



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

## Specification for MCI Endurance Irrigation Prefabricated Pumping System

**1.00 General.** To provide a single source responsibility for the manufacture, warranty, service and operation of a prefabricated, skid mounted, fully automatic pumping system for non-potable water. The pumping system shall automatically maintain a constant discharge pressure regardless of varying flow demands within the station rating. Pumping system shall conform to the following specifications in all respects. This specification covers minimum requirements; however, it should not be construed as all inclusive. It is the successful vendor's responsibility to include all necessary appurtenances to provide for a complete, automatic, smooth operating, and reliable pumping system. The manufacturer shall supply a complete set of general arrangement drawings, electrical power schematics, and control schematics in the operations & service manual.

**1.10 Manufacturer.**

- A. The pumping system shall be as manufactured by MCI Pumping Systems, Dallas, Texas, U.S.A., as basis of design. For consideration of a proposed alternate deduct system, the contractor shall furnish the following data to the engineer at least 10 days prior to the date of the bid opening:
1. A complete specification for the pumping system proposed as an equal.
  2. A statement of full conformance to the following specifications signed by an officer of the manufacturer.
  3. A general arrangement drawing showing overall dimensions and all piping layouts.
  4. Complete submittal data for all components.
  5. An electrical schematic showing power and control wiring and panel layout drawing.
  6. Installation list of 200 similar pumping systems which have been in operation for a minimum of 3 years.
  7. Location of closest factory owned or trained service centers.
  8. Manufacturer's UL electrical industrial control panel file number UL508A and CSA-C22.2 No. 14 .
  9. Manufacturer's complete packaged pump system UL category QCZJ and QCZJ7 file number.
  10. A copy of manufacturer's certificate of insurance showing as a minimum, a general liability coverage of \$1,000,000, and an excess liability coverage of \$10,000,000.

11. A complete list of all field service offices, complete with phone numbers and contact information, having the fields service office closest to the site clearly indicated.
  12. ISO9001 Certification - 2008.
- B. If, in the opinion of the engineer or consultant, the data submitted shows the pumping system to be an acceptable alternate deduct system, the bidding contractor shall be notified not less than 4 days prior to the bid opening date.
- C. All bids shall be submitted using the MCI system as basis of design. Alternate manufacturer's price, whose pumping system has been approved as an alternate deduct, shall be shown as an alternate on the bid form.

#### **1.20 RELATED SECTIONS**

- A. Section \_\_\_\_\_ - Administrative procedures for start-up, testing and field-testing.
- B. Section \_\_\_\_\_ - Water Distribution
- C. Section \_\_\_\_\_ - Storage tanks
- D. Section \_\_\_\_\_ - Telemetry and other control systems
- E. Section \_\_\_\_\_ - Painting

#### **1.30 REFERENCES**

- A. American Water Works Association (AWWA)
- B. American National Standards (ANSI)
- C. American Standards for Testing Materials (ASTM)
- D. Hydraulic Institute
- E. American Society of Mechanical Engineers (ASME)

#### **1.40 Submittal Data Required.** Within four weeks from award of contract, provide three copies of the submittal for approval, properly dated, sectioned, bound, titled, with a table of contents, including no less than the following:

- A. Full set of mechanical drawings including skid framing, connection dimensions, and equipment layout, all to scale
- B. Full electrical schematic, including three line power schematic, ladder logic, PLC and system interface.
- C. Properly indicated pump curves which include pumping system internal losses, manufacturer's name (other than pumping system manufacturer), pump model number, and motor type, RPM and horsepower

- D. Properly marked cut sheets for each component of the pumping system, both mechanical and electrical
- E. Copies of UL authorizations under categories and QCZJ/QCZJ7 and UL508A and CSA-C22.2 No. 14.
- F. Complete description of the system including operation sequence, alarm sequence, receiving instructions, storage instructions and control feature description
- G. Operation and Maintenance Manuals shall be submitted at the time the pumping system is shipped to the site by the manufacturer. Manual shall have been prepared for this specific project, and shall not be a general manual applicable to many systems. Manual shall bear the same format as the submittal, and shall contain full submittal information. In addition, technical manuals shall be included for each piece of equipment that is field serviceable.

**1.50 Sequence of Operation (PLC):**

- A. General Items applying to each alarm circuit shall include a display of condition on the system display, the illumination of a red indicating light, and manual reset of a persistent condition.
- B. Alarm sequence
  - 1. Low Discharge Pressure alarm circuit shall stop pumping system in the event discharge pressure drops below normal level. Operator interface device, mounted in enclosure door, shall signal low discharge pressure. Pumping system shall not operate until safety has been manually reset.
  - 2. High Discharge Pressure alarm circuit shall shut down pumping system if discharge pressure reaches a predetermined high level. Operator interface device, mounted in enclosure door, shall signal high discharge pressure. Pumping system shall not operate until pressure is reduced and alarm has been reset.
  - 3. Low water level alarm shall serve to protect the pumps from the adverse effects of running dry. Alarm shall be activated when level in the supply reservoir reaches a critical low level. Alarm shall cause the pumps to be retired in an orderly manner. Alarm shall not be capable of being overridden. Alarm shall not allow any pumps to run, whether in the "PLC bypass" or "Automatic" functions of the selector switch until level has been restored and alarm has been reset. Indication of the alarm shall be displayed visually on the control panel door.
  - 4. Main phase failure and low voltage safety circuit shall retire the pumping system if it experiences low voltage, phase failure or phase reversal as monitored at line-side of control enclosure. Phase monitor shall have a time delay to allow for transient low voltage during motor starting and to allow maximum motor protection. Operator interface device, mounted in enclosure door, shall signal phase failure for any affected pump.

5. Individual Phase Failure and Low Voltage alarm circuitry, as part of the overload relay circuit, shall retire any pump that experiences low voltage, phase failure or phase unbalance as monitored at the load-side of each pump motor contactor by the overload relay. Each pump motor shall have its individual protective device and time delay to allow for transient low voltage during motor starting to allow maximum motor protection. The individual pumps or pumping system shall not operate until the voltage problem has been corrected and safety has been manually reset. Incoming phase monitor safety circuit as the only phase failure sensing device is not acceptable.

C. Functional Sequence, Pressure and Flow Sequencing.

1. Initially the Pressure sustaining pump shall operate XL to maintain system pressure during low demand periods.
2. Lead irrigation pump shall start immediately on a drop in system pressure (Adjustable).
3. PLC shall control the speed of the pump to produce constant pressure regardless of demand within the pump's capacity.
4. Lag pump/s shall start on a continued low pressure after a short time delay (Adjustable).
5. PLC shall control the speed of the lead pump to produce constant pressure regardless of demand within the pumps' combined capacity.
6. On failure of either lead or lag pump/s to start or to continue running, the next pump in sequence shall start in its place. Alarm light shall be illuminated, and individual pump fault shall be displayed.
7. Equal sized pumps shall be alternated based on accumulated motor run time after the running pump is retired. The pump with the least run time shall be started first.
8. All data accessible on control panel HMI shall also be available remotely.

**1.60 Codes.**

- A. Without exception, pumping system shall be UL listed as finally assembled under UL category QCZJ/QCZJ7.
- B. Control panel with controls shall be built in accordance to NEC, and U.L. standards. Without exception, the electrical components and enclosure shall be labeled as a complete U.L. listed industrial control panel assembly, with manufacturer's U.L. label applied to the door, under UL category UL508A, control panels.



