ADDENDUM NO. 2
TO THE CONTRACT DOCUMENTS FOR
Well Number 8 Pump Building

To All Planholders and/or Prospective Bidders:

The following clarifications, changes, additions, and/or deletions are hereby made a part of the Contract Documents for the construction of the Well Number 8 Pump Building as fully and completely as if the same were fully set forth therein:

A. PART 1, BIDDING REQUIREMENTS
1. NOTICE INVITING BIDS, Paragraph N-2: Replace "April 26th, 2023" with "May 9th, 2023."

B. PART 2, CONTRACT FORMS
1. None

C. PART 3, CONDITIONS OF THE CONTRACT
1. None

D. PART 4, SPECIFICATIONS
1. Attached Section 33 11 33 Pump and Pump Motor_Addendum 2 replaces Section 33 11 33 Pump and Pump Motor in its entirety.
2. Section 33 12 00 Mechanical Appurtenances (2.1) (D): Strike "Provide ASME Class 250 flanges for valves located on the high pressure discharge side piping."
3. Section 33 12 00 Mechanical Appurtenances (2.11) (A): Replace "Flanges shall be Class 300" with "Flanges shall be Class 150."
4. Section 33 12 00 Mechanical Appurtenances (2.11) (A): Replace "Model 60-11" with "Model 61-02."

E. DRAWINGS AND DETAILS
1. Sheet G-2: Added Sheet C-13A to Index.
2. Sheet C-3: Added clarifying callout for fence posts and panels near existing vinyl fence.
3. Sheet C-5: Modified old reference to Sheet S-8. New reference is to Sheet S-7.
4. Sheet C-6: Modified schedule item 108 to be Model 61-02. Clarified pressure class was not meant to describe pressure rating. All flanged connections intended to be class 125/150 flanges.
5. Sheet C-7: Modified details to indicate oil lubricated lineshaft rather than product lubricated.
6. Sheet C-13A: Added new sheet for City standard detail for curb inlet with single grate.

7. Sheet PP-3: Modified call outs and dimensions for inlet box and combo boxes.
8. Sheet S-7: Added cross-reference in detail A to Sheet C-5. This detail is what is needed for the window into the chlorine room.
9. Sheet E002: Added motor vibration switch to Switch table.
10. Sheet E101: Modified incorrect keynote callout.
11. Sheet E103: Added motor vibration switch to motor.
12. Sheet E503: Changed dimension on Trench Detail 3.
13. Sheet E602: Added motor vibration switch to One-Line Diagram and added the shutdown signal wire to Table VFD.
14. Sheet E604: Added motor vibration shutdown to VFD logic and added High Vibration indication light.
15. Sheet E606: Added motor vibration switch to Digital Inputs, and motor high vibration shutdown to Digital Output lists.
16. Sheet E609: Added motor high vibration pilot light to VFD Controls Arrangement.

F. GENERAL CLARIFICATIONS

1. A 150 hp motor is acceptable if it can be demonstrated to meet the lift and efficiency requirements. Pump lift was updated to better reflect column pipe losses. Total pump lift at 600 gpm is 747 feet.

2. Staging to be confined to the 1 acre area identified by the City's corner staking.

3. City will stake the 1 acre property corners, Contractor responsible for all other construction staking.

4. Traffic Control – encroachment permit (fee waived) from City (Craig Peterson), include both sides of 8600 South.

5. Construction activity is limited to daytime hours only.

6. 2-week notice to the City for water shutdown, plan approved in advance, 72 hour notice to residents.

7. APCO will program and integrate all SCADA functionality. Contractor required to provide the RTU and connections to RTU from Control Panel.

G. QUESTIONS

1. Q: The sizes of the combination boxes is not show either on SD-14 WJC or located on PP-3. Please clarify size and type.

   A: See revised Sheet PP-3 for dimensions. Internal combo box dimension is 3'x 6'.

2. Q: Will Permit fees be either paid or reimbursed by the owner?

   A: The City will not require building permit fees nor encroachment permit fees. The permits will still need to be filed, with the proper insurance forms, but no fees.

