TopVault Above Grade Wet Well Mounted Submersible Pump Control Station

The contractor shall furnish and install one factory assembled, **TopVault**, above grade, wet well mounted submersible pump control station as manufactured by USEMCO, Inc., Tomah, Wisconsin and represented by _____ or pre-approved equal. The station shall be complete with all needed equipment factory installed on reinforced aluminum base with fiberglass cover. The principal items of equipment shall include internal piping, valves, control panel, heater, ventilation, and all internal wiring, all as shown on the plans and specified herein. The **TopVault** will include third party certification from either **INTERTEK Testing Services (ETL)** or **U.L certification for package pumping stations.**

The station manufacturer will also provide a certificate of liability insurance of no less then $10,000,000.00 dollars

Where an "approved equal" clause is provided, it is intended that the "equal" material or equipment be approved in writing by the engineer at least 15 days prior to the time of bidding. "Approved equals" not submitted 15 days prior to the bid will not be considered.

To ensure total quality control, the complete unit shall be designed, fabricated, assembled, and tested in house by the station manufacturer.

All mechanical and electrical components that comprise the pump station shall be **non-proprietary** and available for purchase from vendors other than the pump station manufacturer.

Alternates

The contractor may, if he so chooses, provide an alternate quotation to his base bid. The amount to be added or deducted from the base bid, for a system provided by other system manufacturers, must be indicated with the alternate quotation. This amount shall include all costs or savings, which will result from the proposed alternate and will include any special expenses incurred by anyone affected by the offered alternate. This shall include, but is not limited to, greater energy cost due to less efficient equipment, required greater installation space, or any other item with which this system is to be interfaced.

For an alternate to be considered, it will be necessary for the contractor to provide one set of written information completely describing the alternate fifteen (15) days prior to the bid date. Should the alternate or the information describing it fail to describe its capability in meeting the job requirements or if the contractor fails to furnish complete information, the engineer shall regard the proposal as an inferior alternate and disregard the alternate bid.

Required Information for Consideration of an Alternate

This information shall include complete mechanical dimensions, electrical details and specifications of every value, meter and other instrument to be provided by this section. If a microprocessor or any other similar programmable system is being provided, manufacturer's literature of each of the required two sources shall be provided.

System sketches shall be provided of the hydraulic processes identifying the locations schematically of all process equipment being provided by this contract and the schematic location of the devices being provided in relation to the process equipment.

A written system description of how the control system interacts with the process equipment is to be provided.

A system sketch shall be provided indicating the relationship of telemetry equipment to the system.

A sketch shall be provided of the pump station, indicating the enclosure size and the relative location of panel mounted equipment. All equipment is to be identified on this pump station sketch so that their existence can be checked, and functional relationships determined.

Failure to receive the above information at time of bid will be considered non-responsive and will be cause to reject the alternate. Information submitted with the proposed alternate bid will be used to determine qualifications and quality only of the alternate system supplier and acceptance of the alternate is not to be interpreted as a revision to the requirement of this specification.

System Coordination and Single Source Responsibility

The equipment provided shall have a completely integrated microprocessor based automatic control and monitoring system consisting of the required controller, power equipment, motor starters, level/flow and alarm monitoring equipment in a factory wired and tested assembly. The automatic control and alarm/monitoring system components shall be standard, catalogued, stocked products of the system supplier to assure one source responsibility, immediately available spare/replacement parts, proper system interconnections and reliable long-term operation.

Field Supervision

The services of a factory trained, qualified representative shall be provided to inspect the completed installation, make all adjustments necessary to place the system in trouble free operation and instruct the operating personnel in the proper care and operation of the equipment.

Guarantee

The manufacturer of the pump station shall guarantee for a period of one year from the date station is placed into operation or eighteen months from date of shipment, whichever occurs first, that the entire station and all equipment therein shall be free from defects in design, materials, and workmanship. Normal use items, such as light bulbs and fuses are excluded.

Above Grade Equipment Chamber

The equipment chamber common base shall be reinforced aluminum safety plate. An aluminum hatch located exterior to the equipment chamber shall be provided for access to the wet well The access cover shall be of ¼" aluminum diamond plate, reinforced with stiffener bars as required. The cover shall be able to withstand the live load of 300 lbs. per square foot. The cover will have stainless steel hinges and be equipped with a lifting handle and a padlock locking post (padlock by others). The cover shall open to 90 degrees and lock automatically in that position by a stainless-steel positive locking arm. Hooks will be provided in the access hatch for pump lifting cables or chains.

