NFPA No.

73

MUNICIPAL FIRE ALARM SYSTEMS 1967

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Official NFPA Definitions

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

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Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters. One foot = 0.3048 meters. One inch = 25.40 millimeters. One pound per square inch = 0.06805 atmospheres = 2.307 feet of water. One pound = 453.6 grams.

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Standard for the Installation, Maintenance and Use of Municipal Fire Alarm Systems

NFPA No. 73 — 1967

1967 Edition of No. 73

The 1967 edition of this Standard incorporates changes prepared by the Sectional Committee on Municipal Fire Alarm Systems. The Standard was adopted by the National Fire Protection Association at the May, 1967, Annual Meeting in Boston, Mass., on the recommendation of the Correlating Committee on Signaling Systems. It supersedes the 1964 edition with the principal revisions including a more comprehensive section of definitions; a language clarification, short of technical revisions; and the addition of requirements for radio-type box alarm systems.

Origin and Development of No. 73

This standard is the latest in a long series of editions dating back to 1898. Originally, it was part of a general standard on signaling systems but this material on municipal fire alarm systems was separated from the general standard in 1911. This standard has been revised and reissued in editions dated 1904, 1911, 1926, 1934, 1940, 1941, 1946, 1948, 1949, 1950, 1952, 1954, 1955, 1956, 1962, 1963, and 1964. A record of all changes in the various editions published can be found in the NFPA "Advance Reports" and "Proceedings," issued during the years specified.

Committee on Signaling Systems

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E. S. Ruth, National Electrical Code Committee.

George Saunders, Underwriters' Laboratories, Inc.

Alan Stevens, Chairman, Sectional Committee on Detection and Signaling Systems.

Note: Also, Chairman of Sectional Committee on Municipal Fire Alarm Systems

SCOPE: This Committee serves as a policy-making and correlating group to administer and process reports of the various Sectional Committees dealing with signaling systems and detection devices. All codes, standards, recommended practices and manuals prepared by the Sectional Committees and having received at least a two-thirds affirmative ballot from the voting members of the responsible Sectional Committee are processed through this Committee prior to submission to the Association for action.

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SCOPE: Covers the installation, maintenance and use of all types of municipal fire alarm systems or other facilities for notifying a municipal fire department that a fire has occurred. Reports to the Association through the Signaling Systems Correlating Committee.

†*Non-voting members.*

CONTENTS

Chapter I. Fundamentals.

Chapter II. Fire Alarm Facilities and Installation.

Chapter III. Fire Alarm and Operation Maintenance.

Standard for the Installation, Maintenance and Use of

Municipal Fire Alarm Systems

NFPA No. 73-1967

CHAPTER I. FUNDAMENTALS

ARTICLE 100. SCOPE

1010(a) This standard covers the installation, maintenance and use of all municipal fire alarm alerting facilities.

(b) A municipal fire alarm system is an electrically operated means of notifying a fire department that an emergency has occurred. A municipal fire alarm system fulfills two principal functions, that of receiving alarms from the public and that of transmitting signals to fire companies.

(c) Municipal fire alarm alerting facilities also include the provisions for receipt of emergency calls from persons using other means and also the provisions necessary to alert interested organizations, such as police and water departments, to a fire or other emergency condition.

(d) Radio systems are included if used to perform one or more of the above functions.

1020(a) An auxiliary fire alarm system provides protection to an individual occupancy or building or to a group of buildings of a single occupancy, and utilizes the municipal fire alarm facilities to transmit an alarm of fire to the fire department. Fire alarms from an auxiliary system are received at an alarm communication center on the same equipment and by the same alerting methods as alarms transmitted from fire alarm boxes located on streets.

(b) Installation requirements for an auxiliary fire alarm system within the protected premises and up to the point of connection to the municipal fire alarm facilities are contained in the Standard for Auxiliary Protective Signaling Systems (NFPA No. 72B).

ARTICLE 110. DEFINITIONS

When the words defined in this article are used in this Standard they have the meaning described below.

1101. ALARM COMMUNICATION CENTER: 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; often referred to as Fire Alarm Headquarters.

1102. ALARM SIGNAL: The signal or message from a person or device indicating the existence of an emergency.

1103. BATTERY:

(a) COMMON (also termed master or local). The battery used to power recorders, transmitter, relays and other Alarm Communication Center equipment and, if used, Satellite Communication Center equipment. When Form 4 power is used this battery may also be used to power the converters for box and alarm circuits.

(b) LINE: The battery or batteries used with Forms 1, 2 and 3 power supply to power the individual box and alarm circuits.

(c) BOX: The battery supplying power for an individual fire alarm box where radio is used for the transmission of box alarm signals.

1104. BOX (Fire Alarm): A manually operated device used to send an alarm signal in event of an emergency.

1105. CIRCUIT: The conductor, or radio channel, and associated equipment used to perform a definite function in connection with a fire alarm system. Specific types of circuits are defined below:

(a) ALARM CIRCUITS are those circuits over which alarms are transmitted automatically or manually from Alarm Communication Center to Fire Stations.

(b) BOX CIRCUITS are those circuits to which fire alarm boxes are connected and in Type B systems usually connect to receiving equipment at Fire Stations.

(c) LOCAL CIRCUITS are circuits upon which the transmission or receipt of alarms from box or alarm circuits does not depend.

(d) TIE CIRCUITS are circuits connecting an Alarm Communication Center and a Satellite Communication Center.

1106. CONCENTRATOR-IDENTIFIER: A system for switching signals

from telephone type box circuits over a smaller number of circuits to a fire alarm switchboard and identifying the operated box.

1107. CONVERTER: Any mechanical or electrical device that changes alternating current to direct current.

1108. DYNAMOTOR: A machine which combines both motor and generator action in one magnetic field, either with two armatures or one armature having two separate windings.

1109. ELECTRICAL SUPERVISION: The monitoring of circuits and other system components to reveal defects or faults that would interfere with receipt or transmission of an alarm signal.

1110. EMERGENCY: Any condition endangering, or thought to be endangering, life or property.

1111. ENGINE-DRIVEN GENERATOR: A generator driven by an internal combustion engine.

1112. FIRE STATION: A building occupied by mobile apparatus of the fire department. It may also include locations where other emergency equipment is housed.

