

1.01 FIRE PUMP VARIABLE SPEED DRIVE CONTROLLER AND TRANSFER SWITCH

- A. Furnish and install a complete UL Listed Variable Speed Type Electric Fire Pump Controller and Automatic Transfer Switch.
- B. The components shall be listed by Underwriters Laboratories Inc. and shall be fully approved by the associated factory mutual fire insurance companies, where applicable.
- C. The components shall meet all requirements of the NFPA 20, Standard for Installation of Stationary Pumps for Fire Protection.
- D. Fire Pump Controller:
 - 1. The main fire pump controller shall be a factory assembled, wired and tested unit and shall conform to all the requirements of the latest edition of NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection and NFPA 70, National Electrical Code.
 - 2. The controller components shall be housed in a NEMA Type 2 (IEC IP11) drip-proof, floor mounted enclosure. The Mark II FTA 3100 provides a variable frequency drive (VFD) in a PID process control loop to control the speed of a centrifugal pump for the purpose of limiting the system pressure in a sprinkler system used for fire protection.
 - 3. The controller shall control a fire pump motor having XXX horsepower, XXX voltage, 3 phase and 60hz frequency.
 - 4. The controller shall be listed by Underwriters Laboratories, Inc., in accordance with UL218, Standard for Fire Pump Controllers.
 - 5. Withstand Rating (Short Circuit Current Rating)
 - a. All controller components shall be front mounted, wired and front accessible for maintenance. The minimum withstand rating of the controllers shall not be less than 100,000 Amps RMS Symmetrical at 200-600 Volts.
 - b. The controller shall be equipped with the appropriate number of contacts in order to provide the connection points to the main fire alarm panel to comply with NFPA 20
 - 6. Isolation Switch and Circuit Breaker
 - a. The controller shall include a motor rated combination isolating disconnect switch/circuit breaker, mechanically interlocked and operated with a single, externally mounted handle. When moving the handle from OFF to ON, the interlocking mechanism shall sequence the isolating disconnect switch ON first, and then the circuit breaker. When the handle is moved from ON to OFF, the interlocking mechanism shall sequence the circuit breaker OFF first, and then the isolating disconnect switch.

7. Operator Interface

- a. The fire pump controller shall feature an operator interface with user keypad. The interface shall monitor and display motor operating conditions, including all alarms, events, and pressure conditions. All alarms, events, and pressure conditions shall be displayed with a time and date stamp. The display shall be a 2-line, 20-character, vacuum fluorescent, dot matrix type designed to allow easy viewing from all angles and in all light conditions. The display and interface shall be fully accessible without opening the controller door. A minimum of 3 password levels shall be provided. The display shall be capable of being programmed for any language.

8. Ammeter/Voltmeter

- a. The fire pump controller operator interface shall be capable of displaying true RMS digital motor voltage and current measurements for all three phases simultaneously. Displays requiring push-button and selector switches to toggle between phases or current and voltage shall not be accepted.
- b. Voltage and current shall be measured by True RMS technology to provide the most accurate measurement for all sine waves, including non-sinusoidal waveforms. Average responding meters will not be accepted.
- c. Memory - The controller shall record all operational and alarm events to system memory. All events shall be time and date stamped and includes an index number. The system memory shall have the capability of storing 3000 events and allow the user access to the event log via the user interface. The user shall have the ability to scroll through the stored messages in groups of 1, 10, or 100.
- d. The Event Log in the Fire Pump controller shall log all Jockey Pump starts and stops in memory for customer use in determining water loss in the fire protection system due to leaks. The installing electrician shall be responsible for wiring two control wires from the Firetrol FTA500 jockey pump control panel to the main fire pump controller as indicated on the drawings.
- e. USB Host Controller – The built-in USB Host Controller and Port allows events, alarms pressures and other historical data to be written to a flash memory disk via the USB port. Depending on the size of the flash memory, the amount of history stored could easily cover the lifetime of the controller. Software updates can be installed by simply plugging in a Flash Memory Disk with the updated software program. No laptop computers or external devices are required.
- f. Communications - The controller shall feature two independent communications ports to allow connectivity to computers, modems, or building management systems. The controller shall be network ready with Mod Bus protocol over RS485 or Ethernet.

