NFPA No. 72

Standards for the
Installation, Maintenance and Use of

PROPRIETARY, AUXILIARY AND LOCAL PROTECTIVE SIGNALING SYSTEMS

for

Watchman, Fire Alarm and Supervisory Service

1950

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NATIONAL FIRE PROTECTION ASSOCIATION
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National Fire Protection Association

International

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The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes over a hundred and seventy-five national and regional societies and associations and nearly thirteen thousand individuals, corporations, and organizations. Membership in the National Fire Protection Association is open to any society, corporation, firm or individual interested in the protection of life or property against loss by fire.

This pamphlet is one of a large number of publications on fire safety issued by the Association. The standards prepared by the technical committees of the National Fire Protection Association and adopted in the conventions of the Association, are intended to prescribe reasonable measures for minimizing fire losses. All interests concerned have opportunity through the National Fire Protection Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

Proprietary, Auxiliary and Local Protective Signaling Systems.

The standards for Proprietary, Auxiliary and Local Protective Signaling Systems, like those for Municipal Fire Alarm Systems and Central Station Systems, were originally a part of the rules for alarm systems as prepared by the Committee on Thermo Electric Fire Alarms in 1898. For a detailed history of these rules prior to 1911 see the history of the standards for Municipal Fire Alarm Systems.

The standards for the Construction and Installation of Signaling Systems were amended in 1913, 1915, 1916 and completely revised in 1919 and adopted in 1920. After amendments in 1922 and 1923, a revision was made in 1925 and adopted in 1926 which included a change in name to Protective Signaling Systems. In 1928 a revised edition was adopted and in 1931 the standards were separated into Central Station Protective Signaling Systems and Proprietary, Auxiliary and Local Protective Signaling Systems. Revisions of the latter standards were proposed in 1934 by the new Committee on Signaling Systems and Thermostats and adopted by the Board of Directors. Further revisions were made in 1935, 1940, 1941, 1942, ~~1945,~~ 1948 and 1950.

These standards were adopted by the National Board of Fire Underwriters and published as "Signaling Systems" in 1905, 1913, 1918 and 1920; as "Protective Signaling Systems" in 1926 and 1929; and as "Proprietary Auxiliary and Local Signaling Systems" in 1931 with amendments of 1936, and in 1941 with amendments of ~~1946~~ and 1948 and in 1949 with amendments of 1950 (NBFU Pamphlet No. 72).

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*Serving in a personal capacity in accordance with Par. 11-b-2 of the Regulations on Technical Committee Procedure.

Standards for the Installation, Maintenance and Use of PROPRIETARY, AUXILIARY AND LOCAL PROTECTIVE SIGNALING SYSTEMS

Including Local or Isolated Systems for Watchman, Fire Alarm and Supervisory Service.

(No. 72)

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Standards for the Installation, Maintenance and Use of PROPRIETARY, AUXILIARY AND LOCAL PROTECTIVE SIGNALING SYSTEMS

Including Local or Isolated Systems for Watchman, Fire Alarm and Supervisory Service.

Definitions.

Throughout this pamphlet the following meanings are intended.

ALARM. A signal indicating an emergency requiring immediate action, as an alarm for fire from a manual box, a waterflow alarm, or an alarm from a thermostat system; also to include other emergency alarms.

SUPERVISORY SIGNAL is the general term used to indicate the need of some action in connection with the supervision of watchmen, sprinkler and other extinguishing systems or equipment, or the maintenance feature of other protective systems.

TROUBLE SIGNAL. A signal indicating trouble of any nature relating to a protective signaling system, such as breaks, grounds, etc.

PROTECTIVE SYSTEMS, EQUIPMENT OR APPARATUS includes 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 SYSTEM. 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.

SUPERVISORY SERVICE. This involves services required to assure performance of watchmen patrols and the operative condition of automatic sprinkler systems, automatic alarm systems, and other systems for the protection of life and property.

ALARM SERVICE. This includes service rendered as a result of manual pulling of a fire alarm box, or the transmission of an alarm indicating the operation of protective equipment or systems, such as an alarm for water flow from a sprinkler system, the discharge of carbon dioxide, the detection of smoke, or the detection of excess heat by a thermostat. Also alarms of other protective systems.

MAINTENANCE. This includes repair service and periodic inspections necessary to keep the system and the various devices in good working condition, and the replacement of the system and the devices when for any reason they become unreliable or inoperative.

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

ARTICLE 1.

100. 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. In general the classes of systems are as follows:

101. Proprietary System. A system with supervision by competent and experienced observers and operators in a central supervising station at the property to be protected; the system to include such appliances as to permit the operators to maintain, test and operate the system and upon receipt of a signal take such action as shall be required under the rules established for their guidance by the inspection department having jurisdiction.

(See definition of Class A and Class B Systems, par. 412.)

102. Auxiliary Alarm System. A system maintained and supervised by a responsible person or corporation and consisting of transmitting devices which when operated manually or automatically causes an alarm to be transmitted over a municipal fire alarm system, to the fire station or to fire alarm headquarters for retransmission, either manually or automatically, to fire stations.

Auxiliarizing a municipal fire alarm system has for its object the elimination of delay in traversing the distance from the fire to the street box. Such elimination of delay is considered as primarily of importance in connection with the life hazard of buildings where there will be need of the fire department in rescue work and in halting the rapid spread of fire. Remote control stations are primarily of the manually operated type. The combining of the auxiliary feature with any private alarm system, whether purely of a type providing for exit of occupants or of a type involving automatic transmission of alarms indicating fire, introduces features of maintenance, inspection and supervision requiring special consideration of the inspection department having jurisdiction and usually involves divided authority. Fire alarm systems which transmit an alarm to the fire department independently of the municipal 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.