A caution sign shall be attached to the access hatch. The sign shall read as follows:

Caution: Dangerous/Hazardous Gases
Level 2 Confined Space
Do not enter without proper
Equipment or supervision

The fiberglass cover will be gel coated inside and out and be of suitable thickness and density

formulated to provide durability, abrasion resistance, and color fastness. The coating will also be impervious to sewage, grease, oil, gasoline, and other common chemicals. The exterior finish will consist of 20 to 25 mils of gel coat with an added UV absorber. Fiberglass laminate will then be applied to the backside of the gel coat to an approximate thickness of 1/8". This laminate will be a 25% to 28% chop glass load by weight. The laminate will be rolled out to remove all air and than allowed to cure. Foam insulation board with an R-value of 7 and an aluminum laminate vapor barrier will then be applied and bonded into place. A light layer of laminate is chopped on top of the foam sheet and rolled out to remove air and allowed to cure. A cover coat of gel coat with a surfacing agent is then applied on the inside of the part and allowed to cure.

The exterior shall be a tan textured surface. Smooth and/or glossy exteriors will not be acceptable and will not be considered due to their appearance and reflectivity characteristics.

The cover will have access doors on two sides. The access doors shall be equipped with hinges and tamperproof keyed latches. All hardware for the cover shall be tamperproof. The entire cover shall be removable to service the equipment in the pump station. Removal shall require no more than two maintenance personnel for removal without the use of lifting equipment.

The cover shall be provided with inlet and discharge louvers and a thermostatically controlled fan. The fan shall be plugged into a grounded receptacle that can be unplugged for removal of the fiberglass cover.

The equipment chamber shall be provided with a wall mounted commercial grade 500 Watt electric heater suitable for 120-volt, single phase service. The heater shall be of the fan-forced type, complete with a baked enamel safety grill. The heater shall be hard-wired to the control panel. The heater shall be as manufactured by Berko, Qmark, Dayton or Engineer approved equal. The heater shall be controlled by a digital thermostat separate from the unit heater. If the heater has an integral thermostat, it shall be disabled or turned to the maximum setting. The digital thermostat shall have a PTC 1000 Ohm remote probe with 48" extension. It will have a 120 Volt input and a 16-amp, 250 VAC resistive output to the heater. The display shall be a 3-digit, ½" digits plus Fahrenheit sign and bright red LED.

Removable lifting eyes shall be placed about the perimeter of the equipment base to facilitate lifting and handling of the station.

Piping & Valves

The station sewage piping shall be schedule 40 steel pipe that will extend down through the common base plate terminating in plain ends exterior to the pump chamber. Aluminum transition pipes shall be seal welded where they protrude through the base plate to form a gas tight seal between the pump chamber and wet well. Each discharge line shall be fitted with a plug valve and check valve as specified herein and sized as shown on the plans. All mill scale, rust, weld flux and other foreign matter shall be removed from all steel surfaces by shot blasting to SSPC SP-10 specification for near-white blast cleaning. Surface irregularities shall be removed by grinding. The piping and control panel bracket surfaces shall receive a minimum of two coats of self-priming, hi-build epoxy coating. The coating material shall show excellent resistance to immersion in seawater as well as to splash or spillage of water, petroleum products or salt solutions. These surfaces shall receive two coats at a minimum of 3 mils per coat to a total of 6 mils dry. A paint touch-up kit shall be provided with the station for coating damaged areas.

A ¾" tapping port with a manual ball valve will be installed into the piping assembly to allow for air release to the wetwell through the base with a ¾" NPT sealed connection.

Plug valves of the non-lubricated type shall be furnished and sized as shown on the plans. The valve body shall be of high-quality cast-iron construction with a welded nickel seat. The valves shall be furnished with permanently lubricated, corrosion resistant bearing surfaces in the upper and lower journals to withstand full rated bearing loads and to provide long life in sewage service. Valves shall provide a leak tight seal against full rated pressure in both directions. One handle for valve operation will be provided with the station

Ball check valves sized as shown on the plans shall be installed in the discharge piping. The valve shall permit flow in one direction only and close tightly without slamming when the discharge pressure exceeds the inlet pressure. The valve in the fully open position shall permit full flow through the valve equal to the nominal pipe diameter. The valve body shall be of high-quality cast-iron construction capable of vertical installation. Wafer check valves will not be permitted.