9. Solid State Pressure Transducers

- a. The controller shall be supplied with two solid state pressure transducers with a range of 0-400 psi \pm 1 psi. One transducer shall be an input to the mark II and for display of the system pressure and the other transducer shall be a pressure input to the drive for speed control.
- b. Start, Stop and System Pressure shall be digitally displayed and adjustable through the user interface. The pressure transducers shall be mounted inside the controller to prevent accidental damage. The pressure transducers shall be directly pipe mounted to a bulkhead pipe coupling without any other supporting members. Field connections shall be made externally at the controller couplings to prevent distortion of the pressure sensing elements.

10. VFD Modes of Operation

- a. The controller shall operate a variable frequency drive (VFD) in a PID process control loop to control the speed of a centrifugal pump for the purpose of limiting the system pressure in a sprinkler system used for fire protection. The PID closed-loop controller, resident in the Control Techniques VFD, receives its set point from the Mark II and its feedback from a pressure transducer measuring the system pressure. The output of the PID shall be connected to the speed input of the drive which controls the speed of the AC induction motor driving the pump to maintain the system pressure at the set point
- b. The fire pump controller shall be equipped with a Bypass of the VFD should the VFD become inoperable. The bypass path shall constitute all of the characteristics of a non-variable speed, fire pump controller as provided in a fully rated, full service, FTA1930 solid state digital reduced voltage soft start, soft stop controller upon failure of the failure of the VFD, the Mark II shall bypass and isolate the VFD and operate the pump at rated speed.
- c. The operator interface as the overall fire pump control device is to respond automatically to a low pressure condition with a call to start of the VFD. The Mark II shall monitor and control the operation of VFD via 1) the RS485 serial communications link to the drive and 2) the discrete digital I/O lines to the control terminals of the drive. The VFD shall be entirely configured by the Mark II through the serial communications link as well.
- d. Upon detection of a failure in the drive, it shall bypass and isolate the VFD through the line and load isolation contactors, and run the pump across-the-line at rated speed after first soft starting. The operator may choose to manually operate the drive in BYPASS or VFD. Operation in Bypass mode produces both an audible local alarm and a remote alarm for annunciation of an abnormal condition in the controller.
- e. Set pressure is maintained until the min run time of 10 minutes expires whereupon the controller temporarily lowers the set pressure in order to ramp the drive down sufficiently in speed to perform a sincerity check on system pressure for a period of 5-10 seconds. If system pressure remains above the start pressure during the sincerity check, then system

pressure is stable, indicating there is no longer a demand for flow. Since the low pressure condition no longer exists, the Mark II soft stops the drive.

11. VFD Mode, Manual Operation

- a. The pump may be operated manually via the local start and stop pushbuttons. If the VFD is Ready, the controller will soft start the drive which will ramp the pump up to the speed required to maintain set pressure under PID control upon the operation of the start pushbutton.
- b. Set pressure is maintained until the operator presses stop, whereupon the controller temporarily lowers the set pressure in order to ramp the drive down sufficiently in speed to perform a sincerity check on system pressure for a period of 5-10 seconds. If system pressure remains above the start pressure during this sincerity check, then system pressure is stable, indicating there is no longer a demand for flow, and the Mark II proceeds to soft stop the drive.
- c. If system pressure falls below the start pressure during the sincerity check, a low pressure condition has developed which the Mark II recognizes as an automatic call to start. The Mark II responds to the call to start by resetting the PID reference to set pressure which ramps the pump back up set pressure. The Mark II will continue operating the controller in automatic until system pressure stabilizes indicating there is no longer a demand for flow.

12. VFD Mode, Emergency Run

- a. If an attempt to engage the emergency run bar is made in VFD mode, the Mark II shall drop the drive out of the circuit and go to bypass using the hard stop drive procedure.
- b. An over pressure event will be captured and displayed as an alarm message on the Mark II if system pressure (not PID feedback pressure) is equal to or greater than 115% of Set pressure. A time delay used in the Over Pressure alarm logic shall be applied to avoid nuisance alarms.

13. VFD SMARTCARD Operation

- a. The drive shall have a smart card memory device for saving set up parameters downloaded into the drive from the Mark II. This can serve as a valuable backup for those critical parameters entered into the Mark II by the operator to tune the drive such as acceleration, deceleration, etc. If the Mark II failed, its replacement could obtain these important parameters from the smart card if during system initialization, it detects that these parameters are different from the defaults and that these parameters are valid, i.e. that they lie within established boundaries.
- b. A weekly test timer shall be provided as standard. The controller shall have the ability to program the time, date, and frequency of the weekly test. In addition, the controller shall have the capability to display a preventative maintenance message for a service inspection. The

message text and frequency of occurrence shall be programmable through the user interface.