1113. INVERTER: Any mechanical or electrical device that changes direct current to alternating current.

1114. MOTOR-GENERATOR: A machine which consists of a generator driven by an electric motor.

1115. MUNICIPALITY: Any governmental unit, such as county, city, town or fire protection district.

1116. OPERATOR: A trained person in the Alarm Communication Center who receives an alarm signal and retransmits it to fire stations. Called in some areas the dispatcher or controller.

1117. RECTIFIER: A device without moving parts which changes alternating current to direct current.

1118. SATELLITE COMMUNICATION CENTER OR "SATELLITE": The building used to house part of the control equipment of a fire alarm system (see Section 1230).

1119. SOLAR CELL: A device that converts light or other radiant energy into electrical energy.

1120. SUPERINTENDENT: The municipal employee responsible for operation, maintenance and administration of the municipal fire alarm system.

1121. TRUNK LINE: A telephone line or channel between telephone central offices or switching devices including lines to the fire alarm telephone switchboard.

ARTICLE 120. TYPES OF FIRE ALARM SYSTEMS

1210. Type A Systems (Manual Retransmission)

1211. A Type A system is one where an alarm from a municipal fire alarm box requires an operator to receive, check and retransmit the alarm to fire stations and, if used, to outside alerting devices.

1212. Type A system is permissible for any size municipality or area and is required where the number of emergency calls, however received, exceed 1,500 per year.

1220. Type B Systems (Automatic Retransmission)

1221. A Type B system is one where an alarm received from a municipal fire alarm box is automatically retransmitted to fire stations and, if used, to outside alerting devices.

1230. Satellite Communication Center

1231. It may be desirable for purposes of operational efficiency or other local conditions to subdivide the system, terminating some circuits at equipment located in various satellite communication centers in the protected area. Such arrangements are basically combinations of Type A and Type B systems, suitably coordinated and connected.

1232. The satellite communication center arrangements of this section apply only to systems and equipment under the jurisdiction of one fire authority. They do not apply to independent fire alarm systems under separate fire authorities, such as those interconnected for mutual aid purposes.

1233. Equipment at satellites shall comply with applicable requirements of this Standard.

1234. When the number of alarms from municipal fire alarm boxes to a Type B satellite exceeds 1,500 per year, the Type B satellite shall become a Type A satellite or shall be divided into two or more Type B satellites.

1235. Satellite communication centers with at least one operator on duty at all times may operate independently within an

assigned fire protection area. When operated independently all requirements for Type A or Type B systems shall be met.

1236. A separate tie circuit shall be provided from the alarm communication center to each satellite communication center. The tie circuit between the center and satellite shall not be used as one of the required alarm circuits to a fire station, except where permitted under 1237.

1237. In a Type B system, when all boxes in the system are of succession type, the tie circuit from a satellite may be used as an alarm circuit to fire stations.

1238. In noncoded systems where a concentrator-identifier or similar device is employed as satellite equipment, at least two tie circuits for the first 40 boxes connected shall be provided to the alarm communication center. A tie circuit shall be provided for each 40 additional noncoded boxes connected to the above named device.

ARTICLE 130. FUNDAMENTAL CHARACTERISTICS OF A MUNICIPAL FIRE ALARM SYSTEM

1310. General

1311. Municipal fire alarm system shall be designed, installed, operated and maintained so as to provide the maximum practicable reliability for receipt and transmission of fire alarms. All devices shall be designed to function satisfactorily under the climatic conditions to which they will be exposed.

1312. A system or device having materials, methods of operations or forms different from those detailed in this Standard may be examined and tested by the authority having jurisdiction according to the intent of the requirements and, if satisfactory, will be judged the equivalent.

1313. Plans and information regarding the system shall be submitted to the authority having jurisdiction for approval when requested before the construction of the alarm communication center building or the installation of apparatus is begun, and preferably, before the awarding of contracts.

1314(a) The fire alarm system may be adapted or used for the transmission of other signals or calls of a public emergency nature provided such transmission does not interfere with receipt of fire alarms.

(b) The system may be used as a signaling system for other municipal departments provided that the fire alarm operator is not required to answer routine calls (see 2428).

1320. Equipment and Installation

1321. The system shall be adequate in extent to protect all built-up sections of the city and shall be extended as needed to maintain adequacy.

1322. Means for transmission of alarms by the public shall be available on the streets within distances as specified for alarm boxes elsewhere in this Standard, shall be conspicuous and readily accessible for easy operation, and shall not depend upon voice transmission solely for designating the location.

1323. Simultaneous or concurrent operation of at least four boxes shall not result in the loss of an alarm or cause interference except as specifically permitted by 2425.

1324. The system shall be so designed and installed that it shall be capable of performing its intended function at 85 percent and at 110 percent of the rated voltage.

1325(a) All devices and equipment constructed and installed under the Standard shall be suitable for the purpose for which they are intended.

(b) All systems shall be installed in a workmanlike manner in accordance with established practices and applicable requirements of this Standard.

1326. Supervision

(a) To assure reliability, circuits upon which transmission and receipt of alarms depend shall be under constant electrical supervision to give prompt warning of conditions adversely affecting reliability, except as specifically detailed in 1326(b).

(b) Where each box is served by an individual wired circuit, an automatic periodic test at intervals of 6 minutes or less will be acceptable as electrical supervision.

(c) Warning of conditions adversely affecting reliability of circuits shall be visibly and audibly indicated automatically at the alarm communication center or other suitable municipal location.

1327. The normal operation of the system shall not require the use of a ground to secure any essential function. Circuits extending outside alarm communication center shall normally test free of

ground. This shall not prohibit the use of the ground to secure functioning under abnormal line conditions, provided such use would not prevent reception or transmission of a signal under normal conditions if the circuit was accidentally grounded.

1328. 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.

1329. All apparatus shall be restored to normal conditions as promptly as possible after each test or alarm in which the apparatus functioned, and shall be maintained in the normal condition for operation.

1330. Maintenance and Operation

1331. The system shall be under the supervision of a responsible municipal employee. When maintenance and control is by an organization or person other than the municipality or its employees, complete written records of the installation, maintenance, test, failure, repair and extension of the system shall be forwarded to the supervising municipal employee as soon as possible; notice of failure and restorations of service shall be made immediately to the supervising municipal employee.

