

SECTION 32 84 00A

BOOSTER PUMP STATION AND BACKFLOW

PART 1 - SCOPE OF WORK

1.1 DESCRIPTION

It is the intention of this specification to describe an automatic, prefabricated, self-enclosed, variable speed drive (VFD), horizontal centrifugal booster pump station with piping, valves, and enclosure. The controls shall be an industrial grade PLC incorporating a color touch screen operator interface with software programming written specifically for this project. A formed and reinforced steel base platform and enclosure with lockable aluminum lid shall contain all manifolds, pumps, motors, backflow prevention assembly anchored to a concrete pad furnished by the installer. The pump station base, enclosure and lid shall be painted sandstone. Design, fabrication, testing and service shall be the sole responsibility of the pump station manufacturer. The pump station shall provide water to the system while simultaneously maintaining a constant discharge pressure by using a prefabricated pump station with variable frequency drive (VFD) pumps for pressure regulation, under varying flow conditions up to the maximum specified capacity.

1.2 RELATED WORK

- A. Maintenance of Existing Utilities: Section 01 00 00 GENERAL REQUIREMENTS
- B. Submittals: SECTION 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- C. Concrete: Section 03 30 53, CAST-IN-PLACE CONCRETE (SHORT FORM).
- D. Excavation, Backfill: Section 31 20 00, EARTH MOVING.
- E. Division 26, ELECTRICAL
- F. Section 32 90 00, PLANTING
- G. Section 33 10 00, WATER UTILITIES
- H. 32 84 00, PLANTING IRRIGATION

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PART 2 - EQUIPMENT

2.1 MANUFACTURER AND MODEL

- A. The prefabricated pumping station shall have a minimum capacity and discharge pressure at skid edge as stated in the technical specifications.
- B. The station shall be completely wired, piped, hydraulically and electrically tested prior shipment.
- C. The discharge manifold from the pump station shall terminate at or near the pump station skid edge and be provided by the pump station manufacturer.
- D. The pump station shall be a WaterMax Model 9000 as manufactured by WATERTRONICS, INC. 525 Industrial Drive, P.O. Box 530, Hartland, Wisconsin 53029-0530.
- E. Manufacturer Quotation number 052714KSWMBV-15EPNC
- F. Manufacturer Model number WMFV-9000-1-15x2-460-3-300-90
- G. A complete specification and submittal of all major components for the proposed pump station with individual pump performance verification.
- H. A detailed pumping station proposal drawing complete with component location, sizes and dimensions specific to the installation.
- I. A complete electrical schematic for all high and low voltage circuits showing breaker/ fuse sizing, wire numbering and color shall be furnished after official written authorization to construct has been received and acknowledged by the manufacturer and shall be included in written maintenance and operations manuals.
- J. Pump station manufacturer's U.L. file number for the electrical controls and pump station.
- K. A copy of the manufacturer's certificate of insurance.
- L. Product support technicians shall be capable of accessing all information pertaining to the pumping equipment, e.g. electrical schematics, pump curves, program data, bill of materials, etc. The manufacturer shall have no less than two technicians on call seven days a week.
- M. The pump station manufacturer shall provide factory authorized or factory direct service personnel for the set, start-up, preventative maintenance and general service of the pump system. A factory

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authorized or factory direct service technician shall be located within a two-hundred fifty (250) mile radius of the project site. The pump system technician shall have a minimum of 5 years of experience. The pump station manufacturer shall provide technical phone support twenty-four hours a day seven days a week.

2.2 SPECIFIC PROJECT EQUIPMENT

- A. Per quotation 052714KSWMBV-15EPNC dated 10-17-2014.
- B. External mounted NEMA 3R service rated 60 amp main disconnect panel
- C. U.L listed as a complete package.
- D. Microprocessor controls with Accu-Ware station software to maintain constant pressure at variable flow.
- E. Virtual Vision III color Touchscreen operator interface device with active matrix LCD display including
 - 1. Digital flow (GPM) and pressure (PSI) display.
 - 2. Both cumulative and resettable gallons pumped indicators.
 - 3. Pump ready/running status with elapsed run time display per pump.
 - 4. Flow-based pressure regulation to match discharge pressure with irrigation demand.
 - 5. Individual motor overload reporting.
 - 6. Minute by minute data logging saved to a removable flash RAM card.
 - 7. 32MB card to store approximately 12 months of data.
 - 8. Historic & real time X-Y plotting of pump station operation.
 - 9. Alarm log file with ability to change system parameters such as setpoint pressure, time delays.
- F. Alarm conditions with safety shutdown, time stamp & automatic diagnostic system.
 - 1. Automatic re-pressurization after fault condition.
 - 2. Low discharge pressure shutdown.
 - 3. High discharge pressure shutdown.
 - 4. Individual motor overload/phase loss.
 - 5. VFD fault shutdown.
 - 6. High pump temperature shutdown.
- G. Overload, single phase, phase imbalance/low voltage protection.
- H. Surge protection for main station and solid state controls.

