NFPA No.

72

PROPRIETARY & AUXILIARY PROTECTIVE SIGNALING SYSTEMS 1964

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National Fire Protection Association

International

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This is one of a large number of publications on fire safety issued by the Association. All NFPA codes, standards, and recommended practices are prepared by NFPA Technical Committees and adopted at an Annual Meeting of the Association. They are intended to prescribe reasonable measures for minimizing losses of life and property by fire.

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Adopted Jan. 23, 1964. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

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Standard for the Installation, Maintenance and Use of Proprietary and Auxiliary Protective Signaling Systems for Watchman, Fire Alarm and Supervisory Service

NFPA No. 72 — 1964

1964 Edition of No. 72

The 1964 edition of this standard incorporates changes prepared by the Sectional Committee on Private Fire Alarm Systems. The Standard was adopted by the National Fire Protection Association at the May, 1964, Annual Meeting in Dallas, Texas, on the recommendation of the Committee on Signaling Systems and Thermostats. It supersedes the 1962 edition. Changes in this 1964 edition include the elimination of the coverage previously included on local protective signaling systems (now covered in NFPA No. 72A) resulting in the deletion of former Article 430 (renumbering previous Article 440 to become 430), elimination of previous references to local systems (including the previous title), and changes in Paragraphs 2432, and 4121.a. plus an editorial change in Paragraph 3333.

Origin and Development of No. 72

This standard is the latest in a long series of editions dating back to 1898. Originally, it was part of a general NFPA standard on signaling systems, including not only the type of equipment covered by the present standard, but also Municipal Fire Alarm Systems (separated in 1911, and now No. 73), Central Station Protective Signaling Systems (separated in 1931, and now No. 71), Remote Station Signaling Systems (separated in 1960, and now No. 72C), and Local Protective Signaling Systems (separated in 1964, and now No. 72A). NFPA standards on protective signaling systems have been revised and reissued in editions dated 1904, 1911, 1913, 1915, 1916, 1920, 1922, 1923, 1926, 1928, 1931, 1934, 1935, 1940, 1941, 1942, 1945, 1948, 1950, 1952, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, and 1963. A record of all changes in the various editions published can be found in the NFPA "Advance Reports" and "Proceedings," issued during the years specified.

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Standard for the
Installation, Maintenance and Use of

PROPRIETARY AND AUXILIARY PROTECTIVE SIGNALING SYSTEMS

for

Watchman, Fire Alarm and Supervisory Service

No. 72 — May 1964

A device or system having materials or forms different from those detailed in this standard may be examined and tested according to the intent of the standard and if found equivalent may be approved.

CHAPTER 1. GENERAL

ARTICLE 100. DEFINITIONS.

Throughout this pamphlet the following meanings are intended:

Alarm Signal. A signal indicating an emergency requiring immediate action, as an alarm for fire from a manual box, a waterflow alarm, an alarm from an automatic fire alarm system, or other emergency signal.

Supervisory Signal. A signal indicating the need of action in connection with the supervision of watchmen, sprinkler and other extinguishing systems or equipment, or with the maintenance features of other protective systems.

Trouble Signal. A signal indicating trouble of any nature such as a circuit break or ground, occurring in the devices or wiring associated with a protective signaling system.

Protective Systems, Equipment or Apparatus. Automatic sprinklers, standpipes, carbon dioxide systems, automatic covers, and other devices used for extinguishing fires and for controlling temperatures or other conditions dangerous to life or property.

Protective Signaling Systems. Electrically operated circuits, instruments, and devices, together with the necessary electrical energy, designed to transmit alarms and supervisory and trouble signals, necessary for the protection of life and property.

Alarm Service. The service required following the manual operation of a fire alarm box, the transmission of an alarm indicating the operation of protective equipment or systems, such as an alarm from waterflow in a sprinkler system, the discharge of carbon dioxide, the detection of smoke, the detection of excessive heat, or the transmission of an alarm from other protective systems.

Supervisory Service. The service required to assure performance of watch patrols and the operative condition of automatic sprinkler systems and of other systems for the protection of life and property.

Maintenance. Repair service, including periodically recurrent inspections and tests, required to keep the protective signaling system and its component parts in an operative condition at all times, together with replacement of the system or of its components, when for any reason they become undependable or inoperative.

Proprietary System. A system with supervision by competent and experienced personnel in a central supervising station at the property protected. The system is to include equipment and other facilities required to permit the operators to test and operate the system and, upon receipt of a signal, to take such action as shall be required under the rules established for their guidance by the authority having jurisdiction. The system shall be maintained and tested by personnel or an organization satisfactory to the authority having jurisdiction.

(See Paragraph 4011 for a statement of the distinction between Class A and Class B Proprietary Systems).

Auxiliary Alarm System. A system maintained and supervised by a responsible person or corporation and con-

sisting of transmitting devices and associated equipment which when operated manually or automatically causes an alarm to be transmitted over a municipal fire alarm system, to a fire station or to fire alarm headquarters.

Auxiliarizing a municipal fire alarm system in connection with a private fire alarm system has for its object the transmission of alarms directly to a fire station or to fire alarm headquarters upon operation of an actuating device such as an automatic fire detector, waterflow alarm switch, or manual fire alarm station. Combining the auxiliary feature with any private alarm system introduces features of maintenance, inspection, and supervision, usually involving divided authority, and requires special consideration by the authority having jurisdiction. Fire alarm systems which transmit an alarm to a fire station or to fire alarm headquarters, independently of and in addition to an auxiliary system, provide a duplication of service, increasing the probability of an alarm being received.