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

**2.0 PUMPS and MOTORS:**

A. This specification includes the supply of vertical turbine product lubricated open line shaft pump(s). Each unit shall include a bowl assembly, suction strainer, column and open line shaft, discharge head, sealing assembly and driver.

**2.02 QUALITY ASSURANCE**

- a. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.
- b. Unit responsibility. Pump(s), complete with motor, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump station manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.
- c. The vertical turbine pump(s) specified in this section shall be furnished by and be the product of one manufacturer.
- d. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.
- e. Pump(s) are to be engineered and manufactured under the certification of ISO-9001:2000.

**2.04 PERFORMANCE**

- a. The pump(s) shall be designed for continuous operation and will be operated continuously under normal service.

OPERATION CRITERIA

	Flow (GPM)	TDH (ft.)	Max. Pump Speed (RPM)	Max. Solids Passage	Max. Shutoff Head (ft.)	Minimum Submergence (inches)
Design Condition	XXX	XXX	XXXX	XXX	XXX'	XX"
Secondary Condition	XXX	XXX			XXX'	XX"

- a) Total dynamic head shall be as measured at the discharge of the pump and shall include velocity head and vertical static head from the minimum water level to the centerline of the pump discharge.
- b) Maximum pump speed shall not exceed 1800 RPM.
- c) Driver size shall be limited to XXHP maximum.



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

- d) Liquid pumped is reuse water with a maximum temperature of 80 deg. F.

## 2.05 PUMPS

### A. Manufacturers

1. Pump(s) shall be the product of Fairbanks Morse Pump.
2. Manufacturer shall have installations of like or similar application with a minimum of 5 years' service for this pump size.

### B. Design

1. Rotation
2. The pump will be counterclockwise rotation when viewed from the driver end looking at the pump.

### C. Impeller

1. The impeller shall be of investment cast 316 Stainless steel construction conforming to CF8M. They shall be of one- piece construction, single suction, enclosed, vane and radial flow design. The waterways through the impeller shall have extremely smooth contours, devoid of sharp comers, so as to promote maximum efficiency. **Impellers manufactured of Stainless Steel with metallurgical qualities less than that of 316SS shall not be allowed.**
2. The impeller is to be balanced and secured to the shaft by means of a stainless steel drive collet for bowl shafts 1-15/16" diameter and smaller. For bowl shafts larger than 1-15/16" impellers shall be secured to the shaft using a combination of a thrust washer, key and/or snap rings.
3. Impellers shall be adjustable by means of a top shaft-adjusting nut.

### D. Bowls

1. The bowls shall be made of close-grained cast iron conforming to ASTM A48 CL30. Castings shall be free from blowholes, sand holes and shall be accurately machined and fitted to close dimensions.
2. Bowls 8" and above shall be flange connected. Bowls below 8" nominal diameter may use either flanged or threaded connections.
3. Bowls shall be designed with smooth passages to ensure efficient operation and their interior shall be coated with Tnemec N140 Pota-Pox Plus, or equal.
4. The casing shall be hydrostatically tested to 1.5 times the design head or 1.25 times the shutoff head whichever is greater.

### E. Impeller Shaft

1. Impeller shaft shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).
2. The shaft shall be supported by bronze or neoprene bearings located on both

sides of each impeller.

3. Impeller shaft coupling shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).

#### F. Wear Rings

1. Wear rings shall be provided on both the impellers and bowls on bowls of nominal diameter of 8" or larger so that clearances can be maintained throughout the life of the rings and minimize recirculation. Bowls of 6" and 7" nominal diameter shall incorporate bowl wear rings only.
2. Impeller wear rings shall be of the radial-type.
3. Bowl wear rings shall be of the radial-type.
4. Wear rings shall be attached to the impellers and bowls using an interference fit and Loctite.
5. Wear rings shall be bronze conforming to ASTM, B505 C93200.

#### G. Column

1. Column pipe in sizes 4" through 12" diameter shall be furnished in interchangeable sections not over five feet in length, and shall be connected with threaded, sleeve-type couplings. Column pipe 14" diameter and larger shall be flanged and furnished in interchangeable sections not over five feet in length. **Pumps with column pipes and pump shafting exceeding 5' in sections shall not be permitted.**
2. Threaded column sections shall be connected with threaded, sleeve-type couplings. Column joints are to be butted to insure perfect column alignment after assembly.

#### H. Line shafts

1. Line shafting shall be of ample size to transmit the torque and operate the pump without distortion or vibration.
2. Line shafting shall be made of 416SS and be furnished in interchangeable sections not over five feet in length. **Line shafts exceeding 5 feet in length shall not be permitted.**
3. Line shafting shall be coupled with extra-strong threaded Stainless steel couplings machined from solid bar Stainless steel.
4. Line shafting shall be fitted with stainless steel replaceable sleeves at each bearing and shall conform to AISI 304 material.
5. Line shaft bearings shall be of neoprene material construction.
6. Line shaft bearings shall be retained in bronze guides that are fitted into the column coupling and secured in place by the butted column pipe ends. (For column sizes larger than 16" retainers shall be steel and fabricated into the

column assembly.

I. Discharge Head Assembly (above ground, packed box)

1. The pump discharge head shall be of the above ground type of fabricated steel construction with an ANSI 150# discharge flange with a working class pressure of 275PSI.
2. The discharge head shall be designed for a minimum of 60,000 PSI tensile strength and shall be of sufficient design to support the entire weight of the pump and driver.
3. If the application uses a variable frequency drive, the discharge head shall be fabricated steel and specifically designed to elevate the discharge head natural frequency above the operating speed.
4. A drive shaft of the same material as the line shaft shall extend through the sealing assembly of the discharge head and be coupled to a vertical hollow shaft driver.
5. The product lubricated shaft sealing assembly shall consist of a cast iron packing box, bronze packing gland, bronze packing box bushing, brass packing gland nuts and bolts, a minimum of 6 rings of synthetic packing and dual lantern rings. The discharge head stuffing box shall also incorporate dual bypass tubing for packing lubrication and cooling.
6. The head shall be equipped with a drain piped back to the wetwell. Head shall integrate a capture and release of all air when starting the pump and shall absorb surges.
7. Packing box shall be rated for 400 PSI.
8. Discharge head openings shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

F. Vibration Limitations (Field)

1. The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.

**2.06 Pressure Sustaining Pump.**

- A. A pressure sustaining pump shall be provided to maintain system pressure during non-irrigation periods. Pressure sustaining pump shall be as manufactured by Berkeley Pumps, Inc.
- B. Impellers shall be manufactured of Acetal (POM) with polycarbonate diffusers. Shell, Shaft, Coupling, intake and cable guard shall be from 316 stainless steel. Discharge Bearing shall be from Nylatron and intermediate bearings shall be from Polycarbonate, nitrile rubber or Stainless steel. Discharge adapter and motor adapter shall be from 303

stainless steel. **Above-grade check valve shall be required. An integrated below-grade check valve shall not be allowed.**

- 2.07 Vertical Hollowshaft Motors:** Motors for main pumps shall be high thrust vertical hollow shaft design, WP-I enclosure, shall have a 1.15 service factor, and class F insulation and **Energy Efficient**. Motors shall be wound for full voltage starting and shall be suitable for use with a variable frequency drive. Motor shall be rated for continuous duty and be designed to carry the maximum thrust load of the pump. Motor shall have B10 bearing life of no less than 5 years. Motors shall be equipped with non-reverse ratchets. Motors shall be as manufactured by U.S. Motors, TECO or North American Electric.
- 2.08 Pressure Sustaining Pump Motor:** Motor for pressure sustaining pump shall be a hermetically sealed stainless steel cased submersible type with a 1.15 service factor. Motor shall be X hp, 3450 RPM, suitable for use on 460/3/60 power, as manufactured by Pentek.
- 2.09 Motor Space Heater.** The pumping system manufacturer shall provide on each pump motor a 120 volt, single phase space heater of ample size to prevent condensation from occurring within the motor during non-operating periods. The space heater shall be de-energized when the motor is running.

