NFPA No.
73
File: 70 Series
Electrical

Standards for the

Installation, Maintenance and Use of

MUNICIPAL FIRE ALARM SYSTEMS

June
1956

Thirty-five Cents*

NATIONAL FIRE PROTECTION ASSOCIATION

International

60 Batterymarch Street, Boston 10, Mass.

2M-6-56-WP *Discount for quantities Printed in U.S.A.

National Fire Protection Association

INTERNATIONAL

Executive Office: 60 Batterymarch St., Boston 10, Mass.

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 nearly two hundred national and regional societies and associations (list on outside back cover) and more than sixteen thousand individuals, corporations and organizations. Anyone interested may become a member; membership information is available on request.

This pamphlet is one of a large number of publications on fire safety issued by the Association including periodicals, books, posters and other publications; a complete list is available without charge on request. All NFPA standards adopted by the Association are published in six volumes of the **National Fire Codes** which are re-issued annually and which are available on an annual subscription basis. The standards, prepared by the technical committees of the National Fire Protection Association and adopted in the annual meetings of the Association, are intended to prescribe reasonable measures for minimizing losses of life and property by fire. All interests concerned have opportunity through the Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

NFPA standards are purely advisory as far as the Association is concerned, but are widely used by law enforcing authorities in addition to their general use as guides to fire safety.

Definitions

The official NFPA definitions of shall, should and approved are:

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations, or that which is advised but not required.

APPROVED refers to approval by the authority having jurisdiction.

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters.

Approved Equipment

The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The standards are prepared, as far as practicable, in terms of required performance, avoiding specifications of materials, devices or methods so phrased as to preclude obtaining the desired results by other means. The suitability of devices and materials for installation under these standards is indicated by the listings of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada and the Factory Mutual Laboratories test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

Municipal Fire Alarm Systems

NFPA No. 73—1956

This edition of the Standards on Municipal Fire Alarm Systems incorporates amendments adopted by the NFPA as of June 7, 1956 on recommendation of the Committee on Signaling Systems and Thermostats. It is the latest in a series of editions dating back to 1898.

Initially these standards were general rules and requirements covering many phases of signaling and alarm systems. In 1904 a set of standards was compiled to cover all the separate standards previously prepared and the committee name was changed to Signaling Systems. A general revision of the standards was made in 1911 including separating Municipal Fire Alarms from Signaling Systems. In 1934 a complete revision was made of the 1926 edition and the committee assumed its present name. Amendments of 1940 and 1941 were incorporated in the 1941 edition. More recent amendments have been adopted by the NFPA in 1946, 1948, 1949, 1950, 1952, 1954 and 1955.

Successive editions of this standard have been adopted and also published by the National Board of Fire Underwriters in editions with identical text and the same designating number.

Standards for the Installation, Maintenance and Use of MUNICIPAL FIRE ALARM SYSTEMS

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CHANGES IN 1956 EDITION

Revisions incorporated in the present edition of this standard include:

Paragraph 100-1: addition of a sentence pertaining to the use of municipal alarm systems for other than fire alarms.

Paragraph 202-5: deletion of reference to type RW and addition of reference to National Electrical Code.

Paragraph 204-1: Wording revised and references changed.

Paragraph 205-3: second sentence revised.

Paragraph 206-1: first word "charging" changed to "current supply" and a new sentence added.

Paragraph 207-10: note added pertaining to visibility of fire alarm boxes.

Paragraph 304-1: new sentence added.

FUNDAMENTALS

100. Municipal fire alarm systems shall incorporate the following fundamental characteristics:

100-1. The system shall be so designed, installed and maintained as to provide the maximum practicable reliability for continuous and correct transmission and receipt of fire alarms. The system may be adapted or used for the transmission of police calls or other emergency signals, provided such transmission does not interfere with the receipt of alarms of fire.

100-2. To assure reliability, circuits upon which transmission and receipt of alarms depend shall be under electrical supervision or have equivalent provisions to give warning of conditions adversely affecting operability.

100-3. Systems shall be adequate in extent to protect all built-up sections of the city.

100-4. Means for transmission of alarms by the public shall be available on the streets within distances as specified in Section 207-9, shall be conspicuous and readily accessible for easy operation, and shall not depend upon voice transmission solely for designating the location.

100-5. Simultaneous or concurrent operation of street facilities for transmission of alarms by the public shall not cause interference or loss of an alarm. In residential and minor mercantile areas and outlying industry, a speed of 4 or more strokes per second of a code-sending facility may be considered as meeting this requirement for a Type A (manual) system, under the conditions specified in Section 207-2-3.

100-6. Systems shall be properly maintained to assure reliability and extended as needed to provide adequacy. Maintenance, control and supervision by others than the municipality shall be by contract guaranteeing performance.

100-7. Systems which, because of characteristics or methods of operation, differ from the Standards hereinafter given, but which comply with the intent of these Standards as giving equivalent adequacy and reliability, may be considered as acceptable. Such systems shall be submitted in detail to the authority having jurisdiction before final contract is awarded.

100-8. The following, as used in these standards, are deemed to have the meaning indicated below:

1. **Headquarters:** The building or portion of a building used to house the central operating part of the fire alarm system; usually the place where the necessary testing, switching, receiving, transmitting and current supply devices are located; sometimes called Fire Alarm Headquarters or Central Station or Central Office.

2. **Station or Fire Station:** A building occupied by mobile apparatus of the fire department. Also includes Salvage or Patrol Stations and, in some instances, water works pumping station.

3. **Circuits:** Conductors used to perform a definite function in connection with a fire alarm system. Box circuits are those on which fire alarm boxes are connected, and in Type B systems must also connect to receiving equipment at fire stations. Alarm circuits are the circuits over which alarms are transmitted, automatically or manually, from headquarters to stations. Local circuits are those contained wholly in headquarters; also those, in fire stations or to firemen's homes, which are not an essential part of the alarm system.

101. Operation.

Provision shall be made for the transmission of all alarms, whether received by the signaling systems, telephone, verbal or otherwise, to fire department personnel and to other required points, such as Water Department headquarters. The number of operators necessary for the receipt and transmission of alarms shall be determined upon the following basis; but operators may perform other duties not interfering with their ready availability for the receipt and transmission of alarms of fire.