There are two types of auxiliary systems, the series or local current type, and the shunt type.

Miscellaneous System. Any other protective signaling system.

CHAPTER 2. COMMON REQUIREMENTS.

ARTICLE 200. GENERAL.

2010. Scope.

2011. The provisions of this Chapter apply to all fire-protective signaling systems covered by this standard except as otherwise indicated in other sections.

2012. The intent and meaning of the terms used in this standard are, unless otherwise defined herein, the same as those of the National Electrical Code.

2013. These protective signaling systems consist of electrical circuits and associated instruments and devices having their operation under the control or domination of the owner or others interested in the property to be protected; they shall include owned, leased or rented systems.

2030. Approval.

2031. Information. At the request of the authority having jurisdiction, complete information regarding the system including specifications, wiring diagrams, and floor plans shall be submitted for approval prior to installation of equipment or wiring.

2032. Equipment. All devices, combinations of devices, and equipment constructed and installed in conformity with this standard shall be approved for the purposes for which they are intended.

2033. Acceptance Tests. Upon completion of a system, a satisfactory test of the entire installation shall be made in the presence of a representative of the authority having jurisdiction.

2034. Maintenance Agreement. Where required by the authority having jurisdiction, a satisfactory agreement on the maintenance, operation, and efficiency of the system shall be provided. All systems shall be under the supervision of qualified persons satisfactory to the authority having jurisdiction. These persons shall cause proper tests and inspections to be made at prescribed intervals and shall have general charge of all alterations and additions to the systems under their supervision. For sprinkler waterflow alarm tests, an actual water flow, through the use of a test connection, shall be the method employed for testing

the reliability of the sprinkler alarm unit as a whole. For a wet pipe system, the test connection at the extremity of the system shall be used.

2040. Installation and Design.

2041. Systems. All systems shall be installed in a workmanlike manner and in accordance with specifications and standards approved by the authority having jurisdiction.

2042. Jarring. Devices shall be so located and mounted that accidental operation will not be caused by vibration or jarring.

2043. Grounding. All systems shall test free of grounds except parts of circuits or equipment which are intentionally and permanently grounded to provide ground fault detection, emergency ground signaling, or circuit protective grounding. All systems shall be so designed that they do not depend upon the effectiveness of any ground connection for normal operation.

2044. Pre-Signal Feature. It is recommended that systems in hotels, department stores, hospitals, and similar institutions having sounding devices within the protected premises, be so designed that initial fire signals will sound only in department offices, engine rooms, fire brigade stations and other central locations, with provisions whereby authorized persons may subsequently sound a general alarm.

2045. Use Restriction. Fire alarm systems shall be used for no other than fire-protective signaling purposes, except that local control functions, necessary to make the premises safer in the event of fire, or to make it possible to hear fire alarm signals, may be automatically performed. The performance of automatic control functions shall not interfere with power for lighting or for operating elevators. This does not preclude the combination of fire protective signaling services with other services requiring monitoring of operations.

2046. Voltage Variation. A system shall be so designed and installed that it shall be capable of performing its intended function at 85 per cent and at 110 per cent of the rated voltage.

2047. Rewinding or Resetting. All apparatus requiring rewinding or resetting to maintain normal operation shall be restored to normal as promptly as possible after

each test or alarm, and kept in normal condition for operation.

2048. **Coded Alarm Signal.** A coded alarm signal shall consist of not less than three complete rounds of the number transmitted.

ARTICLE 210. WIRING.

2110. General.

2111. The provisions of this Article apply to installation wiring for interconnecting system components.

2112. Fire-protective signaling circuits, at multiple circuit terminal and junction locations where circuits for other purposes are present, shall be marked for identification or so protected as to avoid interruption of service due to short-circuiting or other conditions of testing and servicing which might affect adversely the connected fire-protective signaling equipment.

2120. Exposure.

2121. **Insulation.** The insulation materials of conductors and cables shall be suitable for the normal conditions to which they are exposed in service.

2122. Wiring, cables, and terminal and junction facilities, unless adequately protected, shall be located where they are not exposed to hazardous or corrosive atmospheres, stored combustible materials, or to other potential hazards which might cause disruption of service.

Outside Wiring.

2130. Circuits.

2131. Wiring circuits reserved solely for fire-protective signaling services and complying with the requirements of the National Electrical Code for communication circuits are acceptable for outside wiring.

2132. To secure the greatest measure of protection and dependability in the operation of protective signaling systems it is recommended that all wires outside buildings be placed underground.

Inside Wiring.

2140. General.

2141. All inside wiring shall be in conformity with the requirements of the National Electrical Code for Class 1

signal systems except as otherwise indicated in this Article, or other Articles, of this standard.

2150. Special Cables — General Circuits.

2151. As an alternative to the requirement of Paragraph 2141, special cable approved for the purpose may be used as a method of wiring circuits operating at 150 volts or less.

2152. Cable for use for general circuits operating at 150 volts or less shall be constructed as follows:

a. Conductors shall be of solid copper, not less than No. 14 AWG for single- and two-conductor cables, not less than No. 18 AWG for three- and four-conductor cables, and not less than No. 22 AWG for cables having more than four conductors.

b. The individual conductors shall have rubber or thermoplastic insulation having a nominal thickness of not less than 1/32 inch.

c. The cable conductors shall have a lead sheath or a moisture-resistant and flame-retardant jacket providing equivalent protection against mechanical injury to that obtained with nonmetallic sheathed cable described in the National Electrical Code.

