j. Wires in vertical conduits shall be supported at the following intervals:

No. 14	to No. 0	Not greater than 100 Ft.
No. 00	to No. 0000	" " " 80 "
No. 0000	to 350,000 C.M.	" " " 60 "
350,001 C.M.	to 500,000 C.M.	" " " 50 "
500,001 C.M.	to 750,000 C.M.	" " " 40 "
Above	750,000 C.M.	" " " 35 "

k. The following methods of supporting cables shall be used except that other approved methods may be used by special permission.

1. Approved clamping devices constructed of or employing insulating wedges inserted in the ends of conduits.

2. Junction boxes may be inserted in the conduit system at the required intervals, in which insulating supports of approved type shall be installed and secured in a satisfactory manner so as to withstand the weight of the conductors attached thereto, and the boxes shall be provided with proper covers.

3. Cables may be supported in approved junction boxes on two or more insulating supports so placed that the conductors will be deflected at an angle of not less than ninety degrees and carried a distance of not less than twice the diameter of the cable from its vertical position.

l. Vertical wires of No. 1 or larger shall not be deflected where they enter or leave a cabinet unless a gutter having a width in accordance with the following table is provided:

Capacity of Feeder Connection Amperes.	Minimum Width of Gutter Inches.
100	3
200	4
400	6
600	8
800	10
1200	12

1008 - Flexible Metal Conduit Work.

a. All requirements for rigid metal conduit work shall apply to flexible metal conduit work so far as they can apply without conflicting with the following special requirements.

b. All couplings, connectors and similar fittings used with flexible metal conduit shall be especially designed and approved for flexible metal conduit of the size and type with which they are used.

c. Flexible metal conduit shall be fastened in place as specified for armored cable in paragraphs (e) and (f) of Section 1010.

d. Flexible metal conduit shall be secured in connectors, boxes, cabinets and other fittings as specified for armored cable in paragraph (c) section 1010.

1009 - Metal Raceway Work.

a. All fittings used with metal raceway shall be of a type especially designed and approved for the size and type of raceway with which they are used. Metal raceway shall be provided at all outlets, etc., with approved terminal fittings which will protect the insulation of the conductors from abrasion, unless such protection is afforded by the construction of the boxes or fittings which the raceway enters.

b. The raceway shall be so installed as to provide an effective electrical and mechanical connection between the raceway and the cabinets, outlet boxes, couplings, elbows, and similar fittings to which it is connected. Joints at couplings, elbows, and similar fittings shall be so made as to prevent abrasion of the conductors or their insulation.

c. Metal raceways shall be continuous from outlet to outlet, or from fitting to fitting. It may be extended through dry walls or dry partitions if in unbroken lengths where passing through; but, where the wall or partition is damp, or where the raceway passes through a floor, an iron pipe sleeve shall be placed over the raceway and shall extend clear of either side of wall or partition, or from the ceiling below to a point at least 8 inches above the flooring. Where exposed to probable mechanical injury, as in shops, store rooms, etc., the pipe sleeve shall extend to a point at least 5 feet above the floor.

d. Metal raceway shall be securely fastened in place with suitable screws, bolts, straps or similar fittings. Nails shall not be used for this purpose. Heads of screws and bolts inside the raceway shall be flush with the interior surface. Outlet, junction, and switch boxes shall be fastened independently of any support afforded by the raceway. When installing metal raceway on brick, concrete, tile or other similar surfaces, attachment shall be made as required for conduit in paragraph (i) of section 1005.

(Fine print note) To comply with the above rule will usually require each length of raceway to be fastened at (or within 5 inches of) each fitting which it enters, including couplings, tees, and crosses, and at intervals of at least 5 feet between fittings. If the surface on which it is being installed is irregular, or if the raceway is liable to be disturbed, the distance between fastenings shall be shortened.

e. Metal raceways shall be grounded as prescribed for rigid metal conduit in paragraph (K), section 1005 of this Code.

f. When combination metal raceways are used both for signal and for lighting and power circuits, the different systems shall be run in separate compartments and the same relative positions of compartments shall be maintained throughout the premises, in which case the provisions of paragraph (c) section 1007, and of paragraphs (a) to (d) inclusive, section 6002, of this Code, shall be considered as having been observed. When such combination metal raceways are used, ten No. 14 wires shall be permitted in the compartment for light, heat and power circuits. In other respects, the provisions of this Code covering single compartment raceways, shall apply.

g. Not more than four No. 14 or No. 12 conductors, nor any circuit protected by fuses larger than 20 amperes at 125 volts or amperes at 250 volts, shall be placed in any metal raceway.

h. For both alternating and direct current systems, all conductors of a circuit shall be placed in one raceway.

1010 - Armored Cable Work.