Wiring

All wiring shall be minimum 600-volt (UL) type MTW or AWM and have a current carrying capacity of not less than 125% of the full load current.

The conductors shall be in complete conformity with the National Electric Code, state, local and NEMA electrical standards.

To ensure the safety of all personnel working with this equipment, as well as providing a simple means of tracing wires when troubleshooting, all wiring shall be color coded in strict accordance with the wiring diagrams furnished by the equipment supplier.

An isolation plate shall be provided for pump and float cord entry into the wetwell. The plate shall be drilled and tapped to accept cord grips that are rated for this service. The plate will be gasketed and installed with a sealant to insure a gas tight fit.

Schedule 40 PVC service conduits shall be provided and terminated in female NPT connection in the TopVault base as follows:

- (1) 1 ½" Station Main Power
- (1) ¾" Alarm Light/ Horn
- (1) ¾" Spare or Phone

Power Supply and Metering

The incoming service shall be ____ volts, ____ phase, ____ wire, 60 cycle. All metering shall be done ahead of the main disconnect and control panel. The contractor in accordance with local power company requirements shall install the meter.

USEMCO Power Pack Control Panel

The control panel shall be constructed in compliance with Underwriter's Laboratories Industrial Control Panels listing and follow-up service; utilizing UL listed recognized components where applicable. The control panel shall bear a UL 698A serialized label.

The described equipment shall be housed in a NEMA 1 painted steel enclosure. The enclosure shall be approximately 30" high and 10" deep. The enclosure shall be constructed of not less than 14-gauge steel.

All major components and sub-assemblies shall be identified as to function with laminated, engraved Bakelite nameplates or similar approved means.

The control shall operate two ___ HP submersible motors specified elsewhere on a pump down mode and include items as specified hereinafter.

An incoming main power distribution block shall be provided as the main connection point for the control panel.

A thermal magnetic circuit breaker shall be supplied as branch circuit protection for each pump motor. The circuit breaker must have a minimum ampere interrupting capacity of 10,000 symmetrical RMS amps.

The circuit breaker shall be properly sized to protect the control circuit conductors, motor starter and the motor against over current due to short circuit or grounds.

A NEMA rated full voltage non-reversing motor starter with manual reset, ambient compensated, 3 phase thermal overload relay shall be provided for each of the pumps.

A lightning arrestor shall be supplied in the control and connected to each line of the incoming side of the power input terminals. The arrestor shall protect the control against damage due to lightning strikes on the incoming power line.

A solid state, phase sequence/failure and under voltage release relay shall be provided when a three-phase service is supplied, to ensure additional running protection for the pump motors. The relay shall be complete with an LED to indicate proper phase sequence, all phases in operation and voltage within limits. The relay shall also include an adjustable voltage monitor, be UL and CSA certified and be complete with automatic reset feature.

As part of the stations control panel, an electrical distribution center consisting of thermal magnetic circuit breakers with a minimum capacity of 15 amps shall be provided for each branch circuit including the following:

Control
Blower
Heater
Convenience Receptacles
Spare/Dialer

The circuit breakers shall indicate when the circuit is open and shall have means provided for manual switching. All breakers shall be labeled as to function with permanently attached phenolic nameplates

A door mounted ground fault interrupter (GFI) type convenience receptacle rated at 15 amperes shall be supplied for the operating of trouble lights, drill, etc. It shall be protected by a separate 15 ampere trip rated circuit breaker.

A two KVA transformer will be provided if 120 VAC can not be derived from the incoming service.

A heavy-duty, three-position, hand-off-automatic selector switch shall be flush-mounted on the door of the control panel for the operation of each motor magnetic starter. This selector switch shall operate the starter when it is in either the "hand" position or the "automatic" position and the automatic control system is calling for the operation of the equipment in the manner as herein described. In addition, a door heavy-duty green pilot light operated from a respective starter auxiliary contact, shall be provided to indicate a "pump running" condition. The pilot light shall have a replaceable bulb.