2160. Limited-Energy Fire Detector Circuit Cables.

2161. Special cable may be used for limited-energy fire detector circuits where the following conditions exist:

a. The open circuit voltage does not exceed 50 volts.

b. Overcurrent protection of not more than 2-amperes rating is provided. A fuse used for this purpose shall be of noninterchangeable type. If the current is taken from a transforming device having energy-limiting characteristics, the fuse may be omitted.

c. The capacity of the supply circuit is limited in its maximum rated output to 100 volt-amperes.

2162. Conductors of a cable for use with limited-energy circuit shall be of solid or stranded copper not smaller than No. 22 AWG and shall have thermoplastic insulation of not less than 0.012 inch nominal (0.010 inch minimum) thickness. The cabled conductors shall have a thermoplastic jacket over-all having a nominal thickness of not less than 0.035 inch (0.030 inch minimum). Two-conductor assemblies may be in flat parallel construction with 1/32 inch nominal integral-insulation jacket and an 0.047 inch minimum web.

Approved low-energy circuit cable may be used. Other insulation having equivalent performance characteristics may be acceptable. If stranded conductors are used, each strand shall be not smaller than No. 30 AWG and strands shall be twisted and soldered together before connection to a field wiring terminal, or attachment to such terminals shall be made by the use of solder lugs or pressure wire connectors.

NOTE: Flexible cord, of the types described in Article 400 of the National Electrical Code or similar thereto, whether or not approved for other use, shall not be used for fire detector circuits.

2170. Cable Installation.

2171. The special cables described in Sections 2150 and 2160 may be installed exposed on ceilings, and on side walls if not less than 7 feet from the floor, if adequately protected against injury. Concealed cable and cable passed through floors or located on side walls within 7 feet of the floor shall be installed in conduit or other approved raceway. Cable shall be supported and terminated in approved fittings.

2180. Line Thermostats.

2181. Line type thermostats, including insulated copper tubing of pneumatically-operated detectors employed for both detection and current-carrying purposes, shall be installed in conformity with paragraph 2171 and shall provide adequate insulation for the voltage applied to the thermostat.

ARTICLE 220. POWER SUPPLY SOURCES.

2210. General.

2211. The provisions of this Article apply to sources of power supply which shall be used, for the type of system involved, subject to acceptance by the authority having jurisdiction.

2212. Equipment. The equipment shall be approved for the particular application.

2213. Installation. All power supply equipment (batteries, battery chargers, rectifiers, switching facilities, transformers, etc.) and wiring shall be installed in conformity with the requirements of the National Electrical Code for such equipment except as otherwise indicated in this Article.

2220. Light and Power Services.

2221. General. A reliable electric light or power service may be used as a source of supply for fire-protective signaling systems under the following conditions:

a. Two-Wire Supplies. A two-wire supply circuit may be used for either the main operating power supply or the trouble signal power supply of the signaling system.

b. Three-Wire Supplies. A three-wire a-c or d-c supply circuit having a continuous unfused neutral conductor, or a polyphase a-c supply circuit having a continuous unfused neutral conductor where interruption of one phase does not prevent operation by the other phase, may be used with one side or phase for the main operating power supply and the other side or phase for the trouble signal power supply of the signaling system.

2222. Point of Connection. The conductors of the signaling system power supply circuit shall be connected on the line side of the main service of a commercial light or power supply circuit or to the main bus bars of an isolated power plant located on the premises. A circuit disconnecting means shall be so installed that it will be accessible only by authorized personnel.

2223. An overcurrent protective device of suitable current-carrying capacity and capable of interrupting the maximum short-circuit current to which it may be subjected shall be provided in each ungrounded conductor. The overcurrent protective device shall be enclosed in a locked or sealed cabinet located immediately adjacent to the point of connection to the light and power conductors.

2230. Motor-Generators.

2231. General. A motor-generator set shall be used only where an operator is on duty at all times. Power for operating the motor-generator shall be available from not less than two independent sources of energy. One source may be a special generator plant driven from some form of prime mover continuously available.

2240. Storage Batteries.

2241. Location. Storage batteries shall be so located or enclosed that the equipment of the signaling system including overcurrent protective devices will not be affected adversely by battery gases.

2242. Charging Source. A reliable source of power supply of not more than 250 volts shall be provided for charging the batteries. Where the record of continuity of the supply source makes it desirable, two separate, independent sources of supply shall be provided.

2243. Over-Current Protection. The battery shall be protected by over-current devices having a rating of not less than 150 per cent and not more than 200 per cent of the maximum operating load applied to the battery.

2244. Charging Method. The method of charging a battery shall provide either integral meters or readily accessible terminal facilities for the connection of portable meters by which the battery voltage and charging current can be determined.

2245. Cycle-Charged Batteries.

a. Duplicate Sets. Duplicate sets of batteries shall be employed for cycle-charging.

b. Capacity. Each set of storage batteries shall be capable of operating the system under the maximum normal load condition without recharging for not less than sixty consecutive hours when employed for a local or auxiliary system and for not less than twenty-four hours when employed for a proprietary system.

c. Charging. Provision shall be made for transferring each set of batteries to either load or charging circuits in a practical manner without affecting the system performance adversely.

2246. Trickle-Charged Batteries.

a. Venting. Provision shall be made to prevent spraying of the electrolyte of the battery while the battery is being charged at the maximum rate permitted by its charging means.

b. Capacity. The battery shall be capable of operating the system for not less than 24 hours with the maximum normal load and with the power supply to the charger disconnected.

c. Charging. Adequate facilities shall be provided to maintain the battery fully charged under all conditions of normal operation.

d. Rectifiers. A rectifier shall be energized by an insulating transformer having a supply circuit of not more than 250 volts.