101-1. For communities receiving less than 600 alarms per year, alarms not retransmitted automatically shall be received and retransmitted to the fire force by a responsible person always on duty for the purpose, who may be

1. A specially designated person or persons, an employee of the local telephone company, or
2. A member of another municipal department, or
3. The house watch at a fire station, with facilities for transfer of service to another municipal office if the house watch responds to fires.

101-2. For communities receiving more than 600 and less than 1,500 alarms per year, at least one operator, especially trained for the service, shall be on duty at all times. Where a street box signaling system is maintained, the operator shall be in the central fire alarm office and be capable of testing and operating the system.

101-3. For communities receiving more than 1,500 alarms per year, at least two fully trained and competent operators shall be on duty at all times.

101-4. A Type A (manual) system is one where alarms from street boxes of any type require an operator to check their receipt and to retransmit all alarms to fire stations, and to outside sounding devices, if used. Type A systems are permissible for any size community and are required where the number of alarms, however received, approximate 1,500 per year.

101-5. A Type B system (automatic) is one where it is not necessary for an operator to check the receipt and transmission of alarms from street boxes of any kind.

102. Installation and Maintenance.

102-1. Especial importance is placed upon the efficiency and reliability of the methods employed in maintaining, inspecting, and testing fire alarm systems. No system is sufficiently automatic or durable to do away with the necessity for periodical inspections and working tests of all its parts.

102-2. All devices and equipment constructed and installed under this standard shall be approved for the purpose for which they are intended.

102-3. Plans and complete information regarding the system should be submitted to the authority having jurisdiction and approved by it before the construction of the building or the installation of apparatus is begun.

102-4. All systems shall be installed in a workmanlike manner and shall comply with applicable requirements of these standards.

102-5. Upon completion of a system installation, a satisfactory test of the entire equipment shall be made in

the presence of an authorized representative of the purchaser, and, if required by the authority having jurisdiction, in the presence of its representative.

102-6. The normal operating condition of the system shall be such that grounds will not be necessary to secure any required function, and that circuits extending outside of headquarters shall normally test free of ground. This shall not prevent the use of the ground to secure functioning under abnormal line conditions provided the ground would not prevent reception or transmission of a signal in the event of an accidental ground on the circuit.

102-7. Systems shall be under the supervision of responsible persons who shall cause proper tests and inspections to be made at intervals not less frequent than those specified in Sections 303-2 and 403-3.

102-8. A complete record shall be kept of all tests and alarm signals, all circuit interruptions and observations or reports of apparatus failures or derangements, and all seriously abnormal or defective circuit conditions indicated by test or inspection; these records shall show date and time.

102-9. All apparatus requiring winding shall be wound as promptly as possible after each test or alarm in which the apparatus functioned, and shall be maintained in normal condition for operation.

103. Alarm Transmission.

103-1. Advancement in the design and construction of electrical transmitting and receiving equipment for signals by means of voice, such as radio or voice amplification, or graphically by symbols, such as the printing telegraph or teletypewriter, has progressed to the point where such equipment and circuits, when installed in accordance with the requirements of these standards, may be considered as acceptable.

REQUIREMENTS FOR ALL SYSTEMS.

200. General.

200-1. The integrity of any fire alarm system is dependent upon the kind of material used and the maintenance. In general, wires in cable, either underground or suspended on messenger wires, are preferable to overhead open wire construction. This applies especially to alarm circuits and to circuits serving boxes in the principal mercantile or congested value districts and industrial areas.

200-2. Wire terminals shall be attached in such a way as to provide good electrical conductivity and minimize breaking from vibration, and shall be of such form as to permit ready installation or removal if necessary.

200-3. Switches and other devices which may, through gravity, open the circuits are prohibited.

201. Cables.

201-1. All cables shall be constructed under approved specifications which provide a high degree of dependability under the most severe conditions of moisture and abuse likely to be encountered. Each cable shall be tested for compliance with the specifications, and a certificate of compliance from Underwriters' Laboratories, Inc., is recommended.

NOTE: The use of specifications of The International Municipal Signal Association is recommended.

201-2. The types of cable as defined by their coverings and recommended as suitable for use in the specified locations, are indicated in the following table:

Underground Conduit	Direct Burial	Aerial on Messenger	Interior
Lead alloy	Lead and armored	Lead alloy	Braid
Rubber	Rubber	Polychloroprene sheath	Loom covering
Polychloroprene sheath		Loom covering	
Polyvinyl chloride sheath*		Polyvinyl chloride sheath*	

*With polyethylene or polyvinyl chloride insulation on individual wires.

NOTE: Unalloyed lead sheath cable shall not be used. Rubber sheathed cable shall not be used where it may be exposed to oil, grease or other substances or conditions which may tend to deteriorate the cable sheath. Braided sheathed cables shall be used only inside of buildings when run in conduit or metal raceways and used in lieu of individual conductors.

201-3. Consideration shall be given to the type of cable covering employed with respect to its ability to withstand the abuse of installation. All cables in manholes shall be properly racked and marked for identification.

201-4. Wires shall be of copper. The sizes of conductors shall be not smaller than as indicated in the table below, for the number of cabled conductors.

No. of Conductors	AWG. Size of Conductors
2	14
4	16
10	18
20 or over	22

201-5. Cables in direct burial or in duct shall be brought aboveground only at points where liability of mechanical injury or of disablement from heat incident to fires in adjacent buildings is minimized. All conduits or ducts entering buildings from underground duct systems shall be effectively sealed against moisture or gases entering building. Cables should be in duct systems and manholes containing low tension signaling system conductors only, except low tension secondary power cables; if in duct systems or manholes containing power circuit conductors in excess of 250 volts, fire alarm signaling cables shall be located as far as possible from such power cables and shall be separated from such power cables by a noncombustible barrier or by such other means as may be practicable to protect the signaling cables from injury. Cable joints shall be located only in manholes, fire stations and other buildings where proper accessibility is provided and where there is little liability of injury to the cable by falling walls or by operations in the buildings. Cable joints shall be so made as to provide and maintain specific conductivity, insulation and protection at least equal to that afforded by the cables joined, and cable ends shall be sealed against moisture.

