

DIVISION 1 - GENERAL ADMINISTRATIVE PROVISIONS

SEC. 93.0101. TITLE.

This ordinance shall be known as the “**Los Angeles Electrical Code**”, a portion of the “**Los Angeles Municipal Code**”. Whenever the word “**Code**” is used in this ordinance, it shall mean the “**Los Angeles Electrical Code**” and whenever “**LAMC**” is used, it shall refer to the “**Los Angeles Municipal Code**”. References to the “**C.E.C.**” and the “**C.B.S.C.**” shall mean the “**California Electrical Code**” and the “**California Building Standards Codes**” respectively.

SEC. 93.0102. PURPOSE.

(a) The purpose of this Code is to reduce the personnel hazard and the fire hazard from electrical causes. To accomplish this, the requirements set forth herein are intended to provide a minimum standard for electrical installations in the City of Los Angeles.

(b) Whenever compliance with the provisions of this Code fail to reduce the demonstrable hazards due to electrical causes to an acceptable level and the hazard is such that the time required to effect a change through normal processes would not be in the common interest, the Superintendent of the Department may require additional safeguards to meet the intent and purpose of this Code.

SEC. 93.0103. SCOPE.

The provisions of this Code shall apply to all electrical systems or equipment installed, used, maintained, rented, leased, or offered for sale or distributed for use in the City of Los Angeles, except those electrical systems and equipment exempted from the provisions of this Code.

It is the intent of this Code to place jurisdiction of electrical wiring on the supply side of service points with the electric utility or serving agency.

SEC. 93.0104. PROHIBITED ACTS.

No person shall install, operate or maintain electrical systems or equipment which do not comply with all of the applicable provisions of this Code. Nor shall any person offer for sale, rent or lease, or distribute any electrical equipment which does not comply with all of the applicable provisions of this Code.

SEC. 93.0105. INTERPRETATION.

(a) If two or more pertinent limitations are not identical, those limitations which provide the greater safety to life and limb, property or public welfare shall prevail.

(b) The Superintendent of Building is empowered to make all interpretations concerning the provisions of this Code.

SEC. 93.0106. OTHER LIMITATIONS.

(a) The permissive provisions of this Code shall not be presumed to waive any limitation imposed by the statutes or ordinances of the City or other governmental agencies.

(b) The provisions of this Code which allow exposed live parts or open wiring systems or which permit access to, or operation or maintenance of such systems by qualified persons shall be subject to the further requirement that special permission must be obtained in each instance.

(c) No person shall cause to be used or energize any electrical systems or equipment installed in, or connected to, any building, vehicle or movable structure which does not conform to, or is in violation of the LAMC, except where the Department determines that a limited or temporary occupancy may be permitted.

SEC. 93.0107. DISTRACTING, CONFUSING OR NUISANCE LIGHTING VIEWED FROM PUBLIC STREETS, HIGHWAYS OR OTHER PUBLIC THOROUGHFARES USED BY VEHICULAR TRAFFIC.

(a) No person shall construct, establish, create, or maintain any stationary exterior electric lighting or illumination system or any interior system which is visible from a public street, highway or other public thoroughfare used for vehicular traffic, that contains or utilizes:

1. An exposed incandescent lamp with a rated wattage in excess of 40 watts.
2. An exposed incandescent lamp with an internal metallic reflector.
3. An exposed incandescent lamp with an external reflector.
4. A revolving beacon light.
5. A continuous or sequential flashing operation in which more than one- third of the lights are turned on or off at one time.
6. An illuminating device or devices which produce illumination in excess of what is permitted in Section 21466.5 of the State of California Vehicle Code.

(b) The provisions of this section shall not apply to:

1. Lighting systems owned or controlled by any public agency for the purpose of directing or controlling navigation, traffic, or for highway or street illumination.
2. Aircraft warning lights.
3. Systems which only display the time of day and/or the atmospheric temperature or programmable electronic messages.
4. Temporary lighting used for repair or construction as required by governmental agencies.
5. Lights that are provided in compliance with Sections 12.21 A.5.(k), 91.6305.2 and 91.8607 of the LAMC.

SEC. 93.0108. EXEMPTED FROM CODE.

(a) **Railways.** The provisions of this Code shall not apply to the following electric wiring installed, owned, maintained or controlled by an interstate, interurban or street railway;

1. Electric wiring in any generating plant, central station or substation used for generating, transforming or transmitting electrical power used exclusively for operating trains, engines, car or trolley coaches; or
2. Overhead and underground distribution systems used exclusively for the operation of equipment listed in Paragraph 1; or
3. Electric wiring used exclusively for signaling and communication purposes.

(b) **Serving Agency.** The provisions of this Code shall not apply to the following electric wiring installed, owned, and controlled by an electrical utility or serving agency which supplies electricity to 100 or more separate premises:

1. Any generating plant, receiving station, switching station, distributing station, or industrial or commercial station under the control of such utility or serving agency. However, nothing contained in this subdivision shall be construed to exempt any electric wiring which is used for general lighting or general power purposes such as heating, cooling, ventilating, elevators, or pumping equipment; nor to exempt any feeder, service, switchboard,

branch circuit panelboard or standby power generator used in whole or in part for general building operation purposes; and

2. Any electrical wiring for its supply lines or mains; and

3. Service drops to the service point which are attached to a structure or the outermost exterior wall of a building, or a roof immediately adjacent to an exterior wall of a building; and

4. Service laterals and their raceways where installed under not less than two inches of concrete beneath a building or other structure and not located in a hazardous location; and

5. All service wiring located within a customer owned station and the high voltage conductors to such station which have all enclosing conduit encased in three inches of concrete; and

6. Service conductors and raceways encased in not less than two inches of concrete, or raceways that are not concealed, which extend from an interior station to service equipment located adjacent to the station; and

7. Meters of metering equipment.

(c) Communication Public Utility Systems.

1. The provisions of this Code shall not apply to installation of communications equipment under the exclusive control of communications public utilities, located outdoors or in building spaces used exclusively for communications purposes in the exercise of its communications utility functions, except where such communications equipment is located in a hazardous location or penetrates any fire-resistive wall or floor system of cable systems that are located in a plenum area or access floor area.

2. Nothing contained in Subdivision 1 of this subsection shall be construed to exempt any electric wiring which is used for external, internal, alternating or direct current power supplies and/or rectifiers exceeding 500va used to supply power to communication public utility equipment or used for general lighting or general power purposes such as heating, cooling, ventilating, elevators, or pumping equipment, nor to exempt any feeder, service, switchboard, branch circuit panelboard or standby power generator used in whole or in part for general building operation purposes, except as to communication public utility equipment for the transmission of audio, data, video and other services housed within a central office exclusively operated by a communications public utility where such equipment is not located in hazardous locations.

(d) Vehicles. The provisions of this Code shall not apply to any vehicle which complies with the California State Vehicle Act. This exemption does not include transportable generating, transforming and related control equipment which is mounted on vehicles and used for the supply of wiring regulated by this Code.

(e) Municipal Systems. The provisions of this Code shall not apply to a Municipal System for street lighting, traffic signal or police and fire alarm where installed outside of buildings on public property.

(f) Mobile Homes, Travel Trailers, Camp Cars and Mobile Home Parks. This Code shall not apply to mobile homes, travel trailers, camp cars and mobile home parks, including permanent buildings, accessory buildings and wiring outside of buildings within such parks.

(g) Hazardous Locations Not Exempted. The foregoing exceptions from the requirements of this Code shall not apply to any electric wiring located in an area classified as a hazardous location by Article 500 of the C.E.C.

SEC. 93.0109. EXISTING CONSTRUCTION.

Except as specified in Section 93.0111 and Subsection (f) of Section 93.0311, nothing contained in this Code shall be construed to curtail the uses of, nor to require any person to reinstall, reconstruct, alter, change or remove any electric wiring or equipment which had complied with the laws and regulations therefor in effect before the effective date of this Code.

SEC. 93.0110. RELOCATED BUILDINGS.

(a) In any building relocated from one place to another within the City and any one-family, two-family or multi-family dwelling moved into the City, may retain the existing electrical wiring provided any such residential building does not become or continue to be a substandard residential building or residential building subject to repair, as those terms are defined in the Municipal Code. However, any electrical wiring which is not in good and safe condition or not working properly shall be corrected. Existing electrical wiring in any building moved into the City, other than one-family, two-family or multi-family dwellings, shall comply with all the requirements of this Code.

(b) New electrical wiring which is installed in any building moved into or within the City shall comply with all the requirements of this Code.

SEC. 93.0111. CHANGE OF OCCUPANCIES.

(a) Any building or portion of a building in which there has been a change of occupancy, after July 1, 1986, to one of the following occupancies, shall be wired in accordance with this Code for that occupancy. (See LAMC Section 91.8203.)

1. Occupancies defined by Division 500 of the C.E.C. or this Code as hazardous locations.
2. Occupancies defined in Article 1, Chapter IX of this Code, and which are required by Article 7, Chapter V, of this Code or where the owner or designer has installed a fire alarm system.
3. Occupancies where the new occupant load exceeds the original or previous value in the building. The occupant load is determined according to the provisions of this Code.
4. Occupancies where the proposed new load density exceeds that of the original or previously used space. Load density is determined based on the load per square foot of area under consideration for the permit.

(b) When the Inspection or Engineering Bureau of the Department of Building and Safety determines by field verification that the extent of the fire damage to a building or structure exceeds the allowable percent as set by Section 91.8106 of this Code, the electrical systems in the entire structure shall be reinstalled to comply with the provisions of Chapter 3 of the C.E.C. (See LAMC Section 91.8106.)

EXCEPTION: The provisions of this section shall not require the replacement of existing raceways, outlet boxes and similar electrical equipment that are suitable for the location and occupancies involved.

SEC. 93.0112. EFFECTIVE DATE.

Electric wiring installed under a permit issued before the effective date of this Code may be installed in accordance with the laws in effect when the permit was issued; and all work begun before the expiration of the permit may be done in accordance with such laws.

SEC. 93.0113. REFERRED DOCUMENTS – COPIES.

Three copies of every law, ordinance, regulation, and specification, or portion thereof which is specifically referred to, or which is mentioned by title and serial designation, or by date of publication, approval or adoption in this Code, shall be kept on file and available for public inspection in the office of the Superintendent of Building.

SEC. 93.0114. RIGHT OF ENTRY.

Right of entry shall be governed by the provisions of Section 98.0105 of the Los Angeles Municipal Code.

SEC. 93.0115. CODE ARRANGEMENT.

Chapters 1, 2, 3 and 4 and the tables of Chapter 9 of the C.E.C. apply as general rules. Chapters 5, 6 and 7 of the C.E.C. apply to special occupancies, special equipment or their special conditions and supplement or modify the general rules. Chapter 8 of the C.E.C. covers communication systems and is not subject to the requirements of Chapters 1 through 7 except where specifically referenced in Chapter 8 of the C.E.C.

SEC. 93.0117. OUTDOOR LIGHTING AFFECTING RESIDENTIAL PROPERTY.

(a) The provisions of this section shall apply to any exterior light source. A light source, as used in this section is a bulb or tube light emitting device, and not a light fixture containing several bulbs or tube light emitting devices.

(b) No person shall construct, establish, create, or maintain any stationary exterior light source that may cause the following locations to be either illuminated by more than two footcandles (21.5 lx) of lighting intensity or receive direct glare from the light source:

1. Any exterior glazed window or sliding glass door on any other property containing a residential unit or units.
2. Any elevated habitable porch, deck or balcony on any other property containing a residential unit or units.
3. Any ground surface intended for uses such as recreation, barbecue, or lawn areas on any other property containing a residential unit or units.

EXCEPTIONS: This subsection shall not apply to:

1. Any frosted light source emitting 800 lumens or less.
2. Any other light source emitting more than 800 lumens where the light source is not visible to persons on other residential property.
3. Any new or existing tennis or paddle tennis court exterior light source which conforms to the following:
 - A. Tennis courts shall be lighted by a maximum of eight horizontally mounted, rectilinear-type, sharp cut-off fixtures shielded in such a manner that the light source cannot be viewable from abutting residential properties. Lamps shall be of the metal halide type of not more than 1,000 watts each, mounted at a height of 20 feet (6096 mm) or less above the court surface and produce not more than 50 footcandles (538 lx) of lighting intensity on the court surface.
 - B. Paddle Tennis Courts shall be subject to all the provisions of Subparagraph 3A, except that the number of fixtures shall be limited to four.
 - C. Tennis or Paddle Tennis Court lights shall not be turned on or left on between the hours of 10:00 p.m. and 7:00 a.m., Monday through Friday, and between the hours of 10:00 p.m. and 8:00 a.m., Saturday and Sunday.
 - D. The light source intensity at locations indicated in this subsection shall not exceed three footcandles (32.3 lx).
4. Decorative lights with individual light sources emitting 300 lumens or less and temporarily installed between November 25 and January 15 of the next year.
5. Emergency lights or temporary lighting sources used for repair or construction as required by governmental agencies.
6. Lighting sources owned or controlled by any public agency for the purpose of directing or controlling navigation, traffic or for highway or street illumination.
7. Aircraft warning lights.

8. Any other light source which is a minimum of 2,000 feet (609.6 m) in distance from any other property with a residential unit or units.

9. Lights that are provided in compliance with Sections 12.21 A.5.(k), 91.6305.2 and 91.8607 of the LAMC.

(c) The owner of property with any existing light source shall bring such light source into compliance with this section upon receipt of written notice from the Department of Building and Safety.

DIVISION 2 - PERMITS, PLANS AND FEES

SEC. 93.0201. PERMIT REQUIRED.

No person shall, install, alter, reconstruct or repair any electrical wiring unless a permit therefor has been obtained from the Department except as otherwise provided in this Code.

EXCEPTIONS:

1. A separate electrical permit shall not be required for any electrical wiring for which a combined building-mechanical permit has been obtained pursuant to LAMC Section 91.107.2.2.

2. No person shall be subject to fine, imprisonment or payment of an investigation fee for starting or doing any electrical wiring without a permit being first obtained if a permit is obtained therefor on or before 12:00 noon on the third day the office of the Department is open for public business after the electrical wiring was started.