2250. Rectifiers, Direct-Connected.

2251. General. A rectifier employed as a direct source of supply for a signaling system shall be approved for the purpose and of adequate capacity to maintain voltage regulation between 130 per cent of rated voltage at no load and 100 per cent of rated voltage at maximum rated load.

2260. Primary Batteries.

2261. Use. A primary battery (including dry cells) shall not be used as the main operating supply of a signaling system. It may be used:

a. As a source of supply for operating trouble signal devices.

b. As an emergency auxiliary source of supply for operating a signaling system temporarily in the event of interruption of the main operating supply.

NOTE: The use of a common battery for both conditions (a) and (b) above is acceptable.

c. As a source of bias potential where depreciation of the battery results in a trouble signal when the circuit becomes inoperative.

2262. Location. Primary batteries shall be located not less than 6 inches nor more than 6 feet above the floor in a clean dry place where the ambient air temperature will not be less than 40° F. and not more than 100° F.

2263. Enclosure. A primary battery shall be housed in a locked substantial enclosure or otherwise suitably protected against movement, injury, and moisture. A reliable separation between cells shall be provided to prevent contact between terminals of adjacent batteries and between battery terminals and other metal parts which may result in depletion of the battery or other deterioration.

2264. Insulating Containers. Battery cells having containers constructed of other than suitable electrical insulating material shall be located on insulating supports.

2265. Connectors. Primary batteries shall be interconnected by suitable connectors.

2266. Inspection and Test. Each primary battery shall be inspected and tested to determine its terminal voltage while supplying the maximum load permitted by its application at least once each month. The battery shall be replaced when this voltage indicates its minimum rated discharge voltage.

2267. Maximum Load. The maximum normal load of a primary battery shall not be more than 2 amperes per cell.

2268. Capacity. A primary battery shall have sufficient capacity to supply 125 per cent of the maximum normal load of the system for not less than one year.

2269. Replacement of No. 6 Dry Batteries. No. 6 batteries shall be replaced under the following conditions:

a. An individual dry battery cell rated 1½ volts shall be replaced when its short-circuit current is less than ten amperes or when a load of one ohm reduces the potential below one volt.

b. A unit assembly of dry battery cells rated 6 volts shall be replaced when a load of four ohms reduces the potential of the unit below four volts.

ARTICLE 230. OVERCURRENT PROTECTION.

2310. General—Batteries.

2311. See Paragraphs 2223 and 2243.

2320. Conductors.

2321. Conductors shall be protected in accordance with their rated current-carrying capacities as given in the National Electrical Code.

2330. System Control Units.

2331. A system control unit shall be protected on the supply side by over-current devices having a rating not greater than 150 per cent of the rating of the control unit.

2340. Transformers.

2341. A transformer shall be protected on either the primary or secondary side by overcurrent devices having a rating not greater than the continuous duty rating of the transformer unless the current is limited to the same value by other approved means.

ARTICLE 240. ELECTRICAL SUPERVISION.

2410. General.

2411. Except as otherwise indicated in this Standard, a system shall be electrically supervised so that the occurrence of a break or a ground fault condition of its installation-wiring circuits which prevents the required operation of the system, or failure of its main power supply source, will be indicated by a distinctive trouble signal.

NOTE: (a) The provision of a double loop or other multiple-path conductor circuit to avoid electrical supervision is not acceptable except as indicated in Paragraph 2424a.

(b) Electrical supervision of conductors for a short-circuit fault is not contemplated by this requirement. A multiple ground condition is considered the equivalent of a short-circuit fault.

2420. Electrical Supervision. The electrical supervision shall include:

2421. Power Supply Circuits Supervision. All sources of energy except the following secondary sources:

a. One employed for the operation of trouble signal circuits and appliances.

b. One employed as an auxiliary means for maintaining the normal operation of the system following trouble signal indication when the main supply source is interrupted.

c. One employed as a means for operating a supplementary circuit for alarm bells, annunciators, time stamps and similar circuits, the failure of which will not prevent the operation of the system for the required signals.

d. The battery leads of a trickle-charged battery.

e. The neutral of a three, four or five wire a-c or d-c supply source.

2422. Signal Initiating Circuits. All circuits for signals initiated by the operation of fire alarm boxes, fire detectors, automatically operated transmitters, or other appliances or devices which initiate or transmit signals either manually or automatically, except:

a. A non-interfering shunt circuit, provided that a fault condition of the shunt circuit wiring results only in the loss of the non-interfering feature of operation.

b. The circuits of a supplementary signal annunciator, provided that the fault condition of this circuit wiring results only in the loss of annunciation.

c. The circuits of thermostats or detectors of a metallic tubing automatic fire alarm system where the wiring terminals of such devices are connected in multiple across electrically supervised circuits.

2423. Supplementary Control Circuit. A supplementary circuit for operating fan motor stops or similar industrial control equipment intended to be actuated at the time of an alarm signal, need not be electrically supervised, provided a fault condition of the circuit in no way affects the normal operation of the signaling system.

2424. Alarm Signal Sounding Circuits. All circuits for operating alarm sounding devices and appliances except:

a. Alarm signal sounding appliances when (1) alternately connected to two or more circuits and approximately equally distributed throughout the building, or (2) connected to a return loop circuit so that a break or ground fault does not prevent the operation of any sounding appliance and with means provided for testing the continuity of the circuit.

b. A circuit employed to produce a supplementary local alarm signal to indicate the operation of an automatically operated alarm transmitter or a manual fire alarm box provided that an open or ground fault of the signal circuit conductor results only in the loss of the supplementary signal.

c. The circuit of an alarm bell installed in the same room with a system control unit, provided the bell circuit conductors are installed in conduit or equivalently protected against mechanical injury and tampering.

d. A trouble signal circuit.