201-6. Current supply for designating lamps at street boxes should preferably be secured at lamp locations from the local electric utility. When this is not possible, how-

ever, lighting circuit wires for supplying such lamps may be included in cables containing fire alarm wires. When lighting circuit wires for supplying designating lamps at street boxes are included in cables containing fire alarm wires, the lighting circuit wires shall be not larger than No. 10 AWG, and the applied load shall not exceed 80 per cent of the current carrying capacity of the conductor as rated by the National Electrical Code. The lamps shall be connected in multiple and both wires of the circuit shall be in the same cable. The potential between any lighting circuit wire and ground shall not exceed 125 volts and shall be supplied by special devices (such as insulating transformers, motor generators or batteries) which effectively isolate the circuits from all other electrical circuits. The special supply devices shall be energized by a permanently grounded supply of not more than 250 volts. The neutral wire of a three-wire circuit or one wire of a two-wire transformer secondary circuit shall be permanently grounded and each ungrounded wire shall be fused at its current carrying capacity as rated by the National Electrical Code. No lighting circuit wire shall be connected to any fire alarm signaling system terminal, junction or test board located outside of headquarters. Lighting circuit conductors in box pedestals or similar places, where not in fire alarm cables under conditions as above, shall be installed in approved conduit or cable.

NOTE: In view of greater facility with which circuits may be run aboveground, it is not considered necessary nor advisable to provide in aerial fire alarm cables special conductors for supplying designating lamps at boxes. Where such conductors are provided in fire alarm cables, they shall be installed in accordance with the provisions of Section 201-6.

201-7. Other municipally controlled signal wires may be installed in the same cable with fire alarm wires. Cables controlled by, or containing wires of, private signaling organizations can be used for fire alarm purposes only on permission of the authority having jurisdiction. Signaling wires, which, because of the source of current supply, might introduce a hazard, shall be protected and supplied as required above for lighting circuits.

201-8. Cables laid in direct burial without enclosure in ducts, shall be in grass plots, under sidewalks and in other places where the ground is not apt to be opened for other underground construction, if complying with specifications for cables specially approved for the purpose. If splices are made, such splices shall, where practicable, be accessible for inspection and tests. Such cables shall be buried at least 18

inches and, where crossing street or other areas likely to be opened for other underground construction, shall be in approved duct or conduit or be covered by creosoted planking at least two inches thick and eight inches wide, or consisting of two creosoted 2 inch by 4 inch planks with half round grooves, spiked or banded together after the cable is installed.

201-9. All cables, when installed, with all taps and splices made, but before connection to terminals, shall be tested for insulation resistance. Such tests shall be made with suitable instruments and shall indicate an insulation resistance of at least 200 megohms per mile between any one conductor and all others and the sheath, or ground.

201-10. Aerial cables shall be supported in an approved manner on messenger wire of adequate tensile strength. (See International Municipal Signal Association Specifications).

202. Overhead Wires.

202-1. Single wire shall not be smaller than No. 10 Roebling gage if of galvanized iron or steel, No. 10 AWG. if of hard-drawn copper, No. 12 AWG. if of approved copper covered steel or No. 6 AWG. if of aluminum. If spans exceed 150 feet, the wire cross-section shall be increased in the ratio of the squares of the lengths of span. The use of 2-conductor special wire is permissible if its tensile strength is not less than that of a No. 10 H.D. copper wire.

NOTE: The 2-conductor special wire is not considered suitable for line wire, particularly not through trees; its purpose is for distribution from cable terminal to nearby boxes, preferably along messenger wires, thus eliminating numerous cable terminal boxes and associated terminal boxes.

202-2. Single wires shall have an approved insulation and covering.

202-3. Wires and cables shall not be attached to a cross-arm carrying electric light and power wires. The distance between the two inside pins on a cross-arm shall be not less than 30 inches. As far as practicable fire alarm wires shall be run under all other wires except communication wires. Suitable precautions shall be provided where passing through trees, under bridges, over railroads and other places where injury or deterioration is probable.

202-4. All vertical leads down poles shall be so located and have protective covering of a type that the wires will not be subjected to mechanical injury; the protective covering if extending to within 6 feet of wires other than communication wires shall not provide a continuous metallic path to the ground or to the box; installation shall in all cases be such as to prevent water from entering the conduit or the box.

202-5. Wires to boxes shall be not smaller than No. 14 AWG copper with National Electrical Code 600 volt insulation approved for wet locations, as defined by the National Electrical Code.*

202-6. Wires entering buildings shall be kept free from contact with other than intended supports. When entering the outside end of a metal conduit or sleeve, the conductors shall be so arranged as to form a drip loop and the conduit shall be equipped with a rain-tight service head. The service head shall be equipped with proper bushings. If a sleeve or conduit is used, it shall be securely sealed on outer and inner wall with sealing compound. The conductor attachment to the building shall not be above the level of the service head or conduit.

203. Wires Inside Buildings.

203-1. Wires inside buildings, including those from point of first attachment, shall be in conduit, electrical metallic tubing, metal moulding, or raceways. Installation shall be in accordance with the National Electrical Code.*

203-2. Wires shall have an approved insulation, with flame retardant and moisture resistant outer covering.

203-3. Wires shall be installed as far as possible without joints. Splices will be permitted only in junction or terminal boxes. Wire terminals, splices and joints shall conform with the National Electrical Code.*

203-4. Wires bunched together in a vertical run connecting two or more floors 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 noncombustible tubing, or are located in a fireproof shaft having firestops at each floor.

203-5. Signal wires and electric light and power wires may be run in the same shaft, if the two systems are

*Standard No. 70 published by the NFPA in the National Fire Codes, Vol. V and in separate pamphlet form.

separated at least two inches, or if either system is incased in noncombustible tubing.

203-6. At headquarters, wires shall extend as directly as possible to the operating room; and all cables and wires shall be installed in conduits, ducts, shafts or raceways of a type of construction affording protection against mechanical injury.

