**Specifications for Variable Speed Systems**

**Scope:**

Furnish and install a **SENCILLOTM Model (E) (V) (S) –** UL/cUL Listed Variable Speed factory assembled Domestic Water Booster System as Manufactured by Sencillo Systems, Aston, Pennsylvania. The System shall be completely Skid Mounted, Pre-Piped, Pre-Wired and Programmed.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Item** | **GPM** | **TDH** | **Boost (PSI)** | **HP** | **RPM** | **Enclosure** | **Voltage/Ph** | **Efficiency** |
| P1 |  |  |  |  |  |  |  |  |
| P2 |  |  |  |  |  |  |  |  |
| P3 |  |  |  |  |  |  |  |  |
| P4 |  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| **System Header Size:** |  |

**Pumps:**

*Option A –* System shall include Horizontal Mounted Close coupled End Suction Centrifugal Pumps with ANSI Flanged Connections. Pump features to include Foot Supported Casing, Hydraulically Balanced Impeller. Pump shall be Cast Iron Bronze fitted construction with a replaceable shaft sleeve and mechanical seal. Motor shall be NEMA close coupled type with a JM frame.

*Option* B - System shall include Multi-Stage Vertical Centrifugal Pumps with ANSI Flanged Connections. The Pump Suction/Discharge Chamber, Motor Stool and Pump Shaft Coupling shall be constructed of Cast Iron. The Impellers, Pump Shaft, Diffuser Chambers, Outer Discharge Sleeve and Impeller Seal Rings or Seal Ring Retainers shall be constructed of Stainless Steel. Intermediate and Lower Shaft Bearings shall be Bronze or Tungsten Carbide and Ceramic. Pumps shall be equipped with a Mechanical Seal Assembly with Tungsten Carbide Seal Faces mounted in Stainless Steel Seal Components. The Pump Motor shall be NEMA C Face Design mounted directly to the top of the pump.

*Option C –* System shall include a Submersible Multi-Stage Pump, Stainless Steel Pump Shell Containment Piping and Welding Certified to ASME Section IX.

**Motors:**

Motor shall be manufactured in accordance with NEMA standards. Motors shall be selected so that they do not exceed nameplate HP rating throughout the programmed sequence of pump operation. Motor shall be high or premium efficiency electric driven, designed for inverter duty application, unless otherwise specified.

**Control Panel:**

The Control Panel shall be a UL508A Listed Panel, and shall have all UL listed devices of “Touch Safe” design, which shall eliminate any barehanded shock hazard. All Primary & Secondary Power Devices shall be Shrouded, Modular “Touch Safe” design for safe removal without the use of tools. The Primary Motor Branch Circuits shall have a Thermal Magnetic Circuit Breaker Protection.

*Enclosure –* The Pump Controller and all of its Components shall be housed in a NEMA 1 UL Listed Enclosure.

Components – Within the enclosure is housed a Main Power Disconnect Switch with External Handle, Circuit Breaker per pump, DC Power Supply, Vents, Piezoelectric Horn and Cables. A single point electrical connection with all Power, both Primary & Secondary to be De-Activated when opening the Main Disconnect Switch. A variable speed drive shall be provided for each pump and a PLC shall be supplied, for main control of the system.

*PLC –* Provide, mount and wire on the skid a Programmable Logic Controller (PLC), to interface the signal from the Pressure Transducer to the VFD’s and provide a stabilized response to speed up or slow down the Lead pump or add the Lag Pump(s) to meet the system requirements. The logic for all automatic operation shall be loaded into the PLC.

*Sensoguard Feature* – the system shall include the following backup features:

1. *Control Components Health Monitoring* - The PLC shall be equipped with a function which monitors the general health of the system by checking status on the major components - drives, transducer, suction pressure switch, HOA position check, PLC status, and control power status and communications connections. The feature shows scan activity on a reporting screen on the HMI and provides an alarm if any irregularities are found.
2. *The Smart Power Recovery™* - The PLC shall be equipped with a function that controls the pumping system immediately after a power failure. The feature automatically manages the pump startup sequence in a measured way, to bring pumps back on-line in a metered sequence, and bring system pressure back up to set point, while preventing pressure spikes, power over-amping, vibration, and pump damage.
3. *PLC Failure Backup Operations* – upon a failure of the main PLC, the lead drive shall lock in as primary drive and continue operations in automatic variable speed mode, using the PID loop controller resident in the drive.
4. *Transducer Failure Backup Operations* - In the event of a Pressure Transducer Failure, the system shall be pre-programmed to turn off all Lag Pumps and run the Lead Pump in “Hand” Mode at a pre-set Hertz Setting, as set at startup.