103. Local Alarm System. A local system of electrically supervised devices, the signals of which are transmitted to one or more places in the premises covered, primarily for the notification of occupants.

NOTE.—Such a system may also include automatic or manual transmission of alarms, and/or trouble signals, to a fire station or fire brigade and may include supervisory service as well as alarm service.

104. Miscellaneous Systems. All other protective signaling systems.

ARTICLE 2.

COMMON REQUIREMENTS.

200. General.

201. The intent and meaning of the terms used in these standards are, unless otherwise defined herein, the same as those of the National Electrical Code.

202. All devices, combinations of devices and equipment constructed and installed under these standards shall be approved for the purposes for which they are intended.

203. Full information as required by the inspection department having jurisdiction shall be furnished to and plans approved by it before the installation of devices and equipment is begun.

204. All systems shall be installed in a workmanlike manner and in accordance with the specifications and rules of the inspection department having jurisdiction and other competent authorities not inconsistent with these standards.

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

206. Except such parts of circuits or appliances as are intentionally and permanently grounded in order to secure their normal operation, all systems shall normally test free of grounds. It is recommended that systems shall be so designed that they will not be dependent upon the effectiveness of any ground connection for the normal operation of the system.

207. Upon the completion of a system, a satisfactory test of the entire installation shall be made in the presence of and under the direction of the inspection department having jurisdiction.

208. All systems shall be under the supervision of qualified persons satisfactory to the inspection department having jurisdiction and other authorized municipal authorities; these persons shall cause proper tests and inspections to be made at frequent intervals and have general charge of all alterations and additions to the systems under their supervision.

209. A complete record shall be kept of the tests and operations of each system and the records shall be open to examination by the inspection department having jurisdiction.

210. All apparatus requiring winding shall be rewound as promptly as possible after each test or alarm, and kept in normal condition for operation.

211. In hotels, department stores, hospitals and similar institutions, systems having sounding devices, within the protected premises, connected thereto should be so designed that initial fire signals in the building will sound only in departmental offices, engine room, fire brigade stations and other central locations, with provisions whereby authorized persons may send subsequent signals to sound a general alarm.

212. Unless otherwise permitted by the inspection department having jurisdiction, complete and satisfactory test of all fire alarm boxes and transmitters shall be made monthly and of combined night watch and fire alarm boxes every six months. Results shall be reported to the inspection department having jurisdiction.

220. Wiring.

221. Outside Wires—Underground.

a. To secure the largest measure of protection and reliability in the operation of signal systems, all wires outside of buildings should be placed underground.

b. Underground conductors shall be of copper and shall be in lead or other sheathing approved for such use. The wire of single or two conductor cables shall be not less than No. 14 A.W.G. The wires of three or four

conductor cables shall be not less than No. 18 A.W.G. The wire of multiple conductor cables may be smaller than No. 18 A.W.G. if of sufficient mechanical strength and current-carrying capacity. Each wire shall have rubber insulation, except that cables having multiple conductors may have paper insulation.*

c. By consent of the inspection department having jurisdiction circuits may be carried in cables with circuits of other signaling systems.

d. Terminal boards and cables shall not be located in rooms into which gas may leak from underground systems.

e. Underground cables and their terminal boards shall not be permitted in rooms exposed by combustible material stored in the vicinity of same.

f. Underground wires shall not be placed in a duct, handhole, or manhole containing electric light or power wires. Where a handhole or a manhole is divided into sections by means of partitions of brick, concrete or tile, each compartment shall be considered as a separate handhole or manhole.

222. OUTSIDE WIRES—OVERHEAD.

Where it is impracticable to place wires underground, the following rules shall be observed:

a. The following conductors or other conductors of equivalent minimum conductivity and tensile strength may be used for single wires:

No. 12 A.W.G. galvanized iron.
No. 12 A.W.G. copper.
No. 14 A.W.G. copper clad.
No. 10 A.W.G. aluminum.

b. Bare wires shall only be used for long runs of pole line construction, free of trees and other obstructions, and then only by special permission of inspection authorities having jurisdiction.

c. Single wires other than those covered by *222b* shall have weatherproof covering equivalent to at least two thoroughly saturated and filled braids or other approved outer covering. Wires passing through trees shall, in addition, be protected against abrasion by a special covering.

d. All wires on poles or where attached to buildings shall be supported by suitable insulators and so far as possible, shall be run under rather than over electric light and power wires; a clear height of 18 feet shall be required across roadways and wires shall not run across roofs without permission of the inspection department having jurisdiction.

e. Wires from the last outdoor support to the protector, and wires attached to buildings shall have rubber insulation on each wire, and in addition the wires, either individually or bunched, shall be covered with a substantial braid.

f. Cables shall comply with requirements for underground cables and shall be supported in an acceptable manner by messenger wire. Cables passing through trees shall be protected against abrasion by wooden strips.

g. Overhead wires shall not be attached to a cross-arm carrying electric light or power wires, nor shall they, when on the exterior walls of buildings be brought closer than four inches to electric light or power wires, unless one system is in conduit or is permanently separated from the other system

*Underwriters' Laboratories, Inc. have issued Standards for Fire Alarm Cables, and will issue certificates covering cables built under these standards.

by a continuous and firmly fixed non-conductor, additional to the insulation on the wires.

h. The metal sheath of aerial cables which are liable to contact with electric light or power wires, unless grounded in an approved manner, shall be interrupted close to the entrance to a building by an insulating joint or equivalent device.

i. The distance between the two inside pins of any crossarm of a pole carrying signal and electric light and power wires shall be not less than 30 inches.