203-7. All cables or wiring at headquarters, and cables carrying more than four circuits in fire stations or other buildings, shall be enclosed in masonry ducts or shafts capable of withstanding a standard two-hour fire test without injury to the cables where extending through garage sections or other places where exposure to fire or mechanical injury is probable.

203-8. Conductors on the switchboards and on cross-connecting racks shall be not smaller than No. 18 AWG, and the outer covering over the insulation on such conductors, or the insulation itself, if no outer covering is present, shall be fire retardant and moisture resistant, or shall be so treated after installation as to be fire retardant and moisture resistant.

204. Circuits.

204-1. All circuits employed outside of headquarters shall be normally of the closed, all-metallic type, except that local circuits, employed as indicated in Paragraphs 304-1 and 404-2 may be open circuits.

204-2. All circuits shall be so routed as to permit ready tracing of circuits for trouble and to permit easy patrolling of any territory left without fire alarm protection due to breakdown of a circuit; in general the interlacing of circuits is inadvisable especially where circuits are in cables. In all installations continuity of service shall be given first consideration.

204-3. The installation of test points on circuits shall be kept to a minimum, and main cables shall not be brought to terminals in box standards. Where test points are essential, they should be in fire stations or other properly protected and accessible locations. In all cases, consideration shall be given to the liability of mechanical injury, to disablement from heat incident to a fire, to injury by falling walls and damage by floods, corrosive vapors or other causes.

204-4. Box circuits shall be sufficient in number and so laid out that, in general, the area which would be left without box protection in case of disruption of a circuit will not exceed that covered by 20 properly spaced boxes where aerial open wire is used, or 30 boxes where underground or messenger supported aerial cable is used. If all boxes on any individual circuit and the associated circuits and equipment are designed and installed to provide for receipt of alarms through the ground in case of a break in the circuit, the area covered by this box circuit may be twice the above figures for aerial open wire circuits and cable circuits, respectively. No alarm circuit shall be connected to alarm instruments in more than five (5) fire stations. (See Section 207-9.)

NOTE: Under the above designation circuits which cover an area needing more than the boxes indicated above would be considered as "overloaded" and therefore required to be split into two circuits even though the circuit was connected to less than this number of boxes. Also the installation of additional boxes in an area now served by the number of properly spaced boxes indicated above does not constitute overloading of a circuit.

205. Circuit Protection.

205-1. Conductors entering headquarters shall be protected by the following devices, in the order named:

1. By a fuse rated 3 amperes and not less than 2,000 volts.

2. By an arrester, which at a temperature of 24° C., with a current of 5 amperes and a potential of not more than 400 volts DC, will dependably discharge 10 times without permanently grounding the circuit; which will not discharge at a potential of less than 200 volts DC.

3. By a fuse rated at one-half ampere. In systems where an operator is constantly on duty, approved mechanical circuit breakers, in addition to the above, may be used.

NOTE: Circuit breakers should be of such design that they will open the line at a current of one-half ampere within 5 minutes and will operate satisfactorily up to 600 volts, but will not open the line at a current of 3 amperes maintained for 2 seconds.

205-2. Aerial open wire circuits should be protected by an arrester as provided in Section 205-1, paragraph 2, at intervals of approximately 2,000 feet. The installation of

arresters in fire alarm boxes is not recommended. Arresters shall be readily reached for inspection.

205-3. Batteries shall be protected by enclosed fuses of not less than 3-ampere capacity, nor more than one half the ampere-hour capacity of the battery at eight-hour discharge rate. Fuses shall be suitably located so that they are not subject to corrosion and battery leads of both polarities shall not be in the same conduit, tubing or cable between the battery and point of fuse protection.

205-4. Leads from rectifiers or motor-generators, with storage battery floating, shall have fuses rated at not less than one ampere and not more than 200 per cent of the normal load carried; where not provided with battery floating the fuse shall be not less than 3 amperes.

205-5. At fire stations or other buildings, each conductor entering from lines partly or entirely aerial shall be protected by an arrester complying with the specifications of Section 205-1, par. 2.

NOTE: Fuses are not recommended for circuits at the point of entrance to fire stations, except that for systems having a headquarters operator always on duty, and in fire stations having a house watch normally on duty, a 2,000-volt, 5-ampere enclosed fuse may be installed on the station side of the arrester.

205-6. At junction of open aerial conductors and cable, and between aerial and underground cables, each conductor shall be protected:

1. By an arrester complying with the specification of Section 205-1, par. 2, which arrester shall be of weatherproof type or be suitably protected from the weather.

2. By a 2,000-volt 7-ampere enclosed fuse in the line on the cable side of the arrester.

3. By a connection between the arrester ground and the metallic sheath of the cable.

4. The fuse shall be on the cable side of a junction with open aerial wires, and on the underground cable side of junctions of cables.

205-7. All fuses and arresters shall be marked with their rated capacity and voltage and the name of the manufacturer.

205-8. All arresters shall be connected to a ground wire of No. 8 AWG. extending to a suitable ground.

206. Current Supply.

206-1. Current supply circuits, together with their associated motors, generators, rectifiers, transformers, fuses and controlling devices, shall be in accordance with the requirements of the National Electrical Code.* 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.

206-2. Current in fire alarm circuits under normal conditions of alarm transmission shall be at least 50 per cent in excess of the minimum necessary for the operation of any connected device.

206-3. Means shall be provided for regulating current in box and alarm circuits so that operating current may be maintained within 10 per cent of normal throughout changes in external circuit resistance from 20 per cent above to 50 per cent below normal.

206-4. The voltage supplied to maintain normal line current on circuits containing street boxes or alarm instruments shall be not less than 10 volts, nor exceed 125 volts, measured under "no load" conditions, and shall be such that the line current will not be reduced below safe operating value by the simultaneous operation of eight boxes.

206-5. Each box circuit and each alarm circuit shall be provided with a secondary source of current. This secondary source shall be independent of other sources and of a high degree of reliability. The secondary source shall be arranged as follows:

1. It shall not operate through or be dependent upon the same motor generator, or converter, or other device having moving parts which supplies the primary or normal supply, except that a storage battery, floating on a rectifier or generator, will be considered as a secondary source.

2. It shall be of such capacity and reliability as to assure operation of the system or circuit in case of interruption of the normal supply.

