**Specifications for Variable Speed Systems**

Model F Duplex

**Scope:**

Furnish and install a **SENCILLOTM Model F DUPLEX–** UL/cUL LISTED Variable Speed factory assembled Domestic Water Booster System as Manufactured by Sencillo Systems, Warrington, 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 |  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| **System Piping Header Size (in):** |  |

**Pumps:**

System shall include **(horizontal cast iron bronze fitted single stage end suction) (all 304 stainless steel construction)** centrifugal pumps with carbon/NI-resist/BUNA/SS parts, and be close coupled to a close coupled standard motor.

**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.

**Controls:**

The controls shall operate to maintain pressure via variable speed operation. Constant speed control with or without pressure reducing valve design shall not be acceptable. The system shall consist of the following components:

*Variable Frequency Drive* - Each pump shall be equipped with a variable speed drive selected per the voltage and HP for the system. 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.

Each drive shall include – Plug and Play philosophy (connect and use) for standard drive and all accessories and options, USB connector for microcomputer connection for using programming and monitoring software as well as updating inverter firmware, Human-Machine Interface (HMI) with backlit graphic display and soft-keys, CC link inductors compliant with IEC61000-3-12 to provide harmonics protection, Intelligent thermal management for full protection of IGBTs, monitoring of heat sink and internal air temperature, automatic and detachable control of the heat sink fan with speed sensor, normal and heavy duty rating, drive protection with failure and alarm warnings, motor overload protection in compliance with IEC 60947-4-2/UL 508 C, memory card built into standard product to allow user to create functions without external PLC, real time clock.

Drive shall include (3) fully programmable Isolated Digital Inputs, (1) Analog Input or for use as 4th Digital Input, (1) 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, Short-Circuit Protection, Automatic Restart after power loss, resettable faults that are selectable and programmable, 2 second power loss ride-thru, feedback signal loss detection, serial communications loss detection, run permissive input, (3) settable critical frequency rejection bands.

*Communications Modules* – Each drive shall be fit with a communications module, with communications wires between drives, to allow complete system integration and duplex operations.

*Customer Power Connection Terminal – A* NEMA 1 UL Listed Enclosure shall be provided, featuring:

* Single customer power connection.
* Main Power Disconnect Switch with External Handle
* Circuit Breaker for each pump

*Programming -* Pump controls shall be capable of menu-driven setting of Pressure Settings, VFD Settings, Calibration, PID Loop, Lead-Lag, Set Point Pressure and Operating Bands, and Time Delays.

*Pump Control* - Pump Process Set Point, HOA’s, Operator Keypad with intuitive pump language, pump start level and start time, sleep mode, automatic system restart, no flow detection, shutdown and automatic restart. Low and high feedback set points, pre-charge low level control, automatic stabilization.

*Alarms – Last 10 faults are displayed.*  These settings shall include:

1. High System Pressure Shutdown with Adjustable Time Delay/Auto Restart
2. Low System Pressure Alternate/Alarm with Adjustable Time Delay
3. Pressure Transducer Fail Sensor with Auto Switch to Lag/Alarm
4. Drive Fault – Overcurrent, Overvoltage, over-temperature, over-torque, under-torque.

**Pressure Transmitter:**

Provide One (1) Discharge Pressure Transmitter 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 Transmitter shall be installed on the System Discharge Header and factory wired to the Controls.

**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 Diaphragm Tank:**

Provide a Hydro-pneumatic diaphragm tank. Tank shall be built of heavy-gauge steel and be NSF-61 approved for drinking water applications. Unit shall with safety relief valve, set to protect from overpressurization. Tank size 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.

**Factory Assembly:**

The Pump System shall be factory assembled on a carbon 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.

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.

**Sequence of Operation:**

The Lead Pump shall run at a speed necessary to maintain system pressure and will be controlled automatically by the programmed logic, using the input from the pressure transmitters. 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 control logic. When the Lead Pump alone can handle the system demand, the controls will shut down the Lag Pump.

No Flow Shutdown/Auto Restart - When a Low or No-Flow condition is reached, the controls will shut down the Pump (sleep mode). The lead pump will restart if the system pressure is not maintained.

Alternation – Each time the system enters sleep mode, the Lead Pump assignment alternates. The pumps will also alternate according to a time clock function, if the system has not entered sleep mode within the specific time in the alternation logic.

**Pressure Regulation:**

*Redundant Pressure Transducers* - Pressure Regulation shall be controlled via the 4-20mA Signals provided by two independent stainless steel Pressure Transducers. The transducers shall act as a completely redundant device, with one transducer assigned to each drive. If any single transducer fails, the alternate transducer takes over operation and an alarm is shown. The pressure setting shall be set during startup to provide the building with minimum water pressure, as selected by the client.

Systems with a single transducer are not acceptable.

**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, and Piping Accessories).

**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, 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.

**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.

All controls devices shall be UL LISTED.

**Basis of Design:**

The basis of Design shall be SENCILLOTM Model F Duplex, as built by:

Sencillo Systems, Inc.

966 Argyle Road

Warrington PA 18976

Tel: (610) 340-2848 ● Fax: (610) 500-5232

[www.sencillosystems.com](http://www.sencillosystems.com)