3. Q: Please clarify the depth of the pump column that the GC is to supply and install.

A: Pump column length must be sufficient to set pump intake at 600' as shown on Sheet C-7. Coordinate with pump supplier to determine individual lengths of pump assembly equipment (column pipe, pump bowls, etc.) so that the pump intake is set at 600' below ground surface.

4. Q: Can the spoils be left on site or does the City have a location where we can dump spoils? This would be a considerable cost savings.

   A: The spoils can be left in the remainder of undeveloped park area, but they must be graded and spread uniformly as possible. Any existing piles already there should be spread flat as well and remove any trash. If there are any build up areas, those will only be at the direction of City staff – Parks division.

5. Q: Please clarify the ornamental fence where it backs up against the vinyl fence. Will there be pilasters. Will the ornament fence run along with the existing vinyl fence?

   A: See clarifying call-out on Sheet C-3.

6. Q: Page E101, assuming keynote for irrigation time switch is #4.

   A: See revised Sheet E101.

7. Q: Page E503, Detail C, seems to be a typo. It says the trench needs to be 16ft Wide, as well as 8ft of concrete above the service conduit. Please clarify.

   A: See revised Sheet E503.
   Trench width: 16"
   Depth to 6" wide magnetic marker tape: 16"
   Depth of concrete encasement above service conduit: 8"

8. Q: There is some confusion as the whether the pump should be product lubricated or oil lubricated. Para 1.1.A states the pump is to be product lubricated, but in para. 2.1.C.2.a Discharge Head, it mentions a tension assembly, which is used on oil lubricated pumps. On drawing C-7, it shows a diagram of the well with a static water level of 331.3 ft. With such a low static water level, we would recommend using an oil lubricated pump. Clarification needs to be provided as to whether an oil lubricated pump will be used or a product lubricated pump, and the wording in the pump spec needs to be consistent with one or the other.

   A: See revised Section 33 11 33 Pump and Pump Motor_Addendum 2. Oil lube will be used.

9. Q: In Paragraph 1.4.A under the operating conditions, you are calling for a National K10MC 16 stage bowl assembly producing 450 gpm at 705 ft. TDH. The pump curve for this bowl assembly indicates that this bowl can operate using a 125HP, 1800 RPM motor. The Non-Overloading Power (NOL) for this pump is barely over 100HP. Table 1 calls for a minimum 250HP, 1800 RPM motor, which is well oversize for

what is needed. I also noticed on multiple drawings in the electrical section that the motor is called out as a 200HP motor. Reference drawing E601 One Line Diagram that calls for a 200HP motor and a 200HP VFD. Also drawing E601 Electrical Schedules, where the schedule for the well pump calls for a 200HP motor. I'm not sure why the motor HP is being called out higher than what would be required, but you might consider looking at the 125HP motor that the pump can operate on. In conjunction with this, paragraph 2.1.C.2.a on the discharge head calls for a minimum 20.5" Base Diameter on the discharge head where the motor would mount. If you did decide to go with a 125HP motor, the typical Base Diameter for that size motor is 16.5".

A: See revised Section 33 11 33 Pump and Pump Motor_Addendum 2. 150 HP motor may be acceptable. Use of a 150 HP motor may require smaller generator size. Confirm with generator supplier.

10. Q: In paragraph 2.1.C.3.a, you are calling for 416SS line shaft. Two paragraphs below that in 2.1.C.3.c you seem to be calling for 416SS sleeves going through the line shaft bearings. It appears you are calling for 416SS line shafts with 416SS sleeves on them. First off, this is a description of product lubricated line shaft. See question regarding oil lube vs. product lube. Second, you would never want to put a 416SS sleeve on a 416SS line shaft in the event you did want to go with a product lubricated pump.

    A: See revised Section 33 11 33 Pump and Pump Motor_Addendum 2.

11. Q: I noticed that you say that the pump is for culinary water, but you have not referenced anything like the NSF61 standard. Is the well for culinary water? The only concern we have with NSF61 requirements is that some of the materials used are technically not certified, although they are compliant. Sometimes statements will appear in the pump spec stating that the pump shall be in compliance with NSF61 standards, without referencing the system as being certified. We can provide a certified pump bowl as long as it's made with the materials that the pump company has certified, but things like the column pipe fall more in the category of being compliant but not certified.

