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Official NFPA Definitions

Adopted Jan. 23, 1964; Revised Dec. 9, 1969. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

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Standard for the Installation, Maintenance and Use of Public Fire Service Communications

NFPA No. 73 — 1973

1973 Edition of No. 73

The 1973 edition of this Standard incorporates changes prepared by the Sectional Committee on Public Fire Service Communications. The Standard was adopted by the National Fire Protection Association on May 15, 1973 at the Annual Meeting in St. Louis, MO, on the recommendation of the Correlating Committee on Signaling Systems. It supersedes the 1967 edition.

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, 1964, and 1967. A record of all changes in the various editions published can be found in the NFPA "Advance Reports,"

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Standard for the Installation, Maintenance and Use of Public Fire Service Communications

NFPA No. 73 — 1973

Chapter 1 Fundamentals

1-1 Scope.

Notice

An asterisk (*) preceding the number or letter designating a paragraph indicates explanatory material on that paragraph in the Appendix.

1-1.1 This standard covers the installation, maintenance and use of all public fire service communication facilities. This standard is not intended as a design specification nor as an instruction manual.

1-1.2 These facilities include a municipal fire alarm system, telephone facilities and fire department radio facilities, all of which fulfill two principal functions; that of receiving fire alarms or other emergency calls from the public and that of retransmitting these alarms and emergency calls to fire companies and other interested agencies.

1-1.3 Fire alarm systems on private premises from which signals are received directly or indirectly by the communications center are covered by other NFPA standards.

1-1.4 A system or device having materials, methods of operation or forms different from those detailed in this standard, when examined and tested by the authority having jurisdiction according to the intent of the requirements and if satisfactory, shall be judged the equivalent.

1-2 Definitions. When the words defined in this section are used in this standard, they have the meaning described below.

Alarm means the signal or message from a person or device indicating the existence of a fire or other emergency which requires fire department action.

Box Battery means the battery supplying power for an individual box where radio is used for the transmission of box alarms.

Common Battery means the battery used to power recorders, transmitters, relays and other Communication Center equipment and, if used, Satellite Communication Center equipment. Common battery is also termed local or master.

Line Battery means the battery used with Forms 2 and 3 power supply to power the individual box and alarm circuits.

Box means a manually operated device used to send an alarm in event of an emergency.

Circuit means 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) **Box Circuit** means a circuit connected to boxes which transmit an alarm to the Communications Center. In Type B systems, box circuits usually connect to receiving equipment at fire stations.

(b) **Dispatch Circuit** means a circuit over which alarms are retransmitted automatically or manually from the Communication Center to fire stations. (Formerly called Alarm Circuits.)

(c) **Local Circuit** means a circuit upon which the receipt of alarms from box circuits or retransmission of alarms on dispatch circuits does not depend.

(d) **Tie Circuit** means a circuit connecting a Communication Center and a Satellite Communication Center.

Communication Center means 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, retransmitting and power supply devices are located.

Concentrator-Identifier means facility for switching signals from box circuits over a smaller number of circuits to a fire alarm switchboard and identifying the operated box.

Converter means any mechanical or electrical device that changes alternating current to direct current or changes direct current voltage to a higher or lower voltage, the latter commonly referred to as a direct current to direct current converter.

Dynamotor means a machine which combines both motor and generator action in one magnetic field, either with two armatures or one armature having two separate windings.

Emergency means any condition endangering, or thought to be endangering, life or property.

Engine-Driven Generator means a generator driven by an internal combustion engine.

Fire Station means a building occupied by mobile apparatus of the fire department. It may also include locations where other emergency equipment is housed.

Inverter means any mechanical or electrical device that changes direct current to alternating current.

Motor-Generator means a machine which consists of a generator driven by an electric motor.

Municipality means any governmental unit, such as a county, city, town or fire protection district.

Operator means a trained person in the Communication Center who receives an alarm signal and retransmits it to fire stations. Called in some areas the dispatcher or controller.

Operations Room means the room in the Communication Center where alarms are received and retransmitted to fire stations.

Parallel Telephone System means a telephone system in which an individual wired circuit is used for each box.

Power Source means the power obtained from the utility distribution system, an engine-driven generator or battery.

Power Supply means a device that receives its input power from a power source and converts the input power to the alternating current or direct current voltage(s) required to operate the system.

Rectifier means a device without moving parts which changes alternating current to direct current.

Satellite Communication Center or "Satellite" means the building used to house part of the control equipment of a fire alarm system (see 1-3.3).

Series Telephone System means a telephone system in which a wired circuit is used to connect several boxes in series.

Solar Cell means a device that converts light or other radiant energy into electrical energy.

Supervision means the monitoring of circuits and other system components to reveal defects or faults that would interfere with receipt or transmission of an alarm.

Trouble Signal means a signal which indicates an abnormal condition.

Trunk Line means a telephone line or channel between telephone central offices or switching devices including lines to the fire alarm telephone switchboard.

User-Powered Box means a coded radio box utilizing power generated by the action of the user.

1-3 Types of Fire Alarm Systems.

1-3.1 Type A Fire Alarm System (Manual Retransmission).

1-3.1.1 A Type A System is one in which an alarm from a box is received and is retransmitted to fire stations either manually or automatically.

1-3.1.2 A Type A System is permissible in any size municipality or area. A Type A System shall be provided when the number of emergency calls from boxes exceeds 2500 per year; or where the number of alarms retransmitted over the alarm circuits exceeds 2500 per year.

1-3.1.3 When a Type A System is required, automatic retransmission of alarms from boxes by use of electronic equipment shall be permissible, only if the following requirements are satisfied:

(a) Reliable facilities are provided for the automatic receipt, storage, retrieval and retransmission of alarms in the order received, and

(b) Override capability is provided to the operators so that manual retransmission and dispatch shall be instantly available.

1-3.2 Type B Fire Alarm System (Automatic Retransmission).

1-3.2.1 A Type B System is one in which an alarm from a fire box is automatically transmitted to fire stations and, if used, to outside alerting devices.

1-3.3 Satellite Communication Centers.

1-3.3.1 For purposes of operational efficiency or other local conditions, it may be desirable to subdivide the system, ter-

minating some circuits in the Satellite Communication Centers in the protected area.

1-3.3.2 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.

1-3.3.3 A Satellite Communication Center shall comply with applicable requirements of this standard.

1-3.3.4 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.

1-4 Fundamental Requirements of Alarm Systems.

1-4.1 General.

1-4.1.1 A fire alarm system shall be designed, installed, operated and maintained so as to provide the maximum practicable reliability for receipt of and transmission of fire alarms.

1-4.1.2 Transmission of Other Signals.

1-4.1.2.1 It is permitted to use a fire alarm system for the transmission of other signals or calls of a public emergency nature provided such transmission does not interfere with the receipt of fire alarms.

1-4.1.2.2 When the system is used as a signaling system for other municipal departments, the fire alarm operator shall not be required to take action or responsibility for routine calls, when the number of routine calls interferes with the proper handling of alarms.

1-4.2 Equipment and Installation.

1-4.2.1 All devices and equipment constructed and installed under this standard shall be suitable for the purpose for which they are intended.

1-4.2.2 All systems shall be installed in a workmanlike manner in accordance with the established practices and applicable requirements of this standard.

1-4.2.3 All the devices shall be designed to function satisfactorily under the climatic conditions to which they will be exposed.