1332. Maintenance and control by an organization or person other than the municipality or a municipal employee shall be by written contract guaranteeing performance acceptable to the authority having jurisdiction.

1333. Fire alarm operators or other persons responsible for the receipt and transmission of alarms shall be specifically chosen for the position on the basis of competency and shall be thoroughly trained to perform the duties. When the responsibility is delegated to other than municipal employees, the arrangement shall be satisfactory to the authority having jurisdiction (see Article 300).

1334. A complete record shall be kept by the municipality of all test 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 include the date and time of all occurrences (see Article 330).

1335. All alarms of fire received by the alarm communication center by any means whatever shall be promptly and accurately transmitted to the fire department for proper response of fire companies.

CHAPTER II. FIRE ALARM FACILITIES AND INSTALLATION

ARTICLE 200. CIRCUITS

2010. General

2011. The National Electrical Safety Code, National Bureau of Standard Handbook H30*, shall be used as a guide for installation of outdoor circuitry.

2012(a) All circuits upon which receipt and transmission of alarms depend shall be under constant electrical supervision except as permitted in 1326(b).

(b) Open local circuits within single buildings are permitted for the operation of alerting devices and alarm equipment additional to that required by this Standard.

2013(a) All circuits shall be so routed as to permit ready tracing of circuits for trouble. However, main cables should not be brought to terminals in box standards and the installation of test points on circuits shall be kept to a minimum. Where test points are essential, they should be in fire stations or other properly protected and accessible locations.

(b) In all installations, first consideration shall be given to continuity of service; particular attention should be given to liability of mechanical injury, to disablement from heat incident to a fire, to injury by falling walls, and to damage by floods, corrosive vapors or other causes.

2020. Box Circuits

2021. Box circuits shall be so routed as to permit easy patrolling of any territory or area left without fire protection due to breakdown of a circuit. The interlacing of circuits is inadvisable, especially where circuits are in cable.

2022(a) Box circuits should not enter buildings or property which is not owned by or under the control of the municipality or the agency responsible for operating or maintaining the system, because of the possibility of damage to conductors or disruption of service.

(b) When a municipal fire alarm box is installed in a building, it shall be placed as near as practicable to the point of entrance

*Available from Superintendent of Documents, Washington, D.C.

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 (NFPA No. 70). Accessible and reliable means, available only to the authority in control of the municipal fire alarm system, shall be provided for disconnecting the loop to the box (es) inside the building, and definite notification shall be given to occupants of the building when interior box (es) is not in service.

2023(a) Box circuits shall be sufficient in number and so laid out that 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 all or any part of the circuit is of aerial open-wire, or 30 properly spaced boxes where the circuit is entirely in underground or messenger-supported cable.

(b) If all boxes on any individual circuit and associated equipment are designed and installed to provide for receipt of alarms through the ground in event of a break in the circuit, the circuit may serve twice the above figures for aerial open wire and cable circuits, respectively.

(c) The installation of additional boxes in an area served by the number of properly spaced boxes indicated above does not constitute overloading of a circuit.

(d) See 2433 for spacing of boxes.

(e) A separate frequency shall be provided for each 250 radio-type boxes.

2024. Fire alarm boxes shall not be connected to circuits connecting satellite communication centers to alarm communication center.

2030. Alarm Circuits

2031. Two separate alarm circuit facilities shall be provided for transmitting alarms to fire stations except as permitted in 2034 and 2762.

(a) One alarm circuit facility shall consist of a constantly supervised circuit for transmission of coded signals or signals for graphic recording. This circuit shall consist of one of the following:

(1) A wired circuit with duplicate power supply as outlined in Article 230.

(2) A radio circuit with duplicate transmitters and with power supply for transmitters and receiver as outlined in Article 230.

(b) The other alarm circuit facility may consist of metallic or radio circuits for transmission of coded signals, signals for graphic recording, or voice signals.

NOTE 1: When an unsupervised radio circuit is employed as one of the required alarm circuits, a separate frequency shall be provided in cities exceeding 200,000 population and should be provided in all cities.

NOTE 2: A circuit to a telephone instrument only shall not be considered as one of the required alarm circuits.

2032. A metallic alarm circuit shall not be connected to alarm instruments in more than five (5) fire stations.

2033. A metallic alarm circuit shall not enter buildings or property which is not owned by, or under the control of, the municipality or the agency responsible for operating or maintaining the system because of possibility of damage to conductors or disruption of service.

NOTE: Alarm instruments installed in private residences or buildings not owned by or under control of the municipality should be on special circuits responsive to relays preferably located in nearby fire stations or other municipal buildings.

2034. Where teletype circuits and voice amplification circuits are used as one of the required alarm circuits, such circuits should be individual to each fire station, or instruments shall be connected in parallel.

2035. Means of acknowledging receipt of the alarm shall be provided from the fire station to the alarm-transmitting operator. Acknowledgement may be by radio (including that on apparatus when responding) or by wired electrical circuits (including department telephone facilities).

2036. Retransmission of signals from radio fire alarm boxes, excluding relay stations, shall be on a frequency different from that assigned to boxes.

ARTICLE 210. CIRCUIT CONDUCTORS

2110. Fundamentals

2111. The integrity of any fire alarm system is dependent upon the materials used, construction, installation and the maintenance provided. In general, wires in cable, either underground or suspended by messenger wires, are preferable to overhead open wire construction. This applies especially to alarm circuits and to cir-

cuits serving boxes in areas and locations where high life hazards exist, and in mercantile and industrial areas.

2112. Wires shall be terminated so as to provide good electrical conductivity and prevent breaking from vibration or stress.

2113. Circuit conductors on terminal racks shall be identified and isolated from conductors of other systems whenever possible and shall be suitably protected from mechanical injury.

2114. Except as otherwise provided herein, cable and wire shall conform to International Municipal Signal Association specifications or equal.

2115. Fire alarm circuit conductors shall not pass under, over, through or be attached to buildings except those directly associated with the Fire Alarm System.

2120. Cables, General.

2121. The insulation and covering of cabled conductors shall have adequate dielectric and mechanical strength for the service to which it will be subjected and the ability to withstand any necessary abuse during installation.

NOTE 1: Cables which meet the requirements of Article 310 of the National Electrical Code (NFPA No. 70) for installation in wet locations are satisfactory for overhead or underground installation except that direct-burial cable must be specifically approved for the purpose.