    A: See revised Section 33 11 33 Pump and Pump Motor_Addendum 2.

12. Q: Speaking of NSF61 certified bowls, in paragraph 2.1.C.4.b for the bowl assembly, you are calling for 17-4 bowl and impeller wear rings with a Rockwell C Hardness of 44. For a National Pump certified bowl, they have not certified 17-4 as one of their certified materials. Per the AWWA requirements, if you are going to put SS bowl and impeller wear rings in a pump bowl, they are supposed to be a different hardness to help prevent galling between the wear rings, and the bowl wear ring is supposed to be the harder of the two. National uses 416SS for the bowl wear ring and 316SS for the impeller wear ring. This is their NSF61 certified material. Plus, it's much less expensive that 17-4.

    A: See revised Section 33 11 33 Pump and Pump Motor_Addendum 2.

13. Q: In paragraph 2.1.C.5.b you are calling for a galvanized cone strainer. If this well is for culinary water, you should call for a SS cone strainer. They are the ones that are certified for use in culinary systems.

A: See revised Section 33 11 33 Pump and Pump Motor_Addendum 2.

14. Q: Paragraph 2.2 is one I wanted to call to your attention. The first three paragraphs (A,B, and C) seem to be referring to a factory performance test. It's a little vague whether that is what is being called for. Was that your intent, to have the pumps pass a Factory Performance Test with test results? If so, the description should probably be expanded a little more. On paragraphs D, E, and F, consideration should be given to completely remove this requirement. This is a very expensive analysis and generally doesn't provide much improvement in the design of the discharge head. It increases the cost of the discharge head by 2-3 times over what it can be produced for without going through this analysis. This is one you could consider if you would like.

A: See revised Section 33 11 33 Pump and Pump Motor_Addendum 2. FEA analysis is still required.

15. Q: In paragraph 2.4.A.1 for the well monitoring tube, the description is a little confusing. You are calling for two (2) 1-1/2" Schedule 80 PVC Sounder Tubes. The description calls for flush threaded couplings. The only comment I have is that flush thread PVC pipe, which is used a lot in this application, only comes in 10' lengths. Your paragraph calls for "sections not over 20' lengths". This could be confusing because there is PVC pipe that can be used that comes in 20' lengths, but it isn't flush thread joints. It would be either bell mouth slip fit joints, which is typical of Schedule 40 PVC pipe, or it would have either slip fit or threaded couplings for Schedule 80 PVC. The reference to "flush threaded couplings" is not what I typically see in specs where the flush thread PVC is wanted. They usually just refer to it as flush thread PVC sounder tube.

A: See revised Section 33 11 33 Pump and Pump Motor_Addendum 2. Use Schedule 80 PVC flush threaded coupling pipe.

16. Q: In Paragraph 2.3 for the motor, you are calling out for a vibration switch and for RTD's for the bearings and windings. This is fine, but when I reviewed the electrical drawings, I didn't notice any reference to them in the drawings. Many times the electrical schematic drawings will make reference to them for the purpose of making sure they are being read by a controller somewhere. I'm not an electrical expert, but I thought I would point it out in case you wanted to verify with your electrical people that they have them designed in with the controls.

A: Vibration switch has been added to revised electrical drawings.

17. Q: Wording was added in the addendum for the pump and motor payment referencing "well conditioning including bailing of the well and video of the well

casing from top of casing to the bottom of the well complete". This is new wording that is not currently included in the pump specification. Clarification should be made pointing this out to make sure the pump suppliers understand that this work is to be performed as part of the scope of work for the pump and motor.

A: Bailing and videoing the well is required prior to installing new pump.

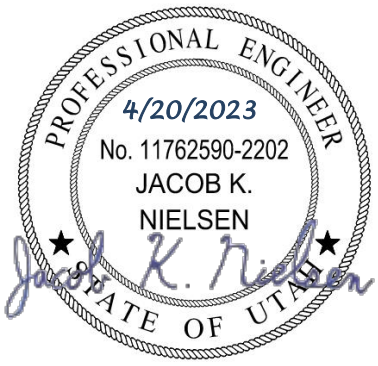
18. Q: On Valve Tag <108> Deep Well Pump Control Valve: At contractor's discretion would a straight body pattern with an elbow fitting be acceptable in place of Angle Pattern? This would give contractor flexibility in sourcing if one had a better price and lead time over the other.