1-4.2.4 Means for transmission of alarms by the public shall be available on the street, shall be conspicuous and readily accessible for easy operation, and shall not depend upon voice transmission solely for designating the location.

1-4.2.5 Means for transmission of alarms from the point of receipt to fire stations and to other locations, as necessary, shall be provided.

1-4.2.6 Upon completion of a system installation, a satisfactory test of the entire equipment shall be made in the presence of the authorized representative of the purchaser and, if required by the authority having jurisdiction, in the presence of its representative.

1-4.2.7 All apparatus shall be restored to normal condition as promptly as possible after each test or alarm in which the apparatus functioned and shall be maintained in the normal condition for operation.

1-4.3 Fire Alarm Boxes — General.

1-4.3.1 Boxes shall be recognizable as such in all municipalities. Boxes shall have instructions for use plainly marked on the exterior surface.

1-4.3.2 The operating device shall be readily available and of such design and so located as to make the method of its use apparent.

1-4.3.3 Boxes shall be as conspicuous as possible. The color shall be distinctive.

1-4.3.4 A box shall be visible from all directions insofar as is possible. A wide band of distinctive colors visible over the tops of parked cars, or adequate signs when completely visible from all directions shall be applied to supporting poles.

***1-4.3.5** Indicating lights of a distinctive color, visible for at least 1500 feet in all directions, shall be installed over boxes in mercantile and manufacturing areas. The street light nearest the box when equipped with a distinctive colored light shall be acceptable.

1-4.3.6 Box cases and parts at any time accessible to users shall be of insulating materials or permanently and effectively grounded.

1-4.3.7 All ground connections to boxes shall comply with the requirements of 1-5.8.4.

1-4.3.8 Boxes shall be securely mounted on poles or pedestals.

1-4.4 Design of Boxes.

1-4.4.1 Boxes when in an abnormal condition shall leave the circuit usable.

1-4.4.2 Boxes shall be designed so that recycling will not occur if the box actuating device is held in the actuating position.

1-4.4.3 Boxes when actuated shall give a visible or audible indication to the user that the box is operating or that the signal has been received by the Communication Center.

NOTE: When the operating mechanism of a box creates sufficient sound to be heard by the user, the requirements are satisfied.

1-4.4.4 Concurrent operation of at least four boxes shall not result in the loss of an alarm.

1-4.4.5 The box housing shall protect the internal components from weather.

1-4.4.6 Doors on boxes shall remain operable under adverse climatic conditions, including icing and salt spray.

1-4.4.7 If a handset is used, the caps on the transmitter and receiver shall be secured to reduce the probability of the box being disabled due to vandalism.

1-4.5 Location of Boxes.

1-4.5.1 Boxes shall be so located as to protect all built-up areas of the municipality.

1-4.5.2 In mercantile and manufacturing districts it shall not be necessary to travel in excess of one block or 500 feet to reach a box. In residential areas it shall not be necessary to travel in excess of two blocks or 800 feet to reach a box.

1-4.5.3 Schools, hospitals, nursing homes and places of public assembly shall have a box at or near the main entrance.

1-4.5.4 When fire fighters are not normally on duty at fire stations, a fire alarm box shall be provided at each station located where it is constantly accessible to the public.

1-4.6 Circuits — General.

1-4.6.1 The National Electrical Safety Code, National Bureau of Standards Handbook H30, shall be used as a guide for the installation of outdoor circuitry.

1-4.6.2 In all installations first consideration shall be given to continuity of service; particular attention 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.

1-4.6.3 Open local circuits within single buildings are permitted for the operation of alerting devices and alarm equipment additional to that required by the standard.

1-4.6.4 All circuits shall be so routed as to permit ready tracing of circuits for trouble.

1-4.6.5 Circuits shall not pass over, under, through, or be attached to buildings or property which is not owned by, or under the control of, the municipality or the agency responsible for maintaining the system.

1-4.6.6 Alarm instruments installed in private buildings shall be on circuits separate from box and dispatch circuits.

1-4.7 Box Circuits — General.

1-4.7.1 If a municipal box is installed inside a building, it shall be placed as near as practical to the point of entrance of the circuit, and the exterior wire shall be installed in conduit or electrical metallic tubing, in accordance with Chapter 3 of the National Electrical Code (NFPA No. 70—1971).

1-4.7.2 Accessible and reliable means, available only to the authority in control of the municipal 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 the interior box(es) is not in service.

1-4.8 Dispatch Circuits — General.

1-4.8.1 Two separate dispatch circuits shall be provided for transmitting alarms to fire stations, except as permitted in 1-4.8.5.2.

***1-4.8.2** One dispatch circuit shall consist of one of the following:

(a) A supervised wired circuit; or

(b) A radio circuit with duplicate base transmitters.

1-4.8.3 If the primary transmitter fails, switchover to the second transmitter shall be automatic, with audible indication to the operators. Microphones shall be duplicated. Duplicate routes to the antenna site shall be provided.

1-4.8.4 The second dispatch circuit shall be either metallic or radio circuits for transmission of coded signals, signals for graphic recording, or voice signals. This dispatch circuit need not be supervised.

1-4.8.5 Type B Systems.

1-4.8.5.1 A box circuit entering a fire station and there connected to automatic recording and sounding facilities shall be considered one of the two required dispatch circuits.

1-4.8.5.2 In those cities which receive less than 600 alarms per year, or where all stations have recording and sounding devices responsive to each box circuit, the second dispatch circuit is not required.

1-4.8.6 If a radio circuit is used as a dispatch circuit, a separate frequency shall be provided, and the transmission of an alarm over the circuit shall be preceded by a distinctive tone to differentiate the alarm from routine radio traffic.

1-4.8.7 Control circuits for radio transmitters shall be supervised.

1-4.8.8 A circuit connected to a telephone instrument only shall not be considered as one of the required dispatch circuits.

1-4.8.9 A metallic dispatch circuit shall not be connected to alarm instruments in more than five fire stations.

1-4.8.10 Where a wired teletype or voice amplification circuit is used as one of the required dispatch circuits, such circuits shall be individual to each fire station or the instruments shall be connected in parallel in the circuit.

1-4.8.11 Means of acknowledging receipt of an alarm from the fire station to the operator shall be provided. The acknowledgment may be by radio (including that on apparatus when responding) or by metallic circuits, including departmental telephone facilities.

1-4.9 Equipment in Fire Stations.

1-4.9.1 When watch is maintained at all times, instruments on all dispatch circuits and the department telephone shall be located in the vicinity of the watch desk. Alarm instruments need not be located elsewhere in the fire station except as necessary to alert all fire fighters.

1-4.9.2 Each fire station shall have two separate and distinct facilities for receiving notification from the Communication Center that response of the apparatus and men is expected, except as permitted in 1-4.8.5.2.

1-4.9.3 When coded signals are used, the signals shall be visually recorded at the fire station.

1-4.9.4 An audible warning signal shall precede any alarm transmitted by voice.

1-4.9.5 When radio transmissions over a supervised carrier circuit are employed as outlined in 1-4.8.2 (b), a supervised receiver with visual or audible indication of the point to which response is to be made shall be provided. The visual indication shall be automatically recorded.

1-5 Requirements for Metallic Systems.

1-5.1 Circuit Conductors — General.