NOTE 2: Paper or pressed pulp insulation is not considered satisfactory for emergency service such as a fire alarm system, except that cables containing conductors with such insulation may be acceptable if pressurized with dry air or nitrogen. Loss of pressure in cables shall be indicated by a visual or audible warning system located where someone is in constant attendance who can interpret the pressure readings and who has authority to have the indicated abnormal condition corrected.

NOTE 3: Natural 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 cable shall be used only inside of buildings when run in conduit or metal raceways.

2122. Wires shall have adequate mechanical strength and suitable electrical conductivity for their intended usage.

NOTE: For guidance, see National Electrical Code (NFPA No. 70) and National Electrical Safety Code.

2123(a) 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 by permission of the authority having jurisdiction.

(b) Signaling wires which, because of the source of current supply, might introduce a hazard, shall be protected and supplied as required for lighting circuits (see Section 2370).

2124. All cables, when installed, with all taps and splices made, but before connection to terminals, shall be tested for insulation resistance. Such tests shall indicate an insulation resistance of at least 200 megohms per mile between any one conductor and all others, the sheath, and ground.

2130. Underground Cables

2131. Underground cables in duct or direct burial 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.

2132. 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 to ground, fire alarm cables shall be located as far as possible from such power cables and shall be separated from them by a noncombustible barrier or by such other means as may be practicable to protect the fire alarm cables from injury.

2133. All cables installed in manholes shall be properly racked and marked for identification.

2134. All conduits or ducts entering buildings from underground duct systems shall be effectively sealed against moisture or gases entering the building.

2135. 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 conductivity, insulation and protection at least equal to that afforded by the cables which are joined. Cable ends shall be sealed against moisture.

2136. 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 splices are made, such splices shall, where practicable, be accessible for inspection and tests. Such cables shall be buried at least 18 inches deep and, where crossing streets or other areas likely to be opened for other underground construction, shall be in duct or conduit, or be covered by creosoted planking at least two

inches thick and eight inches wide, or enclosed by two creosoted 2 inch by 4 inch planks with half-round grooves, spiked or banded together after the cable is installed.

2140. Aerial Construction

2141. 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 possible. Wires and cables shall not be attached to a crossarm carrying electric light and power wires, except that circuits carrying up to 220 volts for municipal communication use are permitted. Such 220-volt circuits shall be tagged or otherwise identified.

2142. Aerial cable shall be supported by messenger wire of adequate tensile strength, except as permitted in 2143.

2143. Two-conductor cable should be messenger-supported. If not messenger-supported, the two-conductor cable shall have conductors of No. 19 gage or larger size and have mechanical strength equivalent to No. 10 hard drawn copper.

2144. Single wires may be bare or may have a covering or insulation.

NOTE 1: A double- or triple-braided weather-resistant covering has little dielectric strength and is not considered as an insulation.

NOTE 2: If a covering or insulation is desired, specifications of the International Municipal Signal Association are recommended.

2145. 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 aluminum. If spans exceed 150 feet, the wire cross-section shall be increased in the ratio of the squares of the lengths of span.

2146. Wires to buildings shall contact only intended supports and shall enter through an approved weather head or suitable sleeves slanting upward and inward. Drip loops shall be formed on wires outside of buildings.

2150. Leads Down Poles

2151. Leads down poles including antenna leads shall be protected against mechanical injury. Any metallic covering shall form a continuous conducting path to ground. Installation shall in all cases be such as to prevent water from entering the conduit or box.

NOTE: It is recommended that metallic covering not be extended within six feet of power lines.

2152. Leads to boxes shall have 600 volt insulation approved for wet locations, as defined in the National Electrical Code (NFPA No. 70). Also see 2121 and 2122.

2160. Wiring Inside Buildings

2161. At Alarm Communication Center, conductors shall extend as directly as possible to the operating room in conduits, ducts, shafts, raceways or overhead racks and troughs of a type construction affording protection against mechanical injury.

2162. All conductors inside buildings, other than Alarm Communication Center building, shall be in conduit, electrical metallic tubing, metal molding, or raceways, except as permitted in 2774(b). Installation shall be in accordance with the National Electrical Code (NFPA No. 70).

2163. Conductors shall have an approved insulation; the insulation or other outer covering shall be flame-retardant and moisture-resistant.

2164. Conductors shall be installed as far as possible without joints. Splices will be permitted only in conjunction or terminal boxes. Wire terminals, splices and joints shall conform with the National Electrical Code (NFPA No. 70).

2165. Conductors bunched together in a vertical run connecting two or more floors shall have a flame-retardant covering sufficient to prevent the carrying of fire from floor to floor. This requirement shall not apply if the conductors are encased in a noncombustible enclosure, or are located in a fire-resistive shaft having fire stops at each floor.

2166. Signal conductors 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 encased in a noncombustible enclosure.

2167. Where cables or wiring are exposed to unusual fire hazards, they shall be properly protected.

ARTICLE 220. CIRCUIT PROTECTION

2210. General

2211. Lighting arresters suitable for the purpose shall be provided on each side of each circuit, aerial or underground, and may permanently ground a circuit only when the discharge potential

is over 500 volt direct current. Lightning arresters shall be marked with the name of the manufacturer and model designation.

2212. All lightning arresters shall be connected to a suitable ground.

2213. To provide adequate mechanical strength an unenclosed No. 8 AWG copper wire or equivalent shall be used to connect a grounding device to a suitable ground. If subject to physical damage, the wire shall be enclosed in a metal U-guard or in a metal pipe grounded in accordance with National Electrical Code (NFPA No. 70) 250-92, and the grounding conductor may then be a No. 14 AWG.

2214. All fuses shall be plainly marked with their rated ampere capacity. All fuses rated over two amperes shall be of the enclosed type.

2220. Protection at Alarm Communication Center

2221. All conductors entering Alarm Communication Center shall be protected by the following devices, in the order named, starting from the exterior circuit:

(a) A fuse rated at 3 ampere and not less than 2,000 volts;

(b) A lightning arrester meeting the requirement of 2211; and,

(c) A fuse rated at one-half ampere.

2230. Protection at Other Buildings

2231. Circuit protection required at Alarm Communication Center shall be provided in every building housing communication center equipment when such equipment is installed in more than one building.