2425. In a Supervising Station. Where personnel responsible for the supervision and operation of the system are on duty continuously, the following features or facilities located in the supervising station need not be electrically supervised.

a. The station circuits for alarm bells and registers which are controlled by devices which have their operating circuits electrically supervised.

b. Main power supply failure if the condition is otherwise indicated so as to be obvious to the operator on duty.

2430. Trouble Signals.

2431. Distinctive Trouble Signals. Trouble signals shall be distinctive from alarm signals and shall be indicated by the continuous operation of a sounding appliance or, where there is supervisory attendance at all times, by a suitable coded signal. An audible trouble signal may be common to several supervised circuits.

2432. Silencing Switch. A switch for silencing the trouble signal sounding appliance may be provided only if it transfers the trouble indication to a lamp or other acceptable visible indicator adjacent to the switch. The visible indicator shall remain operated until the silencing switch

is restored to its normal position unless the audible trouble signal will be obtained when a fault occurs without restoring the switch to normal, or unless the audible trouble signal is again energized upon correction of the fault.

2433. Location of Trouble Signal. Trouble sounding appliances shall be located as required by the authority having jurisdiction.

ARTICLE 250. AUDIBLE SIGNALING APPLIANCES.

2510. Evacuation Systems.

2511. Fire alarm systems provided for evacuation of occupants of factories, workshops, institutions and similar premises shall have one or more audible signaling appliances approved for the purpose on each floor of the building, so located that their operation will be heard clearly regardless of the maximum noise level obtained from machinery or other equipment under normal conditions of occupancy. Each section of a floor divided by a fire wall may be considered as a separate floor for the purpose of this protection.

2520. Distinctive Signals.

2521. Audible signal appliances of a fire alarm system shall produce signals which are distinctive from other similar appliances used for other purposes in the same area. Different types of fire-protective audible signaling appliances in the same area are not recommended.

ARTICLE 260. SIGNAL CAPACITY OF CIRCUITS.

2610. General.

2611. The number of signal transmitting devices connected to any signaling circuit shall be limited to avoid interference. The total number of code wheels connected to a single circuit shall not exceed two hundred and fifty.

2612. The number of waterflow switches which may be connected to actuate a single transmitter shall not exceed five, and the number of supervisory switches which may be

connected to actuate a single transmitter shall not exceed twenty.

2620. Separate Alarm Signal Circuits.

2621. It is recommended that alarm signal transmitting devices be connected to signaling circuits reserved solely for alarm signals.

2630. Combined Alarm and Supervisory Signal Circuits.

2631. When both sprinkler supervisory signals and fire or waterflow alarm signals are transmitted over the same signaling circuit, provision shall be made to either obtain alarm signal precedence or sufficient repetition of the alarm signal to prevent the loss of any alarm signal transmitting devices. The trouble signal of a combined alarm and supervisory signal circuit shall not be used for the supervisory signal feature except as indicated in Paragraph 3422.

2640. Loading Capacity of Alarm Circuits.

2641. One signaling circuit shall serve not more than twenty-five plants.

NOTE: A plant may consist of one or more buildings under the same ownership and the circuit arrangement shall be such that an alarm signal will not be received from more than one transmitting device within a plant at a time.

2650. Loading Capacity of Sprinkler Supervisory Signal Circuits.

2651. One signaling circuit may serve not more than twenty-five plants.

NOTE: A plant may consist of one or more buildings under the same ownership.

2660. Loading Capacity of Watch Supervisory Signal Circuits.

2661. Connections to a watch supervisory signal circuit, or to a combination manual fire alarm and watch signal circuit, shall be so limited that not more than sixty scheduled watch report signals will be transmitted in any one-hour period. Patrol scheduling shall be such as to avoid interference between watch report signals.

CHAPTER 3. TYPES OF SIGNALING SERVICES.

ARTICLE 300. SCOPE.

3010. The provisions of this Chapter apply to signaling services which may be provided individually or in combination by different types of systems except as otherwise indicated for each type of system.

ARTICLE 310. MANUAL FIRE ALARM SERVICE.

3110. Fire Alarm Boxes.

3111. General. Manual fire alarm boxes shall be approved for the particular application and shall be used only for fire protective signaling purposes. Combined fire alarm and watchman's signaling boxes are acceptable.

3112. Mounting. Each box shall be securely mounted. It is recommended that the bottom of the box be not less than 4½ feet and not more than 6 feet above the floor level.

3113. Distribution. Manual fire alarm boxes shall be distributed throughout the protected area so that they are unobstructed, readily accessible, and located in the normal path of exit from the area, and as follows:

a. One box shall be provided on the first floor and on each succeeding alternate floor except that one box shall be provided for each floor where the maximum fire area is 10,000 square feet or more.

b. Additional boxes shall be provided on each floor to obtain a maximum horizontal travel distance of 200 feet to the nearest box.

3114. Coded Signal Designations. A coded fire alarm box shall produce not less than three signal impulses for each revolution of the coded signal wheel.

NOTE: The following suggested coded signal assignment for a building having four floors and basements is provided as a guide:

Location	*Coded Signal*
4th floor	2-4
3rd "	2-3
2nd "	2-2
1st "	2-1
Basement	3-1
Sub-basement	3-2

ARTICLE 320. WATCHMAN'S TOUR SUPERVISORY SERVICE.