Note.- In armored cable work it is essential that care be used in cutting and removing armor at cable ends; that proper fittings be used; that the cable be securely fastened in the fittings; and that the armor be properly grounded. If an inspector discovers evidence of carelessness in these respects, the person or firm installing the cable may be required to test the entire cable installation for accidental grounds or opens in the presence of the inspector.

a. Runs of armored cable connected to different circuits shall not be carried through the same outlet, switch or junction box.

b. Armored cable shall be electrically and mechanically continuous from outlet to outlet, or from fitting to fitting. Each and every piece of armored cable shall be provided with an approved fitting, or combination of fittings, that will protect the insulation.

of the conductors from abrasion where they emerge from the steel armor and where they enter the cabinet, box, or other device in which the cable terminates. In cutting and removing the metal armor from the conductors at cable ends, particular care shall be used to avoid injury to the insulation and to leave no projecting sharp corners.

c. Fittings shall be especially designed and approved for the size and type of cable with which they are used. The cable shall be firmly and rigidly secured in all connectors, boxes, cabinets and fittings which it enters, and in such a manner as to make an effective electrical and mechanical connection between the armor of the cable and the metal of the box, cabinet, or fitting. The threads of fittings and the surfaces of the metals where they come in contact with each other shall be carefully cleaned of enamel, paint, rust, and other non-conducting material so that good electrical contact may be obtained.

d. All bends shall be so made that the armor or the insulation of the cable will not be injured. In no case shall any bend be so made as to open the armor on the outer edge of the bend. Wherever practicable, short bends at boxes, cabinets, etc., shall be avoided by the use of approved angle fittings.

e. Armored cable shall be securely fastened in place independently of any support afforded by boxes or cabinets. Fastenings shall be so placed and arranged that the weight of the cable or short bends will not place a strain at the points where the cable enters connectors, boxes, etc. Fastenings of a type which will not injure the armor shall be used for this purpose. Where exposed runs of armored cable are permitted, the cable shall be fastened at least every two feet and if installed on brick, concrete, tile, or other similar surfaces, attachment to such surfaces shall be made by means of expansion bolts, expansion screws, toggle bolts or other similar or equally effective method; nails or screws driven or screwed into wood plugs shall not be approved for this purpose.

(Fine print note) For concealed armored cable installations in frame buildings the above rule will usually require cable fastenings at least every 4½ feet unless the cable is sufficiently fastened by the structure of the building. Suitable fastening shall also be provided within 24 inches of the point where the cable enters connectors, boxes, etc. The requirements for box supports are given in paragraphs (c) and (d), Section 1103.

f. In frame buildings, joists and timbers shall, except in inaccessible places, be bored for the reception of the cable; provided, that in roof spaces of finished buildings and unoccupied spaces under finished buildings where clear head room of 5 feet or more cannot be obtained, the cable may be run on the top of

bottom edges of the timbers if securely fastened in place. The cable should preferably be run through joists or timbers midway between, or not less than 1¼ inches from, top and bottom edges but in no case shall the cable be so installed as to be exposed to injury from nails or screws driven or screwed into such joists or timbers.

g. The armor of the cable shall be stripped back a sufficient distance to permit fixture and other connections to be properly made, soldered and taped. This will usually require about 6 inches of free conductor in the box for attachment to fixtures or fittings and about 4 inches for other connections. The ends of all conductors at outlet and junction boxes shall be properly connected, soldered, and (except for fixture or fitting connections), taped at the time of roughing in and before inspection is called for.

h. Conductors of armored cable shall not be spliced or tapped in any concealed location except as allowed in paragraph (k) of Section 1004 for mixed knob and tube and cable work.

(Fine print note) Wherever necessary to use rigid metal conduit in an armored cable installation (as, for example, in the case of extensions through an outside wall for the purpose of supplying an outside light or the connection to yard wires for garage or other outbuilding) the rigid conduit shall terminate at an accessible outlet or junction box inside the building.

i. A lead sheath shall be interposed between the outer braid and the steel armor if the cable will be exposed to moisture, or where the cable is exposed to the weather; provided, however, that the lead sheath shall not be required if the cable is laid against a brick wall or laid within an ordinary plaster wall, unless these walls are continuously damp.

j. For both alternating and direct current, all conductors of a circuit shall be contained within one armor; provided, however, that concealed extensions from branch circuit outlets in buildings of fireproof construction may be made by means of single, double or triple conductor armored cable with suitable fittings at outlets. This cable shall not be run in concealed spaces, but may be laid on the face of the fireproofing and may be plastered over. Such extensions shall be confined to the room or suite in which they originate.

k. Metal armored cable shall be grounded as prescribed for rigid metal conduit in paragraph (k) section 1005 of this Code.

1011 - <u>Metal Wireways.</u>

(Fine print note) The requirements relating to the use of metal wireways at distributing centers are set forth in section 1309 of this Code.

a. The requirements of this section shall apply to metal wireways used for enclosing conductors (including bare bus bars), usually at meter boards and distributing centers. The term "metal wireway" is used to distinguish this class of construction from metal raceway (metal molding) work.

b. Any details of construction not covered in this section shall comply with cabinet and box specifications as issued by the Underwriters' Laboratories as far as they can apply without conflicting with the requirements of this section.

c. The wireway shall be of sufficient size, in proportion to the number of contained therein, to permit the installation of the conductors without injury and to permit all splices and taps to be properly made and stowed away without undue crowding. Where bare bus bars are installed, the wireway shall be of such size that the conductors can be laid in the wireway without danger of the insulation being abraded by coming in contact with the edges of the bus bars.