SEC. 93.0202. EXCEPTIONS, PERMITS NOT REQUIRED.

(a) No permit shall be required in the following cases:

1. Electric wiring expressly declared to be exempt from the provisions of this Code by any other sections of the Code or by any other provision of the LAMC.

2. Wiring for temporary theater sets on the theater stages or temporary motion picture or television sets on any property belonging to or under the control of the City of Los Angeles, privately owned studios, theaters, or similar locations designed for that usage.

3. Installation of any portable motor or other portable appliance energized by means of a cord or cable having an attachment plug end, when that cord or cable is permitted by this Code.

4. Repair or replacement of fixed motors or fixed appliances, supplied by branch circuits not exceeding 20 amperes and not exceeding 240 volts nominal, of the same type and rating in the same location where not located in an area classed as "hazardous" under Article 500 of the C.E.C.

5. Festive temporary decorative lighting in dwelling occupancies only, for a period not to exceed 90 days.

6. Repair or replacement of current-carrying parts of any switch, contactor or control device.

7. Reinstallation of attachment plug receptacle, but not the outlets for it.

8. Replacement of any overcurrent device of the same rating and in the same location.

9. Replacement of electrodes, or transformers of the same size and capacity for signs or gas tube systems. Except for the retrofitting of lighting and exit fixtures that are part of a required emergency lighting system.

EXCEPTION: This does not include the retrofitting of exit fixtures that are part of a required emergency lighting system.

10. Taping of joints.

11. Removal of electric wiring.

12. Temporary wiring for experimental purposes in suitable experimental laboratories.

13. The following electrical wiring:

(i) Non-required signaling circuits supplied by an approved Class 2 limited power source, capable of supplying not more than 30 volts and 100 volt-amperes; and

(ii) Non-required communication circuits which have the power limited in accordance with Section 725-41 of the C.E.C.; and

(iii) Non-required amplifier output circuits which are permitted by Section 640-5 of the C.E.C. to employ Class 2 or Class 3 wiring; and

(iv) Any non-required circuit which operates at 15 volts or less and does not generate, transmit, transform, utilize or control more than 25 watts or volt-amperes of electric power.

Provided the wiring for any of the above items is not located in any of the following locations:

(i) Area classified as “**hazardous**” under Article 500 of the C.E.C.; or

(ii) Appurtenant to a required fire warning system as classified under Article 760 of the C.E.C.; or

(iii) Penetrating any fire-resistive wall or floor system; or

(iv) In a plenum, duct or other space used for environmental air including access floors.

14. Any similar repair or replacement determined by the Department not to involve any hazard to life or property.

15. Repair or replacement of incandescent lighting fixtures in single-family dwellings.

16. Any electric wiring, except wiring located in an area classified as “**hazardous**” under Article 500 of the C.E.C. after the branch circuit distribution panelboards used exclusively to supply or interconnect equipment installed, owned, operated or maintained by a communication public utility and used exclusively for communication purposes, in the exercise of its communication public utility functions within the communication public utility controlled areas.

17. The replacement of defective smoke detectors in a single-family dwelling when the work is performed by a contractor with a valid Certificate of Registration pursuant to Section 91.1705. A Certificate of Compliance pursuant to Section 91.108.12 must be filed with the City in lieu of a permit.

(b) The provisions of the foregoing exceptions shall not apply to any repairs or replacements of electrical devices, apparatus, or appliances which were originally installed without a permit when such permit is required for the original installation, or when energized by, or which is a part of any hazardous or illegal wiring system.

(c) The foregoing exceptions from permit requirements shall not be deemed to allow any electric wiring to be done in a manner contrary to other provision’s of this Code.

SEC. 93.0203. SCOPE OF PERMIT.

(a) The issuance of a permit is not an approval or an authorization of the work specified therein. A permit is merely an application for inspection, the issuance of which entitles the permittee to inspection of the work which is described therein.

EXCEPTION: Where the wiring exceeds the amount described in the original permit, the Department is authorized to make such additional inspection as is required and collect supplementary fee therefor by the supplemental permit system subject to the following provisions:

1. The fees charged shall be the difference in cost between the total fees due upon final inspection and fees paid at the time of the original application for inspection.
2. A fee of as specified in Section 98.0415(d) shall be paid for issuing such supplemental permit. The fee required by this subsection shall be in addition to fees required elsewhere in the Code.
3. All fees shall apply only to that work installed for the same person as the “owner” in the permit.
4. All fees shall apply to installations where work has not been discontinued for a continuous period of more than 180 days.

(b) Neither the issuance of a permit nor the approval by this Department of any document shall constitute an approval of any violation of any provision of this Code or of any other law or ordinance, and a permit or other document purporting to give authority to violate any law shall not be valid with respect thereto.

SEC. 93.0204. PERMIT APPLICATIONS.

(a) To obtain a permit, the applicant shall file an application on forms furnished by the Department. The application shall contain all information necessary to the lawful enforcement of the provisions of this Code.

(b) The application shall be accompanied by approved plans and specifications or a suitable diagram when and as required by Section 93.0206.

(c) When the Department determines that the information on the application and plans is in conformance with this Code, the Department shall issue a permit upon receipt of the total fees.

(d) Nothing contained in this Code shall be construed to require the Department to immediately accept or reject any application, whenever it is necessary to investigate the proposed wiring and premises as to its compliance with this Code, or it is necessary to check plans and specifications accompanying the application.

SEC. 93.0206. PLANS AND SPECIFICATIONS.

(a) Plans and specifications required by the provisions of Subsection (b) of this section shall be prepared by and bear the signature and registration number of an appropriate State of California Civil Engineer, Structural Engineer, Geotechnical Engineer (when the work is supplementary to Civil Engineering work), Electrical Engineer or Licensed Architect.

EXCEPTION: Plans and specifications required for Subdivisions 1, 2 and 4 through 10 of Subsection (b) of this section may be prepared and signed by a person holding a state license as a contractor who will perform the work. The work must be within the classification for which the license is issued.

(b) Plans and specifications for all wiring intended to be installed on the premises shall be submitted to and approved by the Department before a permit is issued and before installing any wiring related to the following:

1. Theaters or motion picture theaters.
2. Places of assembly.
3. All health care facilities within the scope of Article 517 of the C.E.C.
4. A new building or an addition to a building if the computed area exceeds 30,000 square feet (2,787 m²), any installation if the total load exceeds 400 amperes, or the installation of equipment rated 600 amperes or more. The

computed area shall be the sum of the areas on each floor bounded by the outside surfaces of the exterior walls and shall include floor areas beneath building projections which extend more than 6 feet (1829 mm).

5. All electrical installations over 600 volts.

6. Installation in locations classified as hazardous locations, unless otherwise satisfactory to the Department.

7. Projects which include the installation of exit signs, egress lighting or security lighting.

8. Installation of a complicated electrical system as determined by the Department, such as, Emergency, Legally Required Standby, Fire Alarm, and Gas Detection Systems, except for the following:

(i) The addition of strobe power supplies and their attached devices connected to any existing fire control unit or panel.

(ii) The installation of special extinguishing, central station monitoring systems, dialers, and their attached devices.

(iii) The addition of any fire warning devices connected to an existing programmable fire warning system.

9. Installation of lighting fixtures weighing more than 300 pounds.

10. Installation of electrical devices, equipment and lighting systems, subject to the California Energy Code.

(c) The applicant shall submit two sets of plans and specifications to the Department for approval. The applicant shall keep one set of approved plans on the job site, and shall make the plans available to the authorized representative of the Department upon request.

(d) When the plans or specifications do not comply with all provisions of this Code, the necessary changes or revisions shall be made thereto by the person specified in Subsection (a) of this section or by his or her duly authorized agent.

(e) Every plan shall be a print or other type of plan approved by the Department. The information contained on a plan shall be clearly legible and specifically indicated, and shall comply with Section 93.0207. No plan for electrical wiring in a building shall be of a scale smaller than 1/8 inch (3.2 mm) per foot (304.8 mm) unless a smaller scale is approved by the Department. Symbols satisfactory to the Department shall be used on all plans.

(f) Specifications, legibly and definitely stated, shall be included either on the plan or on separate sheets.

(g) The approval of any plan or specification shall not be construed to sanction any violation of this Code.

(h) No person shall materially deviate from any approved plan, or fail, neglect or refuse to comply therewith, unless permission to do so has first been obtained from the Department.

(i) A permit shall be secured within the time limit specified in Section 98.0603 of the LAMC.

SEC. 93.0207. INFORMATION REQUIRED ON PLANS OR SPECIFICATIONS.

The following information is required to be shown on plans, specifications and diagrams submitted for review by the Department:

(a) A complete plan showing the layout of the proposed electric systems for each floor or area, including dimensions of all working spaces, a full scope of the project and a legend of all symbols used.

(b) The type, location and capacity of all service equipment.

(c) The size and the length of all service raceways to the manhole, vault or pole of the serving agency or to the service head.

- (d) The size of all raceways and the length of all feeder raceways.
- (e) The dimensions of all pull or junction boxes larger than four inches trade size.
- (f) The number, size, and type of all conductors to be installed in wiring enclosures.
- (g) The location of every proposed outlet and switch in all parts of the building or structure including all fixed showcases, wall cases, and similar wiring.
- (h) The wattage or ampere ratings of each outlet for noninductive loads and the volt-ampere rating of each unit or transformer for electric discharge lighting.
- (i) The location, voltage, and H.P. rating of every motor and the K.W. rating of every generator. The type and code letter of every A.C. motor shall be given unless otherwise satisfactory to the Department.
- (j) The location and K.V.A., or equivalent rating of each transformer, capacitor, ballast, converter, frequency changer, and similar equipment and the location and ampere or wattage rating of other appliances of the noninductive type.
- (k) Details of panelboard, switchboard, and distribution centers, showing type and arrangement of switches, overcurrent devices, and general control equipment.
- (l) Panelboard and switchboard schedules showing wattage and amperage, the number of active branch circuits to be installed, and the number of spare branch circuits for future use. This shall include identifying the circuits to which the outlets are connected.
- (m) The existing load, as calculated in accordance with Articles 210 and 220 of the C.E.C. or by other methods satisfactory to the Department, shall be indicated for existing installations having alterations or additions made to them.
- (n) Other additional information as the Department may consider necessary for proper enforcement of this Code.
- (o) On all occupancies indicating location, rating and method being served for all new and existing power distribution equipment.
- (p) Any or all engineering calculations as applicable for the installation.
- (q) Interconnected wiring between all devices in each branch circuit from any panelboard or switch-board to the last device or load.

SEC. 93.0208. TRANSFER OF PERMITS AND PLAN CHECKS.

No permit shall be transferable from the original permittee to any other person, unless the property owner authorizes the transfer in writing. Upon authorization, the new permittee shall file with the Department a new permit and pay to the Department a fee as specified in Section 98.0415 for issuing the new permit. This fee includes the issuing permit fee specified in Subsection (b) of Section 93.0213.

NOTE: No plan check shall be transferable from one contractor to another contractor. Where the original plans were submitted by a properly state licensed engineer, the plans are valid for use by any installing contractor.

SEC. 93.0209. REVOCATION OF PERMITS.

Permits may be revoked as provided for in Section 98.0602.

SEC. 93.0210. SEPARATE PERMITS REQUIRED.

A separate permit shall be required for each building or structure.

EXCEPTIONS:

1. A permit for a main building for an dwelling occupancy may include electric wiring for an accessory building having a floor area of 1,000 square feet or less located on the same premises as the main building and supplied by a feeder or circuit from the main building.
2. Wiring for structures which are not buildings, or outdoor wiring may be included in any other permit for the same premises. However, a separate permit shall be obtained for each derrick or similar structure erected for the purpose of drilling or maintenance of an oil well.
3. Wiring for temporary construction sheds or structures may be included in any permit for temporary wiring on the same premises.

SEC. 93.0211. EXPIRATION OF PERMITS.

(a) Permits may be expired as provided for in Section 98.0602.

EXCEPTION: The Superintendent of Building may extend the period of validity of a permit, providing that prior to the date of expiration the applicant submits satisfactory evidence that the work could not be started or continued within the allotted time, either because of its magnitude, its unusual construction difficulties, or for causes beyond the control of the applicant.

(b) Before the work authorized by any expired permit shall be started, recommenced or continued, a new permit shall be obtained as provided in this Code for the original permit and the fee or fees to be paid therefor shall be determined on the basis of the uncompleted portion of the work, and the work that has deteriorated or has been damaged to the point where replacement is necessary.

SEC. 93.0212. INVESTIGATION FEE.

Whenever any work, for which a permit is required under the provisions of this Code, has been commenced without the authorization of such permit, a special investigation shall be made before a permit may be issued for such work. In addition to the permit fee, an investigation fee shall be collected. (For fee charge, see Los Angeles Municipal Code Section 98.0402 in the appendix.)

SEC. 93.0213. FEES REQUIRED.

(a) The fees described in this division must be paid to the Department for each electrical installation for which a permit is required by this Code, and must be paid before any such permit is issued except as hereinafter provided.

(b) An issuing fee as specified in Section 98.0415(c) shall be paid for issuing each permit. The fee required by this subsection shall be in addition to fees required elsewhere in this Code.

(c) The fees prescribed in this division shall apply to equipment, appliances, fixtures, and devices that are intended to remain in fixed positions and are connected to permanent wiring either directly or through receptacles provided to facilitate servicing and replacement.

(d) Fees shall be paid for new branch circuits as prescribed in Section 93.0214.

EXCEPTIONS:

1. Fees prescribed in Section 93.0216 shall be paid for new branch circuits for the supply of motors, transformers, heating appliances, studio effects lighting and miscellaneous equipment or appliances not specifically set forth in Section 93.0214.
2. Fees prescribed in Section 93.0223 shall be paid for each swimming pool.
3. Fees for new branch circuits supplying signs and gas tube systems shall be paid as prescribed in Section 93.0222.
4. Fees prescribed in Section 93.0215 shall be paid for new branch circuits supplying temporary lighting.