*Touch Screen –* The Touch Screen / HMI (Human Machine Interface) is mounted on the panel front, and includes a 7” Widescreen TFT, 16 million color, LED backlit 800x480 pixel resolution Color Display with 12 MB User Memory, Status Control diagnostics viewer, Serial/MPI/PROFIBUS DP/PROFINET(Ethernet) Interfaces.

*User Adjustment Interface*

All user adjustments shall be made through the Password Protected Adjustment Screen without opening the Panel Door, or changing adjustment setting on individual drives. The Touch Screen to include the following features:

1. Home Screen (Water Flow Animation / Hertz / System Set-point & Actual Pressure / System Condition Status)
2. Pump Status (Hertz / Amp Draw / Elapsed Timer Meter (Hours))
3. Customer Adjustments
4. Screen Settings (Calibrate / Clean Screen / Set Time-Date)
5. Project Information
6. Spare Parts
7. Sencillo Self-Diagnostic Check System (System Health)
8. Alarm Log
9. Trend Graph over time (Set Point vs. Actual)
10. Programming (Pressure Settings, VFD Settings, Calibration, PID Loop, Lead-Lag,

 Pressure Bands, Time Delays, Trend)

*Alarms -* All Alarm Settings shall be adjustable through the Touch Screen / HMI (Human Machine Interface) Panel. These settings shall include:

1. High System Pressure Shutdown with Adjustable Time Delay
2. High System Pressure Warning with Adjustable Time Delay
3. Low System Pressure Shutdown with Adjustable Time Delay
4. Low System Pressure Warning with Adjustable Time Delay
5. Pressure Transducer Fail Sensor with Adjustable Backup VFD Speed
6. Drive Fault

*Variable Speed Drives:* Variable Speed Drives shall be suitable for Variable Torque Applications using any standard NEMA Design B Squirrel Cage Induction Motor. Variable Frequency Drives shall be sized for the maximum possible Amp draw throughout the Programmed Sequence of Pump Operation. Variable Speed Drives shall include – Three Fully Programmable Isolated Digital Inputs, One Analog Input or for use as 4th Digital Input, One Programmable Analog Output, Complete Protection for Motor and Inverter, Digital Microprocessor Control, Flux Current Control (FCC), Compound Braking for Controlled Rapid Braking, Over-voltage/Under-voltage Protection, Inverter Over-Temperature Protection, Short-Circuit Protection, Automatic Restart.

PANEL OPTIONS

*Redundant Pressure Transducer* – A second pressure transducer is mounted and wired in the control panel, with logic that automatically switches to the backup transducer if the signal from the first transducer indicates a failure. Transducer Failure Alarm is provided.

*Battery Backup Package*– Provides 30 minutes of power (24VDC) to keep the control circuit in operation during a power failure. This option facilitates a faster return to service, once a backup power source is on-line.

*Ethernet Readiness Package* – A Cat 5 Ethernet switch is provided in the controller, to allow remote access to the pump system via Ethernet connection.

*Remote Alarms* – Any of the alarms listed above can be wired via a relay to a terminal block, for customer use.

*Autodialer Module* – A package for alarm notification via wire or cell phone text or recorded message.

*Communications Package Options*:

Modbus (TCP)

Serial Port Connections (RS485 or RS232)

BACNET

**Pressure Transducer:**

Provide One (1) Pressure Transducer that provides a 4-20 mA DC Output, compatible with the System Controls. Pressure Transmitter shall have Splash Proof Plug-In Electrical Connector, 304L/316 Stainless Steel Wetted Parts, High Overpressure Capability. The Pressure Transducer shall be installed on the System Discharge Header and factory wired to the Control Panel.

**System Valves:**

Each Pump shall have Suction/Discharge Full Port Isolation Ball Valves with Stainless Steel Ball & Stem. Each Pump Discharge shall have Silent Non-Slam Check Valve with Stainless Steel Ball & Stem, and sized for a Maximum loss of 3 PSI at Design Flow and be suitable for the maximum working pressure of the System.