(Fine print note) The cases of enclosed switches shall not be used as gutters unless there is ample space to meet the requirements of the above rule and to allow for the proper operation of the switch and the renewal of the fuses.

d. Suitable bushings, shields, or fittings, having smooth, rounded edges shall be provided to prevent abrasion of the insulation where conductors pass between wireways, through partitions of wireways, or between wireways and cabinets or junction boxes.

e. The wireway shall be substantially constructed of sheet metal not less than No. 16 U. S. Standard gage, except as permitted by other sections of this Code for signs, marquise, and for theatre borders and strips. The minimum thickness of sheet metal permissible for the construction of wireways of various dimensions is as follows:

Maximum width of the widest surface of the gutter.	U. S. Standard gage metal
12 inches	No. 16
24 "	No. 14
36 "	No. 12
Over 36 "	No. 10

f. Except sections which must be removable, all joints, splices and seams of wireways shall be made according to one of the following methods:

1. Continuous welding.

2. Flanged or lapped not less than ½ inch and securely fastened at least every 6 inches by rivets, bolts, or machine screws; or by spot welding at least every 6 inches. Where screws are threaded into the metal itself, they shall engage at least two full threads. All screws and bolts, except those in sections of the wireway which must be removable, shall be headed over.

3. Butt joints may be used; in this case, a reinforcing of sheet metal shall be used at all such joints. The metal used for re-inforcing may be two gage numbers less in thickness than the metal of the wireway, and shall extend the full length of the joint or splice. The re-inforcing shall be secured to the metal of the wireway by machine screws, bolts, or rivets, placed not more than 6 inches apart; or by spot welding it at least every 6 inches.

4. A substantial frame of angle iron may be constructed forming a skeleton frame of the dimensions required for the wireway. The sheet metal shall be fastened to this frame by one of the methods specified in this section. The edges of the metal shall meet at all joints.

f. All the metal parts of the wireway shall be grounded as required for conduit in paragraph (k), section 1005 of this Code.

1012 - Insulation Resistance of Completed Installation.

a. A completed installation shall have resistance between conductors, and between all conductors and ground, not less than:

Up to	5 amperes	4,000,000 ohms
Up to	10 amperes	2,000,000 ohms
Up to	15 amperes	800,000 ohms
Up to	50 amperes	400,000 ohms
Up to	100 amperes	200,000 ohms
Up to	200 amperes	100,000 ohms
Up to	400 amperes	50,000 ohms
Up to	800 amperes	25,000 ohms
Up to	1,600 amperes	12,500 ohms

b. The above values shall be determined with all cutouts and safety devices in place. If lamp sockets, receptacles, fixtures, and other appliances are also connected, the minimum resistance required shall be one-half that specified in the table.

1015 - Installation of Decorative Lighting.

a. Temporary installations of approved systems of decorative lighting in buildings shall be used only when permission therefor has been granted by the Electrical Division. (For installations out of doors, see Section 1605.

b. The voltage between the conductors of any circuit or between conductors and ground shall not exceed 150 volts, and the connected load on any circuit shall not place more than 15 amperes on a branch circuit fuse.

c. The supply for decorative lighting shall be taken only from points on the wiring system where the correct fusing can be provided for.

d. For string or festooned lights, approved keyless weather-proof sockets, properly connected to standard rubber covered wire (not flexible cord), shall be used. Joints shall be properly made, soldered and taped, and staggered where practicable. Lamps used in lanterns or similar devices shall be provided with standard lamp guards.

e. Wiring for decorative lights shall be kept well separated from easily ignitable material, and shall not be made to serve as a support for inflammable decorations.

ARTICLE 11.

OUTLET BOXES AND CABINETS.

1101 - Outlet Fittings - General Requirements.

a. Outlet fittings, and junction or pull boxes not over 150 cubic inches in size, shall be composed of pressed steel not less than 0.076-inch (No.14 U.S.sheet metal gage) in thickness, or of cast metal having a wall thickness not less than 1/8 inch.

b. Junction or pull boxes of over 150 cubic inches in size shall be composed of metal and shall conform to the requirements for cabinets and cutout boxes, except that the covers shall consist of single flat sheets secured to the box proper by screws or bolts instead of hinges.

(Fine print note) Boxes having covers of this form are for use only for inclosing joints in wires or to facilitate the drawing in of wires or cables. They are not intended to inclose switches, outlets or other control devices.

c. Junction boxes shall be of sufficient size to permit easy insertion and withdrawal of conductors from the conduit system, and to accommodate all splices and taps without undue crowding. (See also section 1102, paragraph (d)).

d. Outlet boxes intended for use where gas outlets are present shall be so designed that they may be securely fastened to the gas pipes in an approved manner.

e. A fixture stud, which is not an integral part of the outlet box, shall be composed of malleable iron or other approved material.

f. Switch and outlet boxes shall be so designed that they can be securely fastened in place independently of the support furnished by the conduit; provided, however, that with exposed conduit, boxes having threaded or other approved connections may be supported by the conduit itself if the latter is firmly secured in place.

g. Switch and receptacle boxes shall completely enclose the devices on sides and back, and shall provide a substantial support for them. The screws supporting the box shall not be used for the attachment of the device contained therein.

h. Metal covers of outlet boxes shall be of thickness equal to that of the wall of the box, or shall be lined with firmly attached insulating material not less than 1-32 inch in thickness. Covers of porcelain or other approved material may be used if of such form and thickness as to afford the requisite protection and strength.

i. Flush switch and receptacle plates shall be not less than .04 inch in thickness.

j. Covers of outlet fittings through which flexible cords or duplex wire pendants pass shall be provided with approved bushings, or shall have smooth, well-rounded surfaces upon which the cord or wire may bear. Where conductors, other than flexible cord or duplex wire, pass through a metal cover, there shall be provided a separate hole for each conductor, said hole being equipped with a non-combustible, non-absorptive insulating bushing. (For exception to this rule see item (1) of paragraph (b), section 1102)

k. All unused openings in cabinets and cutout boxes, junction and outlet boxes, shall be effectively closed by metal which will afford protection equivalent to that of the walls of the cabinets, etc.