(e) Where otherwise not covered in this Code, fees shall be paid for outlets, lighting fixtures, appliances, motors, or other utilization equipment added to existing branch circuits as prescribed in Section 93.0215.

(f) Fees shall be paid for any wiring for which a permit is required and no fees provided.

(g) Fees shall be paid for any conduit installed by special permission prior to plan approval.

SEC. 93.0214. FEES FOR NEW GENERAL USE BRANCH CIRCUITS.

(a) The fees prescribed in this section apply to new branch circuit wiring and the lighting fixtures, switches, receptacles, appliances or other utilization equipment permitted to be supplied by these branch circuits. Fees shall also be collected for branch circuits which are temporarily installed for trade shows or carnivals and shall be 50% of the fees prescribed in this subsection.

The term lighting as used in this section applies to general illumination, outdoor and similar lighting except as provided in Section 93.0216 for studio stage effects lighting and in Section 93.0215 for temporary lighting.

FEES FOR NEW GENERAL USE BRANCH CIRCUITS

Rating Type or Use of Branch Circuits	Fees for Each Branch Circuits
15 or 20 ampere 120V lighting or general use receptacle; and dwelling appliances 15 to 50 amperes; and non-dwelling motors or appliances supplying aggregate loads not exceeding 3HP or K.V.A.*	
1 to 10 branch circuits inclusive	\$12.50 Ea.
11 to 40 branch circuits	12.00 Ea.
41 or more branch circuits	11.00 Ea.
15 or 20 ampere 208V to 277V lighting	22.00 Ea.
All other lighting branch circuits 600 V or less	26.00 Ea.

* The fees are prescribed in Section 93.0216 shall be charged for equipment loads exceeding those set forth in this section.

(b) For the purposes of this section, each ungrounded conductor of a multi-wire branch circuit is counted as one circuit.

EXCEPTION: Individual multi-wire branch circuits supplying one appliance may be counted as one circuit.

(c) For the purposes of this section, three-phase lighting branch circuits are counted as two branch circuits.

SEC. 93.0215. FEES FOR ADDING LIGHTING FIXTURES, AND OTHER LOADS TO EXISTING BRANCH CIRCUITS, AND FOR LAMPHOLDING DEVICES.

(a) The fees for outlets and lighting fixtures added to existing circuits and for lampholding devices for temporary lighting for construction purposes or for a fair, carnival, convention, exhibition or similar temporary purposes shall be as given in this section.

For the purpose of determining fees, and where not otherwise provided for in this Code, each outlet added to an existing branch circuit shall be counted as one unit and each lighting fixture connected thereto shall be counted as an additional unit, except as modified in the following provisions of this section.

(b) The fees for units and lamp holders for temporary lighting shall be as follows:

FEES FOR ADDING UNITS OR TEMPORARY LAMP HOLDERS

Number of Units	Fees
1 to 5 units, total	\$13.00
6 to 10 units, total	16.50
Each additional 10 units or fraction thereof	8.50
Lamp holders for temporary lighting 50 or less lamp holders total fee	10.50
More than 50 lamp holders but less than 101 lamp holders total fee	20.00
More than 100, but less than 501 lamp holders, total fee	35.00
Each 100 or less lamp holders in excess of the initial 500, additional fee	8.50

(c) For the purpose of determining fees, an outlet shall mean a point or place on a fixed-wiring installation from which electric current is controlled, or is supplied to a lamp, lighting fixture, fan, clock, heater, range, motor, or other electrical appliance or equipment.

(d) For the purpose of determining fees, an outlet box for two or more switches or receptacles shall be considered as one unit.

(e) For the purpose of determining fees, each five feet or fraction thereof of multioutlet assemblies or continuous incandescent trough lighting fixtures shall be considered equivalent to one unit.

(f) Where electric discharge lighting fixtures or sections thereof are joined in end-to- end or through construction, a fee of two units shall be charged for each fixture or section of fixture containing one or more ballasts, reactors or transformers. (This fee covers both the outlets and lighting fixtures.)

(g) A fee of five units shall be charged for each ballast or transformer where not an integral part of an electric discharge lighting fixture and the primary voltage exceeds 150 volts or the secondary voltage exceeds 1,000 volts.

A fee of two units shall be charged for each ballast or transformer not contained within an electric discharge lighting fixture and not included in the foregoing paragraph. (The fees specified in this subsection include the lighting fixture applied therefrom.)

(h) A fee of one unit for the outlet shall be charged for each outdoor lighting standard used for floodlighting, or for each conduit used for floodlights on buildings or structures

(i) An additional fee of one unit for the fixture shall be charged for each lighting fixture used on an outdoor lighting standard. Each lampholder in a cluster of such fixtures shall be considered a separate fixture. The fee for floodlights on buildings or structures shall be computed in the same manner.

(j) A fee of \$12.00 shall be paid for each appliance, motor or other utilization equipment not exceeding three HP, KVA, or KW in rating that is connected to one existing branch circuit. This fee shall cover any switch outlet or other control equipment for the appliance, motor or equipment.

(k) The fee for permanent yard lighting shall be twice the amount prescribed in Subsection (a) above. The fee for any temporary or yard lighting other than lampholders connected to open wiring shall be that prescribed for permanent wiring.

(l) No fee shall be required for any switch on a switchboard, panelboard or control board.

SEC. 93.0216. FEES FOR MOTORS, TRANSFORMERS, HEATING APPLIANCES, STUDIO EFFECTS LIGHTING AND MISCELLANEOUS EQUIPMENT OR APPLIANCES.

The fees prescribed in this section cover the inspection of the supply branch circuit and the utilization equipment supplied therefrom and the control equipment therefor.

(a) Except where supplied by branch circuits rated over 50 amperes, the fees required by this section apply only to nondwelling occupancies. The fee for each motor, transformer, heating appliance, welder, rectifier, x-ray machine, storage battery system, infrared industrial heating appliance, cooking or baking equipment, studio effects lighting, and other miscellaneous equipment or appliances shall be given in the following table for the rating thereof:

**FEEES FOR MOTORS, TRANSFORMERS, HEATING APPLIANCES,
STUDIO EFFECTS LIGHTING AND MISCELLANEOUS EQUIPMENT OR APPLIANCES**

H.P., K.W., or K.V.A. Rating of Equipment	Fees
Over 3 and not over 5	\$14.00
Over 5 and not over 20	21.00
Over 20 and not over 50	30.00
Over 50 and not over 100	55.00
Over 100	85.00

(b) The fees listed in the foregoing table shall be required for all fixed equipment. Where fixed equipment is supplied by flexible cords to facilitate servicing or replacement, those fees shall apply to the receptacle outlet supplying the equipment. Those fees shall also apply for each receptacle outlet installed for the supply of portable equipment rated larger than three H.P., K.W., or K.V.A.

(c) For any equipment or appliance containing more than one motor, or other current consuming utilization components in addition to the motor or motors, the combined electrical ratings converted to K.V.A. of all utilization equipment shall be used to determine the fee. For the purpose of this subsection, one H.P. or one K.W. is equivalent to one K.V.A. The total ampere ratings of all receptacles installed on a factory fabricated wireway assembly for studio effects lighting may be used in computing the fees therefor.

(d) The fees for a change of location or replacement of equipment on the same premises shall be the same as that for a new installation. However, no fees shall be required for moving any temporary construction motor from one place to another on the same site during the time of actual construction work after a permit has once been obtained for such motor and the fees required therefor have been paid.

(e) The fees for equipment described in this section which are temporarily installed for trade shows or carnivals shall be 50% of the amount shown in the fee table specified in Subparagraph (a) of this section.

SEC. 93.0217. FEES FOR FIRE WARNING ALARM, COMMUNICATIONS, CONTROL SYSTEMS AND SMOKE DETECTORS.

(a) The fees for installing, replacing or relocating each fire warning alarm system, communication, control or signal system equipment, or portion thereof, shall be as follows:

Number or Devices	Fees
1 to 10 total devices	\$35.00
11 to 40 devices	3.00 each
41 or more devices	2.50 each
Each control panel, standby power supply panel, annunciator panel or similar main piece of control equipment for one of the above systems	26.00

For the purpose of this subsection, devices shall include all signaling equipment, stations, power equipment such as damper actuators or door holding devices, communication jacks or outlets, control sensors, or switches or remote indicators, and smoke detectors that are part of fire alarm systems or process control systems.

EXCEPTION: Communications equipment installed, owned or operated and maintained by a communications public utility and exempt under the provisions of Section 93.0108(c).

(b) The fees for installing, replacing or relocating individual smoke detectors in residential units which are energized from the building wiring shall be as follows:

1 residential unit	\$11.00
Each additional residential unit in a multiple dwelling occupancy	9.00
Each additional residential unit over 20 in a hotel, motel, boarding house or lodge	5.50

For the purpose of this subsection, a residential unit shall include a single family dwelling, every dwelling unit in a multiple dwelling and every guest room in a hotel, motel, boarding house or lodge.

SEC. 93.0218. FEES FOR SERVICES AND SWITCHBOARD SECTIONS.

(a) The fees for the installation, reinstallation, replacement or alteration of each service, each panel board and each switchboard section shall be as specified below. Fees shall also be collected for panel boards which are temporarily installed for trade shows or carnivals and shall be 50% of the fees specified in this subsection.

FEES FOR SERVICES, SWITCHBOARD SECTIONS AND PANEL BOARDS

Ampacity and Voltage Ratings of Service Entrance Conductors, Service Switches or Circuit Breakers, Panel boards or Switchboard Sections	Services	Panel board and Switchboard Sections
200-ampere or less rating,	\$12.00	\$ 12.00
201 to and including 600 ampere,	25.00	28.00
601 to and including 1200 ampere,	45.00	35.00
Over 1200 ampere	55.00	65.00
Over 600-volt rating	95.00	100.00

(b) For the purpose of this section, a switchboard section means any portion of complete switchboard, distribution board, or motor control center which is prevented by the structural framework from being, separated into smaller units.

(c) The fees for services shall be determined from the ampacity of the set of service entrance conductors or the total ampere rating of the service equipment.

(d) No fee need be paid for a switchboard section which incorporates service equipment for which service fees were paid.

SEC. 93.0219. FEES FOR BUSWAYS, POWER DUCT, TROLLEY DUCT, CABLE TRAYS, CABLE BUS AND SIMILAR EQUIPMENT.

(a) The fees for busways, power ducts, trolley duct, cable bus and similar equipment shall be as follows:

FEES FOR BUSWAYS, POWER DUCT, TROLLEY DUCT, CABLE BUS AND SIMILAR EQUIPMENT

Ampere Ratings	Less Than 100 Feet	Over 100 Feet Per Foot
0 to 99 amperes	\$25.00	\$0.25 per foot
100 to 400 amperes	\$30.00	0.30 per foot
Over 400 amperes	\$45.00	0.45 per foot

(b) The fee for lighting fixtures, motors and other equipment which are plugged in shall be that given in Sections 93.0214 and 93.0216 of this division and shall be in addition to the fees required by this section. Portable hand tools are not included.

(c) The fee for the inspection of the circuit supplying the busway, power duct, trolley duct and cable bus and similar equipment shall be that given in Section 93.0214 and 93.0216 of this division and shall be in addition to the fees required by this section.

(d) The fee for the inspection of the installation of cable trays shall be \$35.00 for 1 to 100 feet, plus \$0.35 per foot for each foot over 100 feet.

SEC. 93.0220. MINIMUM INSPECTION FEE.

A minimum fee as specified in Section 98.0412(a) of this Code must be paid to the Department for each electrical installation for which a permit is required by this Code. Where the cumulative equipment fees described in this division total less than the minimum fee required by this section, the minimum fee shall be paid. The fee required by this section shall be in addition to the issuing fee required by Subsection (b) of Section 93.0213.

SEC. 93.0222. FEES FOR GAS TUBE LIGHTING, SIGNS AND SIGN FLASHERS.

(a) **Equipment:**

FEES FOR GAS TUBE LIGHTING, SIGNS AND SIGN FLASHERS

Type of Service	Fees
Each sign or gas tube system utilizing not more than one branch circuit	\$26.00
For each additional sign or gas tube system utilizing not more than one branch circuit	10.00
For each additional branch circuit utilized by a sign or gas tube system	11.00

(b) For the purposes of this section:

1. A gas tube system shall mean that electric discharge tubing installed continuously or contiguously for the purpose of illumination or to form a single outline, border, symbol or to convey a message and operating at more than 1,000 volts; and
2. Each ungrounded conductor of a multi-wire branch circuit shall be counted as one circuit and each three-phase branch circuit shall be counted as two circuits.

(c) A fee of \$10.00 shall be charged for each flasher, time clock or other automatic control device that is not an integral component of an approved sign, but is installed separately for the control of signs or gas tube systems.

SEC. 93.0223. FEES FOR SWIMMING POOLS.

The fee for constructing each swimming pool shall be not less than \$65.00. The fee specified in this section shall include payment for inspection of the branch-circuit wiring, bonding, grounding, underwater pool light, pool pump and similar electrically operated equipment directly related to the operation of the pool.

SEC. 93.0224. FEE FOR MISCELLANEOUS PERMIT

(a) The fee for any electric wiring for which a permit is required, but for which no fee is provided herein, shall be as specified in 98.0412(c), provided, however, that no such fee shall be charged when a fee is paid for one or more outlets, fixtures, motors, appliances or other equipment. The fee is in addition to the permit fee under Subsection (b) of Section 93.0213.

(b) When special permission has been obtained from the Department, a miscellaneous permit may be issued for electrical raceways, and enclosures which are to be installed in the ground or masonry floors or installations, where an electrical permit cannot be issued until the required plans have been approved. This special permission shall not include permission to install any raceways, enclosures, wiring, or devices of any description related to a fire alarm, or life safety system until those specific system plans have been approved and permits have been issued. The miscellaneous permit shall not be an authorization to install any additional wiring other than the specified raceways and enclosures.

A miscellaneous inspection fee as specified in Section 98.0412(c) of this Code shall be paid for the inspection and shall be limited to one inspection and one reinspection trip. This fee is in addition to the permit fee specified in Subsection 93.0213(b) of this Code.

