 START-UP AND FIELD TEST

- A. CONTRACTOR shall verify that structures, pipes, and equipment are compatible.
- B. Make adjustments required to place system in proper operating condition.

- C. Field Vibration Tests (perform only if excessive vibration is noticed):
 - 1. A bump test shall be performed on pump in each of two orthogonal planes, one of which shall include the discharge elbow, to ensure that the pumps will not develop lateral and/or torsional critical speeds. These tests shall be performed after the pump has been installed on its foundation, and under both operating and non-operating conditions. Other suitable tests may be substituted subject to ENGINEER'S approval of CONTRACTOR'S written request and description of the tests proposed.
 - 2. Vibration measurements shall be made at the upper motor bearing of pump while operating over its speed range. Measurements shall be made in each of two orthogonal horizontal directions one of which shall be in the plane of the greatest vibration and in the vertical (pump axial) direction. Measured levels in the horizontal direction of the operating pump shall not exceed those in the Hydraulic Institute Standards latest edition.
 - 3. CONTRACTOR shall provide the services of an Engineer to conduct the vibration tests.

- D. Testing, checkout, start-up and commissioning of the equipment shall be performed under the technical direction of the manufacturer's factory-trained representative. The pump system shall not be energized without authorization from the manufacturer's representative.

3.04 MANUFACTURER'S SERVICES

- A. A factory-trained representative shall be provided for installation supervision, start-up and test services and operation and maintenance personnel training services. The representative shall make a minimum of two visits (8 hours, each) to the site. The first visit shall be for assistance in the installation of equipment. The second visit shall be for checking the completed installation and start-up of the system. Manufacturer's representative shall test the system in the presence of the ENGINEER and verify that the pumps conform to requirements. Representative shall revisit the job site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

- B. All costs, including travel, lodging, meals and incidentals, shall be considered as included in CONTRACTOR'S bid price.

END OF SECTION