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- I. MSP combination breaker, contactor and overload.
- J. Variable Frequency Drive pressure regulation.
- K. Pressure drop start.
- L. Hand/off/auto selector switch.
- M. Stainless steel pressure transducer.
- N. Data Industrial 220B flow sensor mounted inside enclosure.
- O. 2 ea. 15 HP, 3600 RPM horizontal centrifugal pump and ODP EISA compliant motors. Pumps to be cast iron with a bronze impeller and mechanical seal.
- P. Silicone filled pressure gauges with isolation valve on suction and discharge piping.
- Q. Station discharge isolation valve.
- R. Force fan air cooled ventilated 14 gauge steel pump station enclosure and steel base painted Sandstone with lockable access cover.
- S. Baked and cured two part polyurethane ultraviolet insensitive paint.
- T. Factory certified dynamic run testing of pump station up to full flow and pressure prior to shipment.
- U. Three operator and maintenance manuals.
- V. 4"x4" Fabricated steel discharge drop pipe with swivel connection, 1-1/2" min dia. blowout port.
- W. 4"x4" Fabricated steel inlet drop pipe with swivel connection.
- X. Dead front external disconnect panel 460 volt power supply connection.
- Y. Opto-coupler to share signal from Data Industrial Flow Sensor with client controller C2.
- Z. 24 volt relay to operate 120 volt normally closed Electronic Butterfly Valve on discharge piping for Master Valve Alarm Function.
- AA. PLC logic to close EBV and shut down station in event of signal from Rain Bird central control system.
- BB. Qty. 3 Rain Bird SD210TURF pulse decoders furnished to Watertronics at the time of final pump station order by the selected irrigation installer to be mounted inside enclosure by Watertronics, relay and logic with opto-isolator.
- CC. Additional Watertronics 9000 steel enclosure with a FEBCO Model 880V Backflow preventer mounted inside, connected to the inlet side of the pump station upstream of the pump station enclosure.

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2.3 PUMPS AND MOTORS

- A. Pumps shall be electric motor driven, horizontal centrifugal with mechanical shaft seal, volute case and impeller.
- B. The shaft seal shall be a self-adjusting mechanical type to prevent leakage and eliminate the need for drain piping. The volute case shall be precision machined from gray cast iron and engineered to modern hydraulic standards. It shall be possible to rotate the discharge connection to any of four positions. A heavy cast iron bracket shall maintain alignment between the motor and volute cast.
- C. The impeller shall be an enclosed type and balanced to provide smooth operation. The impeller shall be keyed to the shaft and locked with a special cap screw and washer. The motor shaft shall be manufactured from high grade steel and of reduced length to increase shaft rigidity, extend bearing life, and reduce the overall length of the pump and motor assembly. The motor shaft shall be protected with a replaceable stainless steel sleeve.
- D. Each pump motor shall be a squirrel cage induction horizontal solid shaft type. The pump impeller shall be direct mounted and keyed to the motor shaft with a stainless steel protective sleeve. The temperature rise of the motor shall be to NEMA Standard MG-1- Class F insulation.
- E. Radial and thrust bearings of ample capacity to accommodate the hydraulic thrust of the pump shall be incorporated into the motor. The motor shall be of proper size to drive the pump at any point on its operation curve without exceeding the service factor nameplate rating.

2.4 BASE, PIPING, VALVES, GAUGES, MECHANICAL EQUIPMENT

- A. Pump station base shall be formed from a single sheet of painted steel. Continuous welded and smooth ground at all corners resulting in a seamless, one piece structure with rounded edges and corners. If required, the base shall be strategically reinforced underneath with structural channel to support pumps, manifold control enclosure and periphery. Flat steel, diamond or checker plate welded over structural steel shall not be permitted. The base shall be drilled and tapped for mounting of pumps, manifolds, relief valves and other equipment. All tolerances shall permit direct bolting of pump station components to