A: A straight body pattern with an elbow fitting is acceptable.

Bidders shall acknowledge receipt and acceptance of this Addendum No. 2 in the Bid Form or by submitting the Addendum with the bid package. Bid Forms submitted without acknowledgment or without this Addendum will be considered in nonconformance.

City of West Jordan

Appended hereto and part of Addendum No.2



END OF ADDENDUM NO. 2

SECTION 33 11 33
PUMP AND PUMP MOTOR_ADDENDUM 2

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish, deliver and install an oil product lubricated surface discharge deep well turbine pump into existing well casing of 20-inches in diameter to depths as shown on the drawings.

B. All pumps supplied under this specification shall be suitable for pumping culinary water. All components, material, coatings, manufacturing, and performance standards shall be in compliance with AWWA E103 and shall be certified to NSF 61 and all applicable joint standards such as NSF 372 and NSF 600. Contractor shall submit documentation necessary to verify all components, materials, and coatings meet these requirements

1.2 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI B 16.1 Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 36 Structural Steel
2. ASTM A 48 Gray Iron Castings
3. ASTM A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
4. ASTM A 108 Steel Bars, Carbon, Cold Finished, Standard Quality

D. AMERICAN WATER WORKS ASSOCIATION

1. AWWA C 651 Standard for Disinfecting Water Mains
2. AWWA C 652 Standard for Disinfecting of Water-Storage Facilities
3. AWWA E 103 Horizontal Centrifugal and Vertical Line Shaft Pumps

1.3 SUBMITTALS

A. CONTRACTOR shall submit for review to the ENGINEER, sufficient literature, detailed specifications, and drawings to show dimensions, make, style, speed, size, type, horsepower, head-capacity, efficiency, materials used, design features, internal construction, weights, and any other information required by ENGINEER for review of all pumping equipment. No pumping equipment will be accepted, and installation will not be allowed, until such review has been completed. All submittals shall clearly state any deviations from the specified requirements. The following shall also be furnished with the submittal:

1. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. The equipment manufactured shall indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the specified design point.
2. Equipment manufactured shall provide complete and detailed information regarding the installation of the pumps. Any installation requirements or operating conditions which the supplier or manufacturer' feel to be critical to the safe and reliable operation of the pumps should be identified and described in detail.
3. Shop drawings submitted for review also shall include electrical diagrams, schematic control diagrams, and a detailed description of how the control system is to function.

1.4 OPERATING CONDITIONS

A. Table I indicates the operating conditions of the pumps.

TABLE I
OPERATING CONDITIONS DEEP WELL TURBINE PUMP

DESCRIPTION	WELL #8
Design capacity of pump (gpm)	600
Design total dynamic head (feet)	747
Pump Setting Depth	600
Nominal Operating Speed (rpm)	1800
Minimum Efficiency at Design Point	80%
Maximum NPSHR at Design Point	12.1 feet
Minimum Motor Horsepower	150
Minimum Column Size (diameter)	6-inch
Minimum Shaft Size (inches)	1-1/2 (C1045)
Diameter of Well Casing	20-inch (19" I.D.)
Maximum Bowl Diameter	13 in.
Approx. Elevation (ft. above MSL)	4,920
Model No.: National	K10MC (17 stage)
Utility Power (volts, phase, hertz)	480, 3, 60

1.5 MECHANICAL DEFECTS AND REJECTIONS

A. CONTRACTOR furnished pumps that have mechanical defects or do not meet the requirements for head-capacity, horsepower, efficiency, and vibration requirements will be rejected, and shall be replaced without additional cost to OWNER for furnishing, removal, reinstallation, and retesting. Mechanical defects shall include excessive vibration, improper balancing of any rotating parts, improper tolerances, binding, excessive bearing or motor heating, defective materials, including materials that do not conform to the Specifications, improper fitting of parts, and any other defect which will in time damage the pump or unreasonably impair its efficiency or operation.