3210. General.

3211. The number of watchman's reporting stations, their locations, and the route to be followed by the watchman for operating the station shall be approved for the particular installation.

3220. Signal Recording.

3221. A permanent record indicating each time each signal transmitting station is operated shall be made at a supervising location.

3230. Suppressed Signal Type.

3231. When intermediate stations which do not transmit a signal are employed in conjunction with signal transmitting stations, distinctive signals shall be transmitted at the beginning and end of each tour of a watchman and a signal transmitting station shall be provided at intervals not exceeding ten stations.

3232. Intermediate stations which do not transmit a signal shall be capable of operation only in a fixed order of succession.

3233. Stations which transmit a signal only when not operated within a prescribed time interval may be used as intermediate stations where a fixed route is not considered necessary to assure complete watch service.

ARTICLE 330. AUTOMATIC FIRE DETECTION AND ALARM SERVICE.

3310. General.

3311. The provisions of this Article apply to systems employed for automatic fire alarm signals.

3320. Supplementary Manual Alarm Signal Operation.

3321. Supplementary means for manually operating an automatic fire alarm system for an alarm signal should be located where designated by the authority having jurisdiction. (See Paragraph 3421.)

3330. Detecting Equipment.

3331. Location. Fire detecting equipment shall be lo-

cated on the ceiling or on the side walls near the ceiling. It shall be installed throughout all parts of the protected premises including all rooms, halls, storage areas, basements, attics, lofts and other subdivisions and accessible spaces; and inside all closets, elevator shafts, enclosed stairways, dumb-waiter shafts, chutes and other minor subdivisions and enclosures.

a. Where codes, standards, laws or authorities having jurisdiction require the protection of selected areas only, the specified areas shall be protected in accordance with this Standard.

b. For the purposes of this Article the area underneath a deck, mezzanine, or floor landings of stairways having a minor dimension of four (4) feet or more shall be considered a separate subdivision and shall be protected accordingly.

c. Protection may be required under large benches, shelves, or tables and inside cupboards or other enclosures not extending to the ceiling.

d. Protection may also be required underneath open loading docks or platforms and their covers, and for accessible underfloor spaces of buildings without basements.

3332. **High Temperature Areas.** Special instructions shall be obtained from the authority having jurisdiction regarding the use of high temperature degree thermostats in boiler rooms, heating boxes, skylights, etc.

3333. **Spacing.** Detector spacings shall not exceed the linear maximums indicated by tests of Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada, and Factory Mutual Engineering Division for the particular device used. Closer spacing may be required due to structural characteristics of the protected area, possible drafts, or other conditions affecting detector operation. Detectors operating primarily on the heat convection principle and installed on a joisted ceiling should have their smooth ceiling spacing reduced where this spacing is measured at right angles to solid joists; in the case of spot detectors, i.e., thermostats, this spacing should not exceed 50 per cent of the listed spacing.

3334. **Support.** Detectors shall be supported in all cases independently of their attachment to the wires.

3335. **Tests.** Fire detectors shall be tested periodically as specified by the authority having jurisdiction.

ARTICLE 340. SPRINKLER SYSTEM WATERFLOW ALARM AND SUPERVISORY SIGNAL SERVICE.

3410. Scope.

3411. The provisions of this Article apply to sprinkler system signaling attachments for indicating the flow of water in the system and for indicating the off-normal condition of sprinkler system components which may affect the performance of the system adversely.

3420. General.

3421. **Supplementary Manual Alarm Signal.** It is recommended that premises having a sprinkler system equipped to provide a waterflow alarm signal have supplementary means for manually transmitting an alarm signal located in the normal path of exit from the area.

NOTE: For combined alarm signal circuits, see Section 2640.

3422. **Supplementary Pressure Supervisory Signal.** A dry pipe sprinkler system equipped for waterflow alarm signals only should provide supplementary supervision of the system air pressure to avoid false alarm signals due to neglect in maintaining air pressure. Connection of the pressure supervisory signal attachment contacts to obtain trouble signal operation of the transmitter used for waterflow alarm signals is acceptable for this purpose.

3423. **Signal Identification.** The signal received shall indicate the particular feature of the sprinklered property which is abnormal (off-normal) and when it has been restored to normal.

3424. **Tampering.** A signal attachment and its circuits shall be so designed and installed that they cannot be readily tampered with or removed without causing a signal to be produced.

3430. Waterflow Alarm Service.

3431. **General.** Provision shall be made to indicate the flow of water in a sprinkler system, except movement of water due to waste, surges, or variable pressure, by an alarm signal. The waterflow signaling attachment shall operate to indicate any leak or flow of water occurring at a rate of ten or more gallons per minute.

3440. Supervisory Signal Services.

3441. **General.** Provision shall be made for supervising the required conditions, which are essential for the proper operation of sprinkler systems except those related to water mains, tanks, cisterns, reservoirs, and other containers of water controlled by a municipality or a public utility.

3442. **Gate Valve Position Supervision.** A gate valve shall be supervised to obtain two separate and distinctive signals, one indicating movement of the valve from its normal position and the other indicating restoration of the valve to its normal position. The off-normal signal shall be obtained either during the first two revolutions of a hand wheel or when the stem of the valve has moved one-fifth of the distance from its normal position.

a. Where the signaling attachments of two or more valves utilize a common circuit a restoration signal shall be obtained only when all of the valves of the group are in their normal positions.

b. An attachment for supervising the position of a gate valve shall not interfere with the operation of the valve nor obstruct the view of its indicator nor prevent access to its stuffing box.

