How to Avoid a "Troubleshoot-out at the O.K. Corral!"

by Dean K. Wilson, P.E.

Question: **One of the larger fire alarm installation companies in this city, has recently closed down and left town. Former clients have scrambled to find a company to take over the maintenance of their fire alarm systems. Our company has snagged some of this business. But, now we find that many of the systems present real challenges to maintain. We want to meet the requirements of the local fire inspector. Can you offer any suggestions?**

The key to troubleshooting and maintaining any fire alarm system rests with the documentation. That's why it becomes critically important for installers to provide the documentation mandated by NFPA 72-2010, *National Fire Alarm and Signaling Code*.

For example, please note and carefully read this extensive list of requirements:

> **10.18 Documentation.**
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> **10.18.1 Approval and Acceptance.**
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> 10.18.1.1 The authority having jurisdiction shall be notified prior to installation or alteration of equipment or wiring.
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> 10.18.1.2* At the authority having jurisdiction's request, complete information regarding the system or system alterations, including speci£lcations, type of system or service, shop drawings, input/output matrix, battery calculations, and notification appliance circuit voltage drop calculations, shall be submitted for approval.
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> **A.10.18.1.2 Shop Drawings.**
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> *General.* Shop drawings for fire alarm systems should provide basic information and should provide the basis for the record drawings required elsewhere in this Code.

Content. Shop drawings should include, to an extent commensurate with the extent of the work being performed, floor plan drawings, riser diagrams, control panel wiring diagrams, point-to-point wiring diagrams, conduit, conductor routing, typical wiring diagrams, and other information as described herein.

All shop drawings should be drawn on sheets of uniform size and should include the following information:

(1) Name of protected premises, owner, and occupant (where applicable)

(2) Name of installer or contractor

(3) Location of protected premises

(4) Device legend in accordance with NFPA 170, *Standard for Fire Safety and Emergency Symbols*

(5) Date of issue and any revisions

Floor plan drawings should be drawn to an indicated scale and should include the following information:

(1) Floor identification

(2) Point of compass (indication of north)

(3) Graphic scale

(4) All walls and doors

(5) All partitions extending to within 10 percent of the ceiling height (where applicable)

(6) Room descriptions

(7) Fire alarm device/component locations

(8) Locations of fire alarm primary power connection(s)

(9) Locations of monitor/control interfaces to other systems

(10) Riser locations

(11) Type and number of fire alarm system components/devices on each circuit, on each floor or level

(12) Type and quantity of conductors and conduit (if used) used for each circuit

(13) Location of all supply and return air diffusers (where automatic detection is used)

Fire alarm system riser diagrams should include the following information:

(1) General arrangement of the system in building cross-section

(2) Number of risers

(3) Type and number of circuits in each riser

(4) Type and number of fire alarm system components/devices on each circuit, on each floor or level

(5) Type and quantity of conductors and conduit (if used) for each circuit

Control unit wiring diagrams should be provided for all control equipment (i.e., equipment listed as either a control unit or control unit accessory), power supplies, battery chargers, and annunciators and should include the following information:

(1) Identification of the control equipment depicted

(2) Location(s)

(3) All field wiring terminals and terminal identifications

(4) All circuits connected to field wiring terminals and circuit identifications

(5) All indicators and manual controls, including the full text of all labels

(6) All field connections to supervising station signaling equipment, releasing equipment, and fire safety control interfaces

Typical wiring diagrams should be provided for all initiating devices, notification appliances, remote indicators, annunciators, remote test stations, and end-of-line and power supervisory devices.

10.18.1.3 Before requesting final approval of the installation, if required by the authority having jurisdiction, the installing contractor shall furnish a written statement stating that the system has been installed in accordance with approved plans and tested in accordance with the manufacturer's published instructions and the appropriate NFPA requirements.

10.18.1.4* The record of completion form, Figure 10.18.2.1.1, shall be permitted to be a part of the written statement required in 10.18.1.3. When more than one contractor has been responsible for the installation, each contractor shall complete the portions of the form for which that contractor had responsibility.

A.10.18.1.4 Protected premises fire alarm systems are often installed under construction or remodeling contracts and subsequently connected to a supervising station alarm system under a separate contract. All contractors should complete the portions of the record of completion form for the portions of the connected systems for which they are responsible. Several partially completed forms might be accepted by the authority having jurisdiction provided that all portions of the connected systems are covered in the set of forms.

10.18.1.5 The record of completion form, Figure 10.18.2.1.1, shall be permitted to be a part of the documents that support the requirements of 10.18.2.4.

10.18.2 Completion Documents.

10.18.2.1 Preparation.

10.18.2.1.1* The preparation of a record of completion, Figure 10.18.2.1.1, shall be the responsibility of the qualified and experienced person described in 10.4.2.

10.18.2.1.2 The preparation of a record of completion, Figure 10.18.2.1.1 shall be in accordance with 10.18.2.1.2.1 through 10.18.2.1.2.8.