It is recommended that signal wires, being smaller and more liable to break and fall, be placed on the lower crossarms.

j. Wires shall enter buildings either through non-combustible non-absorptive, insulating bushings, or through approved rigid conduit. Conduit or bushings shall slope upward from the outside, or, where this cannot be done, drip loops shall be formed in the wires immediately outside the point of entrance. The conduit shall be equipped with an approved service head. More than one wire may enter through one conduit or bushing.

k. The preceding paragraph shall not apply where the wires enter a building in the form of a cable, nor where the entire outside circuit is run underground, and the circuit is so placed as to be free from chance of accidental contact with electric light or power wires of over 250 volts.

223. INSIDE WIRES—IN BUILDINGS; GENERALLY.

a. Wires beyond the protector, or wires inside buildings where no protector is employed, shall be neatly arranged and secured in place in a convenient, workmanlike manner. They shall not approach nearer than two inches to any electric light or power wire unless one system is in conduit or the two systems are permanently separated by a continuous and firmly-fixed non-conductor, additional to the insulation on the wires.

b. Wires bunched together in a vertical run shall have a fire-resisting covering sufficient to prevent the carrying of fire from floor to floor. This requirement shall not apply if the wires are encased in non-combustible tubing, or are located in a fireproof shaft having firestops at each floor.

c. Signal wires and electric light and power wires may be run in the same shaft, if the two systems are separated at least two inches, or if either system is incased in non-combustible tubing.

d. Conductors of systems covered by these standards shall not occupy any raceway, compartment, outlet box, junction box, or similar fitting containing conductors employed for any other purpose, unless the conductors of these signaling systems are segregated from all other conductors by an approved partition or the equivalent. Approved metallic raceways should be provided.

Conductors of systems covered by these standards, including system power supply conductors, may occupy the same enclosure without regard to whether the individual circuits are alternating current or direct current and without regard to differences in operating voltages, only if all conductors are insulated for the maximum voltage of any conductor within the enclosure.

e. Conductors pulled into conduit or raceways in which other conductors are installed shall be cabled and protected by a suitable covering.

f. Transformers or other devices supplying current to signaling systems from electric light or power circuits shall be of a type expressly approved for such service.

g. The following permissible methods of wiring outlined in the National Electrical Code shall apply to apparatus covered by these standards.

Open Wires
Conduit Work
Surface Metal Raceway
Armored Cable
Underfloor Raceways (if used only for Protective Signaling System wires)
Non-Metallic Sheathed Cable
Electrical Metallic Tubing

1. Where approved rubber covered (type R) wires are specified for conduit work, electrical metallic tubing, or for surface metal raceways, approved No. 16 gauge rubber covered fixture wires, solid or stranded, having 1/32 inch insulation (type RF-32), may be substituted.
2. Approved cable may be used as a method of wiring by special permission of the inspection authorities having jurisdiction. The conductors shall be of copper and shall be in lead or other moisture repelling sheathing providing equivalent protection against mechanical injury and approved for such use. The wires of single or two conducted cables shall be not less than No. 14 A.W.G. The wires of three or four conductor cables shall be not less than No. 18 A.W.G. The wires of multiple conductor cables may be smaller than No. 18 A.W.G., if of sufficient mechanical strength and current-carrying capacity. Each wire shall have rubber insulation except that in cables having multiple conductors the insulation may be of approved fibrous material.
3. Special forms of cables of double conductor type may be installed on ceilings or on side-walls at least five feet above the floor, except in basements, for thermostat systems in hotels, dwellings, apartments, stores, offices, institutions, public buildings and other occupancies where there is little liability of mechanical injury. Such cables shall have rubber insulated conductors, protected by metallic sheath, heavy braid or other suitable material and installation shall be made with specially approved insulating fittings which shall not injure the conductors or the insulation and shall not permit the conductors to be nearer than ¼ inch to the supporting surface.
4. All cables shall terminate in and be supported by approved fittings.
5. Cables may be run exposed on side walls or ceilings if suitably protected against mechanical injury. Concealed cables shall be run in approved raceways or in conduit.

h. Wires shall be installed as far as possible without joints. Except in open work, splices will be permitted only in junction or terminal boxes.

i. Wires shall be so spliced or joined as to be mechanically and electrically secure without solder. The joints shall then be soldered, unless made with a splicing device, and shall be covered with an insulation equal to that on the wires. Stranded wires shall be soldered together before being fastened under clamps or binding screws.

j. For open work, wires in bay construction shall follow contour of ceiling, and shall not be strung from beam to beam. In joisted construction, unless run parallel with joists, wires shall have a 4-inch wide wood backing strip with knobs or cleats fastened to the bottom of this strip. When passing through any wall or partition wires shall be protected by bushings or by other approved means.

k. Wires should not be run through coal bunkers but when it is unavoidable shall be run in an approved lead cable in approved conduit.

224. IN BUILDINGS: WHERE THE OUTSIDE DISTRIBUTION SYSTEM CONSISTS OF AERIAL WIRES.

a. An approved protector shall be placed as near as practicable to the point of entrance to the building. The protector shall be mounted on a noncombustible, non-absorptive insulating base and shall consist of an arrester between each line wire and ground and a fuse in each line wire, the fuses protecting the arrester. The protector terminals shall be plainly marked to indicate "line," "instrument" and "ground."

b. The protector shall not be placed in the immediate vicinity of easily ignitable material or flammable gases, or dust or flyings of combustible material.

c. Where the entire outside circuit is run underground a protector shall not be required unless the circuit within the premises is so placed as to be liable to accidental contact with electric light or power wires operating at a potential exceeding 250 volts.

225. GROUNDING.

a. The grounding conductor of the protector shall be of copper not smaller than No. 18 A.W.G. and have a cross section at least equal to that of the conductors of the circuit which it protects. The grounding conductor shall have rubber insulation, covered with a substantial braid. Where necessary, it shall be guarded from mechanical injury.

b. The grounding conductor shall be run as direct as possible to a permanent and effective ground. Where connection is made to a gas pipe, attachment shall be made between the meter and the street main. In every case the attachment shall be made as close to the earth as practicable.