3. It shall, where the normal supply direct to the circuit is not by battery, automatically supply the circuit or circuits upon loss of the normal current-supply source or in case of non-operation of any current supplying device hav-

*Standard No. 70 published by the NFPA in National Fire Codes, Vol. V and in separate pamphlet form.

ing moving parts; in a Type A system this automatic feature may be omitted if suitable provisions are made for instantaneously restoring service by the throwing of a switch.

206-6. The following forms and arrangement of current supply are permissible:

Form 1. Storage batteries, comprising individual duplicate batteries for each circuit.

Form 2. Storage batteries comprising duplicate sets or generator or rectifier with storage battery floating, each battery set, or generator or rectifier and battery set, supplying several circuits in multiple. Permissible (but not recommended where circuits are wholly or partly open wire) for Type A systems only.

Form 3. Storage batteries comprising individual battery sets for each circuit with floating charge by individual rectifier or motor generator.

Form 4. Converters and rectifiers, or motor generators, or rectifiers, supplying individual circuits direct.

206-7. Storage batteries shall be located in the same building with the operating equipment, preferably on the same floor, but in all cases readily available for operation, maintenance and inspection. Batteries shall be installed in a room above ground level or provided with drain connections if water may cause flooding; where necessary to protect against damage by gases or fumes from the batteries, the room shall be provided with suitable ventilation and shall be located, cut off or enclosed in a suitable manner. Lead batteries of other than sealed type with jars of glass or other approved transparent material are not considered suitable.

206-8. Batteries shall be mounted in such a manner as to provide effective insulation from the ground and between different batteries; mounting shall be suitably protected against deterioration, and consideration shall be given to stability especially in territory subject to seismic disturbances.

206-9. Storage batteries shall have the following capacities:

1. Alternate charge and discharge; 60 hours operating capacity in each set with a single source of charging current; or 24 hours operating capacity in each set where there are two independent, reliably and constantly available sources of charging current. (See Section 206-12.)

2. Battery normally floating: 60 hours operating capacity for all connected load, with a single source of charging current; or 24 hours operating capacity where there are two independent, reliably and constantly available sources of charging current. (See Section 206-12.)

3. Where the battery is used to supply a converter, which in turn supplies rectifiers, the capacity of the battery, on the basis of the maximum connected load, may be reduced to 24 hours operating capacity with a single source of charging current or 12 hours operating capacity where there are two independent, reliable and constantly available sources of charging current, provided arrangements are made for supply to the rectifiers direct from incoming AC supplies, and provided also that, where there is a single source of charging current, or either of the duplicate charging currents are of questionable or doubtful reliability, there shall be suitable switching arrangements to permit any or all circuits to be supplied direct from the battery. (See Sections 206-12.)

206-10. Systems using *Forms 3* or *4*, or *Form 2* where battery is floating, shall have a device indicating serious diminution of the normal supply to rectifiers or motor generators. All systems shall have sufficient ammeters and voltmeters to indicate the output to the line and to any battery. Ammeters and voltmeters used in common for several circuits shall be provided with cut-in devices designed to reduce the probability of cross connecting circuits.

206-11. Adequate arrangements shall be provided for giving floating batteries a charge at a higher rate than normal, on the basis of one high rate charging source for each 10 sets of floating batteries, unless sufficient capacity is provided in the individual normal charging sources. The high rate charge may be applied while the battery is connected to line, provided that no more than one battery is charged at the same time from any high rate source.

A battery normally floating may be used alone to supply the circuit, for a period not exceeding one half its operating capacity in terms of hours of service, just prior to an overcharge.

206-12. The two independent, reliably and constantly available sources of current supply specified under Section 206-9 may include:

1. Two separate circuits from a public utility distribution system, so serviced or connected that normal sup-

ply to one will not be affected by trouble which would put the other out of service.

2. One supply from a public utility distribution system and a second supply circuit from a primary or storage battery or from a generator driven by a water wheel, steam engine or turbine or an internal combustion engine, if so located as not to introduce a hazard to the fire alarm office. The generator should preferably be of sufficient capacity and so connected and normally used for emergency lighting of the operating room and shall be operated to supply the system for at least a continuous 3-hour period weekly.

206-13. Where circuits are independently supplied by rectifiers or motor generators, with or without storage battery floating, each rectifier, including its associated transformer, and each generator shall be a separate and complete unit, effectively isolating, electrically and mechanically, each circuit from all other circuits, in which case, a primary source of power common to all circuits may be used.

206-14. For *Form 2* (Section 206-6) batteries, motor-generators or rectifiers shall be sufficient to supply all connected circuits without exceeding the capacity of any battery (Section 206-9) or overloading any generator or rectifier; so as to supply box circuits independently from alarm circuits; and so that circuits developing faults, grounds or crosses with other circuits may be supplied each by a current source other than those supplying circuits not so affected, to the extent required by Section 206-17.

206-15. Local circuits at headquarters may be supplied either by a separate transformer battery, generator or rectifier, or in common with box or alarm circuits, except that devices to give warning of interruptions or dangerous decreases in current flow or other derangements jeopardizing service, shall not, in any event, be dependent for current supply upon the current source or sources supplying the circuits so supervised. The source of current for local circuits on which the operation of essential features of the system depends shall be supervised.

206-16. Rectifiers shall be supplied through an insulating transformer taking energy from a circuit of not to exceed 250 volts. Rectifiers or motor generators employed pursuant to *Forms 2, 3* or *4* shall have reserve as follows:

For *Form 2.* There shall be at least two complete equipments so arranged that the batteries can be switched from one to the other.

For *Forms 3* and *4.* For systems exceeding 10 circuits, complete ready to use units, or spare parts, shall be available, equal to five per cent of the total number of circuits. As an alternate, individual rectifiers or motor generators may be provided of sufficient capacity or voltage to permit two circuits to be supplied in series or in multiple.

206-17. Where batteries, generators or rectifiers simultaneously supply two or more circuits (pursuant to *Form 2*) busses or leads from each such battery, generator or rectifier shall extend to the operating room, and provision shall be made in the operating room for supplying any circuit or circuits from any battery, generator or rectifier. Three-ampere enclosed fuses shall be provided at points where supplies for individual circuits are taken from common battery leads. Under *Form 2,* necessary switches, testing and signal transmitting and receiving devices shall be provided to permit the isolation, control and test of each circuit, to the extent of at least 10 per cent of the total number of box and alarm circuits, but never less than two.