2232. Each conductor entering fire station or other buildings from lines partly or entirely aerial shall be protected by a lightning arrester meeting the requirements of 2211.

2240. Protection on Aerial Construction

2241. At junction points of open aerial conductors and cable, each conductor shall be protected by a lightning arrester of weatherproof type, or suitably protected from the weather, and meeting the requirements of 2211. There shall also be a connection between the lightning arrester ground and any metallic sheath and messenger wire.

2242. Aerial open wire and nonmessenger supported two-conductor cable circuits shall be protected by a lightning arrester meeting the requirements of 2211 at intervals of approximately 2,000 feet.

NOTE: Lightning arresters, other than air gap type, shall not be installed in fire alarm boxes.

2243. All protective devices shall be accessible for maintenance inspection.

ARTICLE 230. POWER SUPPLY

2310. Fundamentals

2311. Power 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 (NFPA No. 70).

2312. The conductors of a fire alarm system power supply circuit shall be connected to the line side of the main service of a commercial light or power supply circuit or to the main conductors of an isolated power plant located on the premises. However, in buildings housing fire alarm and other emergency facilities only, the power supply may be obtained from the load side of the main disconnect switch. The circuit disconnecting means shall be so installed that it will be accessible only to authorized personnel. Circuit protection, enclosed in a locked or sealed cabinet located immediately adjacent to the point of connection to the light and power conductors, shall be provided in series with each ungrounded conductor.

2313. Each box circuit, except as permitted by 2313(d), and each alarm circuit of each alarm transmitting or receiving device shall be provided with two sources of power. The secondary source shall be independent of other sources and of a high degree of reliability. The secondary source shall be arranged as follows:

(a) It shall not operate through or be dependent upon the same motor generator, 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.

(b) It shall be of such capacity and reliability as to assure operation in case of interruption of the normal supply.

(c) It shall automatically supply the circuit or circuits upon loss of the normal source within 30 seconds; in a Type A system this automatic feature may be omitted if suitable provisions are made for manually restoring service within 30 seconds.

(d) A fire alarm box with an individual power supply conforming to the requirements of Section 2340, is considered to meet the intent of the box circuit power supply requirement.

2314. The two sources of power may include:

(a) One supply circuit from a utility distribution system and a second from a storage battery or from a generator driven by a continuously available prime mover.

(b) Two supply circuits from separate utility distribution systems, so serviced or connected that normal supply to one will not be affected by trouble which would put the other out of service.

NOTE: This would require supply from two building services on entirely separate distribution networks from independent generating stations.

(c) Two engine-driven generators with one unit supplying normal system power and the other unit serving as stand-by with facilities to apply its power to the line within 10 seconds.

NOTE 1: If two engine-driven generators are used in lieu of a second source of supply from a utility distribution network, the fire alarm system 4 hour stand-by battery may be omitted. See 2315.

NOTE 2: When two engine-driven generators are used as the only two sources of power for a fire alarm system, a stand-by storage battery having a 4-hour capacity shall be provided.

2315. The forms and arrangements of current supply shall be classified as follows:

Form 1. Permissible for Type A systems only. Each box and alarm circuit served by duplicate sets of storage batteries. Each battery to alternately power its associated box or alarm circuit for 24 hours and then be recharged within the next 24-hour period. Batteries shall have 60-hour stand-by capacity.

Form 2. Permissible for Type A systems only. Box or alarm circuits served in multiple by:

(a) a rectifier or motor-generator powered from a single source of alternating current with a floating storage battery having a 24-hour stand-by capacity;

(b) a rectifier or motor-generator powered from two sources of alternating current, with a floating storage battery having a

4-hour stand-by capacity;

(c) a rectifier or motor-generator powered from two sources of alternating current with transfer facilities to apply power from the secondary source to the system within 30 seconds (see 2313 and 2314(c)).

NOTE 1: This arrangement is permissible but is not recommended where circuits are wholly or partly open wire because of the possibility of trouble from multiple grounds.

NOTE 2: Batteries, motor-generators or rectifiers shall be sufficient: (a) to supply all connected circuits without exceeding the capacity of any battery or overloading any generator or rectifier; (b) to supply box circuits independently from alarm circuits; (c) so that circuits developing grounds or crosses with other circuits may be supplied each by an independent source to the extent required by Note 3 below.

NOTE 3: Provision shall be made in the operating room for supplying any circuit from any battery, generator or rectifier. Enclosed fuses shall be provided at points where supplies for individual circuits are taken from common leads. 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 percent of the total number of box and alarm circuits, but never less than two.

NOTE 4: If common-current source systems are grounded, the ground shall not exceed 10 percent 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.

Form 3. Each box and alarm circuit served by:

(a) a rectifier or motor-generator powered from a single source of alternating current with a floating storage battery having a 60-hour stand-by capacity;

(b) a rectifier or motor-generator powered from two sources of alternating current with a floating storage battery having a 24-hour stand-by capacity.

Form 4. Each box and alarm circuit served by:

(a) an inverter receiving power from a common rectifier receiving power from a single source of alternating current, with a floating storage battery having a 24-hour stand-by capacity;

(b) an inverter receiving power from a common rectifier receiving power from two sources of alternating current, with a floating storage battery having a 4-hour stand-by capacity;

NOTE: For (a) and (b), the system load may be distributed between two or more common rectifiers and batteries.

(c) a rectifier, converter or motor-generator receiving power from two sources of alternating current with transfer facilities to apply power from the secondary source to the system within 30 seconds. See 2313 and 2314(c).

2316. Visual and audible means to indicate a 15 percent or greater reduction of normal power supply (rated voltage) shall be provided.

2317. Local circuits at headquarters may be supplied either in common with box or alarm circuits or by a separate power supply. The source of power for local circuits on which the operation of essential features of the system depend shall be supervised.

2320. Requirements for Constant-Current Systems

2321. Means shall be provided for manually regulating current in box and alarm circuits so that operating current may be maintained within 10 percent of normal throughout changes in external circuit resistance from 20 percent above to 50 percent below normal.

2322. The voltage supplied to maintain normal line current on box or alarm circuits shall be not less than 10 volts nor exceed 150 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.