A suitable ground may be obtained by connection to either a water or a gas piping system, preferably to the former. In the absence of such piping system a ground rod or pipe driven into permanently damp earth is acceptable.

c. The grounding conductor shall be attached to the pipe by means of an approved bolted clamp to which the conductor is soldered or otherwise connected in an approved manner.

d. Steam or hot-water pipes shall not be employed as a ground for protectors.

Current Supply—System Operation and Supervision.

The permissible methods of current supply which may be used subject to the selection and permission of the inspection department having jurisdiction for the type of signaling systems to be installed, and the standards governing their use, are as follows:

226. STORAGE BATTERIES—GENERAL.

a. Batteries shall be installed in a room provided with suitable ventilation and shall be enclosed in such manner that gases or fumes therefrom will not expose fire alarm devices or other apparatus or wiring to injury.

b. Cells shall be suitably insulated against grounds or crosses and shall be substantially mounted in such a manner as not to be subject to mechanical injury. Racks or frames shall be suitably protected against deterioration.

c. A reliable source of charging current shall be provided and if deemed necessary by the inspection department having jurisdiction the current supply shall be taken from two separate and independent sources. The charging source shall not be over 250 volts.

d. Charging circuits and boards shall be installed and protected in accordance with the requirements of the National Electrical Code.

e. Fuses not less than 50 per cent. and not more than 100 per cent. in excess of normal working load or maximum signaling load, which ever is the greater, shall be provided at battery terminals.

f. Suitable provisions on a switchboard shall be made for charging the batteries so that they will be protected from injury due to an excessive rate of charge or to the reversing or interruption of the current; provision shall also be made for shifting the respective batteries from charging to working and from working to charging without opening any of the working circuits and so that charging current can not be accidentally connected to any of the working lines.

227. STATIONARY STORAGE BATTERIES IN DUPLICATE.

a. Storage batteries shall be of approved make and type in duplicate sets, each set capable of operating the system for a period equal to the normal interval between inspections by a competent attendant, but in no case less than 60 consecutive hours without recharging.

228. STATIONARY STORAGE BATTERIES WITH TRICKLE CHARGING FROM MOTOR-GENERATORS OR RECTIFIERS OR DIRECT CURRENT.

a. Only such equipment or devices which have been especially approved for protective signaling systems shall be installed.

b. There shall be provided a sufficient number of motor-generators or rectifiers of adequate capacity to supply all circuits without overloading the equipment, and sufficient spare units to secure continuity of supply, with a storage battery of 24-hours capacity floating across the line so connected that normally the battery will be charged.

c. Suitable provisions on a switchboard shall be made for automatically disconnecting the generators or rectifiers which otherwise would cause discharge of the batteries in case of interruption to the current supply or breakdown in the motor-generator or rectifier set and for operating the signaling system from the storage battery.

d. Each rectifier set shall be provided with replacement parts subject to breakage or rapid deterioration and shall be supplied through a transformer taking energy from a circuit not exceeding 250 volts and arranged to effectively insulate the rectifier circuit from the current supplying the transformer.

229. PORTABLE STORAGE BATTERIES.

Approved types of such batteries may be used for local service in place of primary cells or other source of power where provisions satisfactory to the inspection department having jurisdiction are made for care and recharging:

a. Batteries shall be inspected and recharged at least monthly.

b. A sufficient number of fully charged replacement sets shall be kept in reserve so that the requirements of (*a*) can be met under all conditions.

c. Batteries shall be charged by trained persons having satisfactory equipment for the purpose.

d. Switches shall be provided so that substitution of replacement batteries may be made without opening working circuits.

e. Systems employing such batteries shall be so devised that a trouble signal shall be actuated before the voltage falls below the point required to successfully operate the system.

230. Batteries shall be recharged before the potential thereof, effective during alarm transmission closures, falls below the following minimum values:

Storage batteries of lead type.....1.90 volts per cell
Storage batteries of Edison type.....1.10 volts per cell

231. STATIONARY BATTERIES—PRIMARY.

a. Primary batteries shall consist of approved cells of sufficient capacity to operate the signaling system for at least sixty days and, in the case of local fire alarm systems, to supply all needed current to operate the system for a period of one year and such battery cells shall be of suitable type and size and sufficient in number to provide at least 25% excess over the normal maximum demand.

b. Primary batteries shall be coupled together by approved battery connectors.

NOTE.—For dry cells, such connectors may consist of built-in parts of the cabinet.

c. The current flow from any primary battery shall not exceed that which the component cells are rated as being capable of delivering under intended operating conditions and, in any event, shall not exceed two amperes.

d. Closed circuit primary batteries shall not be used for open circuit work unless a suitable loading coil or suitable supervisory relay is permanently connected in multiple with the terminals of the battery.

e. Primary batteries of the caustic soda type shall have heat-resisting jars; the jar of at least one cell of each such battery shall be transparent.

f. Battery cells, having other than insulating jars or containers, shall be carried by suitable insulated shelving or supports.