SEC. 93.0227. FEES FOR CHANGING ADDRESS.

Whenever it shall become necessary to make an extra inspection trip because the applicant has given an incorrect or wrong location when obtaining a permit required by the Code, a fee as specified in Section 98.0415(a) of this Code shall be paid for correcting the address location in such permit.

SEC. 93.0228. FEES FOR MOVED BUILDINGS AND STRUCTURES.

A fee of \$100.00 shall be charged for the inspection of the existing electrical wiring, if any, in or on a moved building or structure. Fees as required elsewhere in this division shall be paid before any other electrical wiring installed except that necessary to connect the existing electrical wiring to the grounding electrode.

SEC. 93.0229. FEES FOR ADDITIONAL INSPECTIONS.

(a) Each permit shall be entitled to four inspection trips when the job is of a type requiring an inspection before covering or concealing the work. On jobs which may be completely inspected on one inspection trip, two inspection trips will be allowed.

EXCEPTION: The number of inspection trips will not be limited on progress jobs; provided, however, that only one inspection will be permitted for checking a correction. For the purpose of this section, progress jobs are those where circumstances beyond the control of the qualified installer make it impossible for the electrical work to be completed at any specific time.

(b) If more inspection trips than are specified in Subsection (a) of this section are required due to fault or error on the part of the qualified installer or his employees, an additional fee as specified in Section 98.0412(b) shall be paid for each such additional inspection trip.

(c) Corrections shall be completed within 30 days of the date of issuance of a written notice to the qualified installer by the Department. Installations on which a written notice has been issued shall be rechecked by the Department after 30 days have elapsed from the date of issuance of the notice.

(d) The Department may recheck installations upon which violations continue to exist at intervals of 30 days or more until either the violations are eliminated or a total of three rechecks are made. The fees specified in Subsection (b) of this section shall apply for each recheck inspection.

(e) The fees charged under this section are in addition to any other fees shown in this division and the payment of the fees required by this section shall not exempt any person from compliance with other provisions of this Code, nor from any penalty prescribed by law.

(f) Whenever special enforcement procedures are required to obtain compliance with properly executed Department notices or orders, a fee, as specified in Section 98.0407 of the Los Angeles Municipal Code, shall be assessed in addition to the added trip fee specified in Subsection (b) of this section.

SEC. 93.0230. SPECIAL INSPECTIONS.

(a) **Off-Hours Inspection.** The Department may, at its discretion, make emergency inspections at other than normal working hours, upon the request of a permittee, provided that additional fees are paid as specified in Section 98.0406 of the Los Angeles Municipal Code.

(b) **Special Equipment.** The Department may inspect special equipment which is exempt from approval as set forth in the Exceptions to Section 93.0402 upon application therefor by the owner or lessee of the equipment.

The fees for a special equipment inspection shall be charged at the rate as specified in Section 98.0412(d) per hour for each inspector. The fee required by this subsection shall be in addition to the fees required elsewhere in this Code.

(c) **Existing Buildings.** The owner may apply for inspection of the electric wiring in an existing building. The inspector shall notify the owner of any alterations necessary. A Certificate of Inspection will be issued to the building owner when all applicable Electric Code requirements are met. Fees for that inspection shall be paid as provided in Subsection (b) of this section for Special Equipment Inspection.

Where a reinspection is required in order to authorize the serving agency to reconnect an existing service, an owner may apply for inspection in accordance with the above. A fee equal to 50% of those specified in Subsection (b) of this section shall be paid.

SEC. 93.0233. FEES FOR PLAN CHECKING.

(a) Before formally accepting a set of plans and specifications for checking, the Department shall collect a plan check fee.

(b) The plan check fee shall be 80 percent of the fees specified in Sections 93.0214 through 93.0233 of this Code for each of the items shown on the plans, with a minimum fee of \$65.00.

(c) A fee of \$9.00 per thousand square feet, or major fraction thereof, of the floor area which is required to comply with the rules and regulations adopted by the California Energy Commission shall be charged for plan checking for conformity to such rules and regulations. The minimum fee shall not be less than \$50.00. The fee required herein shall be in addition to those fees required by Section 93.0233(b). This fee shall not be subject to the percentage of Sec. 29, Subsection (b) of Section 93.0233.

(d) A complete schedule of the fees due shall be included with each set of plans submitted to the Department.

(e) The plan check fees required by the provisions of this section are in addition to the permit fees required elsewhere in this Code. The total plan check fees shall be paid regardless of whether or not the plans are approved or the proposed wiring as indicated on the plans is abandoned. The plans shall not be approved until the total plan check fees are paid.

(f) **Identical Buildings or Identical Areas.** The plan check fee shall be charged at 50% of the permit fee for identical buildings or identical areas in one or more buildings where the following conditions are met:

1. Multi-building projects are to be constructed at the same time, located at the same site and all plans are submitted at the same time; and
2. Areas within a building or buildings are identical and exceed 20,000 square feet; and
3. Fees of 50% of the permit fee are paid for all identical buildings or identical areas checked.

To be considered identical, the buildings or areas must have the same building design with respect to room and partition arrangement and same electrical design with respect to location of outlets and equipment and circuiting.

(g) Electrical installations that plan checking fees are not included in the fee schedules or when a plan received more than three sets of corrections shall be checked and a fee shall be paid as specified in Section 98.0415(e) of the Los Angeles Municipal Code.

(h) In addition to the fees charged under Subsection (a) of Section 93.0217 and Subsection (b) of Section 93.0233, when replacing, installing or relocating each fire warning system, communication, control or signal system equipment, or portion thereof, the Department may collect a plan check fee as specified in LAMC Section 98.0415(e).

(i) Upon request by an applicant and accepted by the Department, an off-hour plan check fee per Section 98.0422 of the Los Angeles Municipal Code may be collected.

SEC. 93.0235. FEES FOR WITNESSING TESTS OF EMERGENCY SYSTEMS AND FIRE WARNING SYSTEMS.

(a) The fees for conducting or witnessing the original test of an Emergency System or Fire Warning System shall be collected as specified in Section 98.0412(f) for each inspector. The fees required by this subsection shall be in addition to the fees required elsewhere in the Code (see Section 93.0307(c)) of this Code.

(b) The fees for conducting or witnessing an annual test for each existing emergency system, other than unit equipment, shall be prescribed in Table A of this subsection (see Section 93.0307(c).)

**TABLE A
FEES FOR CONDUCTING ANNUAL TEST OF EMERGENCY SYSTEMS**

Combined K.W. of K.V.A. Rating of Supply System	Fees
10 or less	\$50.00
10.1 to 50, total fee	75.00
50.1 to 100, total fee	95.00
For each additional 100 K.W. or K.V.A.	28.00

Where a building contains more than ten occupied floors, a fee of \$30.00 shall be paid for each additional group or portion of a group of ten floors.

The fees for conducting or witnessing an annual test of an existing emergency system comprised of unit equipment shall be as prescribed in Table B of this subsection.

**TABLE B
FEES FOR CONDUCTING ANNUAL TESTS OF UNIT EQUIPMENT**

Units	Fees
1-5 units, inclusive	\$30.00
Each additional unit	1.50

(c) A Certificate of Approval, valid for a period of one year, shall be issued by the Department following each test when the system is found to be in compliance. The Certificate of Approval shall be prominently posted adjacent to the generator or battery system.

EXCEPTION: The Certificate of Approval need not be posted by the equipment provided it is on display on the premises and the location of posting is noted at the generator or battery system location. The Certificate shall show:

1. A technical description of the system;
2. The electrical rating; and
3. Date of issuance.

When systems are found to be defective and additional inspection trips are required, added trip fees shall be paid as specified in Section 93.0229.

(d) Certificates of Approval are subject to revocation by the Superintendent of Building when:

1. It is found that the tests and maintenance prescribed in Article 700 of the C.E.C. are not being accomplished; or
2. The supply system is found to be defective.

SEC. 93.0240. FEES FOR REGISTRATION OF PREMISES COVERED BY A MAINTENANCE CERTIFICATE OF REGISTRATION.

(a) An annual registration fee as specified in Section 98.0414(b)2 shall be paid for premises covered by a maintenance certificate of registration.

(b) The payments of the annual registration fee shall not be construed as waiving any provisions of this division concerning the issuance of a permit or the payment of fees therefor.

SEC. 93.0242. FEES FOR CERTIFICATE OF QUALIFICATIONS.

(a) Every applicant for Certificate of Qualification shall file an application and shall pay a fee specified in Section 98.0414(a)1.

An additional fee as specified in Section 98.0414(a)2 shall be required for each subsequent application and examination if the applicant fails to pass the first time.

(b) An annual renewal fee as specified in Section 98.0414(a)3 shall be paid within 30 days of expiration.

SEC. 93.0243. INSPECTION FEES FOR OFF-SITE INSPECTIONS.

Upon a written request, the Department may, at its discretion make inspections at locations other than the site upon which a building will be located provided such location is within 60 miles of the Los Angeles City Hall.

A fee as specified in Section 98.0412(e), in addition to fees charged elsewhere in this Code, shall be charged for such inspections. The time shall include travel to and from the place of inspection.

DIVISION 3 - ENFORCEMENT

SEC. 93.0301. POWERS OF DEPARTMENT AND BOARD.

The powers of the Department and the Board are those enumerated in Section 98.0403 of the Los Angeles Municipal Code.

SEC. 93.0302. APPEALS.

Appeals or requests for slight modifications in individual cases from the requirements of this Code shall be made in accordance with the procedure established in Section 98.0403 of the Los Angeles Municipal Code.

SEC. 93.0303. NEW MATERIALS AND METHODS OF CONSTRUCTION.

New or alternate materials and methods of construction may be approved by the Department in accordance with the provisions of Division 5 of Article 8, Chapter IX, of the Los Angeles Municipal Code.

SEC. 93.0304. INSPECTIONS.

(a) All electric wiring, for which a permit is required shall be inspected and approved by the Department before being concealed, energized or used. All fees required by this Code shall be paid by the permittee prior to the energizing or use of such wiring.

(b) No person shall use, operate or maintain, or cause or permit to be used, operated or maintained, any electric wiring until it is inspected and approved.

(c) No serving agency shall supply, or cause or permit to be supplied, electric energy to any electric wiring until the wiring has been inspected and approved.

(d) Nothing contained in this section shall prohibit the temporary use of electric energy when and as specifically provided for in Section 93.0308.

(e) Nothing contained in this section shall prohibit the inspection of any electric wiring even though no permit is required therefor.

(f) The inspections provided for in this section shall not be required for construction or installation work done on the premises of a Type II Fabricator to whom an approval has been issued pursuant to the provisions of Division C of Article 6 of Chapter IX of the Los Angeles Municipal Code.

SEC. 93.0305. REQUEST FOR INSPECTION.

(a) Whenever any work regulated by this Code, or any portion thereof, is ready for inspection, the Department shall be notified by the qualified installer that the work is ready for inspection. The notice shall be in writing on forms furnished by the Department, or may be by telephone at the option of the Department. The notice shall be filed with the Department no later than 2:00 PM on the regular business day prior to the requested inspection date and not more than 72 hours before any inspection is desired. Inspections are performed on regular business days between the hours of 8:45 AM and 3:30 PM. Alternate inspection times may be scheduled upon request.

(b) Requests for Fire Life Safety Inspections are made on an appointment basis only. Appointments for these inspections shall be made in person with a Fire Life Safety Inspector and the required pretest inspection sheet shall be completed prior to any scheduling.

SEC. 93.0306. INSPECTION OF ELECTRICAL WIRING AND EQUIPMENT INSTALLATION.

(a) No person shall conceal, close or cover, or cause or permit to be concealed, enclosed or covered, any portion of any electrical wiring or equipment in any manner which will interfere with or prevent the inspection and approval thereof.

(b) Each obstruction which makes impracticable the making of a complete and thorough inspection of electrical wiring shall be removed upon notice (either verbal or in writing) to do so, and shall be kept removed until the electrical wiring has been inspected and approved by the Department.

(c) Before final inspection of any electric wiring, all plaster, concrete or other foreign material shall be thoroughly removed from every box and wiring enclosure, and not less than six inches of jointless conductor shall extend out of each lighting outlet box for future connection thereto.

(d) In any case where one or more taped joints made without splicing devices are found not soldered at the time of inspection, the inspector may require every joint for such electric wiring to be left untaped until the inspection and approval thereof.

(e) In any case where a splicing device is found not in conformity with all the requirements of Subsection (b) of Section 110-14 of the C.E.C., the inspector may require that all covers, tape or other separate sheaths be removed from every splicing device in the installation and all the splices be pulled out of all boxes or other enclosures, and be left exposed for inspection. A ladder or other acceptable means shall be provided by the qualified installer to enable the inspector to make a thorough inspection of all the splices that are out of reach of the ground or floor.

(f) Where there is reasonable evidence that conductors are damaged or do not comply with the requirements of this Code, the inspector may require them to be removed from raceways to determine their condition.

(g) Fixtures, appliances, devices or equipment shall not be connected to any electrical wiring until the rough electrical wiring, including conductors, has been inspected and approved, except as otherwise satisfactory to the Department.

(h) All wiring shall be free from grounds, shorts, or other defects before approval thereof.

(i) Whenever any electrical wiring or equipment has been inspected and found to comply with the provisions of this Code, the inspector of the Department shall leave a notice so stating at the service switch or other suitable place.

(j) The qualified installer shall upon request by the inspector, provide ladders or other means suitable to the inspector, to facilitate inspections of all electric wiring which is not accessible from the ground or floor.

(k) The qualified installer shall arrange for inspection, during the progress of installation of concealed supports for lighting fixtures and appliances, and for the inspection of fixtures assembled on the ceiling, and shall provide for all means necessary for weight tests and other inspections the Department considers necessary.

(l) In addition to the requirements of Division 3 for inspections, a satisfactory acceptance test of the entire fire warning system installation and function shall be made in the presence and under the direction of a representative of the Department of Building and Safety and the Los Angeles City Fire Department prior to final approval.

The test of the fire warning/emergency system may be conducted by only one representative of the Department of Building and Safety or the Los Angeles City Fire Department upon approval from both departments.