1102 - Outlet Fittings - Type and Size Required.

a. At each outlet of conduit, metal raceway, armored cable, or concealed knob and tube work an approved box or plate shall be used; provided, that in fished knob and tube work in finished walls, partitions and ceilings only (see item(1), paragraph (a), section 1002) the outlet box or plate may be omitted when the circuit conductors terminate without splice or tap in an approved surface type closed base receptacle or rosette or at a combination gas electric outlet. In completed installations, the box or plate shall be provided with a cover, unless a fixture canopy is present. This cover shall, at fixture outlets, be provided by the person installing the fixtures.

b. At the ends of conduits, armored cable, or metal raceway from which wires extend to open wiring or to appliances and where a box or plate is not provided as required in the preceding paragraph approved terminal fittings having a separate bushed hole for each wire shall be provided through which fitting the wires shall pass without splice, joint or tap. This construction shall not be employed at fixture outlets. Such terminal fitting shall be accessible except as provided in paragraph (k), section 1004 of this code. Exceptions to this rule are as follows:

1. More than one wire may pass through the same hole in the fitting where the rules permit the conduit to terminate at certain motors, signs, ranges, or other similar equipment without being secured to a junction box or the casing of the equipment; in such cases the conduit shall terminate as close as practicable to the terminals of the equipment.

2. The fitting need not be used where a number of conduit runs terminate at the back of a switchboard, provided the conduits are bushed and are rigidly fastened in place and provided the conductors are so arranged and protected as to avoid damage to the insulation.

c. At all lighting outlets, boxes and plates shall conform to the following requirements:

1. A 4 inch box at least 1½ inches deep (not less than 1-7/8 inches deep when used with 1 inch conduit), having drilled and tapped ears, shall be used, except as noted in item (2) below, and except that shallower boxes or outlet plates having drilled and tapped ears may be used in finished walls, partitions and ceilings, and in locations where the construction of the building is such that it is not possible to use the deeper boxes. Boxes at side wall outlets in new construction shall be provided with covers, having drilled and tapped ears, which will reduce the opening to not more than 2 inches horizontally, nor more than 3 inches vertically. At outlets in concealed work where the conduit or cable enters side of box, the minimum depth shall, unless a plaster ring is used, be 1-7/8".

2. 3 inch by 1½ inch deep boxes may be used by special permission where the use of a 4 inch box would be impracticable. Flush switch or receptacle boxes (with or without fixture stud) may be used at side wall outlets where conductors are fished into finished walls or partitions.

3. In finished buildings, where conditions are such that neither box nor plate can be installed these fittings may be omitted by permission, provided the conduits or armored cable are properly bushed and secured in place.

4. Boxes and plates shall have fixture studs attached, except as noted in item (2) above and except where receptacles only are to be installed in closets, kitchen center, bath center, front and rear porch centers, and in garages, basements, and similar locations (when not rooms); provided, that fixture studs may be omitted in any case where it is desired to use approved fixture supports and connectors (such as clevits, for example), and the outlet box is of suitable size and type for use of such devices. Fixture studs in residences, flats, and apartments shall be 3/8 inch male.

d. Boxes shall be of sufficient size, in proportion to the size and number of conductors contained therein, to permit the installation and withdrawal of the conductors without injury and to permit all splices and taps to be properly made, taped, and stowed away without undue crowding. Not more than 12 wires shall enter a 4 inch by 1½ inch deep outlet or pull box. If the box is used with 1 inch conduit, it shall have a depth of not less than 1-7/8 inches. Switch and receptacle boxes, when used as junction boxes in concealed work shall be at least 4 inches by 1½ inches in size.

(Fine Print Note.) As a general rule for sizes No. 14 and No. 12 not less than 2 cubic inches of space per conductor entering box will be required to comply with the above rule.

e. In making a surface extension from an existing outlet of concealed conduit or armored cable, an extension box or ring shall be mounted over the original box and electrically and mechanically secured to it. The extension shall then be connected to this box in the manner prescribed for the method of wiring employed in making the extension.

f. Round boxes shall not be used where conduit or armored cable enters the side of the box, except where conduit is threaded into the box.

g. At floor outlets, attachment plugs and receptacles where exposed to severe mechanical injury or excessive moisture, shall be enclosed in approved floor outlet boxes, especially designed for this purpose. When installed in varnished, waxed or carpeted floors on wood joists, the ordinary standard type of flush receptacle box may be used if equipped with cover plate so designed that the receptacle will be enclosed automatically when the attachment plug is removed. When installed in elevated wooden flows of show windows in stores the ordinary standard type of flush receptacle box and plate may be used by special permission.

h. When outlet, switch or receptacle boxes are installed in exterior surfaces which are exposed to rain they shall be so designed, constructed or installed that water will not enter the box after the fixture, switch or other device is installed.