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- base. The exterior of the base will have drilled holes for anchor bolts. There shall be two holes at each corner for lifting.
- B. The base and enclosure shall be polyester powder-coated Sandstone.
- C. All fabricated piping shall conform to ASTM specifications A53 for Grade B welded or seamless pipe.
- D. Discharge piping 6" and smaller shall be Schedule 40 Steel pipe. All welding flanges shall be forged steel slip-on or welding neck type. All welding fittings shall be seamless, conforming to ASTM Specification A234, with pressure rating not less than 150 PSI. Standard polyester powder-coat paint color is Sandstone.
- E. Drains shall be provided from any possible low point in the system and are to consist of 1/4" brass petcocks. They include, but are not limited to the following:
1. Drain for each pump discharge check valve
 2. Drain in the discharge manifold
 3. A wash-down 3/4" brass hose bib shall be provided downstream of the control valves, upstream of the main station isolation valve
- F. Pump check valve shall be of the silent operating type that begin to close as forward velocity diminishes and be fully closed at zero velocity preventing flow reversal. Valve bodies shall be cast from ASTM-126C cast-iron or better and shall be free from blow holes, sand holes, and other impurities. 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 bronze disc, seat, and stem guide.
- G. Valves shall be sized to permit full pump capacity to discharge without exceeding a pressure drop of 2.5 PSI. Valves 4" and smaller shall be pressure rated for 250 PSI, and 6" shall be pressure rated to 150 PSI.
- H. Isolation valves shall be butterfly type with ten position lever for sizes 4" and smaller and gear operators for sizes above 4". All shall be rated at 200 PSI WOG working pressure. Trim shall include stainless steel stem, bronze or nickel coated iron streamlined disc, and full faced resilient seat designed to eliminate need for flange gaskets.

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- I. A pressure gauge shall be located on the discharge manifold for the purpose of measuring regulated, downstream pressure. Pressure gauge shall be 304 stainless steel case and bezel construction. Gauge shall be 2-1/2" diameter, liquid filled. Pressure sensing connection shall be 1/4" NPT lower gauge connection.

2.5 U.L.LISTED CONTROL PANEL, LOGIC AND SENSORS

- A. The pump station electrical controls shall be mounted in a self-containing NEMA 3R enclosure fabricated from not less than 12 gauge steel. Door gasket seals shall be neoprene sponge, sufficient to protect interior components from weather and dust. The electrical panel door(s) shall be constructed from 12 gauge steel with integral latches. All external operating devices shall be dust and weather proof. All internal components of the enclosure shall be mounted on a removable back panel. Mounting screws for components shall not be tapped into the enclosure wall.
- B. All internal wiring within, and interconnecting between, the panels shall be complete and no field wiring within the panels shall be required. Wiring troughs and cable raceways shall be self-contained within the enclosure and no external cable trays or wiring roughs are permitted.
- C. No pressure gauges, pressure switches, water activated devices, or water lines of any sort shall be installed in any electrical control panel.
The control panel shall be designed, built, tested and U.L. listed by the pump station manufacture.
- D. The pump station discharge pressure shall be regulated to provide surge-free constant pressure as programmed via the control panel operator interface. The control system will have the following features:
 1. Gradual entry of water from the pump into the discharge manifold to allow for complete purging of air to eliminate pressure surging.
 2. Maintain programmed downstream pressure regardless of discharge flow.

3. Up to six, user adjustable PID control settings to ensure accurate pressure regulation at all flows, programmed pressure, or connected pump combination.
 4. Adjustable pressure ramp-up and ramp-down to assure surge free regulation.
 5. After a drop in pressure, gradually increase system pressure over a user adjustable period of time to eliminate surging.
 6. Rate of change of pressure control to anticipate and eliminate rapid pressure changes caused by changing system demand.
- E. Discharge pressure regulation shall be by a Variable Frequency Drive. Adjustment of regulated downstream pressure shall be accomplished through the control panel operator interface. Hydraulic type, pilot controlled pressure reducing valves shall not be accepted.
- F. The variable frequency drive shall be IGBT based with selectable carrier frequency up to 15 KHZ. The VFD shall include terminals for incoming power, motor output power and control terminals.
- G. The VFD shall generate a sine-coded, variable voltage/ frequency, three phase output for optimum speed control. The VFD shall incorporate power loss ride-through for a minimum of 2 seconds. VFD protective features shall include current limit, auto restart, short circuit protection, electronic motor overload protection and ground fault protection. The VFD shall have a push button programming display for easy access to operation parameters. The VFD shall be protected on the primary side by fuses of the appropriate amperage.
- H. Overload capacity: 120% rated output current for one minute. Voltage Fluctuation: +10%, -15%. Sine wave PWM with full range, automatic torque boost. Frequency Control Range: 0.1 to 400Hz. Frequency Accuracy: Digital, 0.01Hz, Analog. .1%. Motor overload protection, Instantaneous Over current of 180% of rated output current. Over voltage at 820VDC if 460V input. Under voltage: user adjustable. Momentary Power Loss: up to 2 second ride through. Electronic Ground Fault. LED capacitor charge indicator. Input Phase loss alarm. Ambient temperature range of 0 to 50 degrees C. Humidity of 95% non-condensing.

