

TIGERFLOW SYSTEMS, INC  
VFD JUNGLE CAT BOOSTER STATION  
PREFABRICATED PUMP STATION SPECIFICATION  
JOB NAME:  
DATE:  
REP:

## PART 1 – GENERAL

### 1.01 SCOPE OF WORK

- A. The Contractor shall provide a prefabricated UL/C-UL Listed (as a complete assembly) booster pump station designed to provide ----- GPM. The station shall be complete package, from one supplier, with all necessary appurtenances required to provide an 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 operation and maintenance manual.
- B. Furnish all labor, materials equipment, and services for installation of package booster system per the recommended factory installation procedures.
- C. Furnish and install electrical service and all field connections between electrical service and package pumping station. The electrical installation and all components shall be in accordance with the National Electrical Code (NEC) and in accordance with these specifications.
- D. To provide single source responsibility for the manufacturer, warranty and operation of a prefabricated skid mounted, fully automatic pumping system for turf irrigation.

### 1.02 REFERENCES

- A. American Water Works Associations (AWWA)
- B. American National Standards Institute (ANSI)\
- C. American Standards for Testing Materials (ASTM)
- D. Hydraulic Institute
- E. American Society of Mechanical Engineers (ASME)
- F. Underwriters Laboratories (UL)

### 1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01340: Shop Drawings, Product Data, and Samples
- B. Section 01780: Operation and Maintenance Manuals
- C. Section 02510: Water Distribution Piping
- D. Section 02515: Valves – Utility Services
- E. Section 09900: Painting
- F. Division 16: Electrical

### 1.04 MANUFACTURER

- A. The pumping skid shall be manufactured by TIGERFLOW Systems, Inc. 4034 Mint Way, Dallas, Texas 75237, 800-783-6756. The pump station shall be the list listed as describe within the following specification.
- B. For consideration for a proposed equal station, the contractor shall furnish data to the architect/engineer at least 10 days prior to date of bid opening:
- A complete specification for the pumping system proposed as an equal .
  - A statement of full conformance to the following specifications signed by an officer of the manufacturer.
  - A general arrangement drawing showing overall dimensions and all piping layout. Drawing should be available upon request in Auto Cad configuration.
  - A Complete submittal information data for all major components (pumps, motors, valves, and electrical control components, and sequence of pumping operation)
  - An electrical schematic showing power wiring and amp requirements
  - Manufacturer electrical control panel UL 508 number certificate
  - The Manufacturer complete package system U.L. certificate
  - A copy of manufacturers certificate of liability insurance with a general liability of 1,000,000 and a excess liability coverage 5,000,000

If in the opinion of the approving engineer/architect, the data submitted shows the pumping system to be equal to the specified system the bidding contractors shall be given a 7 day notice of the approval prior to opening bid date.

- C. The package pump manufacturer shall have a quality assurance in place.
- D. Detail submittals shall included all components required for a packaged pumping system which is listed as a complete package system.
- E. Manufacturer shall have levels of replacement parts for low down time possibilities.
- F. Manufacturers Information: the Contractor shall submit all manufacturing information required by specifications within thirty (30) days of the date of receipt of SUBMITTALS HOLD FOR APPROVAL.
1. Any additional information data, specifically requested by the Engineer, concerning manufacturer's capabilities (especially relating to requirements described herein before), shall be submitted by the Contractor within 14 Calendar Days of receipt of the written request therefore, unless otherwise specified.

#### 1.05 SYSTEM DESCRIPTION

- A. Pumps arranged in parallel and mounted on common structural base sized to meet the system flow requirements. The pumping system shall automatically maintain a constant flow and pressure requirements as described with-in.
- B. The pump station shall be TIGERFLOW or prior approved equal

Model SESBH-15PC-C-S3-VFD-PEC as manufactured by TIGERFLOW Systems, 4034 Mint Way. Dallas, Texas 75237, 800-783-6756. The pump design capacity of ----- GPM against a total head of -----'TDH. Motors shall be constant speed, ---- Hp, ----- Volt 3 Phase 60 Hz. The pump will be cycled based on pressure and flow.