USEMCO "SENTRY Lite" Pump Controller

The control system shall utilize standard "off the shelf" equipment. Job specific, "one-of-a-kind" customized software and hardware components will not be accepted. A standard system is defined, as one, which has published literature, is available at time of bid, with fully tested hardware and software, such that no development must be done beyond system configuration.

The constant speed drive equipment shall be programmed to respond to variations in the wetwell in a manner wherein the hydraulic requirement will be accommodated in the pumping program using simple menu-related operator interface routines.

Upon power-up, the Controller shall go through a timing routine, which allows the analog signal and display to stabilize before any control, or alarm outputs are enabled. After the stabilization period, the control circuits of the Controller shall be sequentially enabled on a time-step arrangement.

In addition to the time delay upon power-up, the differential-level control circuits shall each be forced to an off condition upon power up so that a level excursion will need to go past their turn-on elevation for them to operate.

The pump controller operates on a 4-20mA input via a submersible transducer and shall be capable of being configured at the factory or jobsite to perform operating functions.

An integral alternator shall operate the pumps in a First-on/First-off (FOFO) sequence and is configured to sequence the pumps every start. The alternator shall have the ability to lock either pump as the lead pump.

It is the specific intention of this functional requirement that a standard programmable logic controller will be employed with features as herein described and be a fully integrated assembly. That is, the furnishing of similar functions using a proprietary controller with custom software, a multiplicity of setpoints, modules or extensive relay-timer logic to accomplish control sequences, etc., is specifically precluded by this specification and will not be acceptable. All timers and setpoints shall be integral to the programable controller.

Backup Float Control

This feature allows the user to connect two (2) floats to the control panel. These floats will be used to back up the level transducer or controller if either should fail. A high-level float condition will activate this feature, signal an alarm, and start all available pumps. If available, the second pump will start after an adjustable (0-5 minute) time delay. The pumps will continue to pump until the low-level float is tipped. Both floats are required for float backup. The high level float must bet installed higher than the normal transducer high level set point.

Motor Overtemperature Protection

Over temperature protection shall be provided in the control panel to operate in conjunction with the over temperature switch in each pump motor. The control shall provide pump lockout of operation upon occurrence of high temperature.

Pump Seal Failure

Pump Seal Fail protection shall be provided in the control panel to operate in conjunction with the moisture sensor in each pump motor. Alarm indication will be provided on the pump controller.

Weatherproof Alarm Light

A weatherproof high water, alarm light assembly including a high impact resistant lexan red lens and wire guard with mounting bracket shall be included and shipped loose for remote mounting.

Weatherproof Alarm Horn

A weatherproof high water audible alarm horn shall be provided. The horn will be shipped loose for remote mounting and shall operate on 115 VAC with a typical 95 DB output. An alarm silence push button shall be included and mounted on the operator's door.

Telemetry
Dry contacts are provided for the following:

- High Level Alarm – Transducer
- High Level Alarm – Back up Float

A 12" high x 8" wide x 8" deep space is provided for an Alarm Dialer, USEMCO Web-Station or RTU.

******Optional Dialer ******

Alarm Dialer

Upon closure of a contact, the dialer will call a pre-determined telephone number called is busy or the dialer is not acknowledged, the dialer will continuously dial up to eight (8) telephone numbers in succession until the dialer is acknowledged.

Alarm conditions monitored are as follows.
-Low Level Alarm
-Pump 1 and 2 Failure
-High Level Alarm
-Transducer Fail

Features shall include:
- Gelled electrolyte battery with charger
- 120 VAC, 60-hertz input
- Standard RJ-11 modular telephone connection
- Dial up to (8) numbers, up to 32 digits each
- Keypad for local programming and status checks
- Unit can be called from any phone for status
- Programmable security code access