- I. A three-pole, main service rated disconnect shall be contained within the NEMA 4 Dead Front control enclosure. An externally mounted service disconnect shall not be acceptable. Disconnect shall isolate all power to the control enclosure. The disconnect shall have an operating handle mounted in the enclosure door, mechanically interlocked to prevent entry while disconnect is in the ON position. Each motor shall be protected by a MSP combination starter and breaker. Device will be UL 508 Type F. Motor starter protector and contactor are electrically and mechanically linked by means of a link module and adapter plate. All starters are suitable for use in group installation applications according to NEC-430-53(c).
- J. A control transformer shall provide 120 volt power to the pump station controls. The control transformer shall be protected on the primary and secondary sides with appropriately sized fuses. No load other than the pump station controls shall be supplied by the control transformer.
- K. The pump sequence controller shall be an industrial grade PLC with diagnostic LED's for monitoring of discrete inputs and outputs. Not less than two additional analog inputs and outputs shall be standard for monitoring and control purposes. The PLC shall contain two communication ports for monitoring and programming purposes. The PLC shall contain an EEPROM, battery backed RAM and non-volatile memory for storage of critical configuration data.
- L. A solid state pressure transducer shall provide a noise free, linear output proportional to discharge pressure. Transducer shall be solid-state, strain gauge type with integral voltage regulating and output accuracy not less than 0.25%. Transducer shall be constructed of stainless steel and rated for the maximum pump station discharge pressure.
- M. The pump station discharge manifold shall incorporate an insertion type, pulse frequency output flow sensor for continuous output to the pump station controls. The flow sensor output pulse shall be conditioned and fed directly to the PLC interrupt input for conversion and display in Gallons Per Minute. For accuracy and security considerations, conversion to an analog signal prior to PLC input shall

not be accepted. Flow sensor accuracy shall be no less than 2% for flow velocities ranging from 1-30 feet per second.

- N. The main power supply feeding the pumping station shall be equipped with a 3 phase secondary surge arrester having a breakdown current rating of not less than 80,000 amps. Duty cycle testing: 2500, 10KA (8x20jus) impulses with less than 10% drift. Sine wave tracking, EMI/RFI noise rejection and <5ns response time. U.L. category C. approvals 1449 2nd addition. Arrester will meet IEEE standard 587.
- O. Single-pole secondary distribution breakers with appropriate ratings shall supply power to each pump starter coil circuit, the control system and to other circuits as specified.
- P. The incoming power and each motor shall be protected by a phase loss/low voltage system dropout relay to de-energize the pump station control circuit or motor contactor if either a phase failure, phase reversal or low voltage condition occurs. If, after attempted automatic re-starts the phase failure/low voltage alarm condition remains, the alarm must be manually reset. Individual motor overloads will also act as phase monitors for each motor.
- Q. Corrosion inhibiting modules shall be installed in all electrical enclosures in accordance with the manufacture's recommendations.

3.0 ALARMS

- A. Controls shall shut down the pump station in the event of the following alarm conditions. The controls shall attempt to restart the system after alarm shutdown or loss of power to minimize loss of irrigation. After a user adjustable number of attempts to re-pressurize the system, the controls will go into hard shut down and remain there until manually reset.
 - 1. Low discharge pressure cutout. Pressure remains 20 PSI below regulated set point for a set time delay.
 - 2. High discharge pressure cutout. Pressure remains 11 PSI above regulated set point for set time delay.
 - 3. Phase / voltage cutout; High or low voltage; loss of phase or phase reversal.
 - 4. High pump volute temperature cutout. Pump temperature stays above 120 degrees F. for a set time delay.

5. Starter fail cutout. Output to starter is not met with corresponding running input for set time delay. Indicates overload, phase imbalance or control fuse.

