

Fire Pump Supervision - Part 2

by Dean K. Wilson, P.E.

Question: As the Authority Having Jurisdiction in my suburban community, I have largely had to deal with relatively small commercial buildings. And, because our municipality has a very strong public water system, I have not had to deal with private fire pumps. Recently, one of the “big box” stores has broken ground for a gigantic distribution center. The architect has delivered the plans for me to review. I notice that this facility will have three fire pumps. Two diesel engine-driven 2,000 gpm pumps take suction from individual 300,000 gallon tanks located on the northeast and southwest corners of the property. The tanks have automatic fill from the public water supply. The third fire pump, an electric motor-driven unit rated at 1,500 gpm, takes suction from a 16-inch connection to a 24-inch public water main. Apparently, the fire alarm system will supervise the fire pumps. I don’t even know where to begin reviewing the fire alarm portion of this installation. Can you help me?

In this second part of the answer to your question, I will certainly continue to try to help you. As promised, I will attempt to guide you in looking at the requirements for monitoring the operational readiness of the two diesel engine-driven fire pumps and their associated water tanks.

Please note that because a diesel engine has a great deal more complexity than an electric motor. The requirements for supervising the diesel engine reflect that increased complexity.

NFPA 20-2010, *Standard for the Installation of Stationary Pumps for Fire Protection*, in Chapter 12, “Engine Drive Controllers,” contains appropriate requirements. First of all, this Chapter states the requirements for the indicators associated with the actual listed fire pump controller. Because the functions of the diesel engine and the fire pump controller that require supervision relate almost directly to the functions annunciated by the controller, you must understand which functions NFPA 20-2010 requires the controller to display. Please note the following requirements:

12.4.1 Indicators on Controller.

12.4.1.1 All visible indicators shall be plainly visible.

12.4.1.2* Visible indication shall be provided to indicate that the controller is in the automatic position. If the visible indicator is a pilot lamp, it shall be accessible for replacement.

A.12.4.1.2 It is recommended that the pilot lamp for signal service have operating voltage less than the rated voltage of the lamp to ensure long operating life. When necessary, a suitable resistor should be used to reduce the voltage for operating the lamp.

12.4.1.3 Separate visible indicators and a common audible fire pump alarm capable of being heard while the engine is running and operable in all positions of the main switch except the off position shall be provided to immediately indicate the following conditions:

- (1) Critically low oil pressure in the lubrication system. The controller shall provide means for testing the position of the pressure switch contacts without causing fire pump alarms.
- (2) High engine jacket coolant temperature.
- (3) Failure of engine to start automatically.
- (4) Shutdown from overspeed.

12.4.1.4 Separate visible indicators and a common audible signal capable of being heard while the engine is running and operable in all positions of the main switch except the off position shall be provided to immediately indicate the following conditions:

- (1) Battery failure or missing battery. Each controller shall be provided with a separate visible indicator for each battery.
- (2) Battery charger failure. Each controller shall be provided with a separate visible indicator for battery charger failure and shall not require the audible signal for battery charger failure.

- (3) Low air or hydraulic pressure. Where air or hydraulic starting is provided (see 11.2.7 and 11.2.7.4), each pressure tank shall provide to the controller separate visible indicators to indicate low pressure.
- (4) System overpressure, for engines equipped with variable speed pressure limiting controls, to actuate at 115 percent of set pressure.
- (5) ECM selector switch in alternate ECM position (for engines with ECM control only).
- (6) Fuel injection malfunction (for engines with ECM only).
- (7) Low fuel level. Signal at two-thirds tank capacity.
- (8) Low air pressure (air-starting engine controllers only). The air supply container shall be provided with a separate visible indicator to indicate low air pressure.
- (9) Low engine temperature.

12.4.1.5 No audible signal silencing switch or valve, other than the controller main switch, shall be permitted for the conditions reflected in 12.4.1.3 and 12.4.1.4.

12.4.1.5.1 A separate signal silencing switch shall be used for the conditions of 12.4.1.4(5), 12.4.1.4(7), and 12.4.1.4(8).

12.4.1.5.2* The controller shall automatically return to the nonsilenced state when the alarm(s) have cleared (returned to normal). This switch shall be clearly marked as to its function.

A.12.4.1.5.2 This automatic reset function can be accomplished by the use of a silence switch of the automatic reset type or of the self supervising type.

12.4.1.5.3 Where audible signals for the additional conditions listed in A.4.24 are incorporated with the engine fire pump alarms specified in 12.4.1.3, a silencing switch or valve for the additional A.4.24 audible signals shall be provided at the controller.

12.4.1.5.4 The circuit shall be arranged so that the audible signal will be actuated if the silencing switch or valve is in the silent position when the supervised conditions are normal.

As you can see, NFPA 20-2010 requires some very significant annunciation on the front panel of the fire pump controller of critical functions related to the diesel engine and the controller, itself. In addition to these requirements for the listed fire pump controller, NFPA 20-2010 also states requirements for contacts that the fire pump controller must provide so that an installer may connect appropriate supervisory initiating device circuits to the controller. These requirements include the following:

12.4.2 Signal Devices Remote from Controller.

12.4.2.1 Where the pump room is not constantly attended, audible or visible signals powered by a source other than the engine starting batteries and not exceeding 125 V shall be provided at a point of constant attendance.

12.4.2.2 Remote Indication. Controllers shall be equipped to operate circuits for remote indication of the conditions covered in 12.4.1.3, 12.4.1.4, and 12.4.2.3.

12.4.2.3 The remote panel shall indicate the following:

- (1) The engine is running (separate signal).
- (2) The controller main switch has been turned to the off or manual position (separate signal).
- (3)* There is trouble on the controller or engine (separate or common signals). (See 12.4.1.4 and 12.4.1.5.)

A.12.4.2.3(3) The following signals should be monitored remotely from the controller:

- (1) A common signal can be used for the following trouble indications: the items in 12.4.1.4(1) through 12.4.1.4(7) and loss of output of battery charger on the load side of the dc overcurrent protective device.
- (2) If there is no other way to supervise loss of power, the controller can be equipped with a power failure circuit, which should be time delayed to start the engine upon loss of current output of the battery charger.
- (3) The arrangement specified in A.12.4.2.3(3) (2) is only permitted where approved by the authority having jurisdiction in accordance with Section 1.5 and allows, upon loss of the ac power supply, the batteries to maintain their charge, activates ventilation in case conditions require cooling the engine, and/or maintains engine temperature in case conditions require heating the engine. (See also A. 4. 6.4 and A.11.4.2.1.)

12.4.3 Controller Contacts for Remote Indication. Controllers shall be equipped with open or closed contacts to operate circuits for the conditions covered in 12.4.2.

Providing remote supervision of the diesel engine and fire pump controller by means of supervisory initiating device circuit or signaling line circuit connection to the facility's fire alarm system becomes quite clear, based on the above requirements. You need to provide three distinct supervisory off-normal signals and their associated supervisory restoration-to-normal signals.

Those three signals must include the following:

1. Fire pump running.
2. Controller main switch in position other than automatic.

3. Trouble on the diesel engine or controller. This single signal provides recipients with the cue to respond to the fire pump room or fire pump house and take note of the more detailed annunciation provided on the fire pump controller.

In the next article, the third and final part of this answer, I will discuss the enabling fire pump supervisory requirements contained in NFPA 72-2010, *National Fire Alarm and Signaling Code*[®]. And, I will discuss the supervisory requirements for other portions of the fire pump installations, such as supervision of the control valves, the water tanks, and the temperature in the pump room or pump house.

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