2323. Visual and audible means to indicate a 20 percent or greater reduction in the normal current in any box or alarm circuit shall be provided. All devices connected in series with any box or alarm circuit shall function properly when the box or alarm circuit current is reduced to 70 percent of normal.

2324. Sufficient meters shall be provided to indicate the current in any box or alarm circuit and the voltage of any power source. Meters used in common for several circuits shall be provided with cut-in devices designed to reduce the probability of cross-connecting circuits.

2330. Batteries — Communication Center

2331. Batteries used shall be of the storage type; primary batteries (dry cells), shall not be used, except as permitted by Section 2340. All cells shall be of the sealed type; lead-acid batteries shall be in jars of glass or other suitable transparent material; other types of batteries shall be in containers suitable for the purpose.

2332. Batteries shall be located in the same building as the

operating equipment, preferably on the same floor, readily accessible for maintenance and inspection. The battery room shall be above ground level and shall be ventilated to prevent accumulation of explosive gas mixtures; special ventilation is required only for unsealed cells.

2333. Batteries shall be mounted in such a manner as to provide effective insulation from the ground and from other batteries. The mounting shall be suitably protected against deterioration and consideration shall be given to stability, especially in territory subject to seismic disturbance.

2334(a). Facilities shall be provided for giving floating batteries a charge at a rate not less than the normal 24-hour charge rate recommended by the manufacturer 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 only one line battery is charged at a time from any high rate source.

(b) 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.

2335. Batteries shall be protected by enclosed fuses of not less than 3-ampere capacity, nor more than 200 percent of maximum connected load. Fuses shall be suitably located so that they are not subject to corrosion from battery gases. Battery leads of both polarities shall not be in the same conduit. tubing or cable between the battery terminals and fuse.

2340. Batteries — Fire Alarm Box

2341. Batteries used to supply power for individual fire alarm boxes may be of the primary type, but shall meet the requirements of this section.

2342. Battery operating characteristics shall be suitable for local temperature extremes.

2343. The battery shall be capable of transmitting the box signal when at 70 percent of rated voltage.

2344. The battery shall provide satisfactory service for normal signaling, including testing, for a period of at least 6 months without need for replacement.

2345. Solar cell recharge of box batteries is permissible.

2346. Indication shall be transmitted automatically to the Alarm Communication Center when battery voltage is decreased to not less than 85 percent of rated voltage. This warning indication shall be included in each signal, under normal operating conditions, for at least 15 days before the batteries become non-operational.

2350. Rectifiers, Converters, Motor-Generators, etc.

2351. Rectifiers shall be supplied through an isolating transformer taking energy from a circuit of not to exceed 250 volts.

2352. Rectifier or motor-generators employed pursuant to Forms 2, 3 and 4 shall have reserve as follows:

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

(b) Forms 3 and 4. For systems exceeding 10 circuits, complete ready-to-use units, or spare parts, shall be available, equal to five percent of the total number of circuits.

2353. 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 percent of maximum connected load. Where not provided with battery floating the fuse shall be not less than 3 amperes.

2360. Engine-driven Generator Sets.

2361. The provisions of this section shall apply to generators driven by internal combustion engines.

2362. The installation of such units shall conform to the provisions of the Standard for Stationary Combustion Engines and Gas Turbines (NFPA No. 37) except as restricted by the provisions of this section.

2363. The unit shall be located in an adequately ventilated cutoff area of the building housing the alarm communication center equipment; the room shall be used for no other purpose except that new spare parts or equipment may be kept in storage in the room with suitable clearance from all sides of the unit. Exhaust fumes shall be discharged directly outside the building.

2364. Fuel shall be stored in outside underground tanks whenever possible and gravity feed shall not be used. Sufficient fuel shall be available for 12 hours of operation at full load if a reliable source of supply is available at any time on two hours notice; if a source of supply is not reliable or readily available or if special

arrangements must be made for refueling as necessary, a supply sufficient for 24 hours of operation at full load shall be maintained.

2365. The unit shall be of sufficient capacity to supply power at least for operating all fire alarm facilities, and emergency lighting of the operating rooms or communication building.

2366. A separate storage battery and automatic float charger shall be provided for starting the engine-driven generator.

2367. The generator shall be operated for a minimum of three hours continuously each week, and with at least one period each month under normal load. It is recommended that this be carried out at a definitely scheduled time every week.

2370. Current Supply to Designating Lights

2371. Current supply for designating lamps at street boxes should preferably be secured at lamp location from the local electric utility company.

2372. When the above is not possible, however, lighting circuit wires for supplying such lamps may be included in cable containing fire alarm wires. The lighting circuit wires shall be not larger than No. 10 AWG and the applied load shall not exceed 80 percent of the current carrying capacity of the conductor as rated by the National Electrical Code (NFPA No. 70). 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 150 volts and shall be supplied by special devices 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.

2373. Alternating current power may be superimposed on metallic fire alarm circuits for supplying designating lamps or for control or actuation of equipment and devices for fire alarm or other emergency signals, provided:

(a) Voltage between any wire and ground or betwen one wire and any other wire of the system shall not exceed 150 volts; the total resultant current in any line circuit shall not exceed one-quarter ampere.

(b) Coupling capacitors, transformers, choke, coils etc., shall be rated for 600 volts working voltage and have a break-down voltage of at least twice the working voltage plus 1,000 volts.

(c) There is no interference with fire alarm service under any conditions.

ARTICLE 240. FIRE ALARM BOXES

2410. General

2411. Boxes should be securely mounted on poles or pedestals.

2412(a) It is desirable that all fire alarm boxes, regardless of make or method of operation, be recognizable as such in all municipalities. Therefore, fire alarm boxes should be of conventional shape, closely resembling the "cottage" style, and should have instructions for use plainly marked on the outer door.

(b) The operating device shall be readily available and of such design and so located as to make the method of its use apparent. It is recommended that essentially like methods of operating for use by the public be provided for all boxes in the municipality.

2413. Box cases and parts at any time accessible to users, including antenna supports for radio type boxes, shall be of insulating materials or permanently and effectively grounded.

2414. All ground connections to boxes shall comply with the requirements of 2213.

2415. Boxes shall be as conspicuous as possible. The color shall be distinctive and preferably bright red. Indicating lights of a distinctive color, visible for at least 1,500 feet in all directions, shall be installed over boxes in mercantile and manufacturing areas and should be installed in residential areas.