#### VALVES:

- 3.01 Grooved Type Butterfly Pump Isolation Valves: Discharge.** Pump isolation valves shall be of the butterfly type with grooved ends to provide for expansion and vibration dampening and a lever operator. **Lug style isolation valves are not acceptable.** The valve shall be complete with a spherical bore design to provide a leak tight stem seal regardless of disc position. Stem sealing force shall be constant throughout the full disc cycle. Design shall provide a bubble tight seal from full vacuum to 300psi when the valve is closed. Stem shall be provided with a secondary seal to provide a lifetime lubrication chamber. Valve body shall be one-piece casting with an integral mounting base for gear operator or handle actuation. Valve shall be designed to meet or exceed the requirements of MSS SP-67. They shall be sized as shown in the pump schedule. Valve body shall be constructed of ductile iron with a nylon coating suitable for a maximum service temperature of +230 F. Valve disc shall be EPDM encapsulated ductile iron with service temperature range of -40F to +230F. Upper and lower shaft shall be of 416SS with EPDM O-rings. Valve shall be rated to 300 PSI. Valve shall be NSF certified. Isolation valve shall be as manufactured by Anvil International
- 3.02 Pump Check Valve.** Pump check valves shall be provided on the discharge of each pump and sized per the pump schedule. Check valves shall be of the silent type. Check valves shall begin to close as forward velocity diminishes and shall be fully closed at zero velocity preventing flow

reversal. Valve bodies shall be cast from Ductile Iron and shall be coated internally and externally with NSF/ANSI 61 certified fusion bonded epoxy. The valve design shall incorporate a center guided, spring loaded poppet, guided at opposite ends and having a short linear stroke that generates a flow area equal to the pipe diameter. Internals shall be machined unleaded bronze disc, seat, and stem guide. Disc shall incorporate a Buna-N insert to provide resilient sealing. **Dual disc style or swing check valves shall not be accepted.** Valves shall be sized to permit full pump capacity to discharge through them without exceeding a pressure drop of 2.5 PSI. Check valves through 8" shall be model 888R rated at 400 psi working pressure as manufactured by Flomatic or Apco.

**3.03 Lug Pattern Butterfly Station Isolation Valve.** Station isolation valve shall be installed on the discharge of the pumping system to completely isolate the pumping system from the distribution system. Valve shall be of the lug style butterfly type. Valve shall have one piece body cast from Ductile Iron. Stem shall be 416 stainless steel. Disc shall be Ductile iron. Stem bushings shall be Acetyl to prevent stem seizure to body during prolonged periods of non-use. Seat shall be Buna-N elastomer, one piece construction, and shall also form the flange sealing gaskets. Valves 6" and smaller shall have a lever operator. Valves 8" and larger shall have a gear operator with hand wheel. Valve shall be rated at 200 PSI bubble shutoff. Station isolation valve shall be as manufactured by Watts or equal.

**3.04 Pressure Relief Valve.**

- A. Pressure relief valve shall be single-seated, diaphragm operated, pilot-controlled, globe or angle valve. It shall be spring loaded & hydraulically operated. Valve spring shall be of stainless steel. Seat ring shall be of stainless steel & readily replaceable with no special tools.
- B. Diaphragm assembly shall be fully guided, top and bottom. Diaphragm shall be of nylon reinforced Buna-N synthetic rubber and shall be fully supported by the valve casting in both the full-open and full-closed positions to eliminate strain on the diaphragm. All necessary repairs shall be possible without removing valve from the line. Packing glands are not permitted. Disc shall be synthetic rubber (Buna-N) and have a rectangular cross section. Valve disc and seat shall have an anti-cavitation design of intermeshing orifices to prevent cavitation from discharge pressure to atmosphere.
- C. The main valve shall be equipped with the following accessories to ensure proper operation.
  - 1. All control valve pilots shall have stainless steel seats, Buna-N sealing surface and a Buna-N diaphragm. Pilot valve bodies shall be from bronze.
  - 2. Pressure-sustaining pilot shall be sensitive to valve inlet pressure. Pilot shall be normally closed and spring-loaded with spring tension adjustment. Pilot shall open automatically against the spring-loading set when pilot inlet pressure exceeds the set value. This pilot shall function to maintain a minimum valve inlet pressure which shall prevent the pumps from operating under an unstable or overloaded condition.



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

3. Isolation cocks shall be provided on control tubing at the valve inlet, outlet and bonnet ports on valves 4" and larger. These valves shall be situated such that the control valve may be manually closed & the valve trim isolated and serviced.
  4. Strainers shall be provided to remove any solids that may be of sufficient size to damage or plug the pilots and other control components. The inner mesh shall be of MONEL and shall be designed to support the outer screen. The outer screen shall be of 0.008" MONEL wire, having a 40 x 40 mesh.
- D. An isolation valve shall be provided at the inlet of the valve conforming to the requirements of the high pressure butterfly pump isolation valves specification.
- E. Valve shall be a model 50A-01B as manufactured by Cla-Val Company of Newport Beach, CA.

#### FABRICATION:

- 4.00 Station base.** Pumping system shall be a completely skid mounted pumping package built by a single manufacturer. All equipment including, but not limited to, pumps, motors, valves, instrumentation and controls, shall be mounted on a common structural steel base to form a complete operating pumping system unless otherwise dictated by site restraints. The pumping system base shall be designed and fabricated to provide proper structural support for all attached equipment. The base shall supply sufficient rigidity to withstand the stresses of reasonable and competent transportation to site, offloading, installation, and operation. All structural members shall be constructed from heavy weight structural tubing, channel or I-beam. Provisions shall be made in the station base for off-loading and handling the station at the site of installation. Base shall include deck plate over all the skid, and structural steel plate mounted under pumps and motors. All deck and structural plate shall be 100% seal welded to peripheral structural members, and skip welded on the bottom to internal structural members. Skip welding of above plates is not permitted. Bent-form bases shall not be permitted on systems beyond 60" in length and 48" in width.
- 4.01 FDA Lined Piping, Fusion Bonding.** All piping shall be constructed from ASTM A105 schedule 40 pipe or heavier as required to maintain a 3 to 1 pressure safety factor. **(Sch10 piping shall not be allowed)** All piping shall be hydrostatically tested to 500 psi. All steel piping shall be blasted internal to SSPC-SP10 and lined with an FDA approved fusion bonded epoxy. Epoxy shall be applied according to manufacturer's requirements, thickness shall be tested throughout and found to be without holidays. **Proposed alternate systems utilizing non-internally coated piping or coated piping less than standard weight or Sch40 shall not be allowed.**
- 4.02 Piping Support.** All piping supports shall cover 120 degrees of arc under the piping and support the weight of the piping and the water it contains. Thrust shall be resisted by proper thrust blocking of the supply and distribution system piping which shall be connected to the pumping system in the field, and through proper anchoring of the pump station to the slab according to manufacturer's recommendations. **Piping supports not occupying at least 120 degrees of arc shall not be accepted.**