NOTE.—Such containers as enameled steel jars or straw board cartons shall not be deemed "insulating" in construing this requirement.

g. A complete equipment of renewal parts of closed circuit cells, consisting of elements, chemicals (preferably in dry state) and oil (if required) shall be kept in reserve so that such batteries may be recharged without delay.

h. Each primary battery shall be inspected and tested at least once in each calendar month.

i. Batteries shall be renewed before the potential thereof, effective during alarm transmission closures, falls below the following minimum values:

Primary caustic soda batteries of ordinary type.....0.63 volts per cell
Primary caustic soda batteries of the so-called "high" voltage type.....0.72 volts per cell

232. RECTIFIER OR MOTOR-GENERATOR.—FOR USE ONLY FOR SYSTEMS WHERE AN OPERATOR IS ON DUTY AT ALL TIMES.

a. A sufficient number of units shall be provided to supply all circuits without overloading any machine. There shall also be provided additional sets to replace at least one out of each four sets normally required for operating the system. Power shall be from at least two independent sources of energy; one of these may be a special generator plant, driven by some form of prime mover continuously available.

233. ELECTRIC LIGHT OR POWER SERVICE.

a. The current supplied from a reliable electric light or power service may be used direct, provided a separate source of current is available for trouble signal devices.

b. Transformers or other devices supplying current to signal system from electric light or power circuits shall be expressly approved for such service.

c. Current procured from a public service supply shall be taken as near as practicable to the service entrance of the premises and on the supply side of the main service switch and cut-out. When the source of supply is an isolated plant located on the premises the supply shall be taken on a connection direct from the main bus-bars.

d. A fuse and suitable resistance, enclosed in a locked or sealed cabinet, shall be installed between the prime source of supply and the signal service conductors in the ungrounded side of the service.

e. It is permissible with the following three-wire types of commercial light or power supplies to use one side or phase to operate the signaling system and the other to operate the trouble devices, providing the record of supply service is satisfactory:

Three wire D. C. with grounded neutral.
Three wire A. C. single phase, with grounded neutral.
Two or three phase A. C. where the interruption of one phase will not prevent operation of the other.
The neutral conductor shall be continuous and unfused.

f. The authority having jurisdiction may permit the use of two wire commercial light and power supplies either for operation and supervision of systems or for operating trouble indicating devices.

234. CURRENT SUPPLY.—TROUBLE INDICATING DEVICES.

a. Any of the above types of supply may be used.

b. Systems deriving energy from storage or closed circuit primary cells may use a reserve set or reciprocally employ alternate sets of batteries to operate the trouble bell under conditions acceptable to the inspection department having jurisdiction.

c. If open circuit batteries are used to ring trouble bells, at least two multiple sets of four cells each shall be provided.

235. Battery Cabinets.

a. Primary batteries shall be placed in substantial well-fitted cabinets, elevated not less than 6 inches and not more than 6 feet above the floor and located in a clean, dry place where the temperature will not fall below 40° F. nor rise above 100° F.

b. Cabinets shall be provided with shelves of approved materials, properly fastened and secured to prevent sagging; if of wood, they shall be not less than ⅞-inch in thickness.

Supports for dry battery cells shall be so constructed that it will be impossible for the cells to come in contact with each other or with a metal enclosure.

Cabinets for liquid batteries shall be so constructed that the condition of the elements may be observed without disturbing the cells.

Doors shall be provided with lock and key, and kept locked.

c. Metal cabinets shall be of approved type, constructed of sheet iron or steel not less than No. 14 U. S. metal gauge.

The interior and the exterior of metal cabinets shall be painted with two coats of approved acid and alkali-proof compound; each coat to be thoroughly dried before the next is applied. Baked enamel will be accepted in lieu of the above.

d. Wooden battery cabinets shall be constructed of the best grade of kiln-dried wood not less than 7/8-inch thick. Doors shall be provided with a suitable lock and kept locked.

Wood cabinets shall be painted on the interior with two coats of asphaltum or other acid resistant compound, and on the exterior with two coats of lead paint, varnish, asphaltum or other approved compound.

240. Sounding Devices.

241. Sounding devices may consist of bells, gongs, whistles or horns of approved types or other approved devices acceptable to the inspection department having jurisdiction.

242. In systems intended to give alarm to occupants, as in factories, workshops and institutions, there shall be installed on each floor of the building one or more approved sounding devices, sufficient in number and efficiency to be heard plainly throughout the floor above the noise of the machinery and other sounds.

Where floors are divided by fire walls, each section may be deemed a separate floor for the purpose of these requirements.

The number, type and location of sounding devices shall in all cases be acceptable to the inspection department having jurisdiction.

243. Systems consisting of several types of sounding apparatus should be avoided.

Sounding devices of the fire alarm systems shall be distinctive in pitch and quality from all other sounding devices used in the same area.

244. Sounding devices should be placed with their lowest parts about eight feet from the floor.

Whenever there is danger of mechanical injury, the entire device shall be enclosed in an approved protecting case made of wire netting or perforated metal.

Whenever necessary hammer rods shall be suitably protected against mechanical injury or derangement by the use of a guard or other suitable means.

245. Electrically controlled whistles or sirens may be required as auxiliary equipment, and shall be installed in a manner acceptable to the inspection department having jurisdiction.

250. Manual Fire Alarm Boxes.

251. All boxes shall be of approved type and if for exterior installation shall be weatherproofed.

252. Boxes shall be used for no other than fire protection purposes, which may include watchman's and other supervisory code signals, and trouble signals. In all cases fire signals shall be distinctive.

253. Manual fire alarm boxes shall be located in the natural path of escape from fire at a readily accessible point which is not likely to be obstructed.

254. All alarm boxes shall be securely mounted and the lower edge of the box should not be lower than four and one-half feet nor more than six feet from the floor level.

255. Distribution of boxes shall be on the following basis:

a. At least one box on any floor where—

Coded signals are used for fire brigade or exit drills, with additional boxes such that the horizontal distance traveled will not, in general, exceed 100 feet;

Or where the floor area of maximum fire section is 7500 square feet or over.

b. Elsewhere there shall be a box in the first story and each alternate story, i. e., third, fifth, seventh, etc.

c. For piers, buildings of large area or buildings where passage is obstructed by partitions, tracks or operating processes, or where the property has multiple tenant ocupancy, there shall be additional boxes, as specified by the inspection department having jurisdiction, where in general the distance traveled horizontally will be 200 feet or more.

