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*. The controller shall be listed by Underwriters Laboratories, Inc., in accordance with UL218, *Standard for Fire Pump Controllers* and approved by Factory Mutual.

The controller components shall be housed in a NEMA Type 12 (IEC IP54) drip-proof, floor mounted enclosure. The Mark IIxg 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. The controller shall control a fire pump motor having the horsepower, voltage, phase and frequency rating shown on the plans and drawings. The controller shall be equipped with both automatic and manual bypass to start and run the motor should a problem arise with the VFD. The controller shall be provided with the following configuration:

- ☐ FTA3100 - VFD with Across-The-Line Bypass
- ☐ FTA3110 - VFD with Autotransformer Bypass
- ☐ FTA3130 - VFD with Digital Soft Start Bypass

Withstand Rating (Short Circuit Current Rating)

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 150,000 Amps RMS Symmetrical at 200-600 Volts.

Isolation Switch and Circuit Breaker

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.

Operator Interface

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 128x64 Backlit LCD capable of customized graphics. The display and interface shall be NEMA rated for Type 2, 3R, 4, 4X, and 12 protection and shall be fully accessible without opening the controller door. The display and user interface shall utilize multiple levels of password protection for system security. A minimum of 3 password levels shall be provided.

Ammeter/Voltmeter

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.

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.

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.

USB Host Controller

The controller shall have a built-in USB Host Controller. A USB port capable of accepting a USB Flash Memory Disk (aka: flash drive, thumb drive, memory stick, etc..) shall be provided. The controller shall save all operational and alarm events to the flash memory on a daily basis. Each saved event shall be time and date stamped. The total amount of historical data saved shall solely depend on the size of the flash disk utilized. The controller shall have the capability to save settings and values to the flash disk via the user interface.

The fire pump controller software shall be automatically upgraded through the USB port by simply inserting a flash disk with the new software. Fire pump controllers that require laptop computers, hand held equipment or specialized devices for software upgrades shall be prohibited.

Solid State Pressure Transducers

The controller shall be supplied with two solid state pressure transducers with a range of 0-300 psi (0-20.7 bar) ±1 psi. One transducer shall be an input to the Mark IIxg and for display of the system pressure and the other transducer shall be a pressure input to the drive for speed control.

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.

VFD Modes of Operation

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 IIxg 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

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 IIxg 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 IIxg through the serial communications link as well.

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.

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 IIxg soft stops the drive.

VFD Mode, Manual Operation
The pump may be operated manually via the local start and stop push-buttons. 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 push-button.

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 IIxg proceeds to soft stop the drive.

If system pressure falls below the start pressure during the sincerity check, a low pressure condition has developed which the Mark IIxg recognizes as an automatic call to start. The Mark IIxg responds to the call to start by resetting the PID reference to set pressure which ramps the pump back up set pressure. The Mark IIxg will continue operating the controller in automatic until system pressure stabilizes indicating there is no longer a demand for flow.

VFD Mode, Emergency Run
If an attempt to engage the emergency run bar is made in VFD mode, the Mark IIxg shall drop the drive out of the circuit and go to bypass using the hard stop drive procedure.

An over pressure event will be captured and displayed as an alarm message on the Mark IIxg 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.

VFD SMARTCARD Operation
The drive shall have a smart card memory device for saving set up parameters downloaded into the drive from the Mark IIxg. This can serve as a valuable backup for those critical parameters entered into the Mark IIxg by the operator to tune the drive, i.e. Pgain, Igain, acceleration, deceleration, etc. If the Mark IIxg 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.

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.

Power Transfer Switch
The power transfer switch shall be an ASCO 7000 series switch with Group 5 control panel in a NEMA Type 12 (IEC IP54) 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.

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.

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.

The controller with transfer switch shall be manufactured by ASCO Power Technologies, Firetrol Products.

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