#### SENSORS:

- 5.00 Pressure Gauge.** A pressure gauge shall be mounted on each header, complete with isolation ball valves. All gauges shall be silicone oil filled to reduce wear due to vibration. Accuracy shall be within 1.5%. Gauge diameter shall be 3.5" minimum. Range shall be at least 30% higher than the highest pressure attainable from the pumps at shutoff head conditions, and shall include bronze internals. Pressure gauge shall be as manufactured by Ashcroft.
- 5.01 Pressure Transducer.** Pressure transducer shall be mounted on the discharge headers and shall provide all pressure signals for the control logic. Pressure transducer shall be a solid-state bonded strain gage type with an accuracy of plus/minus 0.25% and constructed of 316L stainless steel. Resolution of the transducer shall be greater than the resolution of the analog to digital conversion for PLC operation. Transducer shall be rated for pressures greater than station discharge pressure, and shall provide gauge pressure output, rather than absolute pressure.
- 5.90 Magnetic Flowmeter.** This section describes the requirements for an electromagnetic flow meter and microprocessor-based signal converter. Under this item, the pump station manufacturer shall furnish and install the magmeter equipment and accessories as indicated on the plans and as herein specified. The electromagnetic flow meter shall consist of a flow sensor based on Faraday's Law of Electromagnetic Induction and microprocessor-based signal converter, type MAG 5000.

The sensor flow tube and liner material shall be constructed of a composite elastomer (Ebonite) surrounded by two integral coils. Measurement and grounding electrodes shall be 316 stainless steel. Connecting flanges shall be carbon steel. (12" – 48") *The sensor flow tube shall be 304 stainless steel surrounded by two coils. Liner material shall be hard rubber.* Installation: A minimum of 5 pipe diameters up stream and 3 pipe diameters downstream are recommended.

- Operating Temp: -20 to +160° F.
- Submergence: The sensor shall be pedestal sealed against accidental submersion to 3 feet for 30 minutes standard, or permanently submerged to 30 feet when the terminal box is backfilled with a non-setting, transparent potting material.
- Signal converter: Type MAG 5000.
- Enclosure: NEMA 4X enclosure
- Display: Background illumination with alphanumeric 3-line, 20-character display to indicate flow rate, totalized values, settings, and faults (a blind version of the MAG 5000 signal converter is available).
- Power supply: 115/230 VAC or 11-24VDC.
- Operating temperature: -5 to +120 degrees F.
- Outputs: 0-20 mA or 4-20 mA into 800 ohms max. One relay rated at 42 VAC/2 A, 24 DC/1 A. Digital (frequency or pulse) for external display of flow rate or totalizer.
- Communications: Optional HART available.
- Sensor and signal converter performance:



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

- Flow Range: 1.5 fps to 33 fps for accuracies stated below.
- Accuracy: 0.5% of actual flow.
- Separation: Maximum distance of 900 feet between signal converter and sensor without the use of any additional equipment.
- Bi-directional flow capabilities shall be standard
- Totalizer: Two eight-digit counters for forward, net, or reverse flow
- The electromagnetic flow meter shall be a Siemens Model MAG 5100 W flow sensor with a Siemens Model MAG 5000 signal converter. Insertion type flow meters will not be accepted.

**Calibration:** Each flow sensor shall be wet calibrated and all of the calibration information and factory settings matching the sensor shall be stored in an integrally mounted SENSORPROM® memory unit. The SENSORPROM® shall store sensor calibration data and signal converter settings for the lifetime of the product. At initial commissioning, the flowmeter commences measurement without any initial programming. Any customer specified settings are downloaded to the SENSORPROM®. Should the signal converter need to be replaced, the new signal converter will upload all previous settings and resume measurement without any need for reprogramming or rewiring. A certificate of calibration shall accompany each flow sensor.

#### **Signal Converter Function Details**

The following functions shall be provided:

- All programming shall be accomplished through an integral keypad and all programming shall be protected by a user-defined password.
- The signal converter shall be integrally mounted or remotely mounted using a remote-mount kit provided by the manufacturer.
- The signal converter shall provide a 0/4-20 mA DC signal proportional to flow rate into 800 ohms max. Output selectable as unidirectional or bi-directional.
- The relay shall be programmable as error indicator, limit alarm or pulsed output.
- The signal converter system shall be equipped with an error and status log with 4 groups of information.
  1. Information without a functional error involved.
  2. Warnings which may cause malfunction in the application
  3. Permanent errors, which may cause malfunction in the application.
  4. Fatal error, which is essential for the operation of the flowmeter.
- A system error shall be indicated by a flashing icon on the display or activation of the relay when set as an error alarm.



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

- The first nine standing errors shall be stored in the error pending log. A corrected error is removed from the error pending log. A status log shall be provided to store the last 9 error messages received for 180 days regardless of correction.

#### **ARCHITECTURAL and PROTECTIVE COATINGS:**

- 6.10 Paint.** Structural steel and supports shall be grit-blasted with #50 steel grit per SSPC-SP10 to a near white metal condition. The cleaned steel surfaces shall immediately thereafter be primed with an industrial grade electrostatically applied acrylic polyester urethane powder coat to 2.5 mils DFT and baked to 450 degrees F. The test method for this coating shall be ASTM D-3359 for 100% 5B pass adhesion. The coating shall withstand 160 in-lbs direct or reverse impact per ASTM D-2794. The coating shall pass a 1000 Hrs salt spray test per ASTM B-117.

The finish coat shall be electrostatically applied polyester TGIC to a thickness of no less than 3.5 mils and baked to 450 degrees F. Impact resistance shall be to 80 in-lbs per ASTM D-2794 with no appearance of cracks down to the substrate. The coating shall pass a 1000 hour salt spray test per ASTM B117 and Humidity resistance test of 1000 hours with a maximum undercutting of 1/8" and no blistering.

- 6.15 Bolts.** All bolts, nuts, washers, and lock washers used in the assembly of the pumping system shall be zinc plated to retard corrosion.

#### **7.00 CONTROLS:**

**7.01** Scope: Furnish UL Listed 508a complete control panel that will provide the necessary controls to efficiently control the irrigation pumping system. The system shall be comprised of the components described in this section and specified in the technical datasheet. The system will provide all of the required components including but not limited to main disconnect, surge protection, phase monitor, fuses/blocks, Variable Speed Drive, high speed drive fuse protection, dual interlocked contactors, solid state overloads, door devices, color HMI touch screen and plc.

**7.02** Control system shall be a standard product with a configurable program. The system shall not use a custom program or one that requires modification to provide the specified system control. The HMI must use a manufacturer's standard offering without requiring screen or database changes.