1103 - Installation of Outlet Fittings.

a. Outlet boxes or plates, flush switch or receptacle boxes, and cabinets shall be so installed in walls or ceilings composed of plaster on wooden joists or studs that the front edge of the fitting will not set back of the finished surface of the plaster more than ¼ inch. On wooden walls or ceilings the front edge of the fitting shall be flush with the finished surface, or project therefrom. A plaster surface which is broken or incomplete shall be repaired, so that there will be no gaps or open spaces at the edge of the fitting. These requirements shall not apply to walls or ceilings composed of concrete, tile or other non-combustible material.

(Fine print note.) It is not the intent of the above rule to require that boxes be recessed in finished surfaces except in new construction where the wall or partition is open on one side or the ceiling accessible from above.

b. In addition to the requirements of paragraph (a) above, when outlet or flush switch or receptacle boxes are installed in new concealed work (that is, before plastering) in any plastered wall or ceiling, they shall, if practicable, be so installed that the front edge of the box or plaster ring will not project from the proposed finished plaster line. Where the conduit or armored cable enters the side of box, the box shall be of sufficient depth to permit the conduit or cable to enter box back of lath and plaster.

c. Outlet boxes or plates and all switch, receptacle, and junction boxes, shall be securely supported. In armored cable work and flexible metal conduit work, they shall be supported and fastened in place independently of any support afforded by the cable or conduit. In rigid conduit work, they shall, with the exceptions noted in paragraph (d), items 1 to 3 below, be supported and fastened independently of support by the conduit.

d. In all new concealed work, box supports shall be of a type expressly approved for the purpose. In new concealed work in walls or ceilings composed of plaster on wood laths, boxes shall be securely fastened with not less than two No. 8 wood screws (nails not permitted) at least 7/8 inch in length to solid backing boards (not separate wood strips at top and bottom) properly fastened between joists or studs; such backing boards shall be at least 7/8 inch thick by 2½ inches wide; provided, however, that approved metal supports may be used in lieu of such wood backing-boards. Metal supports shall, for all side wall outlets, be equipped with lath holders that are installed as a part of the support unless boxes are provided with plaster covers. Exceptions to the requirements of this paragraph are as follows:

1. In rigid conduit work, either concealed or exposed, additional supports will not usually be required with pressed steel outlet and switch boxes when three conduit ends enter the back of the box nor will such additional supports usually be necessary when at least two conduit ends enter the box on different sides, provided the box rests on or against a surface which will prevent its twisting. In all cases, however, the conduit shall be properly fastened in place and secured to the boxes.

2. In rigid conduit work, independent supports are not required with approved types of threaded fittings used as outlet boxes, etc., when such fittings are firmly secured by screwing on to the conduit.

3. If boxes are imbedded in concrete, as in concealed work in concrete buildings, the concrete shall be considered as affording sufficient support.

c. Junction boxes shall be so installed as to be accessible without removing any part of the building except as provided for terminal fittings in section 1108 paragraph (b) of this code. An attic which has sufficient head room but which is reached only by a portable ladder and permanent hatch, shall be considered permanently accessible. Ceiling outlets in unfinished basements and cellars shall be located where the outlet would be accessible with ceiling finished.

1104 - Cabinets and Cutout Boxes - General Requirements of Design.

(a) Only approved metal cabinets and cutout boxes shall be used.

(b) Cabinets and cutout boxes shall be of such size that the apparatus and devices enclosed therein will be easily accessible for operation and control.

c. The spacing within cabinets and cutout boxes shall be sufficient to provide ample room for the distribution of wires and cables placed in them, and for a separation between metal parts of cabinets or cutout boxes and current carrying parts of devices and apparatus mounted within them as follows:

1. There shall be an air space of at least 1/16 inch, except at points of support, between the base of the device and the wall of any metal cabinet or cutout box on which the device is mounted.

2. There shall be an air space of at least one inch between any live metal part (including live metal parts of enclosed fuses) and the door, unless the door is lined with an approved insulating material, or is of a thickness of at least that of No. 12, U. S. gage metal, when the air space shall be not less than 1/2 inch.

3. Except as noted above, there must be an air space of at least 1/2 inch between the walls, back, gutter partition, if of metal, or door of any cabinet or cutout box and the nearest exposed current-carrying part of devices mounted within the cabinet where the potentials do not exceed 250 volts. This spacing shall be increased to at least one-inch where the potentials exceed 250 volts.

d. The sheet metal of the box proper and of the frames and doors of cabinets and cutout boxes shall be of a gage not less than that given in the following table:

Maximum Size of Largest Surface		Minimum Gage of Metal U. S. Standard		
Dimensions Inches	Area Sq. Inches	Box proper Cabinets Cutout Boxes	Frames and doors Cabinets	Cutout boxes
24	360	16	14	16
40	1,000	14	12	14
60	1,500	12	12	12
Over 60	Over 1,500	10	10	10

e. Cast metal, whether iron or other metal, shall at least one-eighth inch thick at every point, and shall be of greater thickness at tapped holes for conduit, and at reinforcing ribs and door edges.

f. Each cutout box or cabinet shall have the maker's name plainly marked thereon.