3443. **Pressure Supervision.** Pressure sources shall be supervised to obtain two separate and distinctive signals, one indicating that the required pressure has been decreased or increased and the other indicating restoration of the pressure to its normal value.

a. A pressure supervisory signal attachment for a pressure tank shall indicate both high and low pressure conditions. A signal shall be obtained when the required pressure is increased or decreased ten pounds from the required pressure value.

b. A pressure supervisory signal attachment for a dry pipe sprinkler system shall indicate both high and low pressure conditions. A signal shall be obtained when the required pressure is increased or decreased in accordance with requirements of the authority having jurisdiction.

c. A steam pressure supervisory attachment shall indicate a low-pressure condition. A signal shall be obtained when the normal pressure is reduced to a value which is not less than 110 per cent of the minimum operating pressure of the steam-operated equipment supplied.

d. An attachment for supervising the pressure of other sources than those specified above shall be capable of being applied and operated as required by the authority having jurisdiction.

3444. **Water Level Supervision.** Water storage containers shall be supervised to obtain two separate and distinctive signals, one indicating that the required water level has been lowered or increased and the other indicating restoration to the normal level.

a. A pressure tank supervisory attachment shall indicate both high and low level conditions. A signal shall be obtained when the water level is lowered or raised three inches from the required level.

b. A supervisory attachment for other than pressure tanks shall indicate a low level condition. A signal shall be obtained when the water level is lowered 12 inches from the required level.

3445. **Temperature Supervision.** Water storage containers shall be supervised to obtain two separate and distinctive signals, one indicating that the temperature of the water has been lowered to 40° F., and the other indicating restoration to the proper temperature.

3446. **Pump Supervision.** Automatic fire pumps, auxiliary booster and special service pumps shall be supervised as prescribed by the authority having jurisdiction. Where supervision is applied to the electric power supplying the pump, connection of the supervisory device shall be made on the line side of the motor starter so that open fuses or open circuit breakers in the supply line to the pump will be detected at once.

ARTICLE 350. AUTOMATIC SMOKE ALARM SERVICE.

3510. General.

3511. The authority having jurisdiction shall be consulted in all cases before installation of equipment.

3520. Signal Indication.

3521. Abnormal smoke density shall result in transmission of a distinctive smoke alarm signal to the central super-

vising station. The signal transmitted shall designate the building protected. The floor, section or subdivision of the building at which the signal originated shall be indicated also, either by the signal to the central supervising station or by approved visual means in or at the building when the condition of occupancy and application of smoke detection are such that this feature is essential for adequate protection.

3522. Smoke alarm service may include provision for connection of a supplementary circuit for actuation of equipment controlling blowers, fans, shutters, etc., at the time of a smoke alarm signal.

3530. Location of Detectors.

3531. Smoke detectors shall be so located and adjusted to operate reliably in case of smoke at any part of the area protected. The location of detectors should be based upon an engineering survey of the application of this form of protection to the area under consideration. These features include air velocity, number of detectors to provide adequate coverage of cross-sectional areas of the space with respect to travel, diffusion or stratification of smoke; location of detectors with respect to exhaust, intake or circulating blowers; air conditioning facilities, temperature variations, and the like. Such conditions vary with different installations and should be dealt with on the basis of experience in the service.

3532. Special consideration shall be given to the storage of contents of a protected space to provide unobstructed openings for the travel of smoke to the smoke detector.

3533. Where air conditioning or ventilating equipment serves the space to be protected by a smoke detector, particular attention shall be given to the intake, exhaust and circulation of smoke under any condition of operation of the equipment to insure prompt detection.

3534. Photo-electric light beams shall be so located or enclosed or otherwise arranged that movement of objects within the space protected will cause no signal.

3535. Light sensitive equipment shall be so located or shielded that light from any source other than that intended

to be applied to the equipment will have no effect upon the detector. The opening of any enclosure during normal servicing shall cause no smoke alarm signal. A smoke detector shall be so installed as to minimize the possibility of operation due to accumulation of dust, moisture, deterioration of equipment, or any other condition of system operation not associated with fire or smoke.

3536. The conditions of occupancy of each space protected by a smoke detector shall be arranged to avoid operation of the detector due to the use of fumigants, or any other type of fog or mist producing materials, sweeping and cleaning resulting in dust circulation, and the like.

3537. The smoke detection combination shall be able to withstand 110 per cent of the rated voltage continuously without injury during the normal supervisory condition and shall operate successfully during the normal signaling condition at the increased voltage and also at 85 per cent of normal voltage.

3538. All smoke detecting equipment shall be secured reliably in place. The security of separate photo-electric light source and receiver units shall insure against the change of adjustment due to vibration, change in alignment of supporting surfaces, or the like.

3539. Provision shall be made to afford adequate protection of the smoke detection equipment from mechanical injury.

3540. Maintenance Servicing.

3541. All equipment requiring servicing shall be readily accessible and shall provide practical means for cleaning parts which accumulate dust, replacement of illuminating lamps, etc.

3542. Suitable and practical facilities shall be provided to permit periodic testing for sensitivity.

3543. The equipment shall be inspected monthly and maintained in proper operating condition.

3550. Circuit Arrangement.

3551. A smoke detecting combination of a Class A Proprietary System shall be capable of operating for a smoke

alarm signal during a single break or a single ground fault condition of the circuit wiring conductors (a) between the central supervising station and the smoke alarm signal transmitter and (b) between the smoke alarm signal transmitter and the smoke detector control unit, except as indicated in Paragraph 3552.