Supply power is as called out on the technical datasheet.



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

## Ratings/Listings

- a) All products shall be UL labeled and meet the requirements of UL508a and maintain cUL.
- b) 100 ka Short Circuit Current Rating of the panel
- c) Service Entrance Rated
- d) Manufactured by an ISO9001:2008 facility

## Environmental requirements

- e) Temperature 14 to 122 Deg F.
- f) Relative Humidity 98% maximum

## Construction

**7.03** Enclosure shall be a UL Listed Type 4 Carbon Steel Enclosure with a powder coat finish. All penetrations in the panel shall be made prior to the application of the powder coat finish. Powder coat finish shall be a polyester Textured RAL 7035 heat guard finish. The powder coat process shall be a minimum 5 stage process. The enclosure shall contain a pour in place two part urethane gasket. **Adhesive strip gaskets shall not be allowed.** The enclosure door shall use a 3 Point latch system. The enclosure will be furnished with a 6" leg kit.

**7.04 Surge Arrestor** - Incoming Power shall be a UL Type 1 with bicolor led status indicators. 120 Vac shall be SQD with replaceable modules.

**7.05 Main Service Disconnect:** Main service disconnect shall be a rotary fusible disconnect with J Class fuses. Handle shall be padlock able and interlock with main panel door to prevent opening the door without first turning the disconnect to the off position. See through covers shall be provided to cover line and load side lug connections.

**7.06 Phase Monitor:** Phase monitor shall be an 8 Pin replaceable type unit with line side fuse protection. Provides protection from low/high voltage, phase loss, reverse phase and voltage unbalance. Unit shall be provided Diagnostic LED with adjustable trip delays.

**7.07 Short Circuit protection:** Control Panel shall be protected by J Type fuses. XL Motor shall be protected by J Type fuses. Fuse blocks shall be finger safe and provided with covers. High clarity see-through covers allow for inspecting wire terminations or to take thermography measurements without removing cover. Probe holes included for easy, safer testing and troubleshooting. Built-in lockout/tag out feature improves safety. VSD shall be protected by high speed J type fuses such as the Bussman DFJ.

Panel will require a set of mechanically interlocked contactors with one solid state overload per pump. Contactors shall be Allen Bradley C series contactors. Coils shall be 110 Vac control and include varistor protection. Solid state overload shall be E1 Plus as manufactured by Allen-



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

Bradley. Overload shall provide phase loss protection, ambient compensated and wide current adjustment range of 5:1.

**7.08 Variable Speed Drive:** One variable speed drive will be provided sized of the appropriate horsepower per equal size of main pumps. Furnish complete VFD as specified herein or in the equipment schedule for loads designated to be variable speed. VFD's shall be user-selectable for either constant or variable torque loads.

The VFD shall be a six-pulse input design. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform and shall output a waveform that closely approximates a sine wave.

The manufacturer of the VFD shall demonstrate a continuous period of manufacturing and development of VFD's for a minimum of 40 years. VFD's that are brand-labeled are not acceptable. The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or de-rating.

VFD shall automatically boost power factor at lower speeds. In variable torque applications, the VFD shall provide a CT-start feature and be able to provide full torque at any speed up to the base speed of the motor. In either CT or VT mode, the VFD shall be able to provide its full rated output current continuously and 110% of rated current for 60 seconds.

Switching of the input power to the VFD shall be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes. Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocks.

The VFD shall include an integral RFI filter conforming to the A2 standard as a minimum. VFD shall provide full galvanic isolation with suitable potential separation from the power sources (control, signal, and power circuitry within the drive) to ensure compliance with PELV requirements and to protect PLC's and other connected equipment from power surges and spikes. All inputs and outputs shall be optically isolated. Isolation boards between the VFD and external control devices shall not be required.

The VFD shall provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor. DC Link reactor shall be installed so that power fluctuations to the DC Capacitors shall be reduced to increase Capacitor life. VFD's without a DC link reactor shall provide a 5% impedance line side reactor and provide spare capacitors.

VFD shall have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.5 msec. Printed Circuit boards shall be conformal coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC 61721-3-3, Class 3C2. VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

VFD shall include current sensors to monitor all three-output phases to detect and report phase loss or unbalance or other power issues to the motor. The VFD will identify which of the output phases is low or lost.

VFD shall provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

removed entirely. The remote mount must meet N4X rating. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD

All VFD's shall be of the same series, and shall utilize a common control card and LCP (keypad/display unit) throughout the rating range. The control cards and keypads shall be interchangeable through the entire range of drives used on the project.

A battery back-up shall be provided to maintain internal clock operation during power interruptions. Battery life shall be no less than 10 years of normal operation.

The VFD shall have an adjustable output switching frequency.

Four complete programming parameter setups shall be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to be programmed for up to four alternate control scenarios without requiring parameter changes.

In each programming set up, independent acceleration and deceleration ramps shall be provided. Acceleration and deceleration time shall be adjustable over the range from 0 to 3,600 seconds to base speed.

The VFD shall have four programmable "Bypass frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature shall offer a Semi-Automatic program to simplify the set-up. ***The pump station manufacture shall identify and record the 1<sup>st</sup> and 2<sup>nd</sup> critical frequencies on any pump operating on a VFD and shall lock out these frequencies. The pump/s may pass through these frequencies on ramp-up and ramp-down but shall not be allowed to reside within these identified frequencies.***

In each programming setup, independent current limit settings, programmable between 50% and 110% of the drives output current rating, shall be provided.

The VFD will include a "loss of follower" function to detect the loss of process feedback or reference signals with a live-zero value and a user-selectable choice of responses (go to set speed, min speed, max speed, stop, stop, and trip).

An initial ramp function shall be available to provide a user-selectable ramp, up to 60 seconds, for applications requiring a faster or slower ramp than the normal ramp.

A Dual Ramp feature shall include a Check Valve Ramp and a final Ramp feature. The Check Valve Ramp shall be programmable to gently seat a check valve and reduce the potential of damage from excess pressure while shutting-down the system. Both time and end speed shall be programmable. On the Final Ramp, the VFD shall be programmable to quickly stop the motor after seating of a check valve or for a more rapid stopping than the normal ramp down setting.

The ambient operating temperature of the VFD shall be -10°C to 50°C (14 to 122°F), with a 24-hour average not to exceed 45°C. Elevation to 3,300 feet (1000 meters) without de-rating. VFD shall provide full torque to the motor, given input voltage fluctuations of up to +10% to -15% of the rated input voltage (525 to 690VAC, 380 to 480VAC, or 200 to 240VAC). Line frequency variation of ± 2% shall be acceptable.

The VFD shall be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port. Danfoss FC or ModBus RTU communications shall be integrally mounted.



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

VFD Keypad shall be mounted and accessible from the exterior of the control panel door in a NEMA 4 configuration. . Keypads mounted internally shall not be allowed.