1105 - Gutter Cabinets

a. Cabinets or cutout boxes intended for the enclosure of dead front panels, or cutout bases used in lieu of such panels, shall be so designed that when used in combination with such panels or cutout bases, access may be had to all switch buttons or handles, and to plug fuses without exposing any circuit or feeder wires. (See Section 1307).

b. Cabinets or boxes which enclose devices or apparatus connected within the cabinet box to more than 4 circuits shall have side gutters or wiring compartments or back-wiring spaces unless the conductors leave the cabinet or box directly opposite their terminal connections. This shall not apply to cabinets for the enclosure of sign flashers.

c. Side wiring spaces, side-gutters or side wiring compartments of cabinets shall be rendered tight enclosures by means of covers, barriers or partitions extending from the bases of the devices contained in the cabinet to the door, frame or sides of the cabinet. Partially enclosed back wiring spaces shall be provided with covers to complete the enclosure.

d. No electrical device shall be mounted on the door of a cabinet. When an electrical device is in or on the trim or removable gutter lining of a cabinet, it shall be independently supported so that the trim or gutter lining can be readily removed and the device and connections to same will not be disturbed.

1106 - Weatherproof Cabinets.

a. For wet locations and outdoor service cabinets and cutout boxes shall be so designed and constructed that a beating rain or moisture running down conduits or wall will not allow water to enter. They shall be provided with external fastenings for mounting. Hinges shall be of cast metal or sheet bronze. If threaded holes are provided for conduit they shall be reinforced to provide metal at least one-quarter inch in thickness. Bushed holes for open wiring shall not be located either in the top or back except when special hood fittings are provided, and when located in the sides, shall be formed to provide a downward direction for conductors leaving the cabinet.

b. Devices made of sheet metal lighter than No. 10 U. S. sheet metal gage shall be galvanized after forming and assembly. Cabinets and cutout boxes made of sheets of No. 10 U. S. gage in thickness, or heavier, need not be galvanized after forming and assembly, provided galvanized sheets are used and all cut edges are painted.

(Fine print note) Cabinets and cutout boxes installed on the exterior of buildings shall be considered as being in a wet place unless under cover or otherwise suitable protected by additional enclosures. Cabinets and cutout boxes exposed to excessive or continued moisture or condensation shall be considered as being in a wet place.

1107 - Installation of Cabinets and Cutout Boxes.

a. Cabinets and cutout boxes shall be so placed that the apparatus enclosed therein will comply with the provisions of this Code. They shall not be placed on ceilings when any other location is practicable.

b. Wood plugs in brick, concrete or tile shall not be used for the support of cabinets or cutout boxes. Lead shields, expansion bolts or some equivalent method shall be used.

c. Cabinets and cutout boxes shall be supported independent of the screws or bolts supporting the devices enclosed within the box or cabinet.

d. Cabinets and cutout boxes having swinging doors secured directly to, and telescoping with, the walls of the box proper, which are designed for surface mounting, shall not be recessed in any wall or partition except when used for the enclosure of externally operated switches and except where the depth of partition is not sufficient to permit the installation of the flush type cabinet or cutout box. Surface mounted cabinets and cutout boxes shall not be used except on exposed conduit or raceway systems or with fished work; provided, however, that they may be used with concealed wiring systems if connections are from the back.

e. Conductors of different systems may be brought into the same cabinet, provided they are separated by permanent barriers of code gage metal. An exception shall be made in the case of wiring in existing buildings where the expense of providing absolute separation of the two systems in the gutter would not be warranted. In such cases, however, the circuits of the different systems shall be suitably marked so that each system may be readily identified. (See section 1007(c)).

ARTICLE 12

SIZE OF CONDUCTORS AND ALLOWABLE CARRYING CAPACITY

1201 - Size of Conductors; General.

NOTE: - For the requirements relating to size of ground conductors see section 1705; of fixture conductors see section 1906. Motor wiring data is included in Article 25.

a. Conductors smaller than No. 14 shall not be used except as allowed for fixture work and flexible cord. Service conductors shall not be smaller than No. 10.

b. In 3-wire (not 3 phase) systems, the neutral conductor shall be of sufficient size to carry the maximum load current to which it may be subjected in the event of the opening of the fuse or circuit breaker in one of the outer conductors.

c. In 3-wire circuits with grounded neutral the two outer conductors, and in a 3-phase circuit the three conductors shall be of the same size. Departure from this rule may be allowed by special permission given in advance in extreme and unusual cases.

d. Bus bars shall have a cross-sectional area of not less than one square inch for each 1000 amperes of demand. (See sections 1202 and 1203).

1202 - Size of Services and Mains.

NOTE: The necessary wattage capacity which must be provided for various classes of lighting installations is given in Article 18. The requirements relating to the use of two-wire and three-wire services are given in section 1603.

a. In determining the size of conductors in services and mains, each branch circuit shall be considered as carrying full connected load unless a demand factor is allowed. When no conductor of the required capacity is indicated by the table in section 1209 of this Article, the conductor having a rated capacity nearest to that required may be used except where operating conditions are such that the maximum connected load will be used.

continuously, in which case the conductor having a rated capacity next larger shall be used. When the required carrying capacity is midway between two standard ratings, the conductor having a rated capacity equal to the smaller of the two ratings may be used except as otherwise noted in this paragraph for continuous loads.

b. The minimum load in amperes for lighting and appliance branch circuits shall, unless otherwise provided for in this code, be considered to be:

For 1000 watt circuits.....10 amperes
For 1500 watt circuits.....15 amperes
For 2500 watt circuits.....25 amperes
For 5000 watt - 250 volt circuits.....25 amperes

c. The size of conductors and cutout bases for 3-wire 125-250 volt domestic range installations used singly or in combination with 1000 watt branch circuits shall be not less than indicated in the tables below. (It will be noted from Table II that installations comprising two ranges or less per service (with or without other circuits) must have wiring capacity to permit the installation of ranges not smaller than 9 K. W.)