10.18.2.1.2.1 Parts 1 through 14 of the record of completion shall be completed after the system is installed and the installation wiring has been checked.

10.18.2.1.2.2 Parts 15 and 16 of the record of completion shall be completed after the operational acceptance tests have been completed.

10.18.2.1.2.3 A preliminary copy of the record of completion shall be given to the system owner and, if requested, to other authorities having jurisdiction after completion of the installation wiring tests.

10.18.2.1.2.4 A final copy of the record of completion shall be provided after completion of the operational acceptance tests.

10.18.2.1.2.5 One copy of the record of completion shall be stored at the tire alarm control unit or other approved location.

10.18.2.1.2.6 This copy shall be updated to reflect all system additions or modifications and maintained in a current condition at all times.

10.18.2.1.2.7 Where not stored at the main fire alarm control unit, the location of these documents shall be identified at the main fire alarm control unit.

10.18.2.1.2.8 If the documents are located in a separate enclosure or cabinet, the separate enclosure or cabinet shall be prominently labeled FIRE ALARM DOCUMENTS.

10.18.2.2 Revision. All fire alarm system modifications made after the initial installation shall be recorded on a revised version of the original record of completion.

10.18.2.2.1 All changes from the original information shall be shown.

10.18.2.2.2 The revised record of completion shall include a revision date.

10.18.2.3 Documentation Required. Every system shall include the following documentation, which shall be delivered to the owner or the owner's representative upon final acceptance of the system:

(1)* An owner's manual and manufacturer's published instructions covering all system equipment

A.10.18.2.3(1) The owner's manual should include the following:

(1) A detailed narrative description of the system inputs, evacuation signaling, ancillary functions, annunciation, intended sequence of operations, expansion capability, application considerations, and limitations

(2) Operator instructions for basic system operations, including alarm acknowledgment, system reset, interpretation of system output (LEDs, CRT display, and printout), operation of manual evacuation signaling and ancillary function controls, and change of printer paper

(3) Adetailed description ofroutine maintenance and testing as required and recommended and as would be provided under a maintenance contract, including testing and maintenance instructions for each type of device installed.

This information should include the following:

(a) Listing of the individual system components that require periodic testing and maintenance

(b) Step-by-step instructions detailing the requisite testing and maintenance procedures, and the intervals at which these procedures shall be performed, for each type of device installed

(c) A schedule that correlates the testing and maintenance procedures that are recommended by A.10.18.2.3(1)(3)(b) with the listing recommended by A.10.18.2.3(1)(3)(a)

(4) Detailed troubleshooting instructions for each trouble condition generated from the monitored field wiring, including opens, grounds, and loop failures [These instructions should include a list of all trouble signals annunciated by the system, a description of the condition(s) that causes such trouble signals, and step-by-step instructions describing how to isolate such problems and correct them (or how to call for service, as appropriate).]

(5) A service directory, including a list of names and telephone numbers of those who provide service for the system

(2) Record drawings

(3) For software-based systems, record copy of the site-specific software

(4) A written sequence of operation

Are you exhausted from reading all those requirements? I hope not. Instead, I hope that you saw the answer to your dilemma. If you had all the required documentation for each system now

under your care, you would much more easily be able to maintain each system. That's why it becomes critically important to provide every bit of this documentation for every new system you install.

Identifying every conductor by means of a wire number and providing a chart of where every numbered wire originates and terminates will go a long way toward easing your maintenance and troubleshooting of a fire alarm system. You should mark every conductor on the working drawings by number. You should provide details for each junction point. Some installers even take extensive photographs during an installation to help document that system.

What's in that junction box 20 feet off the floor? Look at the drawings and at the photographs you took when you installed that junction box. Get the idea?

So, what you can do with these undocumented systems that you have taken over. Start now and thoroughly document every part of the system you have to troubleshoot and maintain. Over time you will begin to build up documentation that will certainly help you over the long term.

In the future, when the former client of another alarm system installer asks you to assume responsibility to troubleshoot and maintain a fire alarm system be certain that you count the real cost of doing so. You may want to submit a proposal to document the existing system. Or, you may develop a two-tier pricing schedule. One tier covers fire alarm systems with proper documentation. The other tier covers fire alarm systems that do not have the proper documentation.

I urge the Authorities Having Jurisdiction reading this article to insist on thorough and complete documentation for every system installed in your jurisdiction. Insist that the owner keep the documentation on file, as well as supply a copy for your records. Then, when the owner notifies you that a new company will assume the maintenance of that fire alarm system, insist that the

owner supply a complete copy of the documentation to the new maintenance company. And, make certain the owner retains the original copy for future reference.

Then, make certain that the new maintenance company keeps the documentation up-do-date, as required by the *Code*. If you join with the other stakeholders in the fire alarm system, you can help preserve the operational integrity of every fire alarm system in your jurisdiction.

Failure to take these important steps will likely result in a "Troubleshoot-out at the O.K. Corral!"

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