*The utilization of an electrically actuated valve as a variable speed drive backup device shall be permitted by other manufacturers providing only that the unit is a valve providing linear proportional control and surge protection. Valve shall be either ball valve or eccentric plug valve. **Non-Linear lug or wafer butterfly valves shall not be allowed as the design does not provide for efficient proportional and linear control nor provide surge protection.** Actuator shall provide modulating service utilizing PID loop. Actuator shall be a totally enclosed and sealed worm gear actuator and position indicator with externally adjustable open/close stops. The worm gear segment shall be ASTM A536 grade 65-45-12 ductile iron with a precision bore and keyway for connection to the valve shaft. Bronze radial bearings shall be provided for the segment gear and worm shaft. Alloy steel roller thrust bearings shall be provided for the hardened worm. All gear actuators shall be designed to withstand, without damage, a rim pull of 200 lbs on the handwheel and an input torque of 300 ft-lbs for nuts.*

**The VSD shall be provided with a six year warranty. This warranty includes coverage's for momentary line or load anomalies such as lightning strikes. This includes the cost for travel for one visit to the customer site for repair or replacement of the VFD**

**7.09 Control Power Transformer:** Control power transformer shall be a minimum of 350 VA and include primary and secondary fuse protection.

**7.10 Programmable Logic Controller:** Programmable logic controller shall be an Allen Bradley compactlogix processor with built in dual port Ethernet and one USB port. Processor utilizing battery for program storage will not be acceptable. Unit shall operate on 24 Vdc and shall include 750 KB user memory. The operating range of the processor shall be 32 to 140 degrees Fahrenheit. PLC shall be provided with capability of using SD memory card for data logging. I/O shall be 24 Vdc. Processor shall be capable of expanding the I/O with the addition of up to 4 expansion modules. The processor shall be provided with the following on board I/O:

- a) 16 DC Inputs
- b) 16 DC Outputs
- c) 4 Analog Inputs current and voltage
- d) 2 analog Outputs current and voltage
- e) 4 High Speed Counters

**7.11 Color Touchscreen:** HMI Color Touch Screen interface shall be an Allen Bradley Panel View Plus 6 10" HMI and shall include 512MB memory, and Windows® CE 6.0 operating system. Recipe management, machine setup, and data-tracking through .csv files. HMI shall include;

- a) built-in PDF viewer for context-sensitive operator support.

- b) Built-in full Unicode font to support multiple languages with a single run-time application.
- c) Base-configured terminal available with display and logic modules.
- d) Supports real-time monitoring of your terminals through a web browser.
- e) RS-232 and Ethernet networks available through built-in communication ports.
- f) Built-in USB ports and SD card slot
- g) Allen Bradley 24 DC Power Supply: 5 Amp DC power supply with built in status indicators.
- h) Allen Bradley 5 Port Ethernet Switch with 24 Vdc supply power.
- i) Panel devices shall be Allen Bradley NEMA 4 30 mm heavy duty devices. Panel indicator lamps shall be 24 vDC LED types.
- j) Level sensing relays shall be Crozet PNR utilizing 3W2 SS probe tips.
- k) HMI shall contain job specific drawings and data which shall be user accessible within PDF format.

**7.12 Control System Configuration:** The control system configuration and operation parameters shall be configurable through the HMI touch screen and shall be available remotely. (With communication package option the station manufacture shall be capable of remote programming of PLC and HMI) No laptops or programming devices shall be required to configure the system for operation. The system configurable parameters are protected by password levels to ensure correct personnel are making system configuration changes. Manufacture shall be capable of remote access to the actual PLC and HMI programs for upgrades and modifications. The following are parameters that are required but not limited to be configurable through the touch screen.

- a) File Set up System; Allow changes to be saved to a SD memory card. Existing parameters may be uploaded from the SD memory card. This shall allow the system to be returned to last state, factory default or new configuration.
- b) Pump System: The quantity, type and operational parameters are assignable through the touch screen.
- c) Pump Control Assignable safeties, lockouts, limits, anti-cycle, and faults, shall be assignable to each pump.
- d) Auxiliary pumps: Quantity and mode of operation shall be configurable.
- e) Lake Level Controls: Enable/disable of lake level controls. Selectable operation from probes or analog level transmitter. Delay times, and analog set points if analog mode is chosen.
- f) Inlet Screen: Enable/disable with flow and flush parameters.
- g) Chemical Injection: Enable/disable with flow set point and scaling parameters.

- h) Station Filter: Enable/disable with flow and flush parameters.
- i) Station Safeties: Enable type of safety and associated time parameters and operational set points. System should contain the following type of safeties
  - a. Pump Protection: Consist of selectable low level, low inlet or loss of prime. High Pump Temp for horizontal pumps.
  - b. Station Safeties: Low/high Discharge pressure set points, phase fail and VSD fault.
- j) Analog Scaling: Analog inputs shall be able to be scaled for min/max for raw and scaled values.
- k) I/O Mapping: All PLC inputs/outputs regardless of type can be assigned from the HMI.
- l) All data accessible through HMI shall be available with remote access.

**7.13 Operation Setup:** the operation parameters are configurable and settable based on the operating needs of the site system;

- a) Pump Sequence: Settable parameters to set the start/stop for the sequence of pumps that includes pressure/flow set points and timers to verify required operation. This includes transition speeds and timing when starting/stopping lag pumps. Includes configuration of flow stop parameters.
- b) Variable Speed Bypass: Start/stop set points which include delay timer settings for configuration when the variable speed drive is in bypass mode.
- c) PID Turning: Includes tuning parameters for different PID loop requirements and advanced PID tuning of a minimum of 3 pressure ranges. Includes status indications and trend graphing to assist in the tuning process.
- d) VSD Controlled Shutdown: Configurable parameters to add in smoothly transition to an off state.
- e) High Pressure Check: System parameters to verify if flow demand exist and at what point to shut the system down to no flow demand.
- f) Line Fill: Configurable set points to allow slow filling of the distribution system during the initial startup or recovery after power failure.
- g) Lockouts: Time and day of the week settings to restrict the number of pumps that may operate during the restrictive times. Maximum pressure and VSD speed are configurable set points. The lockouts can be enable/disable.
- h) Time/Date Configuration: Allows sync of real time clock of PLC with HMI and allows manual setting of the time and date.

**7.14 Maintenance:** Settings to assist in troubleshooting and repairing of the control system.

- a) Project Documentation: HMI must include the ability to store and view PDFs from the touch screen display. This includes manuals, bill of materials and drawings. It shall be a requirement that manufacture provide these deliverables within the HMI.
- b) Pump Sequence Logic: Provides status indications of what current step the program is in and the amount of the high pressure accumulator. This screen also provides for temporally overriding the amount of pump run time. The alternation of pumps is based on least run time and this provides a method to either have a pump run more or lease often.
- c) Lamp Test: Provides a method to test all lighted panel devices with one push button.
- d) Email Setup: When connected to the internet the system shall provide the ability to send email and text messages due to an assignable fault occurrence. It also provides the ability to attach the event log for review. A configuration screen is provided for input of the required parameters.