14. Power Transfer Switch for Generator Set Emergency Power Source

- a. The fire pump listed power transfer switch shall be an ASCO 7000 series switch with Group 5 control panel in a NEMA Type 2 (IEC IP11) drip-proof enclosure attached directly to or in close proximity to the fire pump controller. The fire pump controller/power transfer switch shall be factory assembled, wired and tested as a unit prior to shipment.
- b. The power transfer switch shall include a motor rated disconnect/isolating switch capable of interrupting the motor locked rotor current. The disconnect/isolating switch shall be mechanically interlocked so that the enclosure door cannot be opened with the handle in the ON position except by a hidden tool operated defeater mechanism. The disconnect/isolating switch shall be capable of being padlocked in the OFF position with up to three padlocks for installation and maintenance safety, and shall also be capable of being locked in the ON position. The enclosure door shall have a locking type handle and three-point cam and roller type vault hardware. A disconnect and circuit breaker combination shall be provided on the normal utility side with overcurrent protection as required by NFPA20. The transfer switch shall be service entrance rated and require no disconnecting means between the utility transformer and the transfer switch connection.
- c. The automatic transfer switch shall consist of an inherently double throw power transfer switch mechanism and a microprocessor control panel to provide automatic operation. The transfer switch and control panel shall be of the same manufacturer. The transfer switch control panel shall have a 4 line 20 character LCD display and keypad for viewing all available data and setting desired operational parameters. Voltage and frequency on both the normal and emergency sources shall be continuously monitored. Source status screens shall be provided for both normal and emergency to provide digital readout of voltage frequency and phase rotation on all 3 phases.
- d. An auxiliary contact shall be provided on the transfer switch to prevent starting of the emergency generator set when the transfer switch or the main fire pump controller are being serviced.
- e. The transfer switch circuitry shall be capable of sensing both the normal power source and the emergency power source. The normal power source pickup shall be set at 95 nominal voltage. The emergency power source shall be set to pick up at 90 nominal voltage and 95 nominal frequency all voltage sensing, frequency sensing, and time delays shall be field adjustable to accommodate individual installation requirements. The transfer signal shall be delayed for one second, delaying the transfer and engine start signals so as to compensate for momentary, normal power outages. An automatic delay of three seconds shall be provided upon transfer to or from the emergency power source to allow the motor to slow sufficiently, preventing line disturbances that could trip either the generator set or fire pump circuit breakers.

- f. The transfer switch shall have transfer switch normal, transfer switch emergency and emergency isolating switch off LED's, test and transfer bypass switches, audible alarm device and silence alarm pushbutton mounted on the flange of the enclosure. The power transfer switch shall be furnished with both normally open and normally closed auxiliary contacts for an engine start signal when normal power failure occurs. Auxiliary contacts shall also be provided and wired to terminals to indicate the transfer switch position. The transfer switch shall be electrically operated and mechanically held, and shall be capable of being operated by a manual transfer mechanism located on the switch.
- g. Designs utilizing components of molded case circuit breakers, contactors or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

- 15. The controller with transfer switch shall be manufactured by ASCO Power Technologies, Firetrol Products.
- 16. The power transfer switch shall be a Firetrol FTA900/903 for normal utility power and engine generator set emergency power.

E. Start Up:

- 1. Controller manufacturer shall have an authorized sales and service agent in the area with a minimum of 10 years experience with their product. 24 hour 7 day service access must be available, as well as availability of spare parts.
- 2. The controller manufacturer, prior to shipment, shall test the jockey pump controller as a completed assembly. This test shall include, but not be restricted to, each function the controller may be required to perform including manual start-stop, automatic start-stop and minimum run timing.
- 3. The Controller manufacturer shall provide the services and local representation of a factory trained representative to the initial start up and to the final acceptance tests.
- 4. Coordination of final acceptance test with underwriting authorities shall be made by the installing contractor.

F. Warranty:

- 1. The manufacturer shall warranty all components against defects in workmanship and material for a period of one (1) year from date of start-up not to exceed 18 months from date of shipment.