PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Provide UL listed and FM approved fire pump complete with pump, driver, controller and accessories in accordance with all requirements of NFPA 20 and FM Global Engineering Data Sheet 3-7.

B. Related Requirements:
   1. Section 21 10 00 Water-Based Fire-Suppression Systems.
   2. Basic Mechanical Requirements.
   3. Basic Materials and Methods.
   4. Electrical Requirements.

PART 2 - PRODUCTS

2.1 FIRE PUMP

A. Horizontal split case, bronze fitted, centrifugal type, with suction and discharge connections in the lower half of the case.

B. The pump shall furnish not less than 150 percent of rated capacity at not less than 65 percent of total head. The shut off head shall not exceed 120 percent of rated head for split case pumps, or more than 140 percent for end suction pumps.

C. Impeller: Cast bronze, enclosed type, dynamically balanced, keyed to shaft and locked in position.

D. Wearing rings: Renewable cast bronze locked in position.

E. Bearings: Grease lubricated type with external mounted grease fittings.

F. Stuffing Boxes: Deep seal type with split packing glands.

G. Shaft: Carbon steel with bronze shaft sleeves.


I. Coupling: Pump shall be directly connected to motor by flexible coupling. Coupling guard shall be provided.

J. Baseplate: Mount and level pump and motor on and bolt to a one piece cast iron bedplate with drip rim.

K. Motor: Open drip proof, ball bearing type. Locked rotor current shall not exceed the values specified in NFPA 20.

L. Provide a complete set of UL listed and FM approved fire pump fittings, suitable for capacity and service conditions, including but not limited to the following:
   1. Casing (circulation) relief valve. Valve shall be set below the shut-off pressure at minimum expected suction pressure. Valve shall allow sufficient circulation to prevent the pump from overheating when operating with no discharge.
   2. Suction reducer and discharge increaser when required.
   3. Automatic air release valve.
   4. Suction and discharge gauges.
   5. 3-way, [Flush] [Free standing], [polished brass] outside pump test hose valve manifold, complete with 2½” rough brass hose gate valves with cap and chain. Cast brass plate lettered “Pump Test Connection.”

M. Tests:
1. The pump shall be hydrostatically tested to twice the working pressure but not less than 250 PSI.

2. The pump unit shall be given a complete factory performance test. Furnish characteristics curves prepared from the test results. Include curves and test results in the Operation and Maintenance Manuals.

3. Provide a field performance test and obtain approval of the installation by the Owner.

N. Project requirement:

[X,XXX] GPM at [XX] PSIG at 100% of standard pump rating.

O. Pump Rating:

1. [X,XXX] GPM at [XX] PSIG.

2. [XX] HP, [XXX]/60/3, 1760 RPM.

P. Pump shall be Peerless [4AEF11] or owner approved equal.

2.2 FIRE PUMP CONTROLLER

A. Provide a fire pump controller as indicated and specified below and comply with the requirements of NFPA 20.

B. Factory assembled, wired and tested motor control equipment, UL listed and FM approved for fire pump purposes. Enclose all equipment in approved drip tight enclosures. Combined manual and automatic type incorporating the following:

1. Disconnect switch: Normal source and emergency source. Externally operable.

2. Circuit breaker: Normal source and emergency source. Symmetrical amp interrupting capacity of 100,000 amps withstand rating.

3. [If there is an emergency source:] Automatic transfer switch: Electrically operated, mechanically held switch including the following:

   a. Form C engine contacts.

   b. 0.5 to 6 second power outage override.

   c. 0-30 minute retransfer timer.

   d. By-pass switch.

   e. Test switch.

   Solid state control panel shall include 0 to 5 minute engine cool down timer and a 0 to 5 minute adjustable transfer to emergency timer. Switch shall be rated 150 amps at [460]/60/3

4. Motor starter: Shall be [primary reactor reduced voltage] [across the line] start. Starter shall be capable of being energized automatically through the pressure switch or manually by means of an externally operable handle.

5. The controller shall have two independent pressure transducers. One shall be for the fire pump controller and one shall be for the suction pressure. The digital pressure switch shall have start and reset settings that can be set to the nearest 1.0 psi. These settings shall be readable through the door.

6. All transducers, pressure switches, and all related pressurized wet parts shall all be mounted externally to the side of the controller. They shall also be mechanically protected from damage. No water pressure connection of any kind shall be provided inside the controller enclosure.

7. Running period timer: Set to keep motor in operation for a minimum period of time when started automatically.

8. Restart time delay: To ensure that 3 seconds elapse between stopping and restarting motor.

10. Pilot Lights:
   a. Power On.
   b. Phase Reversal.
   c. Transfer Switch Normal.
   d. Transfer Switch Emergency.
   e. Emergency Isolating Switch Open.