#### 1.06 SUBMITTALS

- A. Detail shop drawings, wiring diagram, pump curves, operating and maintenance manuals and parts list.
- B. Written certifications for UL Listings for the complete pumping system.
- C. Operation and Maintenance Manuals
- D. Provided unloading instructions, acceptance at site procedures and on site storage and protection information.
- E. Provide factory suggested installation instructions and mounting points.
- F. All Shop drawing shall be in 3D Auto Cad, and/or mechanical desktop

#### 1.07 QUALITY ASSURANCE

- A. The pump station shall be the product of a single supplier who shall have sole responsibility for the complete pumping system.
- B. The pump station manufacturer shall have a minimum of ten years experience in building this type of pump station.

#### 1.08 WARRANTY

- A. The manufacturer shall warrant the water pumping system to be free of defects in material and workmanship for a period of one year from date of authorized start-up, not to exceed 18 eighteen months from date of manufacturer invoice of ready to ship. Manufacturer shall support a network of technical service agents who shall be utilized for service work and shall supply the name, address of local qualified service agent.

#### 1.09 START-UP SERVICE

- A. When discharge piping, electrical connections, and electrical inspection have been completed, the pump station manufacturer shall be contacted for start up. A one-week notice shall be given to manufacturer prior to scheduled start up date. During start up , the complete pumping system shall be given a running test of normal start and stop, and fully loaded operating conditions. During this test of the pump shall demonstrate its general ability to operate without undo vibration or overheating, and shall demonstrate its general fitness of service. All defects shall be corrected and adjustments shall be made for proper operating system. After station startup has been completed and accepted, a training session shall be given to the owner or owner's representative familiarizing that person with pumping system operations, maintenance and adjustments. Minimum start up assistance, exclusive of time travel time, shall be one 8-hour day. Provide for minimum of an 8-hour training session, exclusive of travel

time, in addition to the start up assistance. Start up and training assistance shall be by the manufacturers technical service agent.

#### 1.10 IDENTIFICATION-NAMEPLATES

- A. System shall be provided with substantial nameplate, securely fastened in place clearly inscribed with manufacturers name, year of manufacture and serial number.

### PART 2 – PRODUCTS

#### 2.01 PUMP ASSEMBLY

- A. Performance requirements: The pump and drive motor shall be capable of operating satisfactorily under the full range of conditions from shut-off through run-out. Motors shall be **non-overloading** throughout the range of operations.
- B. The pump shall be of the horizontal end suction centrifugal type back-pull designed with flow and head defined in the attached technical specification. The horizontal pump shall be manufactured according to the standards of the Hydraulic Institute and to ANSI specification number. B58.1. The pump casing shall be ASTM 48, Class 30, cast iron capable of hydrostatic test @ 150% of maximum discharge and have a discharge replaceable wear ring. All mating shall have a register fit to ensure alignment.
- C. The impeller shall be enclosed, single piece bronze casting Completely machined on all outside surfaces and dynamically balanced at the time of pump assembly. The Impeller shall be keyed to the shaft and securely fastened with a vibration resistant lock screw and washer.
- D. The mechanical seal shall be a Type 1 design with carbon vs ceramic faces and buna elastomers. Mechanical seal shall be install on a bronze or stainless shaft sleeve.
- E. The pump and motor shall connected by an ASTM 48, Class 30, cast iron bracket incorporating a full isolating shield with dual slinger rings to prevent moisture from entering the front motor bearing.

#### 2.02 MOTORS:

- A. All motors shall be built in accordance in the latest NEMA, IEEE, ANDI and AFBMA standards where applicable. The motor shall have Class F insulation with a temperature rise as specified by NEMA standards and shall be furnished with a 1.15 service factor.
- B. Leads shall be terminated in a connection box and shall be clearly identified.

- C. The motors shall be equipped with adequate bearings that are locally available and have a minimum B-10 at the design condition of 40,000 hours.
- D. The motor shall be designed for across the line starting. Motors shall be **ODP**, 3 phase, 60 cycle, 230/460 volt. Motors shall be non-overloading through-out the complete pump curve.

2.03 STATION BASE:

- A. The pump station 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 transportations to site, off loading, installation, and operation. Main structural members shall be constructed from heavy weight channel, tubing, or I-beam steel. Provisions shall be made in the station base for off-loading and handling the station at the site of installation. The steel base shall create a flooring substructure when installation is per factory recommendations will aide in installation of pump station as per recommended Hydraulic Institute standards. All bolts for the package assembly shall be plated to retard corrosion.

