<table>
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<th>91 Installation Wiring Diagram/Instructions</th>
<th>Page(s) / Note</th>
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<td><strong>90.1</strong> An installation wiring diagram shall be provided with each product (other than an end-of-line device) illustrating the field-connections to be made. The drawing shall be attached to the unit or, when separate, shall be referenced in the marking attached to the unit by the name or trademark of the manufacturer, drawing number, and issue date and/or revision level. When separate, a copy shall be supplied with each individual product or with each single shipment when multiples of the same product are shipped directly to an end customer in a single shipment.</td>
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<td><strong>90.2</strong> The drawing shall show the installation terminals or leads to which field connections are to be made as they would appear when viewed during an installation. The terminal numbers on the unit shall agree with the numbers on the drawing.</td>
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<td><strong>90.3</strong> The information specified in 90.4 – 90.11 shall be included in the installation wiring diagram.</td>
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<td><strong>90.4</strong> The following information shall be marked on the installation wiring diagram/instructions for the applicable circuits to which field connections are made. In addition, each circuit shall be marked to indicate that the circuit is &quot;Supervised&quot; or is &quot;Not Supervised.&quot;</td>
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<tr>
<td>a) MAIN SUPPLY CIRCUIT – Volts, frequency, and maximum current input or specific power supply with which it is intended to be used. A terminal for the connection of a grounded conductor shall be properly identified.</td>
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<td>b) RECHARGEABLE BATTERY CIRCUIT – Voltage, maximum circuit current, maximum amphour capacity, type of suitable battery, and expected standby operating time(s).</td>
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<td>c) INITIATING DEVICE CIRCUIT – The following information shall be indicated:</td>
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<td>1) Reference to the type of devices to be used as well as their intended connection;</td>
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<td>2) Initiating devices having integral trouble contacts shall be shown connected to the initiating device circuit such that transfer of the contacts do not impair alarm signaling from any other initiating device;</td>
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<td>Exception: Initiating devices signaling a trouble condition caused by electrical disconnection of the device, or by removing the device from its plug-in base.</td>
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<td>3) The maximum line impedance.</td>
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<td>4) Maximum current, voltage, and frequency</td>
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<td>d) NOTIFICATION APPLIANCE CIRCUIT – The following information shall be included:</td>
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<td>1) The type of signaling devices and their connection shall be indicated. When the circuit is intended for the connection of a polarized appliance, the field connections to which the appliance is to be wired shall be marked with plus or minus (+, -) symbols, or equivalent, to indicate the proper field connection.</td>
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<tr>
<td>2) Maximum current, voltage, and frequency.</td>
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<tr>
<td>3) The maximum line impedance or equivalent shall be indicated.</td>
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<td>4) Each circuit shall be identified by the one of the rating designations shown in Table 61.1. Circuits identified as special application shall describe by manufacturer's name and model designation the specific appliance(s) and device(s), along with the maximum number, intended to be connected to the circuit.</td>
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<td>5) Maximum RMS operating current for any single notification appliance that may be connected to the circuit, where synchronized notification appliances may not be employed.</td>
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<td>6) Each circuit shall identify whether synchronized notification appliances are permitted to be connected. When synchronized notification appliances are to be employed, the maximum number that may be connected per circuit shall additionally be specified.</td>
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<td>e) SUPPLEMENTARY CIRCUITS – Maximum current, voltage, and frequency.</td>
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<td>f) SIGNALING LINE CIRCUIT – Maximum current, voltage, and frequency. The maximum line impedance or equivalent shall be indicated. The instructions shall describe by manufacturer’s name and model designation of the specific appliance(s) intended to be connected to the circuit.</td>
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<td>g) REVERSE POLARITY COMMUNICATIONS LINE CIRCUIT – Maximum current, voltage, and frequency, and the following, or equivalent wording, shall appear.</td>
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<tr>
<td>1) For a remote-station receiving unit: “INTENDED FOR CONNECTION TO A POLARITY REVERSAL CIRCUIT OF A CONTROL UNIT AT THE PROTECTED PREMISES HAVING COMPATIBLE RATINGS.”</td>
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2) For a remote-station unit at the protected premises: “INTENDED FOR CONNECTION TO A POLARITY REVERSAL CIRCUIT OF A REMOTE STATION RECEIVING UNIT HAVING COMPATIBLE RATINGS.”

In lieu of the above, a drawing of typical connection may be shown which provides equivalent information.

h) MUNICIPAL BOX CONNECTION – The type of connection, either series (local energy) or shunt, and the resistance value of the trip coil, the trip current and the maximum voltage and frequency. When a shunt-type connection is indicated, the following notation shall be added adjacent to the terminals: “THE SHUNT CONNECTION IS RECOGNIZED ONLY AS A SUPPLEMENTARY SIGNALING UNIT AS PART OF A LOCAL CONTROL UNIT AND IS NOT RECOGNIZED AS AN AUXILIARY CONTROL UNIT CONNECTION PER NFPA 72.”

i) COMMUNICATIONS CIRCUITS – Maximum current and voltage. The maximum line impedance or equivalent shall be indicated.