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

2420. Design of Boxes

2421. Noninterference 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 an improper signal.

2422. Succession devices, either mechanical or electrical, shall be designed so that no signal will be lost if the starting levers of at least two boxes are pulled at or about the same time.

2423. Boxes transmitting a coded indication shall send three or four rounds of the box number. See 2783(b).

2424. Boxes transmitting a coded alarm, except for radio type boxes, shall be capable of being adjusted to a desired speed. For a Type A system they shall preferably operate at 3 or more strokes per second but not slower than 2 strokes per second. For a Type B system they should operate at not slower than 1 stroke per second.

2425. Boxes shall be noninterfering and successive, except that in a Type A system operating at 3 or more strokes per second, circuits may include boxes of plain interfering type if the area served is of a residential nature composed of one- and two-family detached dwellings.

2426. Boxes, when in an abnormal condition, shall leave the circuit usable. Radio type boxes shall be designed so that recycling will not occur if the box actuating device is held in the actuating position, but will be ready to transmit a new signal as soon as the actuating device is released.

2427. Boxes, when actuated, shall give a visual or audible indication to the user that the box is operating or that the signal has been received by the Alarm Communication Center. When a signal device is provided in a radio type box to indicate to the user the receipt of a signal by the Alarm Communication Center, a frequency different from the box transmitting frequency shall be used to actuate the signal device.

NOTE: When the operating mechanism of the box creates sufficient sound to be heard by the user, the requirement may be satisfied.

2428. All signals from boxes should be received at Alarm Communication Center, except where facilities for selective switching of nonfire messages have been provided for use by the police or other authorized persons. See 1314.

2430. Location of Boxes

2431. Boxes shall be so located as to protect all built-up areas of the municipality.

2432. Boxes shall be installed at street intersections in a manner such that they are visible from all intersecting streets whenever possible.

2433. A box should be visible from the main entrance of any building in congested districts. In order to reach a fire alarm box it shall not be necessary to travel in excess of one block or 500 feet in mercantile or manufacturing districts, with a distance of 300 feet being preferable, nor in excess of two blocks or 800 feet in residential areas, with a distance of 500 feet being preferable.

2434. Schools, hospitals, nursing homes and places of public assembly should have a box at or near the main entrance.

2435. 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. It is recommended that a fire alarm box be installed at or near the entrance to all fire stations.

2436. Box numbers should be assigned, as far as practicable, so that consecutive numbers will be closely grouped.

ARTICLE 250. COMMERCIAL TELEPHONE FACILITIES

2510. General

2511. It is generally recognized that there is no other thoroughly satisfactory means of sending and receiving fire alarms than a municipal 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.

2512. The provisions of this Article apply to the facilities necessary to receive alarms transmitted by citizens using the commercial telephone system and the facilities necessary to provide communication between the various fire department stations and offices.

2520. Public Telephone Service

2521(a) A specific telephone number shall be assigned for fire alarm emergency service with a separate number assigned for nor-

mal fire department business. Telephone directory listings shall be as follows:

ON THE INTRODUCTORY PAGES:
"To report a fire, dial (or call) ..... (fire number)"
IN THE ALPHABETICAL SECTION:
"FIRE DEPARTMENT
To report a fire ..... (fire number)
Nonfire purposes ..... (business number)"

(b) The Fire Department listing shall also appear in the alphabetical section under the name of the municipality.

(c) If the directory covers an area which is protected by more than one fire department or protection district, each such department or district shall be listed as outlined above.

NOTE: It is recommended that the fire department distribute suitable "emergency telephone" number cards to all residences and places of business.

2522(a) At the Alarm Communication Center, at least one telephone line shall be assigned for fire alarm emergency calls; in larger municipalities additional lines shall be so assigned, the number to depend upon the traffic handled. Additional telephone lines should be provided responsive to the business number as required by the department.

(b) For manual switching type telephone systems, connections to reserved lines shall be made only for fire reporting. Where dial system service is used, provisions shall be made for automatically selecting the reserved lines first and progressing to the general business lines, when the emergency number is dialed, but the reserved lines shall not be made selective to a dialing of the general business numbers.

2523. The telephone company supervisor or other responsible employee, when called, should give special attention to all incoming alarms and oversee their proper transmission to the fire department.

2524. Outside alerting devices may be activated directly by the telephone company employees, under conditions satisfactory to and by consent of the authority having jurisdiction.

2530. Departmental Telephone Service

2531. Where there are two or more fire stations in the municipality, the telephone lines from the different fire stations should connect with a common switching point at the alarm communication center. Facilities shall be provided for communications to fire

stations and with all public telephone systems within the district of the connected fire stations, together with required alarm transmission means.

2532. A private switchboard, or equivalent facilities operated by a person under control of the municipality, shall be provided in municipalities having six or more fire stations where men are normally on duty.

2533. Where one or more operators are required, such common switching points should be located in the operating room at Alarm Communication Center.

2534. Receipt and transmission of fire alarms and other emergency calls by telephone shall be recorded automatically.

2540. Telephones in Fire Stations

2541. There shall be a telephone at each fire station, connected by individual lines to the departmental system. Such telephones shall be used exclusively for fire department purposes.

2542. Required telephones at fire stations should be arranged so that they cannot be called by the public except:

(a) through a common switching point arranged as outlined in 2531, and

(b) where there is but one fire station in the community.

NOTE: This is not meant to apply to office of chief and other executive officers or to the Alarm Communication Center which may be housed in a fire station.

2543. Commercial telephones installed in fire stations for personal use and convenience of firemen shall not be listed in the telephone directory.

ARTICLE 260. ALARM COMMUNICATION CENTER

2610. Building Location and Construction

2611. The building should be located so as to be unexposed for a distance of at least 150 feet. If so located as to be exposed, then special attention shall be given to guard against damage from such exposure by protecting openings, and by constructing the roof so as to resist damage which might be caused by falling walls.

NOTE 1: It is desirable to locate the building in a park or public square where the conditions of exposure can be fully met.

NOTE 2: An Alarm Communication Center should not be located below grade unless the structure is specifically designed for such locations.

2612. The building shall be of fire-resistive (3-hour classification) construction as defined in the Standard Types of Building Construction (NFPA No. 220) and in the National Building Code published by American Insurance Association (NBFU).