1-5.1.1 Wires shall be terminated so as to provide good electrical conductivity and prevent breaking from vibration or stress.

1-5.1.2 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.

1-5.1.3 Except as otherwise provided herein, exterior cable and wire shall conform to International Municipal Signal Association specifications or equal.

1-5.2 Cables — General.

1-5.2.1 Cables which meet the requirements of Article 310 of the National Electrical Code (NFPA No. 70—1971) for installation in wet locations are satisfactory for overhead or underground installation except that direct-burial cable shall be specifically approved for the purpose.

1-5.2.2 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.

1-5.2.3 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.

1-5.2.4 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.

1-5.2.5 Signaling wires which, because of the source of current supply, might introduce a hazard, shall be protected and supplied as required for lighting circuits.

1-5.2.6 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.

1-5.3 Underground Cables.

1-5.3.1 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.

1-5.3.2 Cables shall 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.

1-5.3.3 All cables installed in manholes shall be properly racked and marked for identification,

1-5.3.4 All conduits or ducts entering buildings from underground duct systems shall be effectively sealed against moisture or gases entering the building.

1-5.3.5 Cable joints shall be located only in manholes, fire stations, and other locations 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.

1-5.3.6 Direct burial cable, without enclosure in ducts, shall be laid in grass plots, under sidewalks or 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 of at least two-inch by four-inch planks with half-round grooves, spiked or banded together after the cable is installed.

1-5.4 Aerial Construction.

1-5.4.1 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 at 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.

1-5.4.2 Aerial cable shall be supported by messenger wire of adequate tensile strength, except as permitted in 1-5.4.3 below.

1-5.4.3 Two-conductor cable shall be messenger-supported unless it has conductors of No. 20 AWG or larger size and has mechanical strength equivalent to No. 10 AWG hard-drawn copper.

1-5.4.4 Single wire shall meet International Municipal Signal Association specifications and 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. Span lengths shall not exceed manufacturers' recommendations.

1-5.4.5 Wires to buildings shall contact only intended supports and shall enter through an approved weatherhead or suitable sleeves slanting upward and inward. Drip loops shall be formed on wires outside of buildings.

1-5.5 Protection on Aerial Construction.

1-5.5.1 At junction points of open aerial conductors and cable, each conductor shall be protected by a lightning arrester of

weatherproof type, or be suitably protected from the weather. There shall also be a connection between the lightning arrester ground and any metallic sheath and messenger wire.

1-5.5.2 Aerial open wire and nonmessenger supported two-conductor cable circuits shall be protected by a lightning arrester at intervals of approximately 2,000 feet.

1-5.5.3 Lightning arresters, other than air-gap type, shall not be installed in fire alarm boxes.

1-5.5.4 All protective devices shall be accessible for maintenance inspection.

1-5.6 Leads Down Poles.

1-5.6.1 Leads down poles 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.

1-5.6.2 Leads to boxes shall have 600 volt insulation approved for wet locations, as defined in the National Electrical Code (NFPA No. 70 — 1971).

1-5.7 Wiring Inside Buildings.

1-5.7.1 All conductors inside buildings shall be in conduit, electrical metallic tubing, metal molding, or raceways. Installation shall be in accordance with the National Electrical Code (NFPA No. 70 — 1971).

1-5.7.2 Conductors shall have an approved insulation; the insulation or other outer covering shall be flame-retardant and moisture-resistant.

1-5.7.3 Conductors 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 (NFPA No. 70—1971).

1-5.7.4 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 metallic conduit, or located in a fire-resistive shaft having fire stops at each floor.

1-5.7.5 When signal conductors, and electric light and power wires are run in the same shaft, they shall be separated by at

least two inches, or either system shall be encased in a noncombustible enclosure.

1-5.7.6 Where cables or wirings are exposed to unusual fire hazards, they shall be properly protected.

1-5.7.7 Cable terminals and cross-connecting facilities shall be located in or adjoining the operations room.

1-5.8 Circuit Protection — General.

1-5.8.1 The protective devices shall be located close to, or be combined with the cable terminals.

1-5.8.2 Lightning arresters suitable for the purpose shall be provided. Lightning arresters shall be marked with the name of the manufacturer and model designation.

1-5.8.3 All lightning arresters shall be connected to a suitable ground.

1-5.8.4 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 in accordance with the practices of the local electrical utility. 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—1971) Article 250–92, and the grounding conductor may then be a No. 14 AWG.

1-5.8.5 All fuses shall be plainly marked with their rated ampere capacity. All fuses rated over two amperes shall be of the enclosed type.

1-5.8.6 Circuit protection required at the Communication Center shall be provided in every building housing Communication Center equipment.

1-5.8.7 Each conductor entering the Communication Center, fire stations or other buildings from lines partly or entirely aerial shall be protected by a lightning arrester.

1-6 Management.

1-6.1 General.

1-6.1.1 The system shall be under the control of a responsible municipal employee.

1-6.1.2 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.

1-6.1.3 When maintenance is provided by an organization or person other than the municipality or its employees, complete written records of the installation, maintenance, test, and extension of the system shall be forwarded to the responsible municipal employee as soon as possible. Notice of failure and restoration of service shall be made immediately to the responsible municipal employee.

1-6.1.4 Maintenance 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.

1-7 Testing.

1-7.1 General.

1-7.1.1 Tests and inspections shall be made at intervals not less frequent than those specified in this standard.

1-7.1.2 Testing facilities shall be installed at the 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.

1-7.2 Boxes.

1-7.2.1 Boxes shall be tested by operation under conditions simulating actual use and test signals shall be transmitted and recorded at the Communication Center.

1-7.2.2 Fire alarm boxes shall be examined, cleaned and tested at least every 60 days.

1-7.3 Dispatching Systems.

1-7.3.1 Manual test of dispatch circuit instruments shall be made and recorded at least once in each 24 hours.

1-7.3.2 Outside devices, radio, telephone or other facilities for alerting volunteer and off-duty firemen shall be tested daily.

1-7.3.3 At least twice daily all telephone and voice amplification circuits shall be subjected to talking test, and lines for transmission of signals graphically shall be tested by a message transmission. This does not apply to box circuits.

1-7.4 Power.

1-7.4.1 An emergency power source other than batteries shall be operated to supply the system for a continuous period of one hour at least weekly. This test shall require simulated failure of the normal power source.

1-7.4.2 Periodic tests shall be performed to insure that the batteries are capable of supplying the system with power when required to do so. The required tests and the maximum interval at which they are to be performed are as follows:

	Maximum Interval
Measure Float Voltage	
Of entire battery or a pilot cell	1 week
Of each cell	3 months
Measure Specific Gravity	
Of a pilot cell	6 weeks
Of each cell	6 months
Discharge for two hours	1 year
Clean and Inspect	3 months
Calibrate Float Voltage Voltmeter	6 months

1-8 Records.

1-8.1 General.

1-8.1.1 Complete records, sufficient to assure reliable operation of all alarm system functions, shall be maintained in a satisfactory manner.

1-8.1.2 When a combination of leased/owned facilities exists, records required to be maintained by the lessor for the municipality shall be specified.

1-8.1.3 A report of operations summarizing important statistics shall be prepared annually by the superintendent.

1-8.2 Circuits. Records of wired circuits (box and dispatch) shall include: outline plans showing terminals and box sequence; diagrams of office wiring; materials including trade name, manufacturer and year of purchase or installation.