2.04 PIPING:

- A. Piping shall be A312 for Seamless and Welded Austenitic Stainless Steel schedule 40 pipe or heavier as required to maintain a 3 to 1 pressure safety factor (including 1/16" corrosion allowance). All piping shall be hydrostatically tested to 150% of maximum shutoff pressure.. Piping between pumping system suction and discharge connections shall be roll grooved for maximum flexibility, minimize vibration and the stress of transportation and operation.
- B. Discharge Z-pipe:  
Piping shall conform to ASTM specifications A312 for welded and seamless pipe. The piping shall be for connection to the main line piping. The piping shall be of Schedule 40 steel, exterior painted to match pump system and sized for depth and termination based on main line piping requirements.

2.05 ENCLOSURE:

- A. The pumping system enclosure shall be weather resistant nature manufactured entirely of marine grade aluminum alloy 5052-H32 unpainted, with a thickness of one eighth inch. The main housing shall be solid sheet construction punched on the sides louvers for ventilation. The Enclosure shall have a lockable hinged door for easy compartment access.
- B. A ventilation fan shall be mounted in the enclosure. The fan shall have rodent protective guards. The fan shall be size for proper ventilation required to keep motor now more than 10 degrees above ambient temp.

2.06 SYSTEM BY-PASS:

- A. Provide a full size system by-pass with a single isolation valve that shall be installed between system and suction connection point.

2.07 VALVES:

- A. Pump isolation valves shall be lug style butterfly valves for 2” and above.. Valves body shall be constructed of ductile iron. Valves shall be rated for rated for 150 PSI operating pressure. Valve shall have aluminum bronze disc, stainless steel shaft. Station isolation valves shall be provided by others.
  - B. Provide check valve wafer style center guided, bronze disc on each pump. Valve shall be rated for system design pressure. The check valves shall be manufacture by Val-Matic or approved equal.
  - C. station will have a “Y” strainer on the incoming line along with an epoxy Coated check valve as specified above.
  - D. Provide a Non-Electric temp probe and purge assemblies for each individual pump.
- 2.08 GAUGES:
- A. Pressure gauges shall supplied for Suction and Discharge system pressures. All gauges shall be glycerin filled stainless steel bottom mounted. Accuracy shall be within 1.5%. Gauges shall be 2-1/2” minimum with pressure ranges at least 30% higher than highest-pressure attainable from pumps at shutoff head conditions. Pressure gauges shall be as manufactured by WIKA or approved equal.
- 2.09 ELECTRICAL
- A. To provide complete instrumentation and controls to start and stop the pumps automatically. Full alarms and safety features needed to protect the equipment and piping systems shall be included.
  - B. Control Enclosure
    - 1. Controls shall be housed in a NEMA 4 enclosure with integral latches. The control enclosure shall be constructed of 12-gauge steel and the back plate assembly shall be constructed of 12-guage steel. All indicating lights, reset buttons, selector switches and operator interface shall be mounted on enclosure door and shall be NEMA 4 by device manufacturer. All internal components shall be mounted upon and secured to the removable back plate assembly.
  - C. CONTROL POWER:
    - 1. Power for the controls shall be provided by a control power transformer, which shall provide 120 Volt, single-phase power for the pumping system control operation. The control power transformer shall be protected on the primary side by control limiting fuses of adequate size and voltage rating. All control components shall be protected by time delay circuit breakers of adequate size.
  - D. STARTING EQUIPMENT:
    - 1. Motor starting equipment shall be Variable speed drive with PWM and 3% line reactor
  - E. FLOW METER:
    - 1. The Pump station shall have a flow sensor installed, which shall be utilized to display the pump station flow rate, and total flow through the panel mounted operator interface. The flow sensor shall be a six bladed design, which shall provide a low impedance

signal proportional to the flow. Flow sensor accuracy shall be plus/minus 2% of actual flow rate between flow velocities of 1-30ft/sec. A flow meter run shall be a minimum 10 pipe diameters straight run upstream and 5 pipe diameters downstream for proper meter accuracy. Meter run shall be as shown on technical data sheet. Flow sensor shall be as manufacture by Data Industrial.