207. Boxes.

NOTE: Transmitters connected to box circuits will be considered as boxes for the purposes of this rule, except that where sounding or recording devices are provided to warn operators of the receipt of an alarm the transmitter need not be of non-interfering type.

207-1. Boxes shall be of an approved type; boxes of interfering type shall be normally unwound and boxes of non-interfering, non-succession type should preferably be normally unwound. Boxes should leave the circuit closed when in a run-down condition.

Boxes designed to use ground return in case of line interruption shall be provided with a ground connection which will permit a current flow at least 25 per cent in excess of the minimum necessary for the operation of the receiving instruments. Where suitable ground connections cannot be obtained at the box, there should be provided a special conductor as specified under Section 202-1 effectively grounded at intervals to secure the above current flow. Grounding to the grounded neutral wire of a power or light system is permissible where the maximum voltage to ground does not

exceed 150 volts and the neutral is effectively grounded in at least four places.

NOTE: The National Electrical Safety Code recommends as a protection to life provision a resistance in ground connections not in excess of 25 ohms.

207-2. Boxes shall be non-interfering and succession, except as follows:

1. In a system consisting of not to exceed 60 boxes, the boxes need not be succession but shall be non-interfering except that, in such a system, up to 20 boxes on a circuit may be of interfering type, but if more than one such circuit, non-interference between circuits shall be provided.

2. In a system not equipped with or requiring automatic repeating mechanism, or with suitable provisions at headquarters to provide for non-interference and succession, and where only one box is connected on a circuit, the box may be of plain interfering type.

3. In a Type A system operating at 4 or more strokes per second, circuits may include boxes of plain interfering type, if all of such boxes have closed-type break-wheels, the area served is of a dwelling or minor mercantile or outlying industrial character and boxes are so placed that the distance between boxes in any one circuit, via highway, does not exceed 1200 feet.

207-3. Non-interference devices, either mechanical or electrical, shall be designed so that manipulation of box starting levers, singly, concurrently or consecutively, will not under any circumstances result in a false signal.

207-4. Succession devices, either mechanical or electrical, shall be designed so that no signal will be lost if the starting levers of two boxes are pulled at or about the same time.

207-5. Boxes transmitting coded indication shall send three or four rounds of the box numbers. Four rounds are required where outside alarm devices are operated directly from the boxes for summoning firemen.

207-6. Boxes shall be capable of being adjusted to desired speed. For a Type A system they shall preferably be operated at 4 or more strokes per second but never slower than 2 strokes per second. For a Type B system they shall

be set to operate at the speed of the slowest instrument connected for response to the circuit, consistent with Section 208-2.

207-7. The operating device of boxes shall be readily available and of such design and so located as to make the method of its use apparent. Where a door must be opened to reach the operating device, the device must be visible through a transparency in the door. It is recommended that essentially like methods of operating for use by the public be provided for all boxes in the municipality.

NOTE: Doors with a glass guard covering a permanently attached handle or key for opening door to give access to the means of operation are permissible but not recommended. It is recommended that such doors be changed to make the operating device visible.

207-8. Box cases and parts at any time accessible to users shall be of insulating materials or permanently and effectively grounded by a No. 8 AWG. copper wire or its equivalent. Boxes equipped with arresters which discharge at a potential of less than 400 volts DC shall have box and arrester effectively grounded through the use of a fire alarm box grounding assembly. The ground wire or grounding assembly shall be properly attached to a driven rod, to an underground water piping system or to a grounded neutral of a power or light system provided the voltage to ground of the system does not exceed 150 volts and the neutral is effectively grounded in at least four places.

NOTE: An approved fire alarm box grounding assembly is described in detail in the International Municipal Signal Association Specifications and Operating Standards, Specification No. 61, or latest revision thereof. These specifications may be obtained on request from the Secretary, IMSA, 130 West 42nd St., New York 36, N. Y.

207-9. Boxes shall be located so as to suitably protect the city or town. (See Section 204-4.)

NOTE: In general it is considered that a box should be plainly visible from the main entrance of any building in congested districts. In mercantile or manufacturing districts it should not be necessary to traverse more than one block nor more than 300 feet to reach a box; in residential districts this distance should not exceed one block or 500 feet.

Schools, hospitals, nursing homes and places of assembly should have a box at or near the entrance.

207-10. Boxes shall be conspicuously located at street corners where practicable. These boxes shall be of conventional shape, painted red, with instructions for use plainly marked on the outer door. A special colored light shall be

provided at or near every box in closely-built sections, to indicate location at night.

NOTE: Provision should be made so that the location of a box is visible from all directions. In general, a wide band of distinctive color, preferably red, and visible over the tops of parked cars, should be painted on supporting poles. Adequate signs, when completely visible from all directions, are acceptable.

207-11. The placing of boxes in buildings on circuits with street boxes is not generally desirable; when such boxes are installed in buildings, they shall be placed as near as practicable to the point of entrance of the circuit and the interior wires shall be installed in conduit or electrical metallic tubing, installed in accordance with Chapter 3 of the National Electrical Code. Accessible and reliable means, available only to the authority in control of the municipal fire alarm system, shall be provided for disconnecting loops to boxes inside the buildings, and definite notification shall be given to the occupants of the building when interior boxes are not in service.

207-12. The use of municipal fire alarm circuits as a means of transmitting fire alarms from a protective signaling system shall be permitted only when such system and the method of auxiliarizing the municipal fire alarm circuit are in accord with the Standards for Central Station Protective Signaling Systems* or with the Standards for Proprietary, Auxiliary, Remote Station and Local Systems.*

207-13. Boxes shall be maintained in good operative condition. They shall be examined, cleaned and tested at least every 60 days, and, if on circuits partly or wholly aerial, after electrical storms and after high tension crosses. Boxes shall be tested by operation under conditions simulating actual use. All operating tests shall be recorded. In systems using repeating facilities, the circuit on which the box is located may be disconnected from the repeating facilities and connected to a recording device, but at all such times a competent operator shall be on duty at headquarters; where repeating facilities are depended upon, the test of one box from every circuit from which no alarm was transmitted during the past month shall be transmitted over the entire system, different boxes in the same circuit being tested in rotation in succeeding months.