**Hydro-pneumatic Bladder Tank:**

Provide a Hydro-pneumatic tank per Section VIII, ASME Code, National Board stamped. The tank shall be complete with FDA approved replaceable bladder with bottom connection, and air fill valve. The Hydropneumatic tank shall be adjacent to the skid, shipped loose for field mounting. The discharge header on the system shall include a feed connection (NPT), with isolation valve. Piping from the discharge header connection and tank connection shall be by others. Tank shall be \_\_\_ gallons.

**Fabrication:**

All Headers, Nipples and Welded attachments to the Headers shall be Type 304 Stainless Steel. All welding shall be in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. All welding on Stainless Steel piping shall be performed by welders qualified under that standard.

**Factory Assembly:**

The Pump System shall be factory assembled on a 304 Stainless Steel welded Structural Baseplate including Suction/Discharge Headers, Pumps, Motors, Control Panel, Valves, Piping and Wiring. Branch Piping and Tank Connection (if Applicable), shall be the same material as the suction and discharge headers. Provide Isolation Valves on the Suction and Discharge of each Pump (See System Valves).

Individual Pumps, Motors and Valves may be serviceable with the Pump System in Normal Operation and all components shall be suitable for the Maximum Working Pressure and Temperature in the System.

**Additional Options:**

Flow Meter with Readout and Accumulator

Phase Monitor Alarm

Remote Control Enable

Data Logging

Flow/Pressure Certified Test Reports

**Sequence of Operation:**

The Lead Pump shall run only as necessary to maintain System Pressure and will be controlled automatically by means of a Pressure Transmitter and Programmable Logic Controller (PLC) programmed to prevent short cycling. If the Lead Pump is unable to maintain System Pressure the Lag Pump will be called on and will operate in parallel with the Lead Pump in accordance with the PLC program. When the Lead Pump can handle the system demand, the controls will shut down the Lag Pump. When a Low or No-Flow condition is reached, the controls will shut down the Pump and Alternate.

**Pressure Regulation:**

Pressure Regulation is controlled via the 4-20mA Signal provided by the Pressure Transducer to the Programmable Logic Controller (PLC). . The setting shall be set during startup to provide the building with minimum water pressure, as selected by the client.

**Factory Test:**

The Pump Booster System shall be hydrostatically tested after all appurtenances have been installed to a minimum of 1.5 times the specified System Working Pressure. The Pump System shall undergo a complete electric and hydraulic test at the Factory. All Control Devices including Transmitters and all safety features shall be factory calibrated and tested.

**Start-Up Service:**

A qualified factory trained technician shall be made available on the jobsite for initial Start-Up and Training for Operating Personnel (Pump, Motor, Control Panel, Piping Accessories). A Start-Up report will be provided to the Owner.

**Warranty:**

The Pump Booster System shall be warranted against defects in materials or workmanship under normal use and service for a period of (12) months after date of original operation but not more than (18) months from date of shipment from the Company’s factory when installed and used in accordance with good standard practice. Make available to the Owner factory Authorized Field Service Technicians after the Warranty period.

**Submittals:**

A complete submittal package shall be supplied. The package shall include electronic PDF format of the complete color submittal, including general arrangement drawing, submittal data sheets on all components, pump curve, sequence of operations, P&ID, System Configuration Sheet, and warranty certification. Operation & Maintenance manual shall include the submittal data plus a maintenance and parts manuals for the equipment.

**Quality Assurance:**

All equipment under this specification shall be furnished by a single supplier and shall be built using components that are readily available worldwide. The supplier shall have sole responsibility for the proper functionality of the system and components. The package supplier shall have a quality assurance program in place.

**Qualifications:**

**The entire system shall carry a UL/cUL certification as a LISTED PACKAGED PUMPING SYSTEM**.

The manufacturer shall have a minimum of ten (10) years in experience in the manufacturing and application of this type of pumping equipment, and upon request, shall demonstrate proof of facilities, equipment and skills to deliver the package according to required performance.

The control panel shall be UL508A LISTED Control Panel.

**Basis of Design:**

The basis of Design shall be SENCILLOTM Domestic Water Booster System:

Sencillo Systems.

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