256. a. For Code ringing boxes, not less than three taps shall be given at each revolution of the breakwheel.

NOTE.—The following suggestion is offered as a guide in the arrangement of the signal code, but it is not to be considered as mandatory.

Single Building, four floors and basements.	4th floor	2-4
	3rd floor	2-3
	2nd floor	2-2
	1st floor	2-1
	Basement	3-1
	Sub-basement, etc.	3-2

b. Boxes used in systems employing electro-mechanical gongs shall be so designed that closed circuit periods will be not less than one-half the intervals between strokes of the gongs.

c. Boxes used in systems in which whistles, vibrating bells or horns are employed shall be so timed that the sounding devices will give the code signal clearly.

260. Control Boards and Devices.

261. Under the term "control boards" are included all panels or switchboards and similar devices carrying relay instruments, transmitters, resistors, switches or other mechanisms used for the purpose of supervising or testing circuits or for transmitting or recording signals.

262. Control boards shall be of a type expressly designed and approved for the system for which they are used.

263. Control boards shall be conveniently located where they will be least affected by vibration.

264. Relays shall be so located as to avoid danger of sparking contacts igniting flammable gases or flyings; and, except in stations where competent operators are on duty, shall be enclosed in an approved case under lock and key.

270. Electrical Supervision.

271. Systems except those covered by Section 610 shall be under electrical supervision so that a break or ground which prevents the normal operation of the system will immediately be indicated by a distinctive trouble signal.

272. The electrical supervision shall cover all sources of energy except that for trouble indicating devices so that failure of energy will be indicated by a trouble signal. It shall also cover:

a. All building circuits for boxes, thermostats or other appliances used for initiating a signal.

b. All alarm sounding devices, except where it is necessary to use sounding devices such as vibrating bells not readily susceptible to electrical supervision, in which case sounding devices shall be alternately connected to two circuits and approximately equally distributed throughout the building.

NOTE.—This requirement will usually involve electrical supervision of all main relays, contactor relays and other current-carrying parts of devices or control boards. It does not preclude the use of normally open secondary circuits, contacts and the like in transmitter control boards, recording devices and other appliances, the operation of which is subsequent to and dependent on the operation of the electrically supervised main circuits, provided such circuits or parts are suitably enclosed, protected and installed so as not to be liable to mechanical injury.

In thermostatic systems this rule shall not be interpreted to require the thermostats themselves or the detector of metal tubing systems to be electrically supervised when connected in multiple across electrically supervised circuits.

273. The current used for electrical supervision shall be sufficient to retain in normal condition all relays and other devices in a positive and reliable manner, with a suitable factor of safety and to prevent derangement by jars, shocks or vibration.

280. Trouble Signals.

a. Each electrically supervised circuit shall be so connected that in event of a circuit trouble condition affecting the operation of the system it will continuously operate a trouble bell or other approved trouble indicating device which may be common for several such circuits.

b. Trouble bells shall be of an approved design and give a distinctive signal.

c. Trouble bells shall not be fitted with silencing switches, except in such a manner that the act of silencing the bell, by the operation of the switch, automatically and positively transfers the trouble signal to a lamp in the control unit.

d. Trouble bells shall be located as required by the inspection department having jurisdiction.

290. Circuit Capacity.

291. Circuits used for the transmission of alarms, including the circuit from an automatic central office to the fire department, shall be limited as to devices connected to it such that interference with the receipt of alarms will be minimized to a degree acceptable to the inspection department.

292. Preferably alarm transmission devices, including fire alarm boxes, water flow alarm transmitters, and thermostatic alarm transmitters, should be on circuits over which are received only alarms of fire or alarms indicating the operation of fire protection equipment.

293. Where supervisory or other types of signals, other than watchman supervisory signals, are handled over the same circuit with alarm devices, the alarm device relating to fire protection shall be of such a type as to take

precedence over other signals or produce sufficient repetition of the alarm as to eliminate the loss of the alarm.

294. Manual fire alarm boxes on the same circuit with other alarm devices and serving the same building shall be of a design giving the manual fire alarm box control of the circuit; shunt non-interfering shall be acceptable.

295. Not over 25 buildings from which distinctive alarms or signals are sent shall be connected to a single circuit. Not over 50 transmitting devices shall be connected on a single circuit, except that in buildings in which the device or circuits or both are so designed that alarms or signals cannot be sent simultaneously from more than one device, the entire group of devices shall be considered as one, but this shall not allow more than 250 signaling breakwheels to be connected in a single circuit.

Where only supervisory signals, such as those in connection with a protective system, equipment or apparatus, are transmitted over a circuit, the limitation shall be twenty-five sets of transmitters and not to exceed one hundred breakwheels.

ARTICLE 3.

TYPES OF SERVICES.

300. General.

301. The types of services covered by this section may be used for Proprietary or Local Systems. Any special requirements for each service provided by a particular system are listed under the section applying to the system.

310. Manual Fire Alarm Service.

a. Fire alarm boxes shall be installed in accordance with Section 250.

b. Inspection authorities having jurisdiction shall be consulted in all cases prior to the installation of combination services.

320. Watchman's Supervisory Service. (Separate or combined with fire alarm service.)

321. For the supervision of the watchman's service covering any definite building or premises, the location of stations which must be visited and of the route to be traveled shall be as approved by the inspection department having jurisdiction. The system shall be such as to record at the central supervising station each time each station is visited or shall be so designed that stations shall be actuated in a fixed order of succession; provided that where boxes are so located that a fixed route is not deemed necessary to assure complete watch service, a fixed order of actuating boxes shall not be necessary if each box is of such a type as to indicate within the time limit set that it has not been operated by the watchman. Distinctive signals shall be transmitted at the beginning and completion of each round of the watchman, and in every case there shall be a transmitting station at intervals not exceeding ten stations.