*Standards Nos. 71 and 72 published by the NFPA in the National Fire Codes, Vol. V and in separate pamphlet form; also by the National Board of Fire Underwriters in NBFU Nos. 71 and 72.

207-14. Box numbers should be assigned, as far as practicable, so that consecutive numbers will be closely grouped.

207-15. Where firemen are not normally on duty at fire stations, a fire alarm box shall be provided at each station, located where constantly accessible to the public.

208. Outside Sounding Devices.

208-1. Except for warning signals at important street intersections, there shall be no outside sounding device which calls the attention of the public to a fire call, except where volunteer or call members of the fire department or off-shift men are called.

208-2. Outside sounding devices may be either of two types depending upon the operation of the department. First, a code sounding device where the location of the fire is indicated; second, non-code sounding, where an alarm is sounded and the firemen, on responding to the fire station, determine the location of the fire from the register at the fire station or are informed of the location by the telephone operator. Outside code sounding devices which are not operable at a speed of at least 1 blow or stroke in 1½ seconds shall be operated over a special circuit from a manual transmitter or through an automatic speed reducer.

208-3. Sounding devices shall be tested daily.

208-4. Any electrical supply to an outside sounding device of a general alarm type, either coded or non-coded, shall be by a separate service connection not used for other power or light or by a connection on the street side of the main fuses, and shall have adequate capacity for the load to be carried as given in the National Electrical Code and be provided with overload protective devices of such rating and so set that they will open the circuit only under short-circuit conditions. Where suitable reliability cannot be obtained from the normal service, a separate service, which may be from a reserve generator, operated by an internal combustion engine, a water wheel or steam engine, arranged to start automatically on failure of the normal service, shall be provided. Such appliances shall be tested at least once weekly under operating conditions.

208-5. Where fire departments include volunteers or call men, or off-shift members are required to respond, outside sounding devices or other means of notification, shall

be provided. If definite regulations are provided that firemen must respond to the fire station and not to the fire, circuits operating outside sounding devices and instruments for the notification of firemen need not be arranged to give coded signals but shall sound a distinctive alarm. Sounding devices may be provided in residences or places of business of officers and other responsible members of the fire department, and it is recommended that such sounding devices shall be connected by a special normally-closed circuit or circuits controlled by a relay or relays responsive to the box circuit or circuits and located preferably at headquarters. In any event all portions of box circuits and alarm circuits, including relays connected therein for control of special circuits, should preferably be located at points accessible at all times for purposes of maintenance and test.

208-6. Compressed air systems shall have sounding devices having a distinctive tone; if of coded type, blasts shall not be less than ½ second or more than 1½ seconds, with silent intervals of 1 to 1½ times the blast. Storage tanks shall comply with A.S.M.E. specifications for non-fired pressure vessels, be equipped with a safety valve, be of sufficient capacity to give consecutive blasts corresponding to 8 times the longest number of blasts assigned to a box, with a minimum of 50 blasts, and shall have a compressor arranged to restore normal pressure within 30 minutes. Compressor shall be suitably and reliably powered, arranged to automatically maintain storage pressure within 15 per cent of normal and be capable of operating continuously for 6 hours. Sounding device shall be actuated automatically from the fire alarm circuit either direct, through weights or other mechanical force or through a local electrical circuit provided with a suitable secondary source of power which may be a battery floating on the line; such circuit shall be so arranged that serious diminution of current will sound a trouble signal at a point where someone is on duty, or will give a warning blast. Piping or tubing of ferrous material shall be provided with scale traps of a type permitting ready cleaning, and shall be of over size. Installation shall be arranged to permit ready inspection and repair.

209. Telephone Alarms.

NOTE: It is generally recognized that there is no other thoroughly satisfactory means of sending and receiving fire alarms than an approved fire alarm system. Telephones in the home or place of business should not be relied upon to replace needed boxes on the street, nor to supplement any inadequacy in number or location of street boxes.

A fire alarm system, as required by these standards, should be employed for the transmission to fire stations of all fire alarms, whether originating from boxes, from telephones, or verbally.

209-1. There shall be a telephone at each fire station. Such telephones shall be used exclusively for fire department purposes, and should be connected by individual lines.

NOTE: Should local conditions justify, authority may permit two or more fire stations per line, in cities having a population of less than 20,000 and complying with requirements of Section 209-3.

209-2. Telephones at fire stations should be so arranged that they cannot be called from any public telephone central office except as follows:

1. Telephones connecting with public telephone central offices only through a common switching point arranged as required by Section 209-3.

2. Telephones located in fire alarm headquarters or elsewhere, as required by Sections 101-1 and 401-9, where there is always some person on duty who is competent to send and has facilities for sending alarms over the fire alarm system.

3. Telephones at offices of chiefs or other executive officers.

4. Where there is but one fire station in the community.

209-3. Where there is more than one fire station in the community, the telephone lines from the different fire stations should connect with a common switching point, preferably at the headquarters of the fire alarm system, where facilities shall be provided for communication with any fire station and with all public telephone systems within the district of the connected fire stations, together with alarm transmission means at least equal to those required by Section 401-9.

209-4. In communities having more than five fire stations where men are normally on duty, such switching point facilities shall comprise a private branch switchboard operated by a person under control of the municipality.

209-5. In communities where one or more operators are required at fire alarm headquarters (see Sections 101 and 403) such common switching point should be located in the room with the fire alarm headquarters apparatus; in

other communities, it should be located where the requirements of Section 401-9 are complied with.

209-6. Alarms for fires in buildings, received either verbally or by telephone, shall be first communicated to fire headquarters or to the fire station nearest the fire, or to all fire stations, but shall be followed by the number of the nearest box over the fire alarm system.