1-8.3 Boxes.

1-8.3.1 Records of boxes shall include: box identification; location address; circuit number (if applicable); physical mounting; description by manufacturer, model number, date of installation and power source (radio); test dates and time.

1-8.3.2 Field inspection forms shall include:

(a) Physical condition, paint, mounting, door function, drop wire or antenna, and

(b) Tests of all box design functions.

1-8.4 Operations.

1-8.4.1 Emergency calls, however received, shall be appropriately recorded and tabulated to indicate source of origin.

1-8.4.2 Dispatch of apparatus in response to emergency calls shall be recorded. Records shall indicate companies and supervisory officers for first and subsequent alarms, time of acknowledgment by companies, time of arrival at scene and time back in service.

1-8.5 Emergency Generating Equipment. Emergency generating equipment periodic test records shall include: date and time; fuel, electrical, coolant and exhaust system conditions; operating time.

Chapter 2 Communication Center

2-1 Building and Equipment.

2-1.1 Communication Center Location.

2-1.1.1 If the building is located within 150 feet of another structure, special attention shall be given to guard against damage from such exposure by protecting openings, and by constructing the roof as to resist damage which might be caused by falling walls.

2-1.1.2 Communication Center Construction. A Communication Center shall not be located below grade unless the structure is specifically designed for such locations.

2-1.1.3 The building shall be of fire-resistive construction as defined in the Standard Types of Building Construction (NFPA No. 220—1961) and in the National Building Code published by American Insurance Association.

2-1.1.4 No combustible materials shall be permitted in the construction. Interior finish material shall be flame-spread of 25 or less.

2-1.1.5 When the building is occupied for purposes other than municipal signaling, the Communication Center shall be cut off by wall construction having a fire resistance rating of at least four hours, and floor and ceiling construction having a fire resistance rating of at least three hours. When entrance into the Communication Center is from inside the building, the opening between the Communication Center and other portions of the building shall be protected by an approved self-closing Class A fire door on each side of opening.

2-1.1.6 At least two approved portable fire extinguishers, suitable for the hazards involved, shall be provided.

2-1.1.7 Sufficient emergency lighting shall be provided to permit necessary operations.

2-1.1.8 The Communication Center and other buildings housing essential operating equipment shall be protected against physical damage due to vandalism and civil disturbances. Entry to these buildings or locations shall be restricted to authorized persons only.

2-1.2 Fire Alarm Equipment — General.

2-1.2.1 All devices and instruments, the failure of which would adversely affect the operation of the system, shall be mounted upon noncombustible bases, pedestals, switchboards, panels or cabinets. All mounting shall be of such design and construction that all components will be readily accessible.

2-1.2.2 Wires on switchboards shall not be 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.

2-1.2.3 Equipment 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.

2-1.2.4 The normal operation of the system shall not require the use of a ground to secure any essential function. Circuits extending outside the 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.

2-1.3 Supervision.

2-1.3.1 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.

NOTE: Where each box is served by an individual wired circuit, an automatic periodic test at intervals of six minutes or less will be acceptable as electrical supervision.

2-1.3.2 The power supplied to all required circuits and devices of the system shall be supervised.

2-1.3.3 Trouble signals shall actuate a sounding device located where there is always a responsible person on duty.

2-1.3.4 Trouble signals shall be distinct from alarm signals and shall be indicated by both a visual light and audible signal.

NOTE 1: The audible signal may be common to several supervised circuits.

NOTE 2: A switch for silencing the audible trouble signal is permitted if the visual signal remains operated until the silencing switch is restored to its normal position.

2-1.3.5 The audible signal shall be responsive to faults on any other circuits which may occur prior to restoration of the silencing switch to normal.

2-1.4 Facilities for Receipt of Box Alarms — General.

2-1.4.1 Alarms from boxes shall be automatically received and recorded at the Communication Center.

2-1.4.2 A permanent visual record and an audible signal are required to indicate the receipt of an alarm. The permanent record shall indicate the exact location from which the alarm is being transmitted.

NOTE: The audible signal device may be common to several box circuits and arranged so that the fire alarm operator can manually silence the signal temporarily by a self-restoring switch.

2-1.4.3 All voice transmissions from boxes for emergencies shall be recorded with the capability of instant playback.

2-1.4.4 A voice recording facility shall be provided for each operator handling incoming alarms in order to eliminate the possibility of interference.

2-1.4.5 Facilities shall be provided which will automatically record the date and time of receipt of each alarm, except that time only is acceptable in voice recordings.

2-1.4.6 If an incoming telephone call is not answered within one minute, a trouble indication shall be automatically transmitted to a nearby manned location, or other location acceptable to the authority having jurisdiction.

2-2 Commercial Telephone Facilities.

2-2.1 The provisions of this section apply to the facilities necessary to receive alarms transmitted by citizens using the commercial telephone system.

2-2.2 A specific telephone number shall be assigned for fire alarm emergency service with a separate number assigned for normal fire department business. Telephone directory listings shall be as follows:

(a) On the inside front cover of the white pages directory:

FIRE [Symbol optional] ..... (FIRE NUMBER)

In the white pages directory:

"FIRE DEPARTMENT

To report a fire . . . . . (FIRE NUMBER)

Nonfire purposes . . . . . (business number)"

(b) The fire department listing shall also appear in the white pages directory under the name of the municipality.

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

2-2.3 Where suitable arrangements have been made for the receipt and handling of all emergency calls for fire, police, ambulance, etc., at a single Communication Center, such as through the use of the national emergency number "911," the directory listing shall be appropriate.

2-2.4 Telephones at Communication Centers.

2-2.4.1 At the 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 of lines shall depend upon the traffic handled. Additional telephone lines should be provided responsive to the business number as required.

2-2.4.2 In addition to the above, at least one unlisted line shall be provided.

2-2.4.3 For manual switching type telephone systems, connections to assigned lines shall be made only for fire reporting. Where dial system service is used, provisions shall be made for automatically selecting the assigned emergency lines first and progressing to the general business lines, when the emergency number is dialed, but the assigned lines shall not be made responsive to a dialing of the general business numbers.

2-2.5 In cases where the Communication Center is not the primary answering agency for fire calls, the answering agency shall transfer the call directly to the fire alarm operator and remain on the line until assured that the transfer is effected. This transfer procedure shall be used instead of relaying the information to the operator.

2-2.6 Fire calls received by telephone shall be recorded automatically and be provided with capability of instant playback.

2-2.7 A voice recording facility shall be provided for each operator handling incoming alarms in order to eliminate the possibility of interference.

2-2.8 Facilities shall be provided which will automatically record the time of receipt of each alarm.

2-2.9 Where private fire alarm equipment arranged to automatically transmit a signal to the fire department over commercial telephone facilities is in use, a separate unlisted telephone line(s) shall be used to receive such signals. The private equipment shall not be permitted to automatically connect to the telephone lines required by 2-2.2 (a), 2-2.4.1, or 2-2.4.2.

2-3 Dispatching Systems.

2-3.1 Facilities for Retransmission of Alarms — General.

2-3.1.1 Facilities for retransmitting alarms to fire stations shall be installed at the place where telephone alarms are received.

2-3.1.2 Two separate facilities shall be provided, one of which shall be connected to a supervised dispatch circuit, except as outlined in Section 1-4.8.5.2.