**7.15 Operation:** Screens to provide indication of the system operation, events, alarms, trends and totalizes.

- a) Dashboard: Screen will provided indication of the systems current state. Display shall provide current flow, pressure, set point, VSD speed, pump status, pump run time, and status indicators for auxiliary controls.
- b) Current Alarms: Displays any current alarms with time/date stamp of occurrence.
- c) Historical Alarms: Displays historical alarms with time/date stamp of occurrence. Additional information that is captured with each alarm is flow rate, pressure, status and operational method of each pump, and speed of the VFD. The last 100 alarms are stored on PLC memory and are viewable thru the HMI.
- d) Trends: Trend screen provides trending information of pressure set point, PID set point, Pressure, VSD speed & flow rate. The status of each pump is trended that will provide indication of pump is running or off and if the pump is operating across the line or on the VSD. HMI must be able to store 300,000 Points of trend data for trend view.
- e) Historical Events: Displays historical event occurrence and the status of the system at the time of the event. The event is time/date stamped. System conditions such as flow, pressure, set point, VSD speed and pump status is reordered with each event. The last 200 events shall be stored on the PLC memory and shall be accessible for view thru the



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

HMI. All historical events are logged to an HMI data log CSV file. A new data log file shall be created weekly. The data log file shall be capable of being extracted to be viewed on a PC with excel viewer program.

- f) Totalizers: Provides current and two previous years cumulative totals for system flow and for each pump run times and number of starts. This is displayed in daily, monthly and yearly totals.
- g) Auxiliary Pumps: Enable time clock controlled pumps or auxiliary devices. Start start/stop time per day. Day of week operation is selectable.
- h) Dashboard shall also be configured to provide each pumps status.
- i) Help Screen: Provides contact information for MCI Pump Service Group to provide 24/7 phone support and field support.

#### **7.16 Remote Cellular Connection (OPTIONAL)**

- a) Unit shall be provided with the ability to install a cellular modem to provide a remote connection via the internet utilizing any smart phone, tablet or PC that is capable of connection to the WEB.
- b) This system shall not require any modification to the pump station control system to install and operate this feature.
- c) The cellular option shall be a MPC-RCM as provided by Motor Controls, Inc. of Dallas, TX.
- d) The MPC-RCM will provide a cellular modem, antenna and first year of service included with this option. No additional software changes shall be allowed.

#### **OPTIONAL EQUIPMENT:**

##### **G. Pump Cans**

- i. Main pumps and PS Pump shall be can mounted with cans extending below grade to a depth as detailed on the pump station drawing. Cans shall be fabricated from standard weight sch40 steel.
- ii. Can design shall provide uniform first stage impeller suction bell inflow velocity.

- iii. Vertical pump shall hang freely suspended and without restraining attachments.
  - iv. Flow straightening vanes shall be provided for pump capacities greater than 3000 gpm. A pair of vanes shall be centered on the barrel inlet and extended to above the normal liquid level or to the top of the barrel as applicable. The vanes shall protrude as far as practical into the barrel. A set of vanes in the form of a cross shall be provided under the pump bell.
  - v. Intake piping must be sized large enough to limit draw down below the recommended minimum liquid level to a period of less than 3 seconds during start-up.
  - vi. Suction branch piping shall be sized to provide a minimum 5 pipe diameters of pipe length to the face of the can suction flange and shall be sized to provide a max flow velocity of 4ft/second.
  - vii. Can suction flange shall be positioned a minimum of 2 pump can inside diameters from the bottom of the can.
  - viii. Can shall be sized to provide a velocity of 5ft/second max between can interior wall and edge of pump suction bell.
  - ix. The pump shall be positioned with its suction bell flange measuring a distance of  $\frac{1}{2}$  the pump suction bell diameter from the bottom interior of the can.
  - x. The can shall be equipped with a 150lb class 150 flange which shall provide a sealed matting connection for the pump head. Plate without a sealed register fit shall not be allowed.
- b) **3.04 (OPTIONAL) Resilient Seated Buried Gate Pump Isolation Valves: Suction.** Gate valve body, bonnet and wedge shall be from cast iron. Stem shall be machined from forged manganese bronze bar stock. Anti-friction washers shall be from polymeric compound. Body and bonnet shall be fusion epoxy coated to a nominal thickness of 10 mils, internally and externally, and shall conform to AWWA C550 and shall be certified to NSF 61. Stem shall include three O-ring seals, two above the thrust collar and one below. Wedge shall be guided by extended guides cast as part of the wedge. Wedge shall be fully encapsulated in rubber conforming to ASTM D2000. Anti-friction washers shall be installed above and below the thrust collar to help minimize operating torque in both directions. Valve shall be rated at 250 psi maximum working pressure. Valve shall have a full, round, unobstructed flow way. Valve shall be warranted by the valve manufacturer for ten years. Valve shall be equipped with a nut actuator for buried service. Contractor or installer to provide extension handles for valve actuation and valve handle boxes. Valves shall be as manufactured by J&S valve.
- c) **3.05 (OPTIONAL) Dismantling joints.** The pump station shall be provided with buried service dismantling joints to provide adjustability to equipment installation of the below ground manifold and pump suction branch piping. Longitudinal adjustment shall be made possible by the telescoping action of the unit. Flanges shall be in accordance with AWWA Class D and rated for 150 PSDI working pressure. Adapter body shall be ASTM A53, ASTM A283 Grade C carbon steel having a minimum yield of 30,000psi. Follower flange shall be ductile iron per ASTM A536

having a minimum yield of 30,000psi. Gasket shall be Nitrile certified to NSF/ANSI 61. Flange shall be per AWWA C207. Spigot shall be ASTM A53, ASTM A512 or carbon steel having a minimum yield of 30,000psi. Studs shall be ASTM A325 or A307. Tie Rods shall be ASTM A 193 Grade B7. Coating shall be Flexi-coat fusion bonded epoxy per AWWA C213. Units shall ship loose for field installation by installer.

**3.07 Wye Strainer, Auto Flush.** The pump station shall be equipped with a wye strainer sized per technical datasheet. The unit shall be cast iron with a 304SS strainer. Flanges shall conform to ANSI class 125 (ANSI B16.1) and WW-S-2739 type 2 and body shall be lead-free cast iron. Unit shall be installed as indicated on the pump station drawing and shall be equipped with a drain/blow-off connection complete with a 24Vac solenoid valve. Pressure rating shall be no less than 200psi at 210F. Screen shall be 304SS with 3/16" perforation. The wye strainer shall be equipped with isolation lug butterfly valves with fusion bonded epoxy body, EPDM elastomers and ductile iron disc. A bypass shall be provided utilizing a lug butterfly valve matching the wye strainer isolation valves build of materials and equipped with actuators as shown on the pump station drawing. Filter flush line shall be 2" and shall terminate at the skid edge with a 4" threaded companion flange.

**8.01 FILTER** – The pump station shall be equipped with a filtration system to assure a clean water supply to the irrigation system.

The specific filter model number and filter screen micron rating shall be called out in the technical specification. The fine screen shall be flushed periodically to remove accumulated debris. Flushing initiation shall be a timed interval, (user adjustable), and a pressure drop across the screen, (user Adjustable). Flushing control shall be governed by the pump station PLC. Separate flushing controls shall not be required. Flushing action shall be initiated by the pump stations PLC upon activation of an electronically actuated ball valve. To assure tolerance to dirty water, the electric ball valve shall open/close at a programmed rate to eliminate excessive pressure drop or pressure spike. The actuator shall be equipped with a stop limit feature to limit the travel of the ball valve.

Operation: Water shall flow into the **316 stainless steel** filter body and through the 316 stainless steel filtering screen from the inside out allowing blocked contaminants to accumulate on the inside surface of the filtering screen.