11. Alarm contacts: Normally open and normally closed remote contacts for the following alarms:
   a. AC Power Failure.
   b. Phase Reversal.
   c. Pump Running.
   d. System Trouble.
   e. Transfer Switch Normal.
   f. Transfer Switch Emergency.
   g. Emergency Isolating Switch Open.

12. Automatic controller: Equipped to start fire pump automatically or manually and wired for manual shutdown.


C. All printed circuit boards, low voltage field connections, and the HMI display shall be located in a separate compartment of the main enclosure with its own access door. All connections to this compartment from other sections of the enclosure shall be routed through sealed fittings. No voltages above 50 volts shall be present in this compartment so site personnel can access these components without the use of high incident energy Personal Protective Equipment (PPE).

D. The fire pump controller shall be comprised of modular chassis with plug-in printed circuit boards, relays, and connectors. These plug-in parts shall be securely latched or locked in place.

E. Control power shall be 24 VDC and shall be derived from 3 independent, electrostatically shielded, control power transformers with redundant isolated rectifier circuits.

F. A Human Machine Interface (HMI) shall be provided to set up the controller and display the status but shall not be relied on for the controller operation. The accuracy of the display shall be 2 percent or 2 digits and shall be traceable to the National Institute of Standards and Technology.

G. The starting and running functions controller shall operate independently of the HMI and shall even operate with the HMI damaged or disconnected.

H. The HMI shall be a 5.7 inch, 64 K color touch screen interface that simultaneous displays all 3 phase voltages and currents, the System Pressure, Start/Reset settings, Manual/Auto Stop setting, and the Weekly/Monthly test setting. It shall also display the starting sequence and pump running status.

I. It shall also capture the pump acceptance test values for the following flow condition when the save button is pressed. At 0%, 25%, 50%, 75%, 100%, 125%, and 150% flow, the HMI shall save the time and date, discharge PSI, suction PSI, L1-L2, L2-L3, L3-L1 line voltages, and L1, L2, L3 line currents. The saved values shall be plotted to show the pump curve.

J. In addition, the HMI shall be capable of enabling or disabling remote or deluge start, auto testing, minimum run timing, setting sequence timing, and acceleration timing.

K. Further, it shall display the following alarms: AC Volts Low, AC Failure, CB Trip, Fail to Start, Load Shed, Lockout, Low Discharge Pressure, On Demand, Motor Overload, Over Pressure,
Phase Reversal, PhaseSmart, 8 Pump House Trouble inputs, Pump Run, Single Phase Running, and Transducer Failure.

L. A password protected Setup Assistant screen is provided to quickly access the pressure start/reset settings, the sequence, accelerate time settings, the remote/deluge start settings, and the weekly/monthly test settings.

M. A Setup summary screen accessible to anyone is available to view all the controller settings.

N. A Remote alarm contact testing screen shall be provided to operate each remote alarm contact individually to facilitate remote alarm testing.

O. The Alarm Silence shall be provided with a 24 hour auto re-sounding function.

P. The internal Data Recorder shall download directly through an external USB waterproof adapter to a USB drive. No codes, settings, or menu operations shall be required. Once the USB is inserted, the data recorder shall recognize the USB drive and indicate “USB Active”. The file shall then be automatically transferred and indicate “USB OK”. The USB drive can then be removed.

Q. The Data Recorder shall record the system pressure every hour or every time the pressure changes by 5 psi. It shall also record all 3 phase voltages and currents on every alarm event and every 5% change from the previous reading. In addition, all active alarms and the starting sequence shall be recorded.

R. A test valve solenoid shall be provided on the outside of the enclosure to facilitate local pressure drop testing or auto testing. It shall include a y-strainer to protect the valve from debris.

S. Anytime the test valve is operated, either through the local pressure drop test button or through the auto testing function, the transducer shall be tested. If the pressure reads greater than 10 psi while the valve is open, a Transducer/DVS failure alarm shall activate. If the transducer is disconnected, the pump shall start.

T. Phase Smart logic shall be provided to assure that the controller will not start the fire pump under single phase conditions when the voltage on any phase is lower than 65% of the rated motor voltage.

U. A control system shall be provided to assure that the controller will not start the fire pump motor under single phase conditions when the voltage on any phase is lower than 65% of the rated motor voltage. However, if the motor is already running when a phase loss occurs, the controller shall keep the motor running.

V. The Power Available signal shall indicate when the controller line voltage is less than 85% of the controller rated voltage on any or all phases.