1.6 WARRANTY

A. CONTRACTOR furnished equipment covered by these specifications shall be warranted against defective parts due to faulty material or workmanship for one (1) year after date of installation. CONTRACTOR shall guarantee to replace any defective parts within the period of time specified at no additional cost to OWNER. If CONTRACTOR has to pull pump to replace defective parts, CONTRACTOR shall guarantee to pull and replace pump at no additional cost to OWNER.

PART 2 PRODUCTS

2.1 DEEP WELL VERTICAL TURBINE PUMP

A. The pumps shall be of the deep well, oil lubricated, vertical turbine type suitable for pumping culinary water. All material, manufacturing and performance standards shall be in accordance with AWWA E 103, NSF 60, NSF 61, and NSF 372 as applicable.

B. Performance Requirements

1. Pump Speed - The pumps shall operate as specified in Table I.
2. Pump Characteristics - The pump shall be characterized by head capacity curves of steadily decreasing head with increasing capacity. Maximum head shall be at zero flow. The pump shall have a minimum efficiency as provided in Table I during operation against the system head. Pump head - capacity curves shall indicate that these losses have been included. Pumps shall have head-capacity curves similar to that of the specified pump. Pumps having curves that show a flatter or near horizontal slope over a section in the head – capacity curve will not be accepted. Curves with head-capacity curves with slopes of the curve flatter than that shown for the specified pump will not be accepted.
3. The pump and motor shall be capable of producing the flow rate and total dynamic heads indicated in Table I.
4. Motor Characteristics - Under no operating conditions shall the required pump brake horsepower exceed the nameplate rating of the motor being furnished.
5. The pump shall be designed to operate throughout its entire range without excessive vibration or noise.

C. Vertical Turbine Pump Components

1. Pumps

a. The vertical turbine pump for the well shall be as manufactured by National Pumps or approved equal and shall be a multi stage product lube bowl assembly (or equal).
b. Unless otherwise stated herein, the pump shall in all respects conform to the American National Standard ANSI/AWWA-E103 for “Horizontal Centrifugal and Vertical Line Shaft Pumps” and shall comply with all local and state sanitary and safety regulations.

2. Discharge Head
   a. The discharge head shall be fabricated steel (ASTM A53 Grade B Pipe and ASTM A 36 Steel Plate), accurately machined and with a surface discharge. Discharge flange shall be machined and drilled to ANSI standards for 150 lb. rating and shall be sized to match the specified system. The top of the discharge head shall have a rabbet fit to accurately locate the vertical hollow shaft driver, and have a diameter equal to the driver base diameter (BD) and not less than 20.5- inches. Lifting lugs of sufficient strength to support the weight of the complete unit shall be provided. The base shall be round or square. Head must be able to accept the monitoring tube, well vent, and other tubing as shown on the drawings. CONTRACTOR shall modify the well base dimensions on the drawings to match supplied head.
   b. The discharge head shall be equipped with a tube tensioning device to apply and maintain proper tension to the shaft enclosing tube. This device shall consist of a cast iron ASTM A48 Class 30 tube tension plate and bronze ASTM B584 alloy C83800 combination tube tension nut and bearing. Tension shall be applied to the shaft enclosing tube through internal threads in the top tube After proper tensioning, nut shall be locked into position with a steel cap screw. Sealing between the plate and the discharge head and the plate and shaft enclosing tube shall be accomplished by means of “O” rings.
   c. The top line shaft (head shaft) shall be of C1045 Grade Carbon Steel and shall not exceed 10 feet in length. Impeller adjustment shall be provided at the top of the head shaft by means of a bronze adjusting nut of ASTM B584 alloy C83800 which shall be positively locked in position.
   d. A lifting soleplate shall be supplied and installed, if required by the pump manufacturer.
   e. The pump manufacture shall include the method of adjusting the pump impellers at the top of the head shalt. This method shall provide a positive locking device.
   f. CONTRACTOR shall be responsible for ensuring that the discharge head is structurally and mechanically adequate for the provided and installed pump configuration.