322. There shall be no more watchmen reporting over a single circuit during one tour interval than one for each ten transmitters of a combined watch and fire alarm type or a straight watch type system, or one watchman for each two transmitters of a suppressed signal type, up to the total permissible loading per circuit (50 transmitters per circuit).

330. Automatic Fire Alarm Service.

331. Thermostatic systems, other than local systems, shall be arranged to transmit a signal designating the building protected, and shall also indicate, either in the signal or by approved visual means in or at the building, the floor, section or subdivision from which the signal originated, except that the inspection department having jurisdiction may, upon application, waive this specific indication where the area, height or special conditions of occupancy are such that this indication is not deemed to be an essential feature of thermostatic protection of the property. Local systems shall sound an audible alarm and preferably indicate the building and floor from which the signal is transmitted.

332. Transmitters, manual alarm boxes, testing boxes and annunciators shall be of an approved make, and so installed that a considerable jar cannot start their mechanism.

333. Where a property is provided with an automatic fire alarm system and has not an approved and properly maintained manual fire alarm system, one or more manual fire alarm boxes may be required, usually at the main entrance of the building, or the principal buildings where a group of buildings is protected.

334. Installation of Thermostats.

a. Thermostats shall be placed throughout premises, including inside of all closets, in basements, lofts, elevator wells and under stairs. Special instructions shall be obtained relative to placing them under large shelves, decks, benches, tables, overhead storage racks, and platforms and inside small enclosures, chutes and cupboards. No portion of the premises shall be exempted without the written consent of the inspection department having jurisdiction.

b. Special instructions shall be obtained from the inspection department having jurisdiction as to the location of high-temperature degree thermostats in boiler rooms, heating boxes, skylights, etc.

c. The spacing and distribution of thermostats shall be as determined by the Underwriters' Laboratories and indicated in the List of Inspected Fire Protection Appliances.

d. The distance from wall or partition shall not exceed one-half the distance between thermostats in the same direction.

e. A line of thermostats shall be run on each side of partitions.

f. Special instructions shall be obtained from the inspection department having jurisdiction relative to location of thermostats under floors and roofs of panel or other unusual construction and for which provision is not hereinbefore made.

g. Thermostats shall be supported in all cases independently of their attachment to the wires, except in open wiring when cleats or knobs are within one foot of each side of thermostats.

h. Thermostats for hatch closers shall be placed at the top of the elevator wall or hoistway equipped, and on the ceiling below each floor opening in such numbers and so arranged in each case as may be required by the inspection department having jurisdiction.

i. Where automatic sprinklers are to be installed spacing of thermostats shall be such as to assure operation in advance of the automatic sprinkler.

340. Sprinkler equipment supervisory and water flow alarm services:

NOTE.—These standards are also applicable to protective fire appliances using other fluids than water or using gases.

341. GENERAL.

a. The inspection department having jurisdiction shall be consulted in all cases before installation is begun.

b. The Central supervising station shall be able to determine from the signal received the particular feature of the sprinklered property which is abnormal and when it has been restored to normal.

342. DEVICES, CIRCUITS, ETC.

a. Shall be so arranged that devices cannot easily be tampered with or removed without giving a signal in the central supervising station.

343. GATE VALVE SUPERVISION.

a. Gate and stop valves, other than those on water mains controlled by a municipality or a public utility, which are essential to the operability of protective or fire extinguishing apparatus, equipment, or systems, shall be provided with approved devices or attachments to give a signal over a circuit. Devices shall be so attached as not to interfere with the operation of the valve nor obstruct the view of indicator nor prevent access to stuffing box.

b. Attachments on all valves shall give a signal between the first and second revolutions of the hand wheel tending to move the valve from its proper position; or when valve is not controlled by hand wheel, signals shall be given before the valve has moved 1/5 of the stem movement from its proper position.

Two separate and distinctive automatic signals will be required for the gate valve alarm, one signal to show that a valve has been moved from its normal position, and another distinctive and different signal to show that the valve has been returned to its normal position. The latter signal shall not be given until all valves have been returned to their normal position, or at least to the point where the first or trouble signal was given.

344. PRESSURE SUPERVISION.

a. Pressure on protective or fire extinguishing apparatus, equipment, or systems shall be supervised, where the continued maintenance of pressure is essential to proper operation. Pressure on water mains controlled by a municipality or a public utility is generally not considered as needing supervision.

Pipe to which supervisory devices are connected shall be provided with a plugged test gauge connection and a stop and relief valve of satisfactory pattern; the whole to be so arranged that pressure on attachment and plugged connection can be released for testing purposes.

b. Pressure tank attachment shall give a high and low pressure signal at ten (10) pounds below and ten (10) pounds above the normal pressure.

c. Steam pressure attachment shall give a low pressure signal at ten (10) per cent above the minimum operating pressure.

d. Attachment to dry-pipe pressure system shall give a high and low pressure signal at ten (10) pounds variation above or below normal pressure.

e. In special cases and for other pressure sources specific instructions shall be obtained from the inspection department having jurisdiction.

f. Two separate and distinctive automatic signals will be required for pressure alarm, one to show that the pressure has gone below or above the required amount, and another distinctive and different signal to show that the normal pressure has been restored.