2-3.1.3 Devices for transmitting coded or other types of signals shall be arranged for manual setting and operations.

2-3.1.4 Coded signals shall be transmitted not slower than two strokes per second. If outside alerting devices are employed, transmission shall be over separate circuits, but shall be at a speed suitable for such devices.

2-3.1.5 The facilities shall include automatic recording of alarms transmitted over the supervised dispatch circuit. Provisions shall be made to automatically record the date and time of transmission.

NOTE 1: Alarms may be transmitted by coded signals, or by signals for graphic or facsimile reproduction.

NOTE 2: Manual entry of date and time by the operator is satisfactory when graphic symbol transmission is used.

2-3.1.6 Automatic recording facilities, separate from that used for recording voice alarms from boxes, shall be provided for alarms transmitted by voice.

NOTE: When only one operator is required, a single recording facility may be used for the receipt and transmission of alarms by voice.

2-3.2 Special Requirements for Retransmission of Alarms — Type B System.

2-3.2.1 In a Type B System, the requirements in the following paragraphs also apply.

2-3.2.2 Facilities shall be installed to transmit automatically alarms received from any box to all fire stations and where employed, to outside sounding devices.

2-3.2.3 The effectiveness of noninterference and succession functions between box circuits shall be no less than between boxes in any one circuit. The disablement of any metallic box circuit shall cause a warning signal in all other circuits and, thereafter, the circuit or circuits not otherwise broken shall be automatically restored to operative condition.

2-3.2.4 Control facilities shall permit any or all circuits to be individually connected to or disconnected from the repeating mechanism.

2-3.2.5 Code transmitting devices using metallic conductors shall be provided with means for transferring the facilities from one box circuit to another.

2-3.2.6 In those cities which receive less than 600 alarms per year or where all stations have recording and sounding devices responsive to each box circuit, only the supervised dispatch circuit facility need be provided.

2-3.3 Radio.

2-3.3.1 All fire apparatus and other fire department emergency vehicles shall be radio equipped.

2-3.3.2 The Communication Center shall be equipped for radio communication with fire apparatus. A duplicate system shall be provided.

NOTE: It is recommended that each fire department have its own frequency or frequencies, with a separate frequency provided for common communication with other neighboring departments. However, it may be satisfactory for several small departments in an area to share the same frequency(ies).

2-3.3.3 Repeater stations shall have dual supervised transmitters, dual supervised receivers, and dual antennas. The primary receiver and transmitter shall be so arranged to automatically switch to the second or standby receiver and transmitter should any failure occur.

2-3.3.4 A visual and audible alarm shall be provided at the Communication Center when the relay station has switched from primary to secondary (standby) transmitters.

NOTE: This can be accomplished by the installation of a receiver at alarm headquarters to monitor all messages transmitted from the relay station.

2-3.4 Telephones in Fire Stations.

2-3.4.1 There shall be a telephone at each fire station.

2-3.4.2 Where there is no other means of voice communications with fire stations, the telephones at fire stations shall be arranged so that they cannot be called by the public except:

(a) through a common switching point in the Communication Center, 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 Communication Center which may be housed in a fire station.

2-3.4.3 Telephones installed in fire stations shall not be listed in the telephone directory.

2-3.5 Other Alerting Facilities.

2-3.5.1 Outside alerting devices indicating an alarm of fire shall be utilized only where no other effective means is provided for alerting volunteer or off-shift fire department personnel.

2-3.5.2 When coded alerting devices are not operable at speeds of at least one actuation per second, a special operating circuit shall be provided. Four rounds of coded signals are required where outside alerting devices are operated for summoning firemen.

2-3.5.3 Telephone or other alerting facilities provided for volunteer or off-duty firemen shall be so arranged that at least 50 percent of such personnel will be called. Where radio alerting receivers are employed, a secondary power supply shall be provided for each unit.

NOTE: Such facilities need not actuate an outside alerting device.

2-3.5.4 Electrical power essential for operation of alerting devices shall meet the requirement of Section 2-5. This shall include power for control equipment such as relays, timers, coders, etc., and where required, for operation of the alerting device itself.

2-3.5.5 Compressed air alerting devices shall have a distinctive tone; if coded, duration of blast shall be not less than one-half second nor longer than one-and-one-half seconds with silent intervals of one to one-and-one-half times the blast.

2-3.5.6 Storage tanks shall comply with ASME specifications for unfired pressure vessels and be equipped with a safety-relief valve. Size shall be such that at 85 percent of normal pressure, eight times the largest number of blasts assigned to any box can be sounded but not less than 50 blasts.

***2-3.5.7** Compressor shall have sufficient capacity to fill storage tanks to normal pressure within 30 minutes. Piping of ferrous material shall be provided with adequate scale traps, accessible for ready cleaning. All piping shall be arranged to permit inspection and repair.

2-4 Dispatching Operations.

2-4.1 Organization.

2-4.1.1 The number of operators shall be as follows:

(a) For municipalities receiving less than 600 alarms per year, alarms not retransmitted automatically shall be received and retransmitted to the fire force by a responsible and competent person always on duty for the purpose, as follows:

(i) A specially designated person or persons, an employee of the local telephone company, or

(ii) A member of another municipal department, or

(iii) The house watch at a fire station, with facilities for transfer of service to another municipal office if the house watch responds to fires.

(b) For municipalities receiving more than 600 and less than 2,500 alarms per year, at least one operator, especially trained for the service, shall be on duty at all times.

(c) For municipalities receiving more than 2,500 alarms per year, at least two fully trained and competent operators shall be on duty at all times.

(d) Additional operators shall be provided as warranted by the actual traffic.

(e) The number of operators required to be on duty shall be increased to the satisfaction of the authority having jurisdiction when operators are expected to perform duties not directly connected with the receipt and transmission of other fire alarms and other emergency traffic, except as otherwise provided in this standard.

(e) The number of operators required to be on duty shall be increased to the satisfaction of the authority having jurisdiction to handle peak traffic loads of a seasonal or temporary nature, such as brush fire periods, civil unrest, etc.

2-4.1.2 The operators shall be at the Communication Center and be capable of operating the system, and testing the system unless other persons qualified and on duty are assigned this work.

2-4.2 Operator Qualifications.

2-4.2.1 Operators shall be in good health and free from disabling physical and mental defects that would affect their ability to efficiently handle the duties assigned. They shall be temperamentally suited to the position, including being able to remain calm and take decisive action during emergencies, to remain alert during periods of inactivity and when carrying out normal repetitive operations, and to work harmoniously with other persons.

2-4.2.2 Operators shall be familiar with general fire department operations, with the locations of streets, important structures including schools, hospitals and other buildings with a high life hazard, and congested and/or hazardous areas.

2-4.2.3 Operators shall have a working knowledge of the fire alarm system and shall be capable of making the prescribed tests. They shall be familiar with rules and regulations relating to equipment in use, including those of the Federal Communications Commission pertaining to radio.

2-4.3 Operating Practices.

2-4.3.1 An alarm of fire, including requests for multiple alarms, received by any means whatsoever, shall be transmitted to the proper fire department companies over the required dispatch circuits.

2-4.3.2 The first fire company arriving at the location of the alarm shall give a brief preliminary report on condition observed to the Communication Center.

2-4.3.3 Where supervisory devices or tests indicate that trouble has occurred anywhere on the system, the operator shall take appropriate steps to repair the fault or, if this is not possible, isolate the fault and notify the official responsible for maintenance.