2. The Pump station shall have a flow switch installed, which shall be utilized to activated the pump station on minimum flow rate, and start de-staging sequence under no flow conditions.

F. CONTROLS AND ENCLOSURE:

1. The pump station manufacturer shall build the complete control panel in accordance with the NEC and be so authorized under UL508A. All equipment and wiring shall be mounted within the enclosure and each device shall be mounted within the enclosure and each device shall be labeled for proper identification. All adjustments shall be performed from the front of the control enclosure. A complete wiring circuit diagram and legend with terminal components and wiring completely identified shall be provided. All disconnects shall be interlock with he front door.

G. PROGRAM LOGIC VARIABLE SPEED CONTROLLER:

1. A programmable logic controller (PLC) shall have a 4 Line Operator 20 character LCD industrial operator interface shall allow data entry and readout. Unit shall have a EPROM base memory with a EEPROM user variable controller. A separate set point controller is not acceptable. All adjustment shall be made thru a 16-button interface keypad. PLC shall have a built in clock calendar. The PLC shall be a **Tiger Eye MARK V**, Series Solid State Variable Speed Controller. This device shall allow the operator to view and modify any register in the PLC. The Unit shall store its messages in non-volatile memory. The operator interface device shall incorporate multi-level password protection for data integrity. The controller shall allow for display and modification of each timer, set point, lockout time, etc. PLC shall display all system functioning points, settings and alarm set points with full access with scroll buttons ad passwords. Control software shall be parameter driven, fully documented, shall user to change any operational parameters easily. Standard control features and equipment, which shall be included are:

Alternation of equal size pumps (24 hr or Sequential)

Alarms and shutdowns:

Low Discharge pressure

High Discharge pressure

Low Suction pressure

Low System Pressure

Phase Loss

### Low Voltage

#### Individual Motor Overload/Phase Loss

(\*\*) All pressure alarms have adjustable time delays and the option of automatic or manual resets

A general alarm horn signal with digital alarm readout in English of first activated alarm. Individual alarm contacts signal for each possible alarm.

**Controller shall have data logging capabilities with access thru the keypad for last 10 alarm activations.**

#### H. INDIVIDUAL MOTOR ALARMS:

1. Individual motor phase failure and low voltage safety circuitry shall retire any pump that experiences low voltage, phase failure or phase unbalance as monitored at the load side of each pump motor contactor. Each pump motor shall have its individual protective devices and time delay to allow for transient low voltage during motor starting providing maximum motor protection. Separate main phase failure and low voltage safety circuit shall also be provided to retire pumping system if it experiences low voltage, phase failure or phase reversal as monitored at load side of main disconnect. Phase monitor shall have a time delay for transient low voltage during motor starting and to provide maximum motor protection.

#### I. PANEL SWITCHES

1. Individual pump run indication (digital readout)
2. Keypad pump-on/off touch buttons
3. Keypad Hand/ Off/Automatic touch buttons
4. Keypad Alarm reset button
5. Local/Telemetry switch for local panel control or telemetry control.

J. PLC Emergency pump individual **by-pass** switches shall be mounted inside panel to allow user to manually operate pumps should PLC fail.

K. Provide Lighting arrestor.

## 2.10 ADJUSTABLE FREQUENCY DRIVES

A. The AFD package as specified herein shall be enclosed in a NEMA I enclosure, completely assembled and tested by the manufacturer in an ISO9001 facility. The AFD shall operate from a line of +30% over nominal, and the undervoltage trip level shall be 35% under the nominal voltage as a minimum.