345. WATER LEVELS SUPERVISION.

a. Tanks, cisterns, reservoirs, and other storage containers, other than those controlled by a municipality or a public utility, the contents of which are essential for the operability of protective or fire extinguishing apparatus, equipment, or systems, shall have approved water level signaling devices designed to withstand corrosion and possible mechanical obstructions.

b. Devices shall give a low water signal in all supplies, except pressure tanks, when water drops 12 inches below the required level. Pressure tank device shall give a signal when water drops 3 inches below or rises 3 inches above the required level.

c. Two separate and distinctive automatic signals will be required for water level alarm, one to show that water has changed from the required level, and another to show that the water level has been restored.

346. TEMPERATURES SUPERVISION.

a. All tanks, cisterns, reservoirs, and other storage containers, other than those controlled by a municipality or a public utility, the freezing of which will prevent the operation of protective or fire extinguishing apparatus, equipment, or systems, shall be supervised as to temperature, by an approved attachment or device in the containers, if located where subject to possible freezing.

b. The indicator shall give a separate and distinctive signal when temperature falls below 40° F., and another distinctive and different signal to show that the water has been restored to the proper temperature.

347. FIRE PUMPS SUPERVISION.

Where automatic fire pumps are used a complete supervision shall be provided in each case, for which special instruction shall be obtained.

350. WATER FLOW ALARM SERVICE.

a. Satisfactory and positive connections shall be made by an approved device for indicating the flow of water in the sprinkler system, except that due to waste, surges or variable pressure.

b. The device shall indicate at the central supervising station any leak or flow of water in the sprinkler system equal to or greater than at the rate of ten (10) gallons per minute. The trouble signals shall be distinctive and different.

c. Where any private local water flow alarm system is in use, the supervisory water flow alarm shall be so arranged that it shall not be dependent upon the operation of or interfered with by trouble on the local private alarm circuit.

360. Automatic Journal Alarms.

361. GENERAL.

a. All journal apparatus shall be of an approved type.

b. Permanently fixed ladders shall be provided wherever needed to make bearings readily accessible.

362. CIRCUITS AND CONNECTIONS.

a. Circuits shall be so sub-divided that not more than fifty (50) thermostats will be on any one circuit and circuits shall be limited as near as possible to individual buildings.

b. Where bearings are not fixed, such as tighteners, etc., a special approved flexible stranded conductor shall be used.

c. Thermostats shall be on every bearing not subject to constant inspection where heating will result in fire or where an explosion hazard exists

d. Journal thermostats shall be securely fastened in place, but shall be so arranged that they can readily be taken out of the bearings and disconnected without impairing the wiring or connections in any way, and their connections shall be so arranged that journal boxes can be removed and replaced without breaking the wires.

e. Journal thermostats shall be set to give an alarm at approximately 165° F., except by special consent of the inspection department having jurisdiction, when thermostats may be set at not over 212° F .

363. SOUNDING DEVICES.

a. When vibrating bells are used the service shall be so arranged that the failure of any one to operate can in no way interfere with the proper action of any other bell.

b. There shall be an annunciator or other suitable indicating device in the engine room, with associated alarm bell having a gong not less than 6 inches in diameter, arranged to sound a code signal or, if a code signal is not used, to ring continuously.

c. Unless there is, in the engine room, a man constantly available for answering journal alarms, such alarms shall be given on each floor unless connected to a proprietary system.

370. Automatic Smoke Alarm Service.

371. GENERAL.

a. The inspection department having jurisdiction shall be consulted in all cases before installation of equipment.

372. SIGNAL INDICATION.

a. Abnormal smoke density shall result in transmission of a distinctive smoke alarm signal to the central supervising station. The signal transmitted shall designate the building protected. The floor, section or sub-section 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 building when the condition of occupancy and application of smoke detection are such that this feature is essential for adequate protection. Local systems shall sound an audible alarm and preferably indicate the building and floor from which the signal is transmitted.

b. 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.

373. LOCATION OF DETECTORS.

a. 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.

b. 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.

c. 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.

d. 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.

e. 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.

f. 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.

g. The smoke detecting 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 80 per cent of normal voltage.

374. 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.

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

376. MAINTENANCE SERVICING.

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

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

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

377. CIRCUIT ARRANGEMENT.

a. 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 (1) between the central supervising station and the smoke alarm signal transmitter and (2) between the smoke alarm signal transmitter and the smoke detector control unit, except as indicated in paragraph 377b.

b. The requirement of paragraph 377a 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.

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

d. The requirements of Section 270 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.

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

ARTICLE 4.

PROPRIETARY SYSTEMS.

400. General.

401. Before acceptance may be obtained for any equipment operating through a central supervisory station, there shall be filed with the inspection department having jurisdiction a general description of the apparatus to be installed, together with such detailed information and drawings as are necessary to the complete understanding of the operation of the system. Daily reports to the inspection department may be required.

402. If the inspection department having jurisdiction requires it, there shall also be furnished:

a. Diagrams showing the manner in which the various equipments will be connected to the station and signals delivered to the city fire department and salvage corps.

b. A satisfactory guarantee as to the service to be rendered and as to the maintenance and efficiency of the system.

403. The station should be located in a fire-resistive, detached building or properly cut-off room, and in any event shall not be near and exposed to the hazardous parts of the premises protected.

404. The central supervisory station shall have reliable means for transmitting alarms to the fire department over wires electrically supervised and under the control of the plant owner. Where permissible and deemed necessary one of these should be a direct electrically supervised line to fire alarm headquarters, with suitable code sending device and register, or a municipal fire alarm box, either ordinary or auxiliary type, within fifty feet of the central supervising station; there should also be a telephone line from the central supervising station to fire alarm headquarters, and the telephone line shall be available throughout the twenty-four hours without going through the hands of the local plant telephone operator.

405. Registering devices shall be so designed and arranged as to give a permanent record. The time of receipt of all recorded signals should be automatically marked adjacent to the signal.