2-4.3.4 An accurate indication of the status of all fire companies, i.e., in the station available for response, out of service at a fire, out of service due to other reasons, etc., shall be readily available to the operators at all times.

2-5 Power.

2-5.1 General.

2-5.1.1 Power 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—1971).

2-5.1.2 The conductors of the 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.

2-5.1.3 Power may be obtained from the load side of the main disconnect switch only when buildings are for the exclusive housing of fire alarm and other emergency facilities. The circuit disconnecting means shall be so installed that it would be accessible only to authorized personnel.

2-5.1.4 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.

2-5.2 Power Source. Each box circuit, except as permitted by 6-2.1, each dispatch circuit, and related alarm transmitting or receiving devices, including equipment at stations needing local power for operation, shall be provided with two sources of power. The two sources of power considered acceptable are:

(a) One 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 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. 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 standby with facilities to apply its power to the line within 30 seconds. A standby, storage battery having a four-hour capacity shall be provided. If two engine-driven generators are used as a second source of power, the fire alarm system four-hour battery may be omitted.

2-5.3 Power Supply.

2-5.3.1 The forms and arrangements of power supply shall be classified as described in the paragraphs below.

***2-5.3.2** *Form 2.* Permissible for Type A systems only. Box or dispatch circuits served in multiple by:

(a) *Form 2A.* A rectifier or motor-generator powered from a single source of alternating current with a floating storage battery having a 24-hour standby capacity;

(b) *Form 2B.* A rectifier or motor-generator powered from two sources of alternating current, with a floating storage battery having a four-hour standby capacity;

(c) *Form 2C.* Duplicate 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 2-5.2). Each rectifier or motor-generator shall be capable of powering the entire system.

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

(i) Batteries, motor-generators or rectifiers shall be sufficient to supply all connected circuits without exceeding the capacity of any battery or overloading any generator or rectifier, so that circuits developing grounds or crosses with other circuits may be supplied each by an independent source to the extent required by (ii) below.

(ii) Provisions 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 ten percent of the total number of box and dispatch circuits, but never less than two.

(iii) 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 dispatch circuit to give

immediate warning of ground leakage endangering operability.

*2-5.3.3 *Form 3.* Each box and dispatch circuit served by:

(a) *Form 3A.* A rectifier or motor-generator powered from a single source of alternating current with a floating storage battery having a 60-hour standby capacity.

(b) *Form 3B.* A rectifier or motor-generator powered from two sources of alternating current with a floating storage battery having a 24-hour standby capacity.

2-5.3.4 *Form 4.* Each box and dispatch circuit served by:

(a) *Form 4A.* An inverter powered from a common rectifier powered by a single source of alternating current, with a floating storage battery having a 24-hour standby capacity;

(b) *Form 4B.* An inverter powered from a common rectifier receiving power from two sources of alternating current, with a floating storage battery having a four-hour standby capacity.

NOTE: For Form 4A and Form 4B, it is permissible to distribute the system load between two or more common rectifiers and batteries.

(c) *Form 4C.* A rectifier, converter or motor-generator receiving power by two sources of alternating current with transfer facilities to apply power from the secondary source to the system within 30 seconds (see 2-5.2).

2-5.3.5 Local circuits at Communication Centers shall be supplied either in common with box or dispatch circuits or by a separate power source. The source of power for local circuits on which the operation of essential features of the system depend shall be supervised.

2-5.3.6 Visual and audible means to indicate a 15 percent or greater reduction of normal power supply (rated voltage) shall be provided.

2-5.4 Rectifiers, Converters, Inverters, Motor-Generators.

2-5.4.1 Rectifiers shall be supplied through an isolating transformer taking energy from a circuit not to exceed 250 volts.

2-5.4.2 Complete, ready-to-use spare units, or spare parts, shall be available in reserve.

2-5.4.3 One spare rectifier shall be provided for each ten required for operation but in no case less than one.

2-5.4.4 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 percent of maximum connected load. Where not provided with battery floating the fuse shall be not less than three amperes.

2-5.5 Engine-Driven Generator Sets.

2-5.5.1 The provisions of this section shall apply to generators driven by internal combustion engines.

2-5.5.2 The installation of such units shall conform to the provisions of the Standard for Stationary Combustion Engines and Gas Turbines (NFPA No. 37 — 1970) except as restricted by the provisions of this section.

2-5.5.3 The unit shall be located in an adequately ventilated, cutoff area of the building housing the Communication Center equipment; the room shall be used for no other purpose except storage of spare parts or equipment. Exhaust fumes shall be discharged directly outside the building.

2-5.5.4 Liquid fuel shall be stored in outside underground tanks 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.

2-5.5.5 Liquefied petroleum gas and natural gas installations shall meet the requirements of standards on Liquefied Petroleum Gases (NFPA No. 58 — 1972) and Installation of Gas Appliances and Gas Piping (NFPA No. 54—1969).

2-5.5.6 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 communications building.

2-5.5.7 A separate storage battery on automatic float charger shall be provided for starting the engine-driven generator.

2-5.6 Batteries — Communication Center.

2-5.6.1 Batteries shall be of the storage type; primary batteries (dry cells) shall not be used. All cells shall be of the sealed type; lead-acid batteries shall be in jars of glass or other suitable transparent materials; other types of batteries shall be in containers suitable for the purpose.

2-5.6.2 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 aboveground except as permitted by 2-1.1.2, and shall be ventilated to prevent accumulation of explosive gas mixtures; special ventilation is required only for unsealed cells.

2-5.6.3 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.

Chapter 3 Telegraph System — Specific

3-1 Circuits.

3-1.1 Tie Circuits.

3-1.1.1 A separate tie circuit shall be provided from the Communication Center to each Satellite Communication Center.

3-1.1.2 In a Type B system, when all boxes in the system are of succession type, it is permissible to use the tie circuit as a dispatch circuit.

3-1.2 Box Circuits.

3-1.2.1 Box circuits shall be sufficient in number and so laid out that the areas 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.

3-1.2.2 When 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, it is permissible for the circuit to serve twice the above figures for aerial open wire and cable circuits, respectively.

3-1.2.3 The installation of additional boxes in an area served by the number of properly spaced boxes indicated above does not constitute geographical overloading a circuit.

3-2 Circuit Protection.

3-2.1 All conductors entering the Communication Center shall be protected by the following devices, in the order named, starting from the exterior circuit:

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

(b) A lightning arrester;

(c) A fuse or circuit breaker, rated at one-half ampere.

3-2.2 The one-half ampere protection on tie-line circuits shall be omitted at the Satellite Communication Centers.

3-2.3 Circuit protection required at Communication Center shall be provided in every building housing communication center equipment when such equipment is installed in more than one building.

3-2.4 Each conductor entering fire station or other buildings from lines partly or entirely aerial shall be protected by a lightning arrester.

3-3 Power Supply.

3-3.1 Requirements for Constant-Current Systems.

3-3.1.1 Means shall be provided for manually regulating current in box circuits so that operating current is maintained within 10 percent of normal throughout changes in external circuit resistance from 20 percent above to 50 percent below normal.

3-3.1.2 The voltage supplied to maintain normal line current on box circuits shall not 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 four boxes.