209-7. There should be a telephone number assigned for fire alarm purposes only. The emergency and service call information in the introductory pages of the telephone directory for the larger places should include the instruction, "In an emergency, dial or call the operator and explain briefly the nature of the emergency, for example, 'I want to report a fire'." For the smaller places the introductory pages of the telephone directory should include the instruction, "To report a fire, dial or call..... (Number)

or dial or call the operator." In all cases the number should also be listed under "Fire Department" in the alphabetical section of the telephone directory. For small places only one reserved telephone line need be assigned exclusively to fire calls, but for larger places at least two lines and as many more as may be required should be thus reserved. Preferably, full knowledge of the fire call number should be further assured through the distribution by the fire department of suitable cards to all homes and places of business.

In addition to these reserved lines, sufficient other lines should be provided to care for the usual departmental business. Where such lines are provided the directory listing should appear as follows:

Fire Department
To Report a Fire, Dial or Call..... (Number)
For All Other Purposes, Dial or Call..... (Number)

The same number should not be used for both classes of service. The fire alarm operator, or other person designated by the fire department to receive an alarm of fire, should refuse any call, other than one for fire, which comes in over the "fire call only" lines; and notify the party calling to use the other departmental number.

In a telephone system, where manual switching is used, connection to reserve lines shall be made only for reporting a fire; where dial system service is used, provision shall be

made for automatically selecting the reserve lines first and progressing to the general business lines, when the fire call is dialed, but the reserve lines shall not be made selective to a dialing of the general business number.

209-8. At the telephone central office, the supervisor or other responsible employee should give special attention to all incoming alarms and oversee their proper transmission to the fire department.

209-9. In communities where the above requirements cannot be met, a system comprising suitable outside sounding devices and transmission facilities as required by Section 401-9 may be directly utilized by the telephone central office employees, under conditions satisfactory to and by consent of the authority having jurisdiction.

209-10. Voice recording of telephone, radio, or other communication systems using voice shall be provided when a telephone switchboard is required in communities having more than five fire stations by Section 209-4 of these standards.

210. Headquarters.

210-1. Building shall be of "fire-resistive Type A (fireproof) construction" as required in the Building Code recommended by the National Board of Fire Underwriters.

NOTE: No combustible material should be permitted in the construction even for window or door trim, closets, instrument cases, etc.; floor surfacing, laid directly upon noncombustible base, may be of combustible material.

210-2. The building should preferably be located so as to be unexposed for a distance of at least 150 feet. If so located as to be exposed, then especial attention shall be given to guard against damage from such exposure, by protection for exposed openings, and by so constructing the roof as to resist damage which might be caused by falling walls.

NOTE: It is desirable to locate the building in a park or public square where the conditions as regards exposure can be fully met. As the building, even for a large city, need be only of moderate size, and since for a slight increase in cost it can be made ornamental in appearance, objection to such locations should not be insurmountable.

210-3. The building should be used for no other purpose than that relating to municipal signaling or fire department service. When any portion of the building is occupied as a heater or boiler room, garage, machine shop or for storage purposes, the part so used shall be cut off and any open-

ing to such portion shall be protected by fire doors on each side of wall at each opening.

210-4. Two approved portable extinguishers shall be provided for each 2,500 square feet of floor area.

210-5. Lighting of operating room shall be such that all lights are not dependent on a single branch line fuse. For Type A Systems two independent services shall be provided or emergency lights, of sufficient illumination to permit operation, shall be provided from storage battery kept charged or trickle charged; this battery may be used to supply local circuits of the headquarters equipment.

SPECIAL RULES APPLYING TO TYPE A SYSTEMS ONLY.

301. Apparatus in Headquarters.

The apparatus in headquarters shall include:

301-1. A cable terminal, with cross-connection facilities, located in or adjoining the operating room. To avoid the possibility of flooding, and to assure convenient access, all cable terminals should be located in rooms having floor above outside ground level.

301-2. A protector board, which may be combined with, and should be close to the cable terminal.

301-3. Protection and testing facilities shall include:

1. Those specified in Section 205-1.

2. Facilities for testing voltage across terminals of each circuit, inside of terminals of protective devices.

3. Facilities for testing for ground leakage. For systems in which each circuit is supplied by an independent current source (see Section 206-6, *Forms 1, 3* and *4*) such facilities shall include means for testing voltage between ground and each side of each circuit inside terminals of protective devices. For common current source systems (Section 206-6, *Form 2*) such facilities shall comprise means for testing voltage between ground and each terminal of each battery or other current source.

4. Facilities for testing voltage between one side of each circuit and opposite side of each of the other circuits. For common current source systems (Section 206-6, *Form 2*) this will involve provisions for successively isolating each

circuit from its normal supply source and testing for crosses between each circuit while so isolated and the current source or sources supplying all other circuits; such isolation to be accomplished without causing any service interruptions.

Facilities listed under Paragraphs 3 and 4 shall be operable without establishing crosses between circuits (except through the voltmeter), and may be combined in one set of devices.

301-4. Operating facilities, which shall include:

1. There shall be means by which the operation of a box will be automatically received and recorded at fire alarm headquarters. The reception shall be by visual code numbers or symbols, and there shall be an audible signal indicating an alarm is being received and transmitted.

2. Visual indicating devices for each box and alarm circuit, to give warning of circuit opening or dangerous diminution of line current.

3. Sounding devices, operated from the above visual devices, which may be in common for each panel or class of circuits, with silencing devices for each circuit.

4. Manual telegraph keys for each coded alarm circuit. Telegraph keys may be omitted on alarm circuits over which non-coded signals are transmitted.

5. For common current source systems (Section 206-6, *Form 2*) if grounded, the ground shall not exceed 10 per cent of resistance of any connected circuit and be located at one side of the battery. Visual and audible indicating devices shall be provided for each box and alarm circuit to give immediate warning of ground leakage endangering operability.

6. Approved devices for accomplishing the functions specified in Section 206.

7. Approved devices for testing voltage and current flow of each circuit and to and from the battery.

8. Time and dating facilities to indicate time of receipt of an alarm and similar facilities to indicate time of transmission to fire stations. These may be in conjunction with registers, signals graphically recorded or voice recording of telephone, radio or other systems using voice.

9. Relays may be provided for each circuit of each class when needed in order to secure proper functioning of required operating facilities, and shall be provided for each