SEC. 93.0307. REINSPECTION OF ELECTRIC WIRING.

(a) The Department is hereby authorized to inspect or reinspect electric wiring installed prior to or after the effective date of this Code.

(b) When any unapproved wiring is found, the Department may condemn the installation under the provisions of Section 93.0311.

(c) No person shall occupy premises required to have an emergency electrical supply under the provisions of this Code without having a valid Certificate of Approval for that system. The Department shall conduct or witness a test on the complete system upon installation and annually thereafter. (See Section 93.0235.)

SEC. 93.0308. TEMPORARY USE OF CURRENT.

- (a) The Department may permit, at its discretion, the temporary use of electrical energy for electrical wiring, before final approval thereof, whenever unnecessary hardship would otherwise result, and inspection can effectively be made after the commencement of the temporary use.
- (b) The Department shall place those restrictions upon temporary use as necessary to insure safety, to secure compliance with all other provisions of this Code, and to facilitate inspection.
- (c) No temporary use of electrical energy shall be permitted in any case where a hazard to life and property would be created.
- (d) The temporary use of electrical energy may be ordered discontinued and the supply disconnected upon proper notice as prescribed in Section 93.0311.
- (e) Nothing contained in this section shall be considered to permit or authorize the sale or use of any electrical equipment not “**APPROVED**” in accordance with Division 4 of this Code.

SEC. 93.0310. POWER TO STOP WORK.

- (a) The Department is hereby authorized to stop the installation of electric wiring or the concealment thereof, whenever an installation is being done in violation of this Code, or where a hazard to life and property is created until the hazard or violation has been eliminated.
- (b) The notice to stop work shall be in writing, served as provided in the Los Angeles Municipal Code, upon the person violating or responsible for the violation of this Code.
- (c) No person shall fail, neglect or refuse to comply with a stop work notice.

SEC. 93.0311. AUTHORITY TO CONDEMN INSTALLATIONS.

- (a) When the Department determines that an electrical installation is in violation of this Code, an order shall be given to the owner or person in responsible charge of the installation to either remove or replace the installation. The order shall be in writing and shall specify the particulars in which the installation is in violation and shall fix a reasonable time for compliance with the order. In cases of extreme danger to life or property, as determined by the Department, the order shall further require that all persons cease using electric current through the installation and to disconnect the installation at once.
- (b) If the violations continue to exist by the expiration of the time fixed by the order, or should the Department find that persons are using an installation that has been ordered disconnected, the Department is hereby authorized to physically disconnect the portion of the installation in violation, or to order the serving agency to disconnect electric service to the consumer’s wiring system.
- (c) Where a disconnection has been made by the Department a seal shall be attached to the electric wiring at the point of disconnection.
- (d) The seal shall be of metal and shall be attached to a tag not less than three inches by four inches in size of substantial paper or cardboard, red in color, and bearing a printed warning that the installation has been sealed by the Department. No person shall break, mutilate, destroy or remove the seal or tag, or energize the wiring until the seal has been removed by the Department. When the required changes or repairs have been made and the work inspected and approved, the Department shall cause the seal to be removed.
- (e) When an electric wiring installation has been sealed by the Department, a person who causes, permits or allows his agent, servant, employee or other persons to use such installation prior to the removal of the seal by the Department or after the seal has been removed or broken by any person other than a representative of the Department, shall be guilty of a misdemeanor.

(f) Nothing contained in this section shall be construed to require a person to change wiring which complied with the laws and regulations therefor in effect before the effective date of this Code and which is maintained to comply with those regulations.

EXCEPTIONS:

1. When the Department determines that the wiring may become a hazard to life and property.
2. Where the occupancy of the building or premises has been changed in accordance with Section 93.0111.
3. Where cord wiring is found in dwelling occupancies it shall be replaced by not less than two approved receptacle outlets in each kitchen, living room and bedroom. A receptacle outlet, which may be one of the kitchen receptacle outlets, must be provided for each washing machine. Kitchen receptacle outlets shall be supplied by at least two branch circuits, one of which may also supply lighting circuits.
4. Where existing plug fuseholders are used in new circuits or in existing circuits with new electric wiring they shall be provided with TYPE S fuse adapters. The Department shall require all the fuseholders in an existing panelboard to be provided with TYPE S adapters where evidence of bridging, tampering or conditions of over-fusing are found in over 10% of the total number of fuses.
5. Where changes are made to utility company transformers or service equipment of existing electrical installations that causes an increase of available short-circuit currents, provisions shall be made as required by Sections 110-9 and 110-10 of the C.E.C. to protect the equipment.

SEC. 93.0312. ABANDONED WIRING.

When a circuit is abandoned or discontinued, its conductors shall be removed from the raceways, or shall be insulated and maintained in wiring enclosures as if in use.

SEC. 93.0314. RESPONSIBILITY FOR COMPLIANCE.

Every person installing, altering, repairing, using or maintaining electric wiring shall be responsible for compliance with this Code.

SEC. 93.0315. NON-RESPONSIBILITY OF CITY.

Neither the City of Los Angeles, nor any department, board, commission, officer or employee thereof shall be held liable or responsible for any damage or injury caused by or resulting from the issuance of any permit issued, or any inspection or approval made under the provisions of this Code.

DIVISION 4 - APPROVED EQUIPMENT

SEC. 93.0401. POWER TO REGULATE.

The Department is authorized, empowered and directed by Division 3 to enforce all of the provisions of Division 4, to adopt standards to which all equipment referred to in Section 93.0402 must conform before its approval, and to make reasonable rules and regulations for the governmental enforcement of such provisions and standards. Such rules and regulations, declared by Section 93.0113 to be a part of this Code, shall be reduced to writing and shall be filed in accordance with Section 93.0113 in the office of the Superintendent of Building.

SEC. 93.0402. SALE, INSTALLATION AND USE.

No person shall sell, offer for sale, advertise, or display for sale, dispose of by way of gift, loan, rental, lease or premium, or install or use any “**equipment**,” as defined in Article 100 of the C.E.C., unless that equipment has been approved by the Department.

EXCEPTION: Equipment listed by an approved laboratory, provided the label, symbol or other identifying mark of the approved laboratory is affixed to the equipment and further provided that the equipment is installed and used in conformance with its listing and this Code.

SEC. 93.0403. USED EQUIPMENT.

(a) Any used or secondhand material, including any fitting, device, appliance, apparatus, or other equipment reinstalled for electric wiring shall comply with the following provisions:

1. All such equipment shall be in good, satisfactory and durable condition, and adequate and satisfactory for the purpose intended or used, all of the foregoing to be determined by the Department. Such equipment must also comply with all requirements of Division 4 regarding approval.

2. No used or secondhand insulated conductors shall be used for services or for circuits operating at more than 250 volts.

(b) Nothing contained in this section shall be construed to waive any other specific requirements of the Code, including requirements for nameplates, enclosure of live parts, horsepower rating of switches, or protection from corrosion.

DIVISION 5 - REGISTRATION

SEC. 93.0501. QUALIFIED INSTALLER.

It is unlawful for any person who is not a qualified installer to install, alter, reconstruct or repair any electric system unless the person is under the direct supervision of a qualified installer.

A qualified installer is:

- (a) A person who holds a valid contractor's license in the proper classification issued by the State of California; or
- (b) A person who holds a valid Maintenance Certificate of Registration issued pursuant to the provisions of this Code; or
- (c) A person who is the owner of a single-family dwelling and has demonstrated to the satisfaction of the Department his or her qualifications to satisfactorily perform electric wiring in the dwelling which is occupied by the owner, and their accessory buildings, provided that all of the following conditions are met:
 - (1) The work is performed prior to sale of the dwelling.
 - (2) The homeowner has actually resided in the residence for the 12 months prior to completion of the work.
 - (3) The homeowner has not availed himself or herself of this exemption on more than two structures during any three year period; or
- (d) A person who is employed by a governmental agency that is required to comply with the provisions of this Code, and who is qualified, as determined by the Department, to supervise or control any work regulated by this Code.

SEC. 93.0502. CERTIFICATE OF REGISTRATION.

- (a) A Certificate of Registration may be issued for maintenance electrical work as set forth in Section 93.0503.
- (b) To obtain a Certificate of Registration, the person, firm or corporation shall make an application giving:
 - 1. The business name and address; and
 - 2. The names of the owners or officers of a corporation; and
 - 3. License Tax Registration Certificate number; and
 - 4. The name of the holder and the registration number of a valid Certificate of Qualification.
- (c) Each Certificate of Registration shall be subject to the following regulations;
 - 1. Certificates of Registration shall not be transferable.
 - 2. Certificates of Registration shall become void 30 days after the holder of a valid Certificate of Qualification ceases to have effective control over the worked performed.
 - 3. Certificates of Registration shall expire one year from the date of issuance unless sooner revoked or suspended by the Department.
 - 4. Certificates of Registration may be renewed upon the payment of the annual registration fee as prescribed in Section 93.0503.
 - 5. The Department may revoke or suspend any Certificate of Registration for failure, refusal, or neglect of the holder to comply with the provisions of this Code or for any reason set forth in Article 8 of Chapter IX of the Los Angeles Municipal Code.

6. No Certificate of Registration shall authorize any person to do work which is not within the specific classification of the Certificate of Registration.
7. The holder of a Certificate of Registration shall be responsible for all electrical work installed.

SEC. 93.0503. MAINTENANCE CERTIFICATE OF REGISTRATION.

- (a) A Maintenance Certificate of Registration may be issued to an owner or occupant of an existing building for the sole purpose of the repair, addition or alteration of existing facilities.
- (b) The owner or occupant shall register a Maintenance Supervisor who is the holder of a valid Certificate of Qualification in the proper classification.
- (c) An annual registration fee shall be paid for premises covered by a Maintenance Certificate of Registration as required by Section 93.0240.

SEC. 93.0505. CERTIFICATE OF QUALIFICATION.

- (a) No person shall act as a Maintenance Supervisor without having a valid Certificate of Qualification of the proper classification issued pursuant to the provisions of this section.
- (b) Every applicant for a Certificate of Qualification shall successfully pass an examination to determine his ability to perform the work. The examination shall include a written test and may include a practical and oral interview. The Department shall determine the scope of the examination and shall establish the regulations for the conduct of the examination.

EXCEPTION: The examination may be waived for applicants who hold a valid State of California Electrical Contractor's C-10 License.

- (c) Every applicant for Certificate of Qualification shall pay a fee as required by Section 93.0242.
- (d) Every Certificate of Qualification for maintenance supervisor shall expire three years following the date of issuance.
- (e) An expired Certificate of Qualification may be renewed at any time within 12 months after expiration without making application as set forth in Subsections (a) and (b) of this section, provided that, after the first month the renewal fee is paid as required by Subsection (b) of Section 93.0242.
- (f) The Department may revoke or suspend any Certificate of Qualification for failure, refusal or neglect of the holder to comply with the provisions of the Code or for any reason set forth in Article 8 of Chapter IX of the Los Angeles Municipal Code.

DIVISION 6 - DEFINITIONS AND REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

SEC. 93.0600. BASIC PROVISIONS.

Chapter 1 of the C.E.C. is hereby adopted by reference for the purpose of providing definitions and requirements for electrical installations with the following additions and amendments and as specifically provided herein.

ACCESS FLOOR. An assembly consisting of panels mounted on pedestals to provide an underfloor space for the installation of electrical, communications, or mechanical systems.

C.E.C. California Electrical Code

CORD WIRING. The use of cord as substitute for the wiring methods permitted by this Code.

DEPARTMENT. The Department of Building and Safety.

ELECTRIC WIRING. Any device or equipment constituting a part of, or connected to, any electrical installation attached or fastened to any building, structure or premise and which installation, or some portion thereof, is designed, intended or used to generate, transmit, transform, utilize or control electrical energy.

EXISTING. (As applied to electric wiring, buildings or portions of buildings) Having a final approval by the Department of Building and Safety.

FIRE WARNING SYSTEM. A system or portion of a system that consists of components and circuits arranged to monitor and annunciate the status of the system locally by sounding an alarm as a result of the operation of any signal initiation device such as manual pull station, water flow switch, smoke detector, heat detector, etc. These systems may incorporate an approved means (such as a dialer) to inform the status of the system to a remote location.

GROUND RESISTANCE. The resistance of the ground soil, as determined by field measurement by a qualified engineer, and the associated grounding electrode system as determined by calculation.

HAZARDOUS WIRING. Any wiring which did not conform with all applicable laws in effect at the time of installation, or wiring which is not in good condition or is being used in an unsafe manner.

INSTALL. The act of attaching or fastening electric systems, temporarily or permanently, in any manner, including the attaching or connecting of portable equipment even though designed to be moved, removed or disconnected at will.

INSTALLATION. That which is installed, regardless of whether or not it is energized.

N.E.C. National Electrical Code.

NFPA 72. The National Fire Alarm Code published by the National Fire Protection Association.

NON-RESIDENTIAL. Where used in this Code, the term “**non-residential**” shall apply to any building or premises other than hotels, motels, lodging houses, apartment houses, dwellings, or portions thereof, or buildings and structures accessory thereto.

PREMISES. Any parcel of land, regardless of the number of contiguous lots, occupied by or under the control of the same person or firm and including all buildings, structures or improvements thereon.

RESIDENTIAL. Where used in this Code, the term “**residential**” shall apply to any hotel, motel, lodging house, apartment house, dwelling, or portion thereof, or building and structure accessory thereto.

SALE OR SELLING. Any act of selling, offering for sale, advertising or displaying for sale, disposing of by way of lease or premium any equipment as defined therein.

SATISFACTORY. Acceptable to the Department.

SERVING AGENCY. A public or privately owned electric utility authorized by the City of Los Angeles to distribute electric energy to 100 or more separate premises.

SIGNALING EQUIPMENT. Any contrivance which produces an audible or visual signal, including doorbells, buzzers, code calling systems and signal lights. This equipment shall not include those audible or visual signals which are part of motor control circuits, data processing systems, fire-warning systems and nurse call systems.

SPECIAL PERMISSION. The express permission in writing from the Superintendent of Building, obtained prior to the commencement of any work for which special permission is required.