3-3.1.3 Visual and audible means to indicate a 20 percent or greater reduction in the normal current in any box circuit shall be provided. All devices connected in series with any box circuit shall function properly when the box circuit current is reduced to 70 percent of normal.

3-3.1.4 Sufficient meters shall be provided to indicate the current in any box 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.

3-4 Design of Fire Alarm Boxes.

3-4.1 Boxes shall transmit three or four rounds of the box number.

3-4.2 Boxes shall be capable of being adjusted to a desired speed. For a Type A system they shall operate at two or more strokes per second. For a Type B system, they shall operate at not slower than one stroke per second.

3-5 Receiving Equipment — Facilities for Receipt of Box Alarms.

3-5.1 Visual Recording Devices.

3-5.1.1 A permanent visual recording device shall be provided for each box circuit and each tie circuit.

3-5.1.2 In a Type A System, these devices shall be installed at the Communication Center. A reserve recording device shall be provided where there are five or more box circuits.

3-5.1.3 In a Type B System, these devices shall be installed either at a location where an operator is constantly on duty or at a fire station(s).

3-5.1.4 When recording devices are installed in unmanned fire stations, sufficient outside alerting devices shall be provided to assure response of fire department personnel even though the recording and sounding facilities in any one receiving location are inoperative.

3-5.2 Sounding Devices.

3-5.2.1 Sounding devices for signals shall be provided for box circuits.

3-5.2.2 In a Type A System, it shall be satisfactory to use a common sounding device for more than one circuit and it shall be installed at the Communication Center.

3-5.2.3 In a Type B System, a sounding device shall be installed on each box circuit at the same location as the recording device for that circuit.

3-6 Testing.

3-6.1 Power Supply. Manual tests of the power supply for box and dispatch circuits shall be made and recorded at least once in each 24 hours. Such tests shall include:

(a) Current strength of each circuit. Changes in current of any circuit, amounting to ten percent of normal current shall be investigated immediately.

(b) Voltage across terminals of each circuit, inside of terminals of protective devices. Changes in voltage of any circuit, amounting to ten percent of normal voltage, shall be investigated immediately.

(c) Voltage between ground and circuits. When this test shows a reading in excess of 50 percent of that shown in test 3-6.1(b) above, the trouble shall be immediately located and cleared; read-

ings in excess of 25 percent shall be given early attention. These readings shall be taken with a voltmeter of not more than 100 ohms resistance per volt.

NOTE (1): The voltmeter resistance has been changed from 1000 ohms per volt to 100 ohms per volt so that false ground readings (caused by induced voltages) will be minimized.

NOTE (2): Systems in which each circuit is supplied by an independent current source (Forms 3 and 4) will require tests between ground and each side of each circuit. Common current source systems (Form 2) will require voltage tests between ground and each terminal of each battery and other current source.

(d) A ground current reading shall be acceptable in lieu of 3-6.1(c) above. When this method of testing is used, all grounds showing a current reading in excess of five percent of the normal line current shall be given immediate attention.

(e) Voltage across terminals of common battery, on switchboard side of fuses.

(f) Voltage between common battery terminals and ground. Abnormal ground readings shall be investigated immediately.

NOTE: Tests (e) and (f) apply only to those systems using a common battery. If more than one common battery is used, each common battery shall be tested.

3-6.2 Control equipment. Manual tests of box and dispatch circuit instruments shall be made and recorded at least once each 24 hours. Where applicable, all box circuit instruments shall be tested by use of operators' keys.

3-6.3 Boxes. 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.

Chapter 4 Series Telephone System — Specific

4-1 Circuits.

4-1.1 Tie Circuit.

4-1.1.1 A separate tie circuit shall be provided from the Communication Center to each Satellite Communication Center.

4-1.1.2 The tie circuit between the Center and Satellite shall not be used for any other purpose.

4-1.2 Box Circuits.

4-1.2.1 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.

4-1.2.2 When 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, it is permissible for the circuit to serve twice the above figures for aerial open wire and cable circuits, respectively.

4-1.2.3 The installation of additional boxes in an area served by the number of properly spaced boxes indicated above does not constitute geographical overloading of a circuit.

4-2 Circuit Protection.

4-2.1 All conductors entering Communication Centers shall be protected by the following devices, in the order named, starting from the exterior circuit:

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

(b) A lightning arrester;

(c) A fuse or circuit breaker, rated at one-half ampere;

4-2.2 The one-half ampere protection on the tie line circuits shall be omitted at Satellite Communication Centers.

4-3 Power Supply.

4-3.1 Requirements for Constant-Current Systems

4-3.1.1 Means shall be provided for manually regulating current in box circuits so that operating current is maintained within 10 percent of normal throughout changes in external circuit resistance from 20 percent above to 50 percent below normal.

4-3.1.2 The voltage supplied to maintain normal line current on box circuits shall not exceed 150 volts, measured under "no load" conditions and shall be such that the line current will not be reduced below safe operating value during the simultaneous operating of four boxes.

4-3.1.3 Visual and audible means to indicate a 20 percent or greater reduction in the normal current in any box circuit shall be provided. All devices connected in series with any box circuit shall function properly when the box circuit current is reduced to 70 percent of normal.

4-3.1.4 Sufficient meters shall be provided to indicate the current in any box 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.

4-4 Design of Fire Alarm Boxes. Boxes shall be designed to permit the Communication Center operator to determine whether or not the box has been restored to normal condition after use.

4-5 Receiving Equipment.

4-5.1 A permanent visual recording device installed in the Communication Center shall be provided to record all incoming box signals. A spare recording device shall be provided for five or more box circuits.

4-5.2 A second visual means of identifying the calling box shall be provided.

4-6 Testing.

4-6.1 Power Supply. Manual tests of the power supply for box circuits shall be made and recorded at least once each 24 hours. Such tests shall include:

(a) Current strength of each circuit. Changes in current of any circuit, amounting to ten percent of normal current, shall be investigated immediately.

(b) Voltage across terminals of each circuit, inside of terminals

of protective devices. Changes in voltage of any circuit, amounting to ten percent of normal voltage, shall be investigated immediately.

(c) Voltage between ground and circuits. When this test shows a reading in excess of 50 percent of that shown in test 4-6.1(b) above, the trouble shall be immediately located and cleared; readings in excess of 25 percent shall be given early attention. These readings shall be taken with a voltmeter of not more than 100 ohms resistance per volt.

NOTE (1): The voltmeter resistance has been changed from 1000 ohms per volt to 100 ohms per volt so that false ground readings (caused by induced voltages) will be minimized.

NOTE (2): Systems in which each circuit is supplied by an independent current source (Forms 3 and 4) will require tests between ground and each side of each circuit. Common current source systems (Form 2) will require voltage tests between ground and each terminal of each battery and other current source.

(d) A ground current reading shall be acceptable in lieu of 4-6.1 (c) above. When this method of testing is used, all grounds showing a current reading in excess of five percent of the normal line current shall be given immediate attention.

(e) Voltage across terminals of common battery, on switchboard side of fuses.

(f) Voltage between common battery terminals and ground. Abnormal ground readings shall be investigated immediately.

NOTE: Tests (e) and (f) apply only to those systems using a common battery. If more than one common battery is used, each common battery shall be tested.

4-6.2 Control Equipment. Manual tests of box circuit instruments shall be made and recorded at least once each 24 hours.