Differential pressure across the filtering screen shall be continuously monitored as the filter cake builds on the inside of the filtering screen. The differential pressure across screen shall be monitored using pressure transducers across the filter assembly. The pump station control logic shall have the capability of graphically tracking the pressure across the filter for troubleshooting purpose locally at the pump station through the touch screen operator interface device and via remote monitoring. When the differential pressure reaches an adjustable threshold (recommended at 7 psi) a flush cycle shall be initiated by the opening of the electric ball flush valve. The opening of the flush valve shall drop the pressure inside the drive chamber allowing flow to reverse through the

suction scanner nozzles. The suction scanner nozzles transfer this reduced pressure at the nozzle location onto the inside of the filtering screen surface.

This reduced pressure on the inside of the filtering screen creates a reversed flow through the filtering screen, exhausting the containments off the screen, back through the suction scanner nozzles and out the flush valve to atmosphere. Once the nozzles have traversed and cleaned the entire screen surface, the flush valve shall close stopping the flush cycle. The drive mechanism of the filter shall **not** consist of electric motor, or limit switches to return the drive mechanism to its start position. The drive mechanism shall allow the suction scanner nozzles to traverse across the screen and return to their start position, and if required, to continue this cycle indefinitely without interrupting the flush flow. A hydraulic motor directly attached to the suction scanner shall drive the suction scanner. The filter screen element shall be **316 stainless steel** with micron opening size called out for in the technical specification. The filter housing and cover shall be manufactured from **316 stainless steel** and shall be manufactured to ASME standards but not stamped unless called for in the technical specification

**8.02 Lake Screen** – A 316SS lake screen shall be provided with adjustable band coupling for fitting to customer's suction flume pipe. Screen shall be constructed with 304SS welded wire interlaced for 1/2" x 1/2" openings on 3 sides. Lake Screen shall be sized to provide a maximum velocity through the flume pipe of 1 ft/sec or less.

**8.02 Discharge Transition Piping - Station discharge transition** piping shall be constructed from ASTM A105 schedule 40 pipe or heavier as required to maintain a 3 to 1 pressure safety factor (including 1/16" corrosion allowance). After fabrication and before coating, piping shall be hydrostatically tested to 150% of maximum shutoff pressure. Transition piping shall be designed for 90 degree turn down and shall be equipped with a rigid coupling to facilitate alignment variances in the field. The pipe shall be equipped with thread-o-lets for customer's use. Transition pipe and thread-o-lets shall be as called out in the pump station technical specifications.

**8.03 Power Pack** – Station shall be equipped with a power pack sized per the technical specifications. Unit shall be a pre-wired combination primary circuit breaker, dry-type shielded transformer, secondary breaker disconnect and secondary power panel. Enclosure shall be UL-3R listed for indoor and outdoor use. A 180C U.L. recognized insulation system is required. Unit shall be electrostatically shielded to provide transient voltage protection. Unit shall fully comply with Article 450-3 of the latest edition of the NEC. A primary main breaker shall protect the transformer and serve as a disconnect device. Primary main breaker shall have a high interrupting capacity to handle fault conditions. Branch circuits shall be typical 1 snap in circuit breakers, regular or duplex. A secondary ground shall be provided within the wiring compartment.

**8.04 Power Conditioner** – Station shall be equipped with a power conditioner sized per the technical specifications to provide noise filtering and surge suppression protection to connected equipment from damage, degradation or misoperation. The unit shall increase the (MTBF) Mean Time Before Failure or protected equipment to 25 years (Typical). The unit shall provide +/- 3% output voltage regulation and 120dB common mode and 60dB transverse mode noise attenuation. Surge suppression shall be tested to ANSI/IEEE

C62.41 Class A & B Waveform with <10 V let through typical. Unit shall be hardwired and shall provide harmonic filtering. Voltage shall be +10% to -20% of nominal continuous at full load and +20% to -35% of nominal for temporary surge or sags. Efficiency shall be up to 92% at full load. Operating temperature shall be -20 to +50C with Humidity <95% non-condensing. Audible noise shall be 35dBA to 65dBA full resistive noise. Unit shall be UL1012 for 60Hz models.

## **POST PRODUCTION:**

- 5.10 General.** Installing contractor shall be responsible for providing all materials, equipment, and labor necessary to install and connect the pumping system.
- 5.15 Unloading and Setting Supervision.** Setting of the pumping system and connection to suction, discharge and power, anchoring of the pumping system, and thrust blocking of the suction and discharge piping that is connected to the pumping system shall be the responsibility of the installing contractor and not the manufacturer. Crane to off-load and set the pumping system onto the concrete slab shall be provided by installing contractor. Pumping system manufacturer shall supply a technician for one day to meet the shipment and advise the contractor on unloading and setting the pumping system. Technician's job shall be supervisory only, in the role of an advisor.
- 5.20 Start Up.** When discharge piping, electrical connections, and electrical inspection have been completed, the pumping system manufacturer shall be contacted for startup. A minimum one week notice shall be given to manufacturer prior to scheduled startup date. During start up, the complete pumping system shall be inspected for proper installation, and shall be given a running test of normal start and stop, and fully loaded operating conditions. During this test, each pump shall demonstrate its ability to operate without undue vibration, or overheating and shall demonstrate its general fitness for service. All defects shall be corrected and adjustments made at the expense of the pumping system manufacturer. Test shall be repeated until satisfactory results are obtained. Startup assistance shall be provided but shall be limited to one 8 hour day.

After the station startup has been completed, but before the technician leaves the job site, a training session shall be given to the owner or the owner's representative to familiarize them with the pumping system operation, maintenance and adjustments.

- 5.25 Warranty.**
- A. The manufacturer shall warrant that the water pumping system shall be free of defects in workmanship for a period of two years from date of authorized start-up but not to exceed thirty months from date of manufacturer's invoice. Variable frequency drive shall be provided with a 6 year warranty as described in the VFD section above and shall include protection against lightning strikes and electrical surges.
- B. Provided that all installation and operation responsibilities have been properly performed, manufacturer shall provide a replacement part or component during the warranty life. Any repairs to be accomplished at manufacturer's expense must be pre-authorized. The start-up certificate must be on file with manufacturer to activate warranty. Upon request, manufacturer shall provide advice for trouble shooting of a defect during the warranty period.



2818 Virgo Lane  
(P.O. Box 59986)  
Dallas, Texas 75229-1986

Tel: 972.247.4440  
Fax: 972.247.8991

- C. Manufacturer shall use only first quality material. As with any mechanical or electrical device, some preventive maintenance efforts are required to assure an adequate service life. A periodic preventive maintenance program recommendation shall be included in the owner's manual. Manufacturer shall support a large national network of technical service technicians. Manufacturer's field service technicians shall be contacted for service. Because of varied conditions beyond the control of manufacturer, this warranty may not be valid or may not cover damage as follows:
1. Default of any agreement with manufacturer.
  2. Misuse, abuse, or failure to conduct routine maintenance.
  3. Handling any liquid other than clean water.
  4. Exposure to electrolysis, erosion, or abrasion.
  5. Presence of destructive gaseous or chemical solutions.
  6. Over voltage or unprotected low voltage.
  7. Unprotected electrical phase loss or phase reversal.