4.0 OPERATOR INTERFACE

- A. Operator interface shall be a full color STN active matrix LCD display unit mounted in the enclosure. Operator interface shall be used for logical display of all pump station functions. The operator interface shall be NEMA 4 rated. The operator interface shall be touch sensitive with intuitive on-screen user instruction for ease of operator use. The use of buttons or keys or off-screen user instructions shall not be permitted. The operator interface shall be LCD color display type with no less than 640 x 480 pixel resolution, with viewing area measuring not less than 7.5" diagonal. User memory for storing critical pump operation data shall not be less than required for up to 1 year of data.
- B. The operator interface shall allow the user to view and modify all pertinent operation parameters. The operator interface shall incorporate password protection for modification of critical pump station parameters. The operator interface capabilities shall include but are not limited to the following:
 1. Overview screen to show pump system configuration. Screen shall show if each individual pump is enable or disabled, the number of hours on each pump, station full flow and pressure design criteria.
 2. Password protected system screen with information on current regulation pressure, setpoint, regulation pressure, System status, restarts remaining, VFD reference speed, pressure regulation method (VFD or EBV modes) and adjust settings button.
 3. Settings menu to allow changes to pressure regulation settings, pipe saver mode, VFD manual mode, analog calibration, flow calibration, program or register settings.
 4. Flow screen to display pressure in PSI, flow in GPM and total gallons pumped in thousands of gallons. Separate display to show total gallons pumped since last reset.
 5. Alarm status with time stamping, display of pump station

conditions at shutdown and restart. Alarms to displayed in red when activated and a separate listing to be displayed in green when the alarm is reset. Alarms to be logged to a compact flash disk allowing the service technician to upload data to a spreadsheet type program.

6. Full control of and capability of monitoring, adjusting and viewing any options present such as water level, inlet strainer, wye strainer, filtration, chemical injection, or liquid tank levels. Adjustment of automatic/manual pressure regulation set points.
7. Graphing capability for up to 1 full year detailing flow rate and pressure. Graphing function shall give option to graph and plot a point every minute. The graph function to be selectable by day, month and year as well as the time of desired graph. All data to be logged to a compact flash allowing the service technician to upload data to a spreadsheet type program.

5.0 MANUFACTURE AND TESTING

- A. Skid wiring shall conform to National Electrical Code Standards. All wiring from control panels to motors shall be in metal reinforced, water tight, flexible conduit with copper conductors rated not less than 600 volts and of proper size to carry the full load amperage of the motors without exceeding 70% capacity of the conductors. A grounding cable sized to National Electrical Code requirements shall be included in the flexible conduit. There shall be no splices between the motor starters and the motor connection boxes.
- B. Wiring to flow sensors and pressure transducer shall be multi-conductor, shielded cable suitable for Class II low voltage controls. Wiring to motor operated valves shall be in flexible conduit with TFFN #18 gauge copper conductors rated not less than 600 volt.
- C. Construction shall be of modular form utilizing a stainless steel base structurally adequate to support pumps, piping, tanks, and electrical equipment as a single integral assembly, a lockable, vented enclosure and cover. All nuts, bolts washers, and fasteners shall be zinc or cadmium plated for corrosion resistance.

- D. Construction shall include a weather resistant, polyester powder-coated steel enclosure with welded lockable lid guides on top and bottom. The front side of the enclosure shall have oversized cooling vents and be easily removable for servicing. The enclosure is to be supplied with twin internally mounted, heavy duty gas filled lift struts to keep the access door open. All components are to be accessible from top and front sides with the lid completely open. Enclosure is to be suitable for mounting to the pump station base and shall include openings for suction and discharge piping. Standard steel enclosure is provided polyester powder-coat Sandstone color.
- E. For the purpose of cooling the pump motor, switchgear and control logic, an exhaust fan shall be located inside the pump enclosure, mounted to the enclosure. The exhaust fan shall be activated upon pump start and shall run until the pump stops. The fan shall be black die-cast aluminum construction with UL94V-0 rated polycarbonate propeller and rated for not less than 240 CFM. Fan motor shall be permanent split capacitor type with stainless steel ball bearings, class B insulation and automatic thermal protection.
- F. Painting of the piping system shall consist of a multi-step coating system which includes metal preparation, and a two part polyurethane finish having a total dry film thickness of not less than 5 mils. Paint shall be ultraviolet insensitive. Pump station components shall be painted polyester powder-coat Sandstone color.
- G. The pump station manufacturer shall conduct a complete factory dynamic test of the pump station prior to shipment. Pump station shall be tested throughout the entire operating range at the net discharge pressure called for in the technical specifications. Individual pump pressure, flow, RPMs, volts, amps, KW and power factor shall be documented for verification by the consulting engineer or owners' representative prior to delivery upon request.