STATION. (Industrial or Commercial.) A building, room or outside enclosure on a customer's premises designed, intended or used to house or enclose the electric distribution and control equipment of the serving agency.

USED MATERIAL. Previously used equipment as defined in Article 100 of the California Electrical Code.

VAULT. A chamber (over 80 cubic feet in volume) in an underground conduit distribution system containing sufficient working space and an entrance for personnel.

VOLTAGE, NOMINAL. A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (*e.g.*, 120/240, 480Y/277, 600). The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

DIVISION 7 - REQUIREMENTS FOR INSTALLATION METHODS AND MATERIALS.

SEC. 93.0700. THE CALIFORNIA ELECTRICAL CODE.

Chapters 1 through 9 of the 2005 Edition of the National Electrical Code (N.E.C.), as published by the National Fire Protection Association (N.F.P.A. 70-2005), the 2007 California Electrical Code and the California Building Standards Code are adopted by reference as part of the Code. When there is a conflict between the 2005 National Electrical Code, the 2007 California Electrical Code and the Los Angeles Municipal Code, Section 93.0105 shall prevail. Except as specified in Divisions 1 through 6 of Article 3, Chapter IX of the Los Angeles Municipal Code, all electrical installations and materials shall be in conformity with the 2007 California Electrical Code, as adopted by reference to be part of this Code and Sections 93.515.17 and 93.515.18 are added as provided here.

93.515.17. OIL AND GAS WELLS.

(a) This article shall be applicable to oil or gas wells located over water, on manmade islands offshore or at land-based locations. Area adjacent to oil or gas wells shall be classified as Class I locations as outlined below, and installations shall comply with the requirement for those locations.

(b) Definitions.

ADEQUATE VENTILATION. (as applied to enclosed areas) A mechanical ventilation system supplied from a nonhazardous source that provides for a minimum of 12 air changes per hour.

ENCLOSED AREA. Roofed areas having at least three walls, or open sumps or pits into which highly volatile liquids are run, or areas surrounded by buildings or walls in which flammable vapors may accumulate.

LOCOMOTIVE CABLE. Cable having the physical property of being oil resistant and constructed as to be suitable for application on power and control circuits in diesel or electric locomotives and suitable for oil rigging applications.

POSITIVE PRESSURE VENTILATION. A mechanical ventilation system capable of providing a minimum outward air velocity of 60 feet per minute through all openings.

(c) Drilling Wells.

1. **Class I, Division I Locations.** The following areas shall be classified as Class I, Division I locations:

- A. Below-grade well cellars, sumps or ditches. See Figures 2 and 6.
- B. Enclosed and inadequately ventilated areas below the derrick floor. See Figure 1.
- C. Enclosed areas containing mud tanks or shale shakers. See Figures 3 through 6.

EXCEPTIONS:

- 1. Adequately ventilated enclosed areas shall be permitted to be classified as Class I, Division 2 locations.
- 2. **(Over 600 volts, nominal):** Oil or gas well in the process of drilling shall have a Division 2 classification within 25 feet of the casing, with the 18 inch height limitation adjacent to the drilling platform. The entire area directly above and below the drilling platform proper shall be considered as Division 2 without height limitation.

2. **Class I, Division 2 Locations.** The following areas shall be classified as Class I, Division 2 locations:

- A. Within ten feet horizontally and 18 inches vertically from the edge of the well cellars or other below grade, Class I, Division I locations.
- B. Within ten feet radially of the center of the bell nipple in open derricks.
- C. The entire area above the derrick floor in enclosed derricks.
- D. Areas adjacent to mud tanks as required in Figures 3 and 4; pits as required in Figure 2; shale shakers as required in Figure 5; or openings as required in Figure 2.

EXCEPTION: In enclosures classified as Class I, Division I locations in Subdivisions (c) 1 above.

(d) Producing Wells.

1. **Class I, Division I locations.** The following areas shall be classified as Class I, Division I locations:

A. **Below-grade well cellars.** See Figures 7 and 9.

B. Enclosed areas such as, wellhead, compressor or pump rooms where volatile, flammable liquids or gases may be present in concentrations sufficient to render the area a hazardous location.

NOTE: See Figures 8 through 10.

EXCEPTIONS:

1. Adequately ventilated enclosed areas shall be permitted to be classified as Class I, Division 2 locations.

NOTE: See Figure 7.

2. **(Over 600 volts, nominal):** In case of producing oil wells, the Division 2 classification shall include an area within three feet of the well casing to a height of three feet around the stuffing box or lubricator, and the area extending ten feet from the well casing to a height of 18 inches above the grade level of all producing oil wells (pumped, flowing or gas injected) having a gas pressure sufficient to cause gas to be liberated to the atmosphere in quantities to create a hazard to employees should liberated gas become ignited. Producing gas wells shall have a similar classified area.

2. **Class I, Division 2 Locations.** The following areas shall be classified as Class I, Division 2 locations:

A. Within ten feet horizontally and 18 inches vertically from the well casing and three feet radially from the stuffing box of all producing wells equipped with beam pumping units.

NOTE: See Figures 8 and 9.

B. Within ten feet horizontally and 18 inches vertically above grade from the edge of well cellars or other below grade Class I, Division I locations.

C. Within ten feet horizontally and vertically from openings in enclosed areas classified as Class I, Division I locations in Subdivision (d) 1. above.

NOTE: See Figures 3, 5 and 10.

3. **Class I, Division 1 and 2.** Areas within a 10-foot radius of oil field auxiliary equipment such as gas vents, oil-gas separator vessels, tanks, pumps, compressors and similar equipment shall be classified in accordance with Figures 11 through 19.

(e) Overload Protection. No overload protection will be required for drilling rigs using railroad locomotive power systems for the draw works, rotary tables and mud pumps.

NOTE: In this electrical system, generators, generator power leads, and DC motors are automatically protected against overload by inherent characteristics of compound and differential field windings in the DC motor and generator, respectively.

(f) Wiring Methods.

1. **General.** Where drilling platforms are not enclosed around the drilling operation, all wiring and equipment within 25 feet of the casing of the well being drilled shall be of the type required for Class I, Division 2 locations, or be installed in enclosed areas supplied with adequate ventilation. The electrical power supply to wiring and equipment within positive pressure ventilated areas shall be arranged to prevent energizing the electrical wiring and apparatus until air pressure has been established, for not less than two minutes, and arranged to automatically actuate an audible and visual alarm with a 5-minute shutdown time delay to allow safe operational shutdown prior to de-energizing the wiring and apparatus when the ventilation fails.

Enclosed areas supplied with positive pressure ventilation from a nonhazardous area shall be permitted to be classified as nonhazardous areas, provided no flammable vapor source exists within the enclosed areas.

2. **Locomotive Type Cables.** Special locomotive cables and other equivalent portable cables may be run in cable trays under the following conditions in all locations:

A. Open cable trays may be run horizontally under floors or ceilings.

B. In all locations, solid covers shall be installed on horizontal runs where persons or materials may accidentally contact the conductors.

C. Vertical runs of trays shall be totally enclosed.

D. Where the rig moves over a series of well holes and a transverse section of cable tray drops trailing cables in a long fixed runway tray, cleats or other means shall be used to secure the cable against shifting in the moving section of the tray.

E. For single hole setups onshore, cables may be buried in the earth or run in covered, wooden troughs between outdoor units of equipment. A substantial, nominal 2-inch thick wooden cover or equivalent, shall be installed over the trough.

(g) **Lighting.** Lighting systems for oil or gas well drilling rigs, production hoists, derricks or masts shall be permitted to be wired using an approved prefabricated assembly of flexible cables with vulcanized, molded or other approved terminating receptacle devices so designed that electric arcs will be confined within the receptacle enclosure which shall be the concealed contact-type. The lighting fixture shall be of the type permitted for Class I, Division I locations, or of the enclosed gasketed-type. These assemblies shall be securely fastened to the drilling rig or hoist structure and so located that they will be protected from physical damage.

(Figures 1 - 19 Inclusive)

93.515.18. BULK-STORAGE PLANTS-TANKER LOADING DOCKS.

(a) **Scope.** The provisions of this section shall apply in addition to the requirements of Article 515 of the C.E.C.

(b) **Definitions.**

BULK STORAGE PLANTS or TANKER LOADING DOCK DESIGNATIONS. The bulk storage plants and tanker loading docks designation shall also include locations where ships carrying bulk cargoes of gasoline or other volatile flammable liquids are loaded or unloaded.

WATER LEVEL. The water level shall be the measured mean value of the high tide lines.

(c) **Loading and Unloading Tanker Ships.**

1. The interior of a building, any portion of which is located in a Class I, Division 2 location, shall be classified as a Class I, Division 2 location.

EXCEPTION: Buildings which are provided with satisfactory positive pressure ventilation, and safeguards, with air taken from a clean air source may be considered to be a nonhazardous location.

2. All electrical power drive pumps and transfer apparatus for flammable liquids shall be provided with an identified “**stop**” or normal control switch within sight and readily accessible to the person operating the equipment.

(d) **Existing Tanker Loading Dock Installations.** All existing electrical installations at tanker loading docks shall comply with the provisions of this section and Article 515 of the C.E.C.

EXCERPTS

Voltage drop calculations for copper or aluminum conductors

I. Conductor Sizes of 2 AWG or Less

The voltage drop and the %VD are calculated using the following equations. These equations are applicable for AC or DC systems with conductor size of **2 AWG or smaller**.

(NOTE: $\sqrt{3} \approx 1.73$ and $\frac{1}{\sqrt{3}} \approx 0.58$)

1. Voltage Drop - 1 ϕ Volts Drop = $I \times R \times 2$ ①
2. Voltage Drop - 3 ϕ Volts Drop = $I \times R \times \sqrt{3}$ ②
3. The voltage drop for a 3-wire 120/240 volt circuit derived (or tapped) from 4-wire 120/240 volt System, where the load is balanced and the circuit or feeder has double pole switching or disconnecting means is calculated as follows:
Voltage Drop - 1 ϕ Volts Drop = $I \times R \times \sqrt{3} \times 1.5$ ③
3. $\%VD = \frac{\text{VoltsDrop}}{V} \times 100$ ④

Where:

I = rms amperes per terminal of a load (or rms demand loads when allowed).

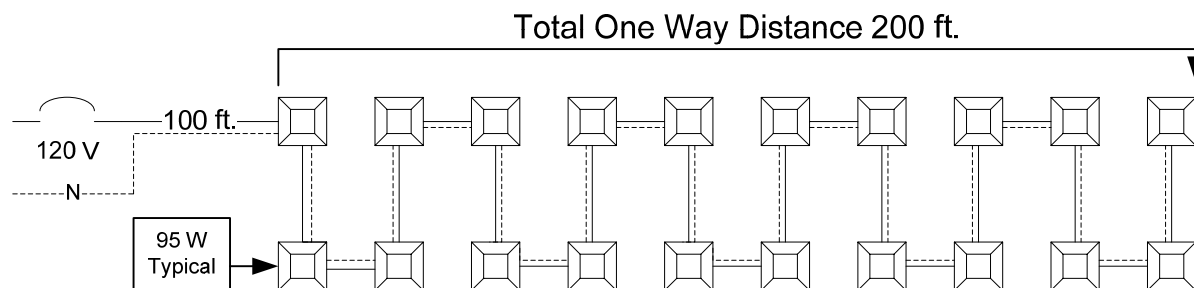
V = Nominal circuit voltage in volts.

R = One way dc resistance of conductor in $\Omega/1000\text{ft}$. The value of R is obtained from Chapter 9, Table 8 of the Los Angeles Electrical Code. (For example 50 feet of No.12 AWG uncoated solid copper conductor will have a DC resistance of 0.0965 ohms. To find this value first check Table 8 of Chapter 9 to find the resistance of 12 AWG per 1000 ft. Then divide this resistance by 1000 to find the resistance per foot (to get 0.00193), and then multiply the resistance per foot by the one way length of the conductor (50 feet) in order to get the actual line resistance (0.0965 ohms)).

EXAMPLE 1

Single Phase (1 ϕ) Voltage Drop

A 120 volt, single phase, 20 ampere branch circuit consist of 300 feet of 12 solid-AWG, uncoated copper conductor supplying 20 luminaires. The home run of this circuit is determined to be 100 feet. Each luminaire draw 95 W of power. The single phase (1 ϕ) percent voltage drop (%VD) of this branch circuit is calculated as follows:



Since this is a single phase circuit use equation ① (Volts Drop = $I \times R \times 2$) and ④ ($\%VD = (\text{Volts Drop}/V) \times 100$) to find the %VD. The current (I), resistance (R) and volts drop as follows:

- Step 1: The total load is 1900 W (20 luminaires \times 95 W/luminaire)
- Step 2: The load current (I) is 15.83 A (1900 W /120 V)
- Step 3: The conductor's resistance for an uncoated 12 solid-AWG from Table 8 of Chapter 9 of this code is found to be 1.93 ohm/1000 ft. This will give us a per foot resistance of 0.00193 (1.93/1000).
- Step 4: The one way length of the circuit is assumed to be at the center of the loads not counting the home run. Subtracting 100 feet of home-run from the total circuit run will yield 200 feet of circuit (300 - 100 = 200) shared by the loads. The center of the load in this case will be about 100 feet after the home run (200/2). The one way circuit length is determined to be 200 feet (100 feet of home run and 100 feet of center of load length).
- Step 5: The circuit resistance is found to be 0.386 (0.00193 Ω /ft \times 200 ft)
- Step 6: Using equation ① the volts drop is 12.22 V (Volts Drop = $15.83 \times 0.386 \times 2$)
- Step 7: The voltage at the load is found to be 107.78 Volts (120-12.22)
- Step 8: Using equation ④ [$\%VD = (\text{Volts Drop} / V) \times 100$] the %VD = **11.34** ($[\%VD = (12.22 / 107.78) \times 100]$)

In this case the % voltage drop is 11.34%. This exceeds the recommended voltage drop of 3% for the branch circuit. To solve the problem, increase the wire size, reduce the branch circuit load or subdivide the load to smaller branch circuits.