1. Environmental operating conditions: 0-40°C, 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.

2. Enclosure shall be rated NEMA 12 and shall be UL listed as a plenum rated AFD. AFD's without this rating are not acceptable.
- B. All AFD's shall have the following standard features:
1. All AFD's shall have the same customer interface, including a backlit LCD two line digital display, and keypad, regardless of horsepower rating. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus. The keypad shall be removable, capable of remote mounting, and shall have it's own non-volatile memory. The keypad shall allow for uploading and downloading of parameter settings as an aid for the start-up of multiple AFD's.
  2. The keypad shall include Hand-Off Auto membrane selections. When in "Hand", the AFD will be started and the speed will be controlled from the up/down arrows. When in "Off", the AFD will be stopped. When in "Auto", the AFD will start via an external contact closure and the AFD speed will be controlled via an external speed reference. Manual pilot devices are not acceptable.
  3. The AFD shall be capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to the setpoint without safely tripping or component damage (flying start). The AFD shall also be capable of DC injection braking at start to stop a reverse spinning motor prior to ramp.
  4. The AFD shall be equipped with an automatic extended control power loss ride-through circuit, which will utilize the inertia of the load to keep the drive powered. Typical control power loss ride-through for a fan load shall be 2 seconds minimum.
  10. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.
  11. The AFD shall have an integral **3% impedance line reactors** to reduce the harmonics to the power line and to add protection from AC line transients.
  12. The VFD shall be capable of sensing a loss of load (broken belt/broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.
- D. All AFD's to have the following adjustments:

1. Two (2) programmable critical frequency lockout ranges to prevent AFD from operating the load continuously at an unstable speed.
  2. PID Setpoint controller shall be standard in the drive, allowing a pressure or flow signal to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus.
  3. Two (2) programmable analog inputs shall accept a current or voltage signal.
  4. One (1) programmable analog output.
  5. Two (2) programmable, digital Form-C relay outputs. The relays shall include programmable on and off delay times. Default settings shall be for run and not faulted (fail safe).
  6. Seven (7) programmable preset speeds.
  7. Two independently adjustable accel and decel ramps.
- E. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alphanumeric codes are not acceptable).
- F. Serial Communications
1. The AFD shall have an RS-485 port as standard. The standard protocol shall be Modbus. Optional protocols that must be available are Johnson Controls N2 bus, Siemens Building Technologies FLN, LonWorks, Profibus and Device Net.
  2. Serial communication capabilities shall include, but not be limited to, run-stop control; speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments. The drive shall have the capability allowing the DDC to monitor feedback such as: process variable feedback, output speed/frequency, current (in amps), % torque, power kW, kilowatt hours (resettable), operating hours (resettable), relay outputs, and diagnostic warning and fault information. Remote VFD fault reset shall be possible. A minimum of 15 field parameters shall be capable of being monitored. The DDC system shall be able to monitor if the motor is running in the AFD mode or bypass mode (if bypass is specified) over serial communications.
  3. The AFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. The serial communications interface shall allow for DO (relay) control and AO (analog) control. This control shall be independent of any AFD function. The outputs can be used for modulating chilled water valves via the analog output, actuate a damper EP, etc. In addition, all drive

digital and analog inputs shall be capable of being monitored by the DDC system.

## **PART 3 – EXECUTION**

### 3.01 INSTALLATION

- A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the AFD manufacturer as outline in the installation manual.
- B. Power wiring shall be completed by the electrical contractor. The contractor shall complete all wiring in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.

### 3.02 START-UP

- A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

### 3.03 PRODUCTS SUPPORT

- A. Factory trained application engineering and service personnel that are thoroughly familiar with the AFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.
- B. A computer based training CD or 8-hour professionally generated video (VCR format) shall be provided to the owner at the time of project closeout. The training shall include installation, programming and operation of the AFD, bypass and serial communication.

### 3.04 WARRANTY

- A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty

shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number.

2.10 PAINTING:

- A. Structural steel, attached piping, and supports shall be grit blasted to a near white metal condition. The clean steel surfaces shall immediately thereafter be primed with an industrial grade primer to a thickness of 2-1/2 to 3 mils epoxy primer. The finish coat shall be acrylic enamel to a thickness of no less than 3 mils.

2.11 TESTS:

A. Factory Tests

In addition to tests specified elsewhere in the specification, factory testing shall include the following:

1. Each pump shall be visually inspected to confirm that it is built-in accordance with required horsepower, voltage, phase and hertz.
2. A non-witnessed (or witness at the owners expense) Hydraulic Institute performance test shall be performed. The pump station shall be completely run tested with an **X-Y Test**. During the test recording of the flow, AMP's, and KW's shall be recorded at 5 point on each pump through complete system flow test.