3. Column Assembly
   a. The line shaft for the well shall be of C1045 Carbon Steel (118,000 psi min.). They shall be furnished in interchangeable sections not over 10 feet in length.
   b. The butting faces shall be machined square to the axis of the shaft, with maximum permissible axial misalignment of the thread axis with the shaft axis 0.002" in 6". The size of the shaft shall be no less than that determined by ANSI/AWWA E103 Specifications, Section 5.5 for C1045 line shaft, and shall be such that elongation due to hydraulic thrust will not exceed the axial clearance of the impellers in the pump bowls. Maximum runout in 10-feet shall not exceed 0.005-inches.
   c. The line shaft bearing shall be of 70 minimum shore hardness, Bronze C89835, snap-in type, internally spiral grooved to flush out sand and other abrasives and mounted in ductile iron A536 Gr. 60-40-18 bearing retainers held in position in the column coupling by means of the butted ends of the column pipe. Bearing spacing shall not exceed 10 feet.

d. The outer column piping shall be of ASTM A53 Grade B Schedule 40 steel pipe in interchangeable sections not over 10 feet in length with the ends of each section faced parallel and machined with 8 straight threads per inch permitting the ends to butt and ensuring alignment when connected by standard mill steel couplings. The weight of the column pipe shall be no less than that stated in ANSI E 103, Section 5.1, “Standard Specifications for Discharge Column Pipe”. Top and bottom sections of column pipe shall not exceed 5-feet in length.
e. CONTRACTOR shall be responsible for ensuring that the column piping is structurally and mechanically adequate for the provided and installed pump configuration.

4. Pump Bowl Assembly
   a. Pump bowl castings shall be of close-grained cast iron ASTM A48 Class 30 or ASTM A536 ductile iron Class 60-40-18 where required to meet the hydrostatic pressure criteria listed below. The water passages shall be free of blowholes, sand holes, and other detrimental defects, shall be lined with porcelain enamel, and shall be accurately machined and fitted. The finished bowls shall be capable of withstanding a hydrostatic pressure equal to twice the head at rated capacity or 1-1/2 times the shut-off head, whichever is greater.
   b. The impellers shall be bronze ASTM B584 alloy C83800, enclosed type, and shall be statically balanced, and shall be fastened securely to the impeller shaft with taper split bushings of steel. Impellers shall be adjustable vertically by an external means. Impeller skirt and series case throat area shall be thick enough to allow for machining and wearing at the time of repair. The bowl wear rings shall be dissimilar from impeller wear rings. The Bowl Wear Rings shall be 416 Stainless Steel. The impeller wear rings shall be 316 Stainless Steel.
   c. The pump shaft shall be of C1045 Carbon Steel turned, ground and polished. Bearings shall be Morse Marine Bearings consisting of sleeve bearings with a Naval Brass outer shell super-bonded to a fluted rubber bearing surface (or approved equal) above and below each impeller. The pump shaft shall have chromed journals at the bearing points. The size of the shaft shall be no less than that determined by ANSI/AWWA Specifications E103, Section A4.3, Paragraph 4.3.3.
   d. The discharge case shall be threaded on the outside for column sizes up to 14 inches and fitted with a cast iron ASTM A48 Class 30 column adaptor of the proper size to connect to the column selected. Likewise, the suction case shall also be threaded on the O.D. and fitted with a cast iron or steel suction adaptor.
5. Suction Pipe and Strainer.
   a. The suction pipe shall not be required.
   b. A 316 Stainless Steel cone strainer shall be provided having a net inlet area equal to at least four times the suction pipe area. The maximum opening size shall not be more than 75% of the minimum opening of the water passage through the bowl or impeller.

2.2 FACTORY TESTING

A. Equipment shall be factory tested and inspected as specified hereinafter. All costs for the tests shall be borne by CONTRACTOR. Conduct the following tests on each indicated pump system:

   1. Factory Non-Witnessed Test

a. Perform tests using the complete pump system to be furnished, including the project motor and variable speed drive, if equipped with a variable speed drive.
b. For pumps with motors smaller than 150 hp, the manufacturer's certified test motor will be accepted.
c. Testing of prototype models will not be accepted.
d. Conduct the following minimum tests and submit the test results:
    1) Hydrostatic Test;
    2) Performance Test:
        a) Conduct performance test at maximum speed, obtain a minimum of 5 hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, and record on data sheets as defined by the Hydraulic Institute standards;
        b) For variable speed pumps, test each pump between maximum and minimum speed at 100 rpm increments;
        c) Submit pump curves showing head vs. flow, bhp, KVA, KW, and efficiency results;
    3) Mechanical Test:
        a) Submit certification signed by a senior official of the pump manufacturer that the pump shaft horsepower demand did not exceed the rated motor horsepower of 1.0 service rating at any point on the curve.
        b) Submit test results to ENGINEER for review prior to delivery of the pumps to the Site.

