Fire Pump Supervision - Part 3

by Dean K. Wilson, P.E.

Question: **As the Authority Having Jurisdiction in my suburban community in the northeastern United States, 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 third and final part of the answer to your question, 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 level and temperature, and the temperature in the pump room or pump house.

The operational integrity of the fire protection water supply for this facility depends on management fulfilling the critical objectives of keeping all control valves fully open, water tanks full and heated in winter, and the fire pump houses or rooms also heated in winter. Regular weekly inspection of all fire protection systems and equipment can help maintain the operational integrity of those systems. In addition, the fire alarm system installed at this facility can provide management with a tool to help fulfill these critical objectives.

NFPA 20-2010, *Standard for the Installation of Stationary Pumps for Fire Protection*, in Chapter 12, states the following requirements:

> **4.16* Valve Supervision**.
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> **A.4.16** Isolation valves and control valves are considered to be identical when used in conjunction with a backflow prevention assembly.
>
> **4.16.1 Supervised Open**. Where provided, the suction valve, discharge valve, bypass valves, and isolation valves on the backflow prevention device or assembly shall be supervised open by one of the following methods:
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> (1) Central station, proprietary, or remote station signaling service
>
> (2) Local signaling service that will cause the sounding of an audible signal at a constantly attended point
>
> (3) Locking valves open
>
> (4) Sealing of valves and approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner
>
> **4.16.2 Supervised Closed**. The test outlet control valves shall be supervised closed.

The alternative of locking valves open has some built-in pitfalls. If management employs a hardened shackle lock to secure a valve in the open position, then the key to that lock must remain readily available, in order to promptly shut the valve if some emergency occurs that requires such an action. Seldom does the management of a facility think this necessity through clearly enough to

ensure that an authorized person can close a valve promptly when necessary. If management employs frangible shackle locks to secure a valve in the open position, while this lock will discourage causal tampering with the valve, a determined individual will soon realize that he or she can break the frangible shackle by striking it with any hard object.

Even if a facility chooses to use an electronic means of supervising the open (or closed) position of fire protection control valves, the weekly self-inspection program provides an all-important backup. A member of management should review these reports and maintain a high level of visibility and interest in such an inspection program.

NFPA 72-2010, *National Fire Alarm and Signaling Code*®, provides some very specific requirements related to the supervision of valves in Chapters 17 and 23.

> **17.16.1 Control Valve Supervisory Signal-Initiating Device.**
>
> **17.16.1.1** Two separate and distinct signals shall be initiated: one indicating movement of the valve from its normal position (off normal), and the other indicating restoration of the valve to its normal position.
>
> **17.16.1.2** The off-normal signal shall be initiated during the first two revolutions of the handwheel or during one-fifth of the travel distance of the valve control apparatus from its normal position.
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> **17.16.1.3** The off-normal signal shall not be restored at any valve position except normal.
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> **17.16.1.4** An initiating device for supervising the position of a control valve shall not interfere with the operation of the valve, obstruct the view of its indicator, or prevent access for valve maintenance.
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> **23.8.5.6* Supervisory Signal Initiation - Sprinkler Systems.**
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> **A.23.8.5.6** This Code does not specifically require supervisory signal-initiating devices to be connected to the building fire alarm system. Connections to the building fire alarm system would be determined by the requirements established by the authority having jurisdiction. See A.1.2.4. Some systems utilize non-electrical methods to supervise conditions of the system such as chains on sprinkler control valves.
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> Supervisory signals are not intended to provide indication of design, installation, or functional defects in the supervised systems or system components and are not a

substitute for regular testing of those systems in accordance with the applicable standard. Supervised conditions should include, but not be limited to, the following:

(1) Control valves 1/2 in. (38.1 mm) or larger

(2) Pressure, including dry-pipe system air, pressure tank air, preaction system supervisory air, steam for flooding systems, and public water

(3) Water tanks, including water level and temperature

(4) Building temperature, including areas such as valve closet and fire pump house

(5) Electric fire pumps, including running (alarm or supervisory), power failure, and phase reversal

(6) Engine-driven fire pumps, including running (alarm or supervisory), failure to start, controller off "automatic," and trouble (e.g., low oil, high temperature, overspeed)

(7) Steam turbine fire pumps, including running (alarm or supervisory), steam pressure, and steam control valves

23.8.5.6.1 Where required by other governing laws, codes, or standards to be electronically monitored, supervisory signal initiating devices shall be connected to a dedicated function fire alarm control unit designated as "sprinkler waterflow and supervisory system" and permanently identified on the control unit and record drawings.

Exception: Where supervisory signal-initiating devices are connected to a building fire alarm system, a dedicated function fire alarm control unit shall not be required.

23.8.5.6.2* The number of supervisory signal-initiating devices permitted to be connected to a single initiating device circuit shall not exceed 20.

A.23.8.5.6.2 Circuits connected to a signaling line circuit interface are initiating device circuits and are subject to these limitations.

Management of this facility may also use the fire alarm system to supervise the level inside the two 300,000 gallon storage tanks. Again, NFPA 72-2010 offers some specific requirements.

17.16.3 Water Level Supervisory Signal-Initiating Device.

17.16.3.1 Two separate and distinct signals shall be initiated: one indicating that the required water level has been lowered or raised (off-normal), and the other indicating restoration.

> **17.16.3.2** A pressure tank signal-initiating device shall indicate both high and low water level conditions.
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> **17.16.3.2.1** The off-normal signal shall be initiated when the water level falls 3 in. (70 mm) or rises 3 in. (70 mm).
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> **17.16.3.3** A supervisory signal-initiating device for other than pressure tanks shall initiate a low water level signal when the water level falls 12 in. (300 mm).

Likewise, since this facility is located geographically where freezing temperatures occur in the winter, the fire alarm system may provide the supervision of water tank temperature and the temperature of the fire pump houses or rooms. Once again, NFPA 72 has some very specific requirements.

> **17.16.4 Water Temperature Supervisory Signal-Initiating Device.**
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> **17.16.4.1** A temperature supervisory device for a water storage container exposed to freezing conditions shall initiate two separate and distinctive signals, as specified in 17.16.4.2.
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> **17.16.4.2** One signal shall indicate a decrease in water temperature to 40°F (4.4°C) , and the other shall indicate its restoration to above 40°F (4.40c).
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> **17.16.5 Room Temperature Supervisory Signal-Initiating Device.** A room temperature supervisory device shall indicate a decrease in room temperature to 40°F *(4A*DC) and its restoration to above 40°F (4.40c).

While in many cases these supervisory initiating devices will connect to the fire alarm system control panel through wires and cables, do not lose sight of the fact that at least one reputable manufacturer has listed and code-complying wireless fire alarm and supervisory initiating devices available to provide fire protection system supervision without the need to install long runs of wires or cables.

As you can see from these requirements in NFPA 20-2010 and NFPA 72-2010, the fire alarm system can offer management a very thorough means of supervising the elements that will

help assure the operational integrity and reliability of the fire protection water supply at this large warehouse/distribution center facility. A fire alarm system can clearly serve a greater function than merely detecting the presence of a hostile fire, notifying the occupants to escape, and summoning emergency responders to the facility. It can serve as a critically important tool for management to help them oversee the fire protection safety and fire protection security of the facility.

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