Exception: Standard protocols identified as RS-232, RS-485, etc., do not require maximum current and voltage ratings.

j) POWER OUTPUT CIRCUITS – Each circuit shall be identified as either “Regulated” or “Special Application”. Regulated circuits shall have a single voltage rating and maximum load current rating. Special application circuits shall describe by manufacturer’s name and model designation the specific appliance(s) intended to be powered by the circuit.

k) LIMITED-ENERGY CIRCUITS – Connections to circuits that may be connected to limited energy cable shall be identified as “Power-Limited Circuit” or the equivalent. Specific field-wire routing instructions when required by 12.3.1 shall be included.

l) Where extra terminals are provided to which field connections are not intended, the marking NC or equivalent shall be employed.

m) RELEASING-DEVICE CIRCUITS – The voltage, frequency, and maximum current. The instructions shall also describe by manufacturer’s name and model designation the specific releasing device(s) intended to be connected to the circuit.

n) RELAY, OPEN COLLECTOR, (and similar) OUTPUT CIRCUITS – The operation of the relay/open collector and similar outputs shall be designated as “Common”, “Zone”, or “Programmable” and described as specified in 57.8. The loading for the circuit, in current, voltages, frequency, and power factor, if applicable, shall also be provided.

90.5 In regard to the requirements in 90.4 (c) – (f), unfiltered half- and full-wave rectified voltages shall be identified.

90.6 Initiating-device, notification-appliance, and signaling-line circuits shall be designated by class or by both class and style, consistent with the circuit’s capabilities as described in Tables 51.1 – 51.3, and 51.1.6. Communication and transmission paths shall be designated by type, consistent with the path’s capabilities as described in 40.2.1 – 40.2.7 for active multiplex; 40.4.1 – 40.4.7 for two-way private-radio frequency multiplex; and 40.5.1 – 40.5.12 for one-way private-radio frequency systems.

90.7 Impedance values for testing at which ground faults are annunciated shall be specified.

90.8 Where a product must be mounted in a definite position to function properly, a description of the correct mounting position shall be indicated.

90.9 For a unit provided with field-wiring terminals as described in 12.5.1 and 12.5.2:

a) When a special tool is required for connection, its use shall be indicated by name of manufacturer and model number or other designation method that has been determined to be equivalent;

b) The range of wire sizes shall be indicated on the installation wiring; and

c) When means for testing for an open and a ground fault on the circuit to which the wiring is connected is not incorporated into the unit, the means shall be indicated.

90.10 Products utilizing radio-frequency signaling shall include at least the following:

a) The minimum signal strength and the maximum ambient noise level shall be indicated;

b) Specific test equipment or specific test method to be used to determine appropriate levels of signal strength and ambient noise level; and.

c) Instructions to test the system for operation upon completion of installation.

90.11 In conjunction with 90.4(c), (d), and (f), when duplicate terminals are not provided to facilitate supervision of the installation wiring connections, and there is no provision to prevent looping an unbroken wire around or under a terminal, the word “CAUTION” and the following or equivalent text shall be included: “FOR SYSTEM SUPERVISION – FOR TERMINALS ___ AND ___, DO NOT USE LOOPED WIRE UNDER TERMINALS. BREAK WIRE RUN TO PROVIDE SUPERVISION OF
CONNECTIONS.” The blanks are to be filled in with the applicable terminal identification.

**Exception:** Markings are not required for circuits that provide supervision without the need for duplicate terminals.

**90.12** When the product consists completely of subassemblies that are to be shipped separately, the installation document for a minimum of one of the subassemblies that will be used in each product configuration shall list the subassemblies necessary to form a minimum control unit needed for each type(s) of control unit configuration and the optional subassemblies which are permitted.

**90.13** An installation instruction containing the information required in 90.15 – 90.24 shall be made available by one or more of the following means:

a) Integral with the installation wiring diagram described in 90.1;

b) Separate printed instructions;

c) Electronic instructions within the basic product software;

d) Electronic media such as CD-ROM, floppy disc, website, etc.; or the equivalent.

**90.14** When the installation instructions are included as described in 90.13 (b), (c), and/or (d), the installation instructions shall be referenced in either the installation wiring diagram or product marking by:

a) Name of trademark of manufacturer;

b) Drawing number, <URL address>, and/or the equivalent identification; and

c) Issue date, revision level, and/or release date.