4-6.3 Boxes. Boxes which operate by voice transmission shall be tested through operation. (See A-5-7)

Chapter 5 Parallel Telephone System — Specific

5-1 Circuits.

5-1.1 Tie Circuits. Where a concentrator-identifier or similar device is employed, at least two tie circuits for the first 40 boxes connected shall be provided to the Communication Center. A tie circuit shall be provided for each 40 or fraction thereof of additional boxes connected to the above named device.

5-1.2 Box Circuits. A separate circuit shall be provided for each box.

5-2 Circuit Protection.

5-2.1 Protection at Communication Centers. All conductors entering the Communication Center shall be protected with devices, in the order named, starting from the exterior circuit as follows:

(a) At least a 20 foot section of 24 AWG copper or smaller diameter conductor or a 3 ampere, 2000 volt fuse;

(b) A lightning arrester;

(c) A fuse or other device, such as a heat coil, rated at not more than one-half ampere; or

(d) Where the design of the system is such that other type protection is necessary, the recommendation of manufacturer shall be followed.

5-2.2 Protection at Other Buildings. Circuit protection required at the Communication Center shall be provided in every building housing Communication Center equipment.

5-3. Design of Fire Alarm Boxes. Boxes shall be designed to permit the Communication Center operator to determine whether or not the box has been restored to normal condition after use.

5-4 Receiving Equipment.

5-4.1 The box circuits shall be terminated:

(a) Directly on a console or switchboard located in the Communication Center or

(b) In concentrator-identifier equipment located in a Satellite Communication Center. In this latter case tie circuits from the concentrator shall be terminated on a console or switchboard located in the Communication Center.

5-4.2 The box circuits in the direct line system or the tie circuits in the concentrator system shall be grouped together on the console or switchboard so that they are readily distinguishable from other circuits also terminated on the console or switchboard.

5-4.3 Audible and visual signals shall indicate an incoming call from a telephone box. When the operator answers the call, the audible signal shall cease, and when two or more operator positions are provided, the visual signal shall change.

5-4.4 Permanent visual recording shall be installed in the Communication Center. A spare recording device shall be provided when the number of boxes exceeds 100.

5-5 Power Supply. To maximize battery life the battery float voltage shall be maintained within the limits shown in the table below:

	High Gravity Battery	**Low Gravity Battery**
Float Voltage		
Max.	2.25 volts/cell	2.17 volts/cell
Min.	2.20 volts/cell	2.13 volts/cell

5-6 Supervisory Facilities. An open, short, ground or leakage condition shall be recognized by either a continuous line test or periodic (up to six minutes) automatic line tests made from a test frame. If one of these conditions occurs, a visual and audible trouble signal shall be actuated where there is always a responsilbe person on duty.

***5-7 Testing.** Boxes which operate by voice transmission shall be tested through operation.

Chapter 6 Coded Radio Systems — Specific

6-1 Box Circuits.

6-1.1 Not more than 500 boxes shall be permitted on a single frequency.

6-1.2 Where acknowledgment indication is provided to the user that the message has been received, a separate frequency shall be used.

6-1.3 Box circuits for coded radio type systems shall be supervised in accordance with 6-5.

6-1.4 Where box message signals to the Communication Center or acknowledgment of message receipt signal from the Communication Center to the box are repeated or relayed, associated repeating or relaying facilities shall conform to the requirements established in 2-3.3.3 of this standard.

6-2 Power.

6-2.1 Boxes powered from a local source are permitted. Batteries used to power the individual box shall meet the requirements in the following paragraphs.

6-2.2 When the battery is at seventy percent of its rated voltage, it must be capable of satisfactory transmission of a message from the box to the Communication Center.

6-2.3 When powered from a local source, each box shall contain a battery to insure normal box operation for at least thirty days in the event of failure of the local source.

6-2.4 When the battery voltage decreases to 85 percent or less of its rated voltage, a specific warning indication shall be contained in all messages. The warning indication shall be part of all messages for no less than fifteen days prior to the time the battery will become nonoperational.

6-2.5 The battery shall provide satisfactory service for normal signaling and transmission, including testing, for a period of at least six months, without need for replacement.

6-2.6 Battery operating characteristics shall be suitable for local temperature extremes.

6-2.7 Solar charging is permissible.

6-3. Fire Alarm Boxes

6-3.1 General. Radio fire alarm boxes shall be designed and operated in compliance with all applicable rules and regulations of the Federal Communications Commission, as well as the requirements established herein.

6-3.2 Design of Boxes.

6-3.2.1 Boxes shall provide no less than three specific and individually identifiable message functions to the Communication Center, and they shall be "Test," "Tamper" and "Fire."

6-3.2.2 Boxes when activated shall transmit to the Communication Center no less than one round for "Test," no less than one round for "Tamper," and no less than three rounds for "Fire."

6-3.2.3 When boxes are used to transmit to the Communication Center request(s) for emergency service or assistance in addition to those stipulated in 6-3.2.1, each such additional message function shall be individually identifiable.

6-3.2.4 An actuating device held or locked in the activating position shall not prevent the activation of other messages.

***6-3.2.5** Boxes shall be so designed as to prevent the loss of a second message during any required transmission delay per Federal Communications Commission design requirements.

6-4 Receiving Equipment.

6-4.1 Facilities for Receiving Box Alarms.

6-4.1.1 Type A System.

6-4.1.1.1 For each frequency used, two separate receiving systems, each including an antenna, audible alerting device, receiver, power supply, signal processing equipment, a means of providing an automatically printed permanent recording of the incoming message that is both timed and dated, and other associated equipment, shall be provided. Both systems and associated equipment shall be in operation simultaneously. Facilities shall be so arranged that a failure of either receiving system will not affect the receipt of messages from boxes.

6-4.1.1.2 The date and time shall be part of the permanent recording of all emergency signals. "Test" signals from boxes need

not include the date as part of their permanent recording, providing that the date is automatically printed on the recording tape at the beginning of each calendar day.

6-4.1.2 Type B System.

6-4.1.2.1 For each frequency used a single complete receiving system shall be permitted, providing each fire station in addition to the Communication Center is so equipped.

6-4.1.2.2 If alarm signals are transmitted to a fire station from the Communication Center using the coded radio-type receiving equipment in the fire station to receive and record the alarm message, a second receiving system conforming to 6-4.1.2.1 shall be provided at each fire station and that receiving system shall employ a frequency other than that used for the receipt of box messages.

6-4.2 Supervision. All coded radio type receiving equipment shall provide constant monitoring of the frequency(ies) in use. Both an audible and visual indication of any sustained carrier signal (when in excess of 15 seconds duration) shall be provided for each receiving system.

6-5 Testing.

6-5.1 Box Testing.

6-5.1.1 Each coded radio box shall automatically transmit a "Test" message at least once in each twenty-four-hour period.

6-5.1.2 Periodic Test. No less than once in each sixty-day period, each box shall be examined, cleaned and tested. The test shall include the operation of all message functions associated with each box tested and such message functions shall be transmitted to the respective Communication Center, received and permanently recorded.

6-5.1.3 When solar charging of box battery(ies) is utilized, the solar cell associated with each box in the system shall be examined and cleaned no less than once in each sixty-day period.

6-5.2 Receiving Equipment. Receiving equipment associated with coded radio type systems shall be tested at least once each hour. The receipt of "Test" messages will be considered sufficient to comply with this requirement, providing at least one such message is received each hour.