3552. The requirement of Paragraph 3551 does not apply to the circuits between the smoke alarm signal transmitter and the smoke detector control unit if both of these units are located in a common enclosure, or in adjacent enclosures not more than three feet apart and having the circuits between the enclosures run in conduit.

3553. The motor of a blower provided as a part of a smoke detector shall be electrically supervised to indicate stalling or burnout.

3554. The requirements of Article 240 for electrical supervision of circuits applies to all wiring employed to interconnect separate units of a smoke detecting system and its power supply circuit wiring at the installation. In addition, the smoke detecting system shall provide electrical supervision of all filaments of photo-electric cell illuminating lamps and the filaments and heaters of all electronic tubes, if their failure prevents normal operation for a smoke alarm signal.

3555. The failure of electrically-supervised circuits and parts shall be indicated by a trouble signal which is distinctive from a smoke alarm signal.

CHAPTER 4. TYPES OF SYSTEMS.

ARTICLE 400. PROPRIETARY SYSTEMS.
(See Chapters 2 and 3, which also apply.)

4010. Scope.

4011. The provisions of this Article shall apply to a system supervised by competent and experienced personnel in a central supervising station at the property protected. The system is to include equipment and other facilities required to permit the operators to test and operate the system and, upon receipt of a signal, to take such action as shall be required under the rules established for their guidance by the authority having jurisdiction. The system shall be maintained and tested by personnel or an organization satisfactory to the authority having jurisdiction. These systems are designated "Class A" and "Class B." A Class A system provides emergency operation for fire alarm, waterflow alarm and watchman's supervisory signals during a single break or a single ground fault of the signaling line circuit. A Class B system does not include this emergency operating feature.

4012. The emergency operation required for Class A systems in Paragraph 4011 shall not apply to circuits providing only manual fire alarm service when:

a. Each circuit serves only one manual fire alarm station or box.

b. Not less than two manual fire alarm boxes are installed on the system.

c. Manual fire alarm stations are so located that there is not more than 400 feet of travel distance between stations.

d. Automatic visual or audible indication is provided at each station or box to indicate that the box is inoperative.

4020. Supervisory Station Structure.

4021. It is recommended that the supervisory station be located in a fire-resistive, detached building or suitably cut-off room, and, in any event, shall not be near or exposed to the hazardous parts of the premises protected.

4030. Fire Department Signals.

4031. General. The central supervisory station shall have reliable means for transmitting fire alarms to the fire department over wires electrically supervised and under the control of the plant owner or occupant.

a. Where permissible and deemed necessary the means shall consist of a direct electrically-supervised line to the fire department, with suitable code-sending device and register, or a municipal fire alarm box, either of ordinary or auxiliary type, within fifty feet of the central supervising station.

b. It is recommended that there be a telephone line from the central supervising station to the fire department, such line to available at all times and independent of the plant telephone switchboard.

4040. Signal Recording.

4041. The proprietary system shall be arranged to receive and record all signals received at its central supervisory station and to transmit to the fire department, indication of the building or group of buildings from which an alarm has been received.

4042. Recording Devices. Recording devices shall be so designed and arranged as to provide a permanent record. The time of receipt of all recorded signals shall be marked adjacent to the signal preferably by automatic means.

4050. Tests.

4051. Circuits. Facilities shall be provided at the central supervisory station on all circuits extending from the central supervisory station and on all local current sources at the central supervisory station for making the following daily tests:

a. Current strength on each circuit.

b. Voltage across terminals of each circuit at the inside terminals of protective devices.

c. Voltage between ground and each side of each circuit.

4052. Devices. Except as otherwise permitted by the authority having jurisdiction and as otherwise indicated in Paragraph 3335 complete and satisfactory tests of all coded and non-coded signaling devices shall be made quarterly.

4053. Records. A complete record shall be kept of the tests and operations of each system. The record shall be available for examination and where required, reported to the authority having jurisdiction.

4060. Durability.

4061. General. The devices and circuits shall be designed and installed so as to meet successfully the most severe conditions liable to be met in practice. No change or alteration shall be made without approval by the authority having jurisdiction.

4070. Operating Personnel.

4071. General. Watchmen and other employees not required to operate the system shall not be admitted to the central supervising station where signals are recorded.

4072. Number of Operators. A sufficient number of reserve operators shall be kept in training so that at least two competent operators are on duty constantly, and, in addition, maintain a service so arranged that any building protected can be reached by a runner within 15 minutes. Runner service shall be so maintained that two operators will always be in attendance except, in an extreme case, one operator may be used as a runner. All runners shall be of a mature age.

4073. Modification. The authority having jurisdiction may modify or reduce the number of operators where alarms are automatically transmitted to the fire department and the number and kind of installations indicates satisfactory supervision can be maintained over the system. Operation and supervision shall be the primary function of the operators and no other interest or activities shall take precedence over the protective service.

4080. Emergency Operation of Circuits—Class A System.

4081. Signaling Line Circuits. Except as provided in Paragraph 4012, each signaling line circuit and the devices connected to it shall be capable of operating for their intended signaling services during a single break or a single ground fault condition of any signaling circuit conductor.

NOTE: It is intended that this emergency signaling feature of operation will be obtained by either automatic or manual adjustments of the signaling circuit when the fault condition is indicated by a trouble signal.

4082. Transmitter Actuating Circuits. An automatic transmitter employed for waterflow alarm signals shall be capable of operating for an alarm signal during a single break or a single ground fault condition of any of its device circuit conductors except as indicated in Paragraph 4083.

NOTE: It is intended that this emergency signaling feature of operation will be obtained by automatic adjustment of the transmitter when the fault is indicated.