**90.15** The installation wiring diagram/instructions for a product that provides initiating circuits intended to be used with two-wire smoke detectors shall include the following information:

a) Maximum rated operating voltage range of the initiating circuit.

b) Minimum (if applicable) and maximum number of detectors including detector name, model number and compatibility identifier.

c) When a product is intended to handle more than one detector in the alarm condition, the installation wiring diagram shall so indicate.

d) When a product is intended to handle detectors with optional features, the installation wiring diagram shall so indicate.

e) A stipulation that detectors of different models are not to be mixed or matched on a system, unless the system is specifically intended to be installed in that configuration. When mixing is permitted, specific limitations shall be included.

f) Compatibility identifier number consisting of any six-digit or less alphanumeric combination (such as a date code, part number, or model number) used to identify the latest revision that has not resulted in a new model number, but that impacts compatibility.

**90.16** Description of the product operation. This shall include, as applicable, the following:

a) Normal standby,

b) Alarm,

c) Alarm test,

d) Alarm silence,

e) Alarm reset,

f) Trouble,

g) Trouble silence,

h) Off-normal position of switches, and

i) Functions of lights or switches.

**90.17** Description of the maintenance procedures of the system. This shall include, as applicable, the following:

a) Fuse replacement;

b) Primary battery replacement (reference to a specific replacement part which must be used with the product shall be indicated; instructions to replace batteries periodically; the period specified shall not be greater than the useful life of the battery, which has been determined by test);

c) Rechargeable battery maintenance and replacement (where a rechargeable battery is used, proper maintenance and testing procedures shall be described); and

d) Maintenance recommendations.
90.18 Description of the testing procedures of the system (this shall include periodic testing recommendations).

90.19 Units employing the multiple detector operation described in 55.3.1 and 55.3.2 shall include guidelines for installing of a minimum of two detectors in each protected space and to reduce the detector installation spacing to 0.7 times the linear spacing in accordance with National Fire Alarm Code, NFPA 72.

90.20 For products utilizing an automatic analog smoke detector sensitivity test feature, the installation instructions shall specify the extent of the range of time intervals between activations of the automatic test feature.

90.21 The installation instructions for a control unit for releasing service shall describe whether the operation of the manual release will override an activated abort switch.

90.22 Products complying with 63.1.3 shall include a minimum secondary (standby) battery de-rating value of 10 percent, when specifying required standby capacity.

90.23 Where the field-programmable software of a product contains both complying as well as noncomplying features or parameters as permitted in 54.1.2, the following (or equivalent presentation) shall be included in the front of the programming manual or the beginning of the program section of the installation manual:

**NOTICE TO USERS, INSTALLERS, AUTHORITIES HAVING JURISDICTION, AND OTHER INVOLVED PARTIES**

This product incorporates field-programmable software. In order for the product to comply with the requirements in the Standard for Control Units and Accessories for Fire Alarm Systems, UL 864, certain programming features or options must be limited to specific values or not used at all as indicated below.

<table>
<thead>
<tr>
<th>Program feature or option</th>
<th>Permitted in UL 864? (Y/N)</th>
<th>Possible settings</th>
<th>Settings permitted in UL 864</th>
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90.24 The installation document for products intended for smoke control applications shall include an explanation of the concepts and requirements for smoke control, consistent with Recommended Practice for Smoke-Control Systems, NFPA 92A, and Recommended Practice for Smoke-Control Systems in Malls, Atriums, and Large Areas, 92B, and specifically how the manufacturer’s smoke control equipment can be used to accomplish the intended smoke control functions. Typically, the following shall be included:

a) Concepts and requirements for smoke control strategy;

b) Delineation of the specific control equipment intended to be employed to form smoke control systems;

c) Wiring diagram(s) showing intended interconnection of the equipment, including guidelines for connection to general HVAC equipment, if separate, as well as to equipment for any required end-to-end verification process;

d) Examples for implementing the system in various applications, such as a warehouse and a high rise application; and

e) Programming of the system for the applicable strategies, including an automatic weekly test for dedicated type systems.

91 Operating Instructions

91.1 A control unit that is not intended to have an operator in attendance shall be provided with simple operating instructions. These instructions shall be on the cabinet front or on a separate sheet that can be framed and located adjacent to the control unit.

91.2 When separate from the control unit, the instructions shall include the model number of the control unit and be referenced in the control unit marking by number and issue number and/or date.

91.3 The instructions shall include a capsule description of pertinent conditions applicable to the particular control unit as described in 90.16 and 90.17.

91.4 In addition to the requirements in 91.1 – 91.3, a blank space shall be provided on the instruction sheet to fill in the name, address, and telephone number of the local service representative to contact in the event of trouble.

91.5 Where the instructions appear on a separate sheet, a notation shall be added on the bottom that the instructions are to be framed and placed adjacent to the control unit for ready reference.

91.6 Operating instructions are not required for a remote station, proprietary, or central station protected premises unit that has no user operating controls and where all signals are annunciated at the receiving unit.