The values of conductor resistance in Table 8 of Chapter 9 are based on 75 °C. To determine the DC resistance of conductors at other temperatures, use the following equation:

$$R_2 = R_1[1 + \alpha(T_2 - 75)]$$

Where:

R_2 = The conductor resistance at new temperature T_2 in °C

R_1 = The conductor resistance at 75 °C temperature.

α = The temperature coefficient of resistivity for copper is $\alpha_{cu} = 0.00323$ and for aluminum is $\alpha_{al} = 0.00330$ at 75°C

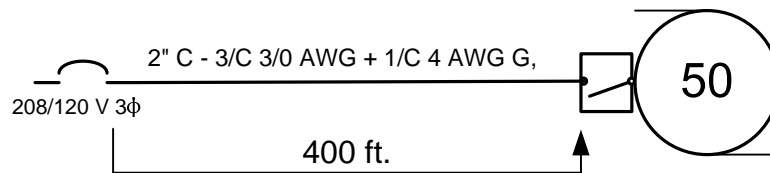
When a conductor is loaded more than 50% of its ampacity, use the maximum permitted insulation temperature rating of the conductor to determine the conductors' resistance. When the load is less than 50% of a conductor ampacity rating, resistance of the conductor may be based on the exposed ambient temperature. Application of the ambient temperature shall be the same as that required for selection of ampacity for conductors as required in section 310-15(A) of the electrical code.

II. Conductor Sizes Larger than 2 AWG

To calculate the voltage drop for all conductors larger than 2 AWG, substitute the resistance (R) value in equation ①, ② or ③ of Part I with the effective impedance (Z). The effective impedance values are found in Table 9 of Chapter 9 of this Code. The percent voltage drop (%VD) is found by using equation ④ as shown in Part I. Unless otherwise known or determined, the circuit power factor shall be assumed to be not more than 0.85.

EXAMPLE 2 Three Phase (3 ϕ) Voltage Drop

A 50 hp, 208 volt three phase motor is supplied from a 208/120 V 3 ϕ source. The motor conductors are 400 feet of 3/C 3/0 AWG uncoated copper and one 4-AWG copper equipment ground installed in a 2-inch steel conduit (EMT) terminating into a disconnecting means on the motor. Unless otherwise given or known, the branch circuit power factor is assumed to be 0.85. The three phase (3 ϕ) percent voltage drop (%VD) of this branch circuit is calculated as follows:



Since this is a three phase circuit, use equation ② (Volts Drop = $I \times R \times \sqrt{3}$) to find the volts drop and equation ④ ($\%VD = (\text{Volts Drop}/V) \times 100$) to find the %VD. The value of current (I), resistance (R) (or Z the impedance) and volts drop are found following these steps:

- Step 1: Per Table 430-150 (or use the name plate rating of the motor if available), a 3 ϕ , 50 hp motor at 208 volts has a full load line current of 143 amperes per line.
- Step 2: Since the ungrounded conductor is larger than 2 AWG we need to use the line impedance rather than the line resistance alone. Furthermore, the circuit power factor is assumed to be 0.85 (unless otherwise known or determined).
- Step 3: The conductor effective impedance for a stranded, uncoated 3/0 AWG with a circuit power factor of 0.85 in a steel conduit from Table 9 of Chapter 9 is found to be 0.094 ohm/1000 ft. This will give us a per foot resistance of 0.000094 ohms (0.094/1000).
- Step 4: The one way length of the circuit is 400 feet.
- Step 5: The circuit impedance is found to be 0.0376 ohms (0.000094 Ω /ft \times 400 ft).
- Step 6: Using equation ② the volts drop is 9.3 volts (Volts Drop = $143A \times 0.0376 \Omega \times \sqrt{3}$).
- Step 7: The voltage at the load is found to be 198.7 volts (208-9.3).
- Step 7: Using equation ④ [$\%VD = (\text{Volts Drop} / V) \times 100$] the %VD = **4.68** ($[\%VD = (9.3 / 198.7) \times 100]$).

In this case the %voltage drop is 4.68% which exceeds the recommended voltage drop of 3% for branch circuits. To solve the problem, the branch circuit impedance is reduced by using either a larger conductor, a different conduit (i.e., PVC or Aluminum) or by using more conductors of the same size or larger in parallel.

The value of the effective circuit impedance in the Table 9 of Chapter 9 of this code is based on a circuit having a 0.85 power factor. When the circuit power factor is lower (i.e., a low power factor load), the effective impedance value of the line (typically consisting of line resistance and line inductance) has to be adjusted using the following equation:

$$Z_e = R \times \text{Cos}(\theta) + X_L \times \text{Sin}(\text{Cos}^{-1}(\theta))$$

Where:

- Z_e = The new effective line impedance in Ω/kft
 $\text{Cos}(\theta)$ = The line power factor
 R = The line resistance in Ω/kft
 X_L = The line reactance in Ω/kft

CONVERSION TABLE - KW to AMPERES

To find amperes of a noninductive load, multiply KW by the constant shown in this table.

System	Voltage	Constant
1 ϕ or DC	120	8.33
	208	4.81
	240	4.17
	277	3.61
	480	2.08
3 ϕ	120	4.82
	208	2.77
	240	2.41
	480	1.2

THREE PHASE DELTA SYSTEM LOAD CALCULATIONS

The three phase Delta systems are either three-wire or four-wire. The following is a step by step procedure to calculate loads that are installed in such systems.

Three-phase (3φ) Three-wire (3W) Delta System. Loads on three-phase three-wire Delta systems generally consist of three-phase and single-phase loads. However, in most cases, these systems are not balanced and thus the system is considered unbalanced. Calculation of loads on unbalanced 3φ, 3W Delta system would normally require converting the unbalanced system to its equivalent balanced system by developing sequence (positive, negative and zero) networks followed by circuit analysis. However, simplified method(s) of calculation can be used which provides a reasonable level of accuracy. In the following step by step procedure, two methods of calculations are demonstrated. Both methods use steps 1 through 5. Following Step 5, choose either method I calculation and continue with Steps 6 through 10 or choose method II and continue using Alt-Steps 6 through 8. When the total unbalanced load per-phase is less than 1% between any phase, after Step 5, multiply each total per-phase load by $\sqrt{3}$ (and divided by the voltage if the load is in Watts) to determine each line current.

This is the Step by Step Calculation procedure. The Steps 1 through 5 is highlighted to show that they are common to both method I and II.

- Step 1:** Convert three-phase loads into three equal per-phase loads by multiplying them by 0.58 (Or dividing by $\sqrt{3}$).
- Step 2:** Add all per-phase and single-phase power loads together to come up with the total per-phase loads.
- Step 3:** Determine the 25% of the largest motor load (LML) per-phase (when motors are present).
- Step 4:** Add the LML (when motors are present) of each phase to the total per-phase load of Step 2.
- Step 5:** Convert the total per-phase power load to the equivalent per-phase currents.

Method I: Since every ungrounded conductor of a service, feeder or branch circuit are required to be of the same ampacity, this method shows how to calculate the load on the conductor which involves the greatest power (or current) consumption and then uses multiplying factors based on the unbalanced load. That factor is applied to the total load to determine the line current. Continue with Step 6 through 10 as explained below.

- Step 6:..... Add together the two largest total phase load current from Step 5.
- Step 7:..... Determine the ratio of the two largest total phase load current to find the multiplying factor ratio.
- Step 8:..... Choose a multiplying factor for unbalance loads based on the ratio determined in Step 7, from the following Table 1:

#	Ratio	Multiplying Factor
1	Not more than 1.7 to 1	0.87
2	Not more than 2.6 to 1	0.89
3	Not more than 3.3 to 1	0.90
4	Not more than	0.92
5	Not more than 7.3 to 1	0.94
6	Not more than 9.3 to 1	0.95
7	Not more than 12.5 to 1	0.96
8	Not more than 18.2 to 1	0.97
9	Not more than 32.0 to 1	0.98
10	Over 32.0 to 1	1

Table A

- Step 9:..... Multiply the calculated total phase load current from Step 6 above with the chosen multiplying factor from Step 8 above.
- Step10:..... The service entrance conductor, service equipment, feeders and panel board ampacity shall be based on this final current magnitude.

Method II: This method utilizes the following equations to determine the line currents.

$$I_{L1} = \sqrt{(I_{\phi A})^2 + (I_{\phi B})^2 + (I_{\phi A} \times I_{\phi B})} \quad (1)$$

$$I_{L2} = \sqrt{(I_{\phi B})^2 + (I_{\phi C})^2 + (I_{\phi B} \times I_{\phi C})} \quad (2)$$

$$I_{L3} = \sqrt{(I_{\phi C})^2 + (I_{\phi A})^2 + (I_{\phi C} \times I_{\phi A})} \quad (3)$$

Where I_{L1} , I_{L2} and I_{L3} are the line currents and $I_{\phi A}$, $I_{\phi B}$ and $I_{\phi C}$ are the phase currents.

- Alt-Step 6: Determine the per-phase currents ($I_{\phi A}$, $I_{\phi B}$ and $I_{\phi C}$) following Steps 1 through 5.
- Alt-Step 7: Substitute the value of the per-phase currents ($I_{\phi A}$, $I_{\phi B}$ and $I_{\phi C}$) in equation (1), (2) and (3) to determine the magnitude of the line currents I_{L1} , I_{L2} and I_{L3} .
- Alt-Step 8: The service entrance conductor, service equipment, feeders and panel board ampacity shall be based on the largest line current magnitude.

EXAMPLE 1

3 ϕ , 3 WIRE DELTA SYSTEMS

A building panel board is supplied by a 3 ϕ , 3W, 240 volt source. The connected loads (figure 1) are as follows:

Description	1 ϕ Load, Amps	3 ϕ Load, Amps
Copier	14.58A	
Coffee Maker	12.50 A	
5 HP - A/C Unit		15.2A
10 HP - Lathe Machine		28 A
Drinking Fountain	13.33 A	

What are the acceptable minimum panel rating and its feeder size? See Panel Schedule A for load distribution.

In solving this problem both Methods I and II are used.

The following solution is based on Method I:

Step 1: Convert all three-phase (3 ϕ) current loads into three equal per-phase power loads and reflect the result in the panel schedule.

1. 5 HP - A/C Unit = $15.2 \text{ A} \times 0.58 = 8.816 \text{ A/phase} \times 240 \text{ V} = 2116 \text{ W/Phase}$.
2. 10 HP - Lathe Machine = $28.0 \text{ A} \times 0.58 = 16.24 \text{ A/phase} \times 240 \text{ V} = 3884 \text{ W/Phase}$.

And convert all single phase current loads to single phase power loads as follows:

3. 14.58 A - Copier = $14.58 \text{ A} \times 240 \text{ V} \approx 3500 \text{ W}$
4. 12.50 A - Coffee Maker = $12.50 \text{ A} \times 240 \text{ V} = 3000 \text{ W}$
5. 13.33 A - Drinking Fountain = $13.33 \text{ A} \times 240 \text{ V} \approx 3200 \text{ W}$

The three phase and single phase load distribution is shown in Panel Schedule A.

Step 2: Add all per-phase and single-phase power loads together to come up with the total per-phase loads.

Step 3: Since there are motor loads, determine the 25% of the largest motor load (LML) per-phase ($3884 \times 0.25 = 971$).

Step 4: Add the LML of each phase to the total per-phase load of Step 2.

Step 5: Convert the total per-phase power load to the equivalent per-phase currents as follows:

1. $I_{\phi A} = 10171 \text{ W} / 240 \text{ V} = \mathbf{42.38 \text{ A}}$ (This is the current between ($L_1 - L_2$))
2. $I_{\phi B} = 10471 \text{ W} / 240 \text{ V} = \mathbf{43.63 \text{ A}}$ (This is the current between ($L_2 - L_3$))
3. $I_{\phi C} = 9971 \text{ W} / 240 \text{ V} = 41.55 \text{ A}$ (This is the current between ($L_3 - L_1$))

Step 6: Take the two largest total phase load current from step 5 and add them together.

$$42.38 + 43.63 = \mathbf{86.01 \text{ A}}$$

Step 7: Determine the ratio of the two largest total phase load current from step 5 (shown in bold) to find the multiplying factor ratio.

$$43.63 \div 42.38 = 1.03$$

Step 8:..... From Table A, since the ratio is not more than 2 to 1 (in this case 1.03 as determined in step 7) choose the multiplying factor 0.87 for the unbalance loads.

Step 9:..... Multiply the calculated total phase load current from Step 6 (**86.01 A**) above with the chosen multiplying factor of 0.87 from Step 8 above.

$$86.01 \text{ A} \times 0.87 = 74.83 \text{ A.}$$

Step 10: The feeder and panel board ampacity should not be less than **74.83 A**.

The following solution is based on Method II:

Alt-Step 6: Following Steps 1 through 5, the per-phase current values ($I_{\phi A}$, $I_{\phi B}$ and $I_{\phi C}$) are found to be: (All values are in amperes)

$$I_{\phi A} = 42.38, \quad I_{\phi B} = 43.63, \quad I_{\phi C} = 41.55$$

Alt-Step 7: The values of per-phase currents ($I_{\phi A}$, $I_{\phi B}$ and $I_{\phi C}$) are substituted in equations (1), (2) and (3) to find the magnitude of the line currents I_{L1} , I_{L2} and I_{L3} as follows:

$$I_{L1} = \sqrt{(I_{\phi A})^2 + (I_{\phi B})^2 + (I_{\phi A} \times I_{\phi B})} = \sqrt{(42.38)^2 + (43.63)^2 + (42.38 \times 43.63)} = 74.48 \text{ A}$$

$$I_{L2} = \sqrt{(I_{\phi B})^2 + (I_{\phi C})^2 + (I_{\phi B} \times I_{\phi C})} = \sqrt{(43.63)^2 + (41.55)^2 + (43.63 \times 41.55)} = 73.78 \text{ A}$$

$$I_{L3} = \sqrt{(I_{\phi C})^2 + (I_{\phi A})^2 + (I_{\phi C} \times I_{\phi A})} = \sqrt{(41.55)^2 + (42.38)^2 + (41.55 \times 42.38)} = 59.41 \text{ A}$$

Alt-Step 8:..... The service entrance conductor, service equipment, feeders and panel board ampacity shall be sized based on the largest line current magnitude of **74.48 A**.