2. In the event of failure of any pump to meet any of the requirements, make necessary modifications, repairs, or replacements in order to conform to the requirements of this Section and re-test the pump until found satisfactory.

2.3 ANALYSIS

A. Tests may be conducted with shop motor to facilitate the manufacturing process.

B. A minimum speed curve shall be plotted on the performance curve, based on the affinity laws and the test data.

C. All gauges shall be calibrated within 30 days of the scheduled test and certified calibration data shall be provided. All flow meters and other test instruments shall be calibrated as required by ANSI/HI standards.

D. In order to ensure that neither harmful nor damaging vibrations occur to the pump structure at any speed within the specified operating range, the following analysis shall be required:

1. Pump manufacturer shall perform a structural frequency analysis of the above ground structural components utilizing a FEA method to ensure that no structural natural frequencies are excited to a degree that would cause measured vibration amplitudes at the top of the discharge head to exceed the requirements of ANSI/HI 9.6.4-2009. When deemed necessary by the experience of the manufacturer, the below ground structural components shall also be included in the analysis.
2. The FEA method should include the use of ProE/Mechanica or an equivalent software. All pump assembly components, including the motor, shall be represented as solid elements, and if idealizations are used in place of solid elements, then a complete description of method for the idealization shall be included in the report. The analysis shall also include all modes of interest and pictorially represent each

mode shape. Modes of interest are defined as those structural frequencies that exist below 120% of the maximum operating speed. When significant modifications are required to lower the system's natural frequency, the pump structure's stresses and deflections shall also be reviewed. Analysis reports shall conclude acceptable operation at the analyzed operating speeds. The design critical frequency shall be at least 20% above or below the operating range of the pump.

E. Manufacturer to provide documentation of the analysis ensuring that the specified requirements have been met, and that documentation should be signed and stamped by the professionally licensed engineer who performed the analysis work.

F. When measured in the direction of maximum amplitude on the pump and motor bearing housings, shall not exceed limits given in the latest ANSI/HI nomograph for the applicable pump type.

2.4 MOTOR

A. Pump motors shall be a vertical hollow shaft, premium efficiency, inverter duty, electric motor, and shall be sized as noted in Table 1. They shall have a non-reverse ratchet, P-base, squirrel cage induction design. Motor shall have Class B or Class F insulation with temperature rise as specified by NEMA standards for class of insulation used and shall have a 1.15 service factor. The pump motor will be operating in an ambient temperature range of 40° - 110° Fahrenheit.

B. Pump motors shall be provided with a vibration switch. Switch rating 120 VAC, 2 amps minimum.

C. Pump motors shall have over temperature protection, which shall consist of a minimum of six RTD’s embedded in the motor windings and two RTD’s at the two bearings. Wiring to an external junction box shall be provided. RTD’s shall be 100– ohm platinum three wire elements.

D. Thrust bearing shall be chosen to handle the continuous down-thrust as specified by the pump manufacturer with an AFMBA B-10 one year minimum or five year average life under design conditions. Provisions shall be made for momentary up-thrust equal to 30% of rated down-thrust.

E. The motor shall be suitable for across-the-line starting, soft start, and shall be capable of reduced-voltage starting.

F. The motor rating shall be such that at design it will not be loaded beyond nameplate rating and at no place on the pump curve shall the loading exceed the service factor.

G. The motor temperature shall be rated no higher than the allowable operating temperature of the motor thrust and radial bearings and in no case shall it exceed the temperature rating of the insulation class used to wind the motor.