******Optional USEMCO Web-Station ******

USEMCO Web-Station

The USEMCO Web-Station cloud-based monitoring system allows the pump station PLC to be capable of being remotely monitored from any device with a HTML web browser such as a PC, tablet, or smart phone. The customer shall be capable of communicating to the pump station PLC over a cellular 4G network, local internet service provider, or satellite communication system. The pump station PLC shall have secure VPN remote access for remote monitoring, troubleshooting, and project tuning. The pump station PLC monitoring shall be cloud based with local data acquisition capabilities. The data acquisition process shall be built around a tagged database in which each tag is associated with an I/O server. Data acquisition shall be capable with the following protocols: Modbus RTU, Modbus TCP, Uni-Telway, EtherNet/IP, DF1, FINS TCP, FINS Hostlink, ISO TCP, PPI, MPI, Profibus, Mitsubishi FX, Hitachi EH, ASCII.
The remote monitoring equipment shall provide full support for alarm triggering, acknowledgment, status, and traceability. Alarm thresholds (4x) and parameters (activation delay, dead band value) shall have the capability of being set on every tag name. The complete alarm cycle (ALM, RTN-return to Normal, ACKnowledgment, END) can be traced and available for monitoring and analysis. Alarm notification can be performed by email or text messaging.
The remote monitoring equipment shall have an integrated web server for configuration and monitoring purposes. The remote monitoring equipment shall have a highly cost-effective HMI, viewable wherever you are through any standard Web browser interface. The remote monitoring equipment shall be modular in design with "off the shelf" option cards for communications and optional extended I/O.

Standard features include:

- Customer Webpage Interface
- Remote Trouble shooting
- Several Levels of Security
- VPN Tunneling
- Local Wan Connection
- Alarm Text Messaging
- Alarm Email Messaging
- Daily Email Status Reports
- One Year of Cellular Service

Submersible Wetwell Level Sensing Transducer

A submersible level transducer shall sense the liquid level of the wetwell. The transducer shall be a 2-wire type to operate from a supply voltage of 10.5 to 24 VDC instrumentation signal in direct proportion to the measured level excursion over a factory-calibrated range of zero to 11.5 feet of water. It shall be of the head-pressure sensing type, suitable for continuous submergence and operation and shall be installed in accordance with manufacturer's instructions. The bottom diaphragm face (2½" diameter minimum) of the sensor shall be installed 6 inches above the floor at elevation ___.

The transducer shall incorporate a diffused silicon semiconductor transducer element to convert the sensed pressure to a corresponding electrical value. The sensed media shall exert its pressure against the diaphragm, which flexes minutely to vary the proximity between an internal ceramic diaphragm created between the two surfaces. A stable, hybrid, operational amplifier assembly shall be incorporated in the transducer to excite and demodulate the sensing mechanism. The transducer shall incorporate laser trimmed, temperature compensation and high-quality components and construction to provide a

precise, reliable, stable output signal directly proportional to the sensed pressure over a factory-calibrated range.

The pump controller shall connect to the submersible transducer through an intrinsically safe module. The module shall provide an intrinsically safe interface for the sensor located in a hazardous area rated Class 1 Groups C and D. The intrinsic safety barrier shall be UL listed.

Wetwell Level Sensing Float Switches

Provide two back up float(s) for redundant control and alarm. The float(s) shall be non-mercury and have a molded polypropylene body, internal redundant polyurethane foam floatation, potted switch/cable connections and fine stranded AWG #18 cable with heavy-duty synthetic rubber jacket in lengths as required to run unspliced to the control panel.

The contractor shall furnish, install, and wire the float switches as shown on the drawings. The float switches shall be individually suspended in the wetwell with weight kits. The float switch cables shall be suspended from a cable rack mounted to the top of the wetwell.

The pump level controller shall connect to the float switch level sensors through an intrinsically safe module. The module shall provide an intrinsically safe interface for the sensors located in a hazardous area rated Class 1 Groups C and D. The module shall contain an LED indicator providing visible indication of sensor actuation. The intrinsic safety barrier shall be UL listed.

Inspection and Test

Prior to assembly, all station components shall be inspected for quality and tested for proper function and freedom from defects. Upon completion, the station shall be connected to a test tank and an operational test performed under simulated field conditions while a final inspection is conducted. Any deficiencies or irregularities shall be corrected at the factory. Automatic controls shall be adjusted to approximate job requirements.

Initial Operation

After the installation is complete, the manufacturer shall provide the services of a factory trained representative for a maximum period of one day to perform initial start-up of the pump station and to instruct the owner's operating personnel in the operation and maintenance of the equipment. Two (2) copies of O and M manuals will be supplied to the owner prior to initial operation.