W. An audible alarm shall be provided to supervise the Emergency Isolating switch in the open position.

X. A mechanical interlock shall be provided between the normal and emergency isolating switches to prevent opening of the normal source until after the emergency source is opened.

Y. The manufacturer’s published warranty certificate for the entire controller shall be submitted to show that it covers parts and labor for a period of 2 years from startup date and parts for a period of 5 years. In addition, a guarantee shall be provided to cover parts damaged by transient voltage surges, including lightning, up to a maximum of $5,000 for a period of 5 years.

Z. An Underwriters Laboratories certificate of compliance verifying electromagnetic compatibility (EMC) with other equipment and immunity from other equipment shall be submitted.

AA. Controller shall be provided in a dust-tight NEMA 12 enclosure with drip-hood, NEMA 4 operators. Enclosure shall be painted with red baked enamel paint.

BB. Line Terminal connections shall be sized to accommodate wire sizes shown on Electrical Drawings.

CC. Manufacturers:
1. The controller shall be Master Control Systems EC Series or owner approved equal.

2.3 JOCKEY PUMP

A. Pump:
   1. Peripheral turbine or centrifugal type pump.
   2. Cast iron body with bronze self-centering enclosure impeller keyed to shaft.

B. Shaft:
   1. 416 stainless steel with mechanical seal and water slinger to protect bearing.

C. Motor:
   1. Open, drip proof type.

D. Provide pump fittings, suitable for capacity and service conditions, including but not limited to the following:
   1. Isolation valves on both sides of pump.
   2. Suction and discharge gauges.
   3. Pressure relief valve.
   4. Coupling.


2.4 VFD JOCKEY PUMP CONTROLLER

A. Provide jockey pump controller as indicated and specified below and complying with the requirements of NFPA-20.

B. The controller shall consist of a motor disconnect switch, VFD, pressure transducer, and a MAN, OFF, AUTO selector switch. The Manual mode shall command the VFD to run at the set pressure.

C. The jockey pump controller shall be built strictly in accordance with UL-508A and shall be listed by Underwriters Laboratories Inc.

D. The controller shall be rated for use in an ambient temperature ranging from +4.5 to 50 degrees Celsius.

E. The manufacturer of the VFD shall be the same as that used in the variable speed fire pump controller for the installation.

F. The variable frequency drive shall provide a through the door display to adjust the system pressure setting and the proportional, integral, differential loop to within 1% of the pressure set point. Further, it shall be able to accelerate an already spinning motor and shall allow deceleration of the motor without causing a motor over-voltage shutdown.

G. The pressure transducer provided to sense the system pressure for the VFD shall be the same as the pressure transducer used in the fire pump controller.

H. The pressure transducer shall be plumbed to the outside of the enclosure using a 1/2 inch FNPT brass bulkhead fitting.

I. The controller shall be provided in a drip-tight, vented, NEMA2 enclosure with a drip hood.

J. Manufacturers:
   1. Master Control Systems or owner approved equal.

PART 3 - EXECUTION

3.1 FIRE PUMP

A. Check and certify final alignment after installation and prior to operation.

B. Pipe all drains from baseplate, reliefs, etc., to floor drain.
C. Provide all suction and discharge isolation valves and check valves required for the system including pump bypass piping to utilize street pressure.

3.2 FIRE PUMP CONTROLLER
A. Provide for relief of pressure to the pressure actuated switch, to test the operation of the controller and pump.
B. Connect pressure sensing line between pump discharge check valve and discharge control valve.
C. Multiple pumps shall each have separate sensing line connected to each controller.

3.3 JOCKEY PUMP
A. Level and align pump and motor after installation.
B. Pipe all drains and relief valves to floor drain.

3.4 JOCKEY PUMP CONTROLLER
A. Set controller to start jockey pump at 5 psi higher than fire pump start point.
B. Connect pressure sensing line between pump discharge check valve and discharge control valve.

3.5 PUMP TESTING
A. Listed fire pump(s) shall meet the test requirements of NFPA-20 and Purdue University. Prior to the final acceptance of the fire pump installation, a complete operational check shall be made under simulated emergency conditions.

3.6 SUCTION PRESSURE REGULATING VALVE
A. Provide a Suction Pressure Regulating Valve for the fire pump as described in the Job Scope specified elsewhere. The valve is to be installed in the discharge line of the fire pump upstream of the backflow device. The device shall be FM approved for its intended use and installed per FM requirements. Pilot control lines to be 1/2 brass. Suction Pressure Regulating Valve to be a Watts figure 116-1FM or approved equal.

END OF SECTION