5.1 INCLUDED OPTIONS

- A. The pump station manufacturer shall supply the inlet and discharge drop pipes (also known as "Z" pipe) for connection to the city supply and irrigation main line. The pipes shall be Schedule 40 steel, painted to match the pump station and sized for depth and termination based on the

installer final requirements, furnished in writing prior to pump station ordering.

- B. The pump station shall be supplied with a 2.5 inch Reduced Pressure Zone (RPZ) backflow prevention assembly integrated into the booster pump station. The RPZ shall be Model 880V as manufactured by FEBCO with Cast-Iron Wye-Strainer model Febco 758A upstream of the RPZ.
- C. Pump station manufacturer shall provide an automatic by-pass back-up mode for constant pressure regulation in the event of VFD failure. The back-up mode shall automatically function on the fly during an event of a VFD failure, without loss of irrigation. The VFD back-up mode shall provide constant pressure at variable flow without causing line surge. A pressure relief valve shall not be utilized. The automatic VFD by-pass mode shall be either controlled hydraulically through a pressure-regulating valve per pump or EBV (electronic butterfly valve(s)).
- D. The pump station discharge pressure shall be regulated to provide surge-free constant pressure as programmed via the control panel operator interface. Discharge pressure shall be regulated by an Electronic Butterfly Valve, consisting of the following:
 - 1. Gradual entry of water from the EBV pump into the discharge manifold to allow for complete purging of pump column air and elimination of surges.
 - 2. Maintain programmed downstream pressure regardless of discharge flow.
 - 3. Up to six, user adjustable PID control settings to ensure accurate pressure regulation at all flows, programmed pressure, or connected pump combination.
 - 4. Adjustable pressure ramp-up and ramp-down to assure surge free pressure regulation.
 - 5. After a drop in pressure, gradually increase system pressure over a user adjustable period of time to eliminate surging.
 - 6. Rate of change of pressure control to anticipate and eliminate rapid pressure changes caused by changing system demand.
- E. Adjustment of regulated downstream pressure shall be accomplished through the control panel operator interface. Individual pressure regulating valves shall be butterfly type with electric motor gear

actuation. The maximum allowable pressure drop across the butterfly valve at full pump capacity shall not exceed one PSI. The Butterfly Valve shall be rated for not less than 285 PSI.

- F. 0.5 KVA transformer shall be mounted inside the enclosure to provide power to client controller C2 and to the site weather station 155volt-24volt transformer. A Breaker panel with two external use circuits shall be mounted on the back side of the enclosure for optional future use. A 3R receptacle 15 amp breaker with one two-gang standard GFI receptacle in weather resistant enclosure shall be mounted on the back outside of the enclosure to furnish occasional temporary use power.

6.0 ORDERING, DELIVERY, PLACEMENT AND CONNECTION

- A. Drawings shall be furnished by the manufacturer within two weeks following receipt of order for manufacture to the COR for approval. Drawings shall indicate pump station alignment, final discharge piping configuration and final electrical service considerations as required of the project and as ordered in writing by the selected irrigation installer.
 - a. The selected irrigation installer shall review ordering information with COR and shall clearly mark documents as "approved" or corrected within one week of receipt.
 - b. Should corrections be required, the process of resubmittal, review by the selected irrigation installer and written approval or correction shall continue until the pump station configuration and considerations are satisfactory to commence manufacturing.
- B. Shipping, off-loading and setting of pump station shall be arranged and executed by the selected irrigation installer. Connection and termination of all pump station elements and appurtenances shall be by the selected irrigation installer. Location and mounting details shall be furnished by the pump station manufacturer. See related sections.

7.0 ON-SITE START UP

- A. Technical start up and official commissioning shall be furnished by the pump station manufacturer or a factory-authorized qualified service agent. Start up and commissioning shall be arranged and documented by the selected irrigation installer.
- B. Technical start up procedures by the pump station manufacturer shall include the following:
 - 1. Station start up and pressurization
 - 2. Pressure, flow and programming adjustments
 - 3. Monitoring of selected irrigation cycles to confirm proper pump station interphase with irrigation system.
 - 4. Participation with the selected irrigation installer in Owner training specific to the pump station operation and presentation of owner manuals. See related requirements in Section 320 84 00.

8.0 WARRANTY

- A. The manufacturer shall warrant the pump station to be free of defects and product malfunctions for a period of one year from date of startup or fifteen months after shipment, whichever occurs first.

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