H. The junction box shall be oversized to accommodate wiring connection.

2.5 APPURTENANCES

A. Well Monitoring Tube

1. The CONTRACTOR shall furnish and install two 1 1/2-inch diameter well monitoring tubes in each well consisting of Schedule 80 PVC pipe. The tubes shall be furnished in sections not over 20 feet in length (10 ft lengths are acceptable) and shall be joined with flush threaded couplings. The PVC tube shall be joined and banded to the pump column with stainless steel bands at maximum of 10 feet. A minimum of two 1/4-inch diameter vent holes for every 10 feet of length shall be provided throughout the entire length of the monitoring tube. The depth of the monitoring tube shall be as indicated on the drawings. The bottom end shall be capped.

B. Well Vent

1. The well vent shall consist of galvanized steel 1 inch diameter pipe through the well surface plate extended up to 18" above the bottom plate of the pump discharge head with a 180 degree bend made of two steel ells. The outlet end of the vent pipe shall be covered with No. 14 stainless steel wire mesh securely fastened by a stainless steel band. The lower end of the vent pipe shall be threaded into the well surface plate and provide a water tight seal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install pump and motor at the location shown on the drawings and according with manufacturer's recommendations.

B. All pumps, complete with drive system, in place at the jobsite, shall not exceed acceptable field vibration limits given in the latest revisions of the Hydraulic Institute Standards. All pumps shall be free of static unbalance; shall be free of dynamic unbalance up to the maximum speed of the pump and drive system; shall be free of torsional vibration from 10 percent below the minimum speed to 10 percent above the maximum speed of the pump and drive system; and shall be free of apparent unbalance caused by defective bearings, by close fittings parts which may rub on the rotating parts intermittently, or by loose discs or rotor parts, or unbalanced loads.

C. The motor/discharge head assembly shall be shimmed with respect to the well casing flange to bring the motor/discharge assembly into optimum alignment with any variations that the pump column and line shaft may exhibit from being truly plumb. Such shims must be structurally sound and securely attached. The water tight seal between the discharge head and the well casing flange must be maintained.

3.2 FIELD TESTS

A. After installation, the pump shall be given an operating test to demonstrate freedom from mechanical defects, excessive noise, and vibration. The test shall include operating the pump continuously while throttling the discharge as needed. The operating test shall be performed for a minimum of one hour, or as directed by ENGINEER. Pumps with variable speed drives shall be tested at maximum speed, and at the average and minimum speeds listed under the specification for the pumps. A copy of actual test data shall be furnished to ENGINEER.

B. Tests for acceptable vibration shall be made, at no additional cost to OWNER, in the field on each pump system, which in the opinion of ENGINEER, seem to have excessive

vibration. All field tests shall be running tests with the pump pumping the product for which it is intended and each pump system shall be tested separately with no other pumps running. All testing shall be done in the presence of ENGINEER. Amplitude as used in this Specification, shall mean total peak-to-peak displacement. The required test for acceptable vibration will be the measurement of this peak-to-peak displacement and will be performed with an IRD Vibration Meter, Model 306; Bently-Nevada TK-8; or equal.

3.3 DISINFECTING

A. Source of Water

1. The Contractor shall assume all responsibility to obtain the necessary water supplies for disinfection of the pumping system.

B. Testing Procedure

1. Leakage and pressure testing must be completed prior to disinfection procedures.
2. All water piping installed under this Contract shall be disinfected using an approved disinfection method in accordance with the "American Water Works Association Standard for Disinfecting Water Mains" (AWWA C651)
3. Pump and related piping installed under this Contract shall be disinfected using an approved disinfection method in accordance with the "American Water Works Association Standard for Disinfecting Water Mains" (AWWA C6512).
4. Heavily chlorinated water shall not be discharged onto the ground. Upon completion of disinfection, Sodium Bisulfate ($NaHSO_3$) shall be applied to the heavily chlorinated water to neutralize thoroughly the chlorine residual remaining. Water shall be neutralized to less than 1 ppm.
5. After approval of disinfection, the Contractor shall flush the new system until the chlorine residual is a maximum of 0.3 ppm.
6. At the end of 24 hours, a bacteriological test will be performed by the Owner to insure adequate disinfection. If the initial disinfection fails to provide satisfactory bacteriological results, or shows the presence of coliform, then the line shall be re-chlorinated, flushed, and retested until satisfactory results are obtained at the expense to the Contractor.

- END OF SECTION -