NOTE: No combustible materials 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.

2613(a) 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 properly cut off.

(b) When building is occupied for any purpose other than that outlined in 2613(a), the Alarm Communication Center area shall be separated by at least 3-hour fire-resistive construction, preferably with entrance only from outside.

2614. Two approved portable extinguishers, suitable for the hazards involved, shall be provided for each 3,000 square feet of floor area.

2615. Operating room shall be arranged so that all lights are not dependent on a single branch line fuse. Sufficient emergency lighting shall be provided to permit necessary operations.

ARTICLE 270. FIRE ALARM EQUIPMENT

2710. General

2711. All devices and instruments shall be mounted upon noncombustible bases, pedestals, switchboards, panels or cabinets. All mountings shall be of such design and construction that all components shall be readily accessible.

2712. Wires on switchboards shall be not smaller than No. 24 AWG. Unsupported wires and wires subject to vibration shall be not less than No. 18 AWG. The outer covering over the insulation of such wires, or the insulation itself if no outer covering is present, shall be flame retardant and moisture resistant.

2713. Cable terminals and cross-connecting facilities shall be located in or adjoining the operating room. All cable terminals

should be located in rooms having a floor above the outside ground level.

2714. Radio antenna supports shall be effectively grounded.

2715. The protective devices shall be located close to and may be combined with the cable terminals.

2720. Facilities for Receipt of Alarms from Street Boxes.

2721. Alarms from fire alarm boxes shall be automatically received and recorded at Alarm Communication Center.

2722. A recorded visual and an audible signal are required to indicate the receipt of an alarm. The recorded visual signal shall indicate the exact location from which the alarm is being transmitted. The audible signal may be common to several box circuits and may be arranged so that the fire alarm operator can manually silence the signal temporarily by a self-restoring switch.

2723. Facilities shall be provided which will automatically record the time of receipt of each alarm and the exact location from which the alarm is transmitted. In addition, all voice transmission shall be recorded; separate equipment may be used for this purpose.

NOTE 1: It is preferable to connect registering devices directly in the box and alarm circuits but relays may be provided for each circuit of each class when needed in order to secure proper functioning of required operating facilities.

NOTE 2: A reserve recorder shall be provided when systems have more than four box circuits, except that when boxes are on individual circuits a spare recorder need be provided only when the number of boxes exceeds 100.

NOTE 3: Automatic time recording equipment may be omitted when there are less than 5 box circuits.

2724. For a radio-type fire alarm system, dual receivers, each with two separate means of identifying the signal (one of which must be an automatic printing recorder with time-date stamp), and an audible alerting device, and necessary associated equipment shall be provided. Both receivers shall be in operation simultaneously. Facilities shall be so arranged that the failure of any unit, including an antenna, will not affect the receipt of signals from boxes.

2725. Relay stations for retransmission of signals from radio-type boxes shall have dual receivers, dual transmitters, and dual antennas. Receivers and transmitters shall operate simultaneously and provisions shall be made to indicate to the Alarm Communication Center malfunctioning of any device.

2730. Facilities for Transmission of Alarms

2731. Facilities shall be provided for transmitting alarms to fire stations by two separate means, consecutively or concurrently, except as otherwise permitted by 2762(b).

2732. The facilities shall include automatic visual recording for alarms transmitted over the supervised alarm circuit. Provisions shall be made to automatically record the date and time of transmission.

NOTE: Graphic indication of time and date by the operator is satisfactory when graphic symbol transmission is used. See also 2723.

2733. Transmitting devices shall be arranged for simultaneous transmission over associated alarm circuits for each class of signals involved.

2734. Devices for transmitting coded or other types of signals shall be arranged for manual setting and operation.

NOTE: Coded signals shall be transmitted not slower than two strokes per second. If outside alerting devices are employed, transmission should be over separate circuits but shall be at a speed suitable for such devices.

2735(a) When radio transmissions (over a supervised carrier circuit) are employed as outlined in Section 2030, dual supervised transmitters, arranged for automatic switching from one to the other in case of trouble, shall be installed. When the transmitters are located where someone is always on duty, switchover facilities may be manually operated, if it can be carried out within 30 seconds. When the transmitters are located where no one is normally on duty, the circuit extending between Alarm Communication Center and the transmitter shall be supervised, all metallic, well installed in underground or messenger-supported aerial cable.

(b) Relay stations shall have dual supervised transmitters, dual supervised receivers, dual antennas, and automatic switchover facilities. Receivers and transmitters shall operate simultaneously and provisions shall be made to indicate to Alarm Communication Center the malfunction of any device.

2740. Supervisory Facilities

2741(a) Trouble signals shall be distinct from alarm signals and shall be indicated by both a visual light and audible signal. The audible signal may be common to several supervised circuits.

(b) Such indication shall be in the operating room.

2742. A switch for silencing the audible trouble signal may be provided if the visual signal remains operated until the silencing switch is restored to its normal position. The audible signal must be responsive to faults on any other circuits which may occur prior to restoration of the silencing switch to normal.

2743. The power supply to all required circuits and devices of the system shall be supervised. The trouble signal shall be automatically activated upon the occurrence of a power interruption or dangerous diminution in current or voltage which would jeopardize operation of the system.

2750. Testing Facilities

2751. Testing facilities shall be installed at the Alarm Communication Center and the Satellite Communication Center, if used, except that, if satisfactory to the authority having jurisdiction, those facilities for systems leased from a nonmunicipal organization may be located elsewhere. This shall not be construed to mean that signals indicating occurrence or clearing of faults need not be in the alarm communication center with the operating equipment.

2752. Circuits operating on a constant-current basis shall have facilities for:

(a) Determining the current strength of each circuit.

(b) Determining the voltage across the line terminals of each circuit, inside of terminals of protective devices.

(c) Determining the voltage loss due to ground leakage for systems in which each circuit is supplied by an independent current source (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, Form 2, such facilities shall comprise means for testing voltage between ground and each terminal of each battery or other current source.

(d) Determining the voltage between one side of each circuit and opposite side of each of the other circuits. For common current source systems, 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.

NOTE: Facilities listed under (c) and (d) shall be operable without establishing crosses between circuits (except through the voltmeter), and may be combined in one set of devices.