RANGE CAPACITY # K. W.	SIZE OF FEEDER AND CUTOUT BASE FOR EACH CONSUMER: Range Alone	With 1 or 2 Circuits	With 3 or 4 Circuits	With 5 Or 6 Circuits	With 7 or 8 Circuits
TABLE I. INSTALLATIONS COMPRISING 3 OR MORE RANGES PER SERVICE					
Not over 3 K. W.	12** : 0-30	10 : 0-30	8 : 31-60		
Not over 4 K. W.	10 : 0-30	8 : 0-30	8 : 31-60		
Not over 5 K. W.	10 : 0-30	8 : 31-60	8 : 31-60		
Not over 6 K. W.	8 : 31-60	8 : 31-60	6 : 31-60		
Not over 7 K. W.	8* : 31-60	8* : 31-60	6* : 31-60		
Not over 8 K. W.	8* : 31-60	6* : 31-60	6* : 31-60		
TABLE II. INSTALLATIONS COMPRISING 2 RANGES OR LESS PER SERVICE (required to have capacity for not less than 9 K.W. ranges)					
Not over 9 K. W.	8* : 31-60	6* : 31-60	6* : 31-60	4 : 61-100	4 : 61-100
Not over 10 K. W.	6* : 31-60	6* : 31-60	4 : 61-100	4 : 61-100	2 : 61-100
Not over 11 K.W.	6* : 31-60	4 : 61-100	4 : 61-100	4 : 61-100	2 : 61-100

Sum of capacities of individual elements.
* 50 ampere fuses may be used with No. 8 wire and 60 ampere fuses with No. 6 wire.
** Service conductors smaller than No. 10 not permitted.

d. The size of mains feeding signs shall comply with section 2105 of this Code.

1203 - Demand Factor - When Permitted.

a. For lighting services and mains the following demand factors shall be permitted:

Classification	Demand Factor
Residences, Flats and Apartments	
1 to 5 circuits	100%
6 to 10 "	90
11 to 15 "	80
16 to 20 "	70
21 to 30 "	60
above 30 "	50

For installations of more than 10 circuits in:

Clothing Mfg. Plants	90%
Department Stores	90
Foundries	75
Garages (except display rooms)	75
Hotels	75
Hospitals	70
Machine Shops	75
Manufacturing plants (General)	75
Office Buildings	100
Packing Houses	80
Printing Establishments	80
Stores (General)	100
Restaurants	100
Tanneries	75
Schools (Services only)	90
Warehouses	65

b. For group motor installations, air heater installations, and for lighting installations in theatres, minor theatres and motion picture houses, services may be calculated for a load less than the total connected load in accordance with a demand factor which shall be approved in advance and in writing in each individual case by the Electrical Division.

c. For domestic electric range loads, the percent of total connected load which may be used in determining the size of feeders shall not be less than given in the following table:

Number of Ranges	Demand Factor*
1 to 2	100%
3 to 4	95
5 to 6	90
7 to 8	80
9 to 11	70
12 to 15	60
16 to 20	55
Over 20	50

*Where the average range capacity exceeds 6 K. W. per range, a demand factor 10 per cent less than indicated by the above table may be used for installations comprising more than 8 ranges.

(Fine print note) The demand factors allowed by this section are based upon average load conditions and may be safely used in the great majority of cases; however, if at any time after the equipment is put in service it shall be found that conductors are of insufficient capacity to carry the maximum demand without overfusing, they shall be increased in size to comply with the requirements for overload protection applying thereto.

1204 - Size of Conductor - Motor Branch Circuits.

a. The conductors of circuits supplying current to a single motor shall have a carrying capacity, according to section 1209 of this Code, which is not less than 125% of the name plate current rating of the motor. (See motor wiring tables, section 2310).

c (Fine print note) In the case of motor circuits supplying current to a single A. C. motor of the type requiring a large starting current the carrying capacity of the conductors in that portion of

the motor circuit between the mains and the motor protective device will usually exceed 125% of the motor name plate current rating - otherwise the rating of the fuses or the setting of the circuit breaker necessary in view of the large starting current would be too large to protect the conductors. The required size of conductor in such cases may be determined by reference to section 1310(a) of this Code.

Similarly, when other types of motors are used in classes of service having peak loads, the carrying capacity of the conductors in the motor circuit must largely exceed the minimum value of 125% of the continuous current rating of the motor. In the majority of cases this value, actually determined by the rating of the fuses or the setting of the circuit breaker, need not exceed the percentages of the motor name plate current ratings given in the following table:

CLASSIFICATION OF SERVICE	PERCENTAGE OF NAME PLATE CURRENT RATING				
	5 minute rating	10 and 15 minute rating	30 and 60 minute rating	2 hour rating	Continuous rating
Operating valves raising or lowering rolls.....	110	120	150	200	200
Rolling tables.....	110	130	150	180	200
Hoists, rolls, ore and coal handling machines.....	110	115	120	150	170
Freight and passenger elevators, shop cranes, tool heads, pumps, etc.....	110	110	110	120	140

1205 - Size of Conductor - Motor Feeder Circuits.

a. Except when a demand factor is permitted, conductors supplying current to a number of motors shall be of sufficient size to carry the starting current of the largest motor in the group plus the sum of the full load currents of the remaining motors; provided, however, that the starting current need not be considered unless there is one motor in the group which has a rating of more than 40% of the total connected load on the feeder.

(Fine print note) For continuous duty direct current motors the starting current shall be taken as 125% of the full load current rating. For continuous duty A. C. motors of the type requiring large starting currents the necessary fuse capacities in both branch and feeder circuits may be determined from the note under section 1310(d) of this Code.

1206 - Size of Secondary Conductors of Slip Ring Motors.

a. The size of conductors in the secondary circuits of slip ring motors shall be determined in accordance with the following requirements:

1. With motors used for continuous service constant speed duty, the rotor leads (conductors from secondary terminals of motor to control equipment) shall be of size having a carrying capacity of not less than 110% of the rated full load secondary current of the motor. The resistor leads, which are in circuit only during the starting period, shall be of size having a carrying capacity, Table (C) Rating, regardless of the kind of insulation used, of not less than 76% of the rated full load secondary current of the motor.

2. With motors used for continuous service varying speed duty, both rotor and resistor leads shall be of size having a carrying capacity of not less than 110% of the rated full load secondary current of the motor.

3. With motors used for intermittent service or duty-cycle work (such as crane and hoist duty), both rotor and resistor leads shall have current carrying capacity, in accordance

with Table (C), regardless of the kind of insulation used, of not less than 110% of the rated full load secondary current of the motor.

(Fine print note) Attention is called to the fact that there is no fixed relation between the primary and secondary currents of slip ring motors. The rated secondary current must be obtained in each case for the particular motor under consideration.

1207 - Size of Generator Conductors.

a. For two wire generators, the conductors from generator or generators to switchboard shall be furnished of such a capacity as to carry 25% in excess of the normal rating of the generator or generators.

b. For three-wire generators, the two outside conductors from generator or generators to switchboard shall be furnished of such a capacity as to carry 25% in excess of the normal rating of the generator or generators. The neutral conductor shall not be less than 50% of the capacity of the outside conductors.

c. Connections to balance coils, when same are used, shall have sufficient capacity to supply the maximum current for which the balance coils are designed.

d. All equalizer connections between generators, or between generators and switchboards, shall be short and direct as practicable. The equalizer connections shall not be of less current carrying capacity than the outside conductors connecting the largest generator in the system with the switchboard.

1208 - Paralleling of Conductors.

a. When two or more conductors are connected in multiple to increase the carrying capacity of the circuit they shall be as nearly as practicable of the same length and in no case shall the difference in length exceed 10 per cent; they shall enter and be disconnected by the same switch (if any); they shall be permanently connected together at the point where they receive their supply; and they shall terminate in a common lug or they may terminate in separate lugs which are brazed, sweated, rivited or bolted to a common bus or connecting strap.

b. Conductors smaller than 200,000 circular mils shall not be combined in multiple except by special permission. When such permission is granted each conductor shall be protected by an individual cutout of the proper capacity, and all the cutouts of like polarity shall be connected on the supply side to a common bus.

1209 - Carrying Capacity of Conductors.

a. The following tables shall be applied when installing copper wires and cables in or on buildings except as smaller sizes may be permitted by other sections of this code. For insulated aluminum conductors, the safe carrying capacity is 84% of that given in the tables for copper conductors with the same kind of insulation.

ARTICLE 13.

AUTOMATIC PROTECTION OF CIRCUITS, APPLIANCES AND APPARATUS

Note: For requirements relating to protection at services see Article 15.

1301 - General Arrangement of Fuses and Circuit Breakers.

a. Fuses or circuit breakers shall be provided on constant potential circuits to protect all ungrounded conductors.

b. No fuse or circuit breaker shall be placed in the neutral of a 3-wire service, feeder or branch circuit nor in any permanently grounded conductor, except as called for in section 1305(a) and 1507(b) of this code and except that a circuit breaker having one of its poles in the neutral or grounded conductor of the circuit may be used if it simultaneously opens all of the conductors of the circuit.

c. When a cutout base has terminals or clips for a fuse in a grounded conductor which is required to be unfused, such terminals or clips shall be permanently and effectively bridged; as, for example, by soldering, riveting or bolting to the terminals a copper or brass bridge of ample size, or in the case of a plug cutout, by removing the insulation between the center contact and the screw shell. Solid bar copper shall be used for bridging knife blade contacts.

d. A fuse or circuit breaker shall, except as provided for motor circuits in Section 1310(c), be placed at every point where a change is made in the size of an ungrounded conductor, unless the fuse or circuit breaker in the larger conductor will protect the smaller; provided, however, that tap connections to circuit cutouts need not be larger than the circuits which they supply when the length of the tap does not exceed 5 feet.