Panel A		125 A - Main lug	240 V - 3 ϕ , 3W SCR:42000 A		
CKT. NO.	CB/POLE	DESCRIPTION	ϕ_A (L ₁ -L ₂) Watts	ϕ_B (L ₂ -L ₃) Watts	ϕ_C (L ₃ -L ₁) Watts
1	20/2	COPIER		3500	
2					
3	20/2	COFFEE MAKER			3000
4					
5	30/3	5 HP - 15.2 A 3 ϕ A/C UNIT	2116		
6				2116	
7					2116
8	40/3	10 HP - 28 A 3 ϕ LATHE MACHINE	3884		
9				3884	
10					3884
11	20/2	DRINKING FOUNTAIN	3200		
12					
		TOTAL 3 ϕ LOAD:	9200	9500	9000
		LML 3 ϕ LOAD:	971	971	971
		TOTAL W/LML:	10171	10471	9971

Panel Schedule A

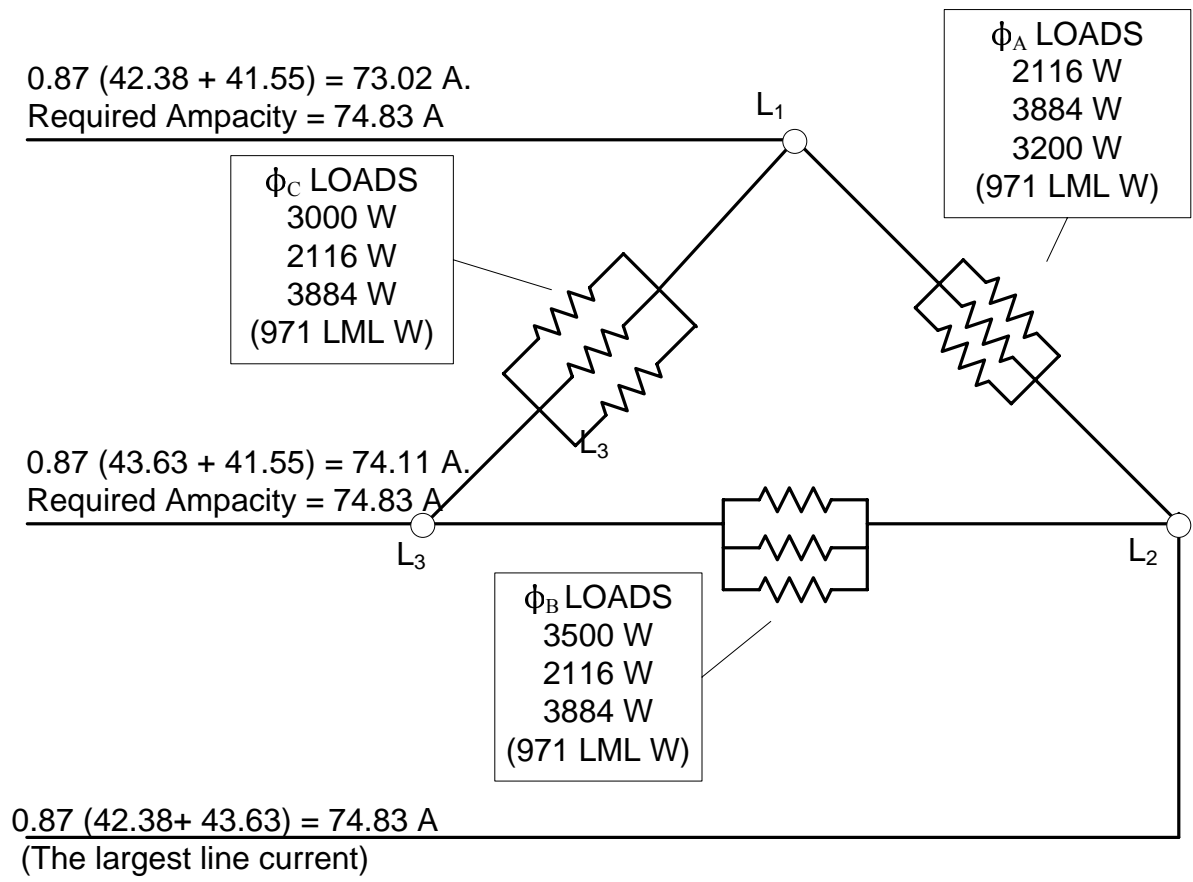


Figure 1

Three-phase (3φ) Four-wire (4W) Delta System. Loads on 120/240, 3φ, 4W systems usually consist of single-phase line to neutral loads in addition to other loads for 3φ, 3W systems. Due to the presence of line-to-neutral loads, the system is always unbalanced. Calculation of loads on 3φ, 4W Delta system would normally require converting the unbalance system to its equivalent balance system by developing sequence (positive, negative and zero) networks and followed by circuit analysis. However, simplified method(s) of calculation can be used which provides a reasonable level of accuracy. In the following step by step procedure, two methods of calculations are demonstrated. Refer to figure B for the representative layout of the 4W Delta system used for this part. Both methods use steps 1 through 7. Following Step 7, choose either method I calculation and continue with Steps 8 through 11 or choose method II and continue after Step 7 with Alt-Steps 8 through 10.

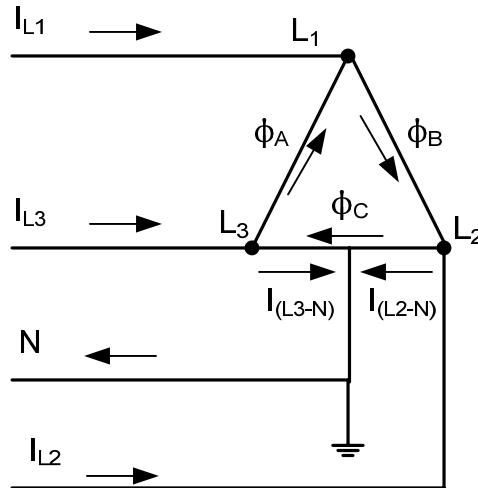


Figure B

The Steps 1 through 7 is highlighted to show that they are common to both method I and II.

- Step 1:**..... Convert three-phase loads into three equal per-phase loads by multiplying them by 0.58 (Or dividing them by $\sqrt{3}$).
- Step 2:**..... Add all line to neutral loads for each affected leg.
- Step 3:**..... Determine the 25% of Long Continues Loads (LCL). The LCL loads are generally the lighting loads that are connected between line-to-neutral.
- Step 4:**..... Add all per-phase and single-phase (line-to-line) power loads together to determine the subtotal per-phase load.
- Step 5:**..... Determine the 25% of the largest motor load (LML) per-phase (when motors are present).
- Step 6:**..... Add the LML (when motors are present) of each phase to the subtotal per-phase load of Step 4 to find the total per-phase load.
- Step 7:**..... Convert the total per-phase and line-to-neutral power loads to the equivalent per-phase and line to neutral currents.

Method I: This method uses multiplying factors based on the unbalanced load. This factor is applied to the total load to determine the line current.

Step 8:..... Determine the line currents I_1, I_2, I_3 in terms of $M_1, M_2,$ and M_3 using the following equations:

$$I_{L1} = (I_{\phi B} + I_{\phi A}) \times M_1 \quad (1)$$

$$I_{L2} = [(I_{\phi C} + I_{(L2-N)}) + I_{\phi B}] \times M_2 \quad (2)$$

$$I_{L3} = [(I_{\phi C} + I_{(L3-N)}) + I_{\phi A}] \times M_3 \quad (3)$$

Where M_1, M_2, M_3 are the unbalanced load multiplying factors, and $I_{\phi A}, I_{\phi B}, I_{\phi C}, I_{(L2-N)},$ and $I_{(L3-N)}$ are the corresponding current values for the $\phi_A, \phi_B, \phi_C, (L_2-N)$ and (L_3-N) .

Step 9:..... Determine the M_1, M_2, M_3 unbalanced multiplying factors using the following equations:

$$M_1 = I_{\phi C} / I_{\phi A} \text{ or } I_{\phi A} / I_{\phi C} \quad (4)$$

$$M_2 = (I_{\phi C} + I_{(L2-N)}) / I_{\phi B} \text{ or } I_{\phi B} / (I_{\phi C} + I_{(L2-N)}) \quad (5)$$

$$M_3 = (I_{\phi C} + I_{(L3-N)}) / I_{\phi A} \text{ or } I_{\phi A} / (I_{\phi C} + I_{(L3-N)}) \quad (6)$$

Use a ratio which yields a multiplying factor larger than 1 ($M_1, M_2, M_3 > 1$).

Step 10: Choose a multiplying factor for unbalance loads from the following Table B using the ratios ((4), (5) and (6)) as determined in Step 9:

#	Ratio	M ₁	Ratio	M ₂ or M ₃
1	Not more than 1.7 to 1	0.87	Not more than 2.1 to 1	0.88
2	Not more than 2.6 to 1	0.89	Not more than 3.0 to 1	0.89
3	Not more than 3.3 to 1	0.90	Not more than 3.3 to 1	0.90
4	Not more than	0.92	Not more than 5.3 to 1	0.92
5	Not more than 7.3 to 1	0.94	Not more than 7.3 to 1	0.94
6	Not more than 9.3 to 1	0.95	Not more than 9.5 to 1	0.95
7	Not more than 12.5 to 1	0.96	Not more than 13.7 to 1	0.96
8	Not more than 18.2 to 1	0.97	Not more than 19.3 to 1	0.97
9	Not more than 32.0 to 1	0.98	Not more than 32.0 to 1	0.98
10	Over 32.0 to 1	1	Over 32.0 to 1	1

Table B

Step 11: Substitute M₁, M₂, M₃ values found in Step 10 in line current values determined in Step 8 ((1), (2) and (3)) to find the line current magnitudes. Choose the largest line current to size the service entrance conductors, service equipment, feeders and panel board ampacity.

Method II: This method utilizes the following equations to determine the line currents.

$$I_{L1} = \sqrt{(I_{\phi A})^2 + (I_{\phi B})^2 + (I_{\phi A} \times I_{\phi B})} \quad (7)$$

$$I_{L2} = \sqrt{(I_{\phi B})^2 + (I_{\phi C} + I_{(L2-N)})^2 + (I_{\phi B}) \times (I_{\phi C} + I_{(L2-N)})} \quad (8)$$

$$I_{L3} = \sqrt{(I_{\phi C} + I_{(L3-N)})^2 + (I_{\phi A})^2 + (I_{\phi C} + I_{(L3-N)}) \times (I_{\phi A})} \quad (9)$$

Where I_{L1}, I_{L2} and I_{L3} are the line currents, I_{φA}, I_{φB}, I_{φC} are the phase currents and I_(L2-N), I_(L3-N) are the line-to-neutral currents (L2-N is line 2 to Neutral and L3-N is the line 3 to Neutral).

Alt-Step 8: Determine per-phase as well as line-to-neutral currents values (I_{φA}, I_{φB}, I_{φC}, I_(L2-N) and I_(L3-N)) following Steps 1 through 7.

Alt-Step 9: Substitute the value of the per-phase and line-to-neutral currents in equations (7), (8) and (9) to determine the magnitude of the line currents I_{L1}, I_{L2} and I_{L3}.

Alt-Step 10: ... The service entrance conductor, service equipment, feeders and panel board ampacity shall be based on the largest line current magnitude.

EXAMPLE 2

3φ, 4 WIRE DELTA SYSTEMS

A building panel board is supplied by a 3φ, 4W 120/240 volt source. The connected loads (figure B) are as follows:

Description	1φ Line-to-Neutral Load Current	1φ Line-to-Line Load Current	3φ Load Current
Copier		14.58 A	
Coffee Maker		12.50 A	
5 HP - A/C Unit			15.2 A
10 HP - Lathe Machine			28.0 A
Drinking Fountain		13.33 A	
Lights (to be divided into three circuits)	37.5 A		
Receptacles (to be divided into two circuits)	33.0 A		

What are the acceptable minimum panel rating and its feeder size? See panel schedule B for load distribution.

In solving this problem both Methods I and II are used.

The following solution is based on Method I:

Step 1:..... Convert all three-phase (3φ) loads into three equal per-phase loads and reflect the result in the panel schedule. (Note: φ = phase)

1. 5 HP - A/C Unit = $15.2 \text{ A} \times 0.58 = 8.82 \text{ A}/\phi \times 240 \text{ V} \approx 2116 \text{ W}/\phi$.
2. 10 HP - Lathe Machine = $28.0 \text{ A} \times 0.58 = 16.24 \text{ A}/\phi \times 240 \text{ V} = 3884 \text{ W}/\phi$.

Then convert all single phase current loads to single phase power loads as follows:

3. 14.58 A - Copier = $14.58 \text{ A} \times 240 \text{ V} \approx 3500 \text{ W}$
4. 12.50 A - Coffee Maker = $12.50 \text{ A} \times 240 \text{ V} = 3000 \text{ W}$
5. 13.33 A - Drinking Fountain = $13.33 \text{ A} \times 240 \text{ V} \approx 3200 \text{ W}$

And finally convert the line-to-neutral loads to their equivalent power loads as follows:

6. 37.5 A - Total lighting load = $37.5 \text{ A} \times 120 \text{ V} = 4500 \text{ W}$
7. 33.0 A - Total receptacle load = $33.0 \text{ A} \times 120 \text{ V} = 3960 \text{ W}$

The three phase, single phase and line-to-neutral load distribution are shown in panel schedule B.

Step 2: Add all line to neutral loads for each affected leg.

Step 3: Determine the 25% of Long Continuous Loads (LCL). The LCL load in this case is the lighting load shown in bold in panel schedule B.

Step 4: Add all per-phase and single-phase (line-to-line) power loads together to determine the subtotal per-phase load.

Step 5: Determine the 25% of the largest motor load (LML) per-phase. The LML load in this case is indicated in bold italics in panel schedule B.

Step 6: Add the LML of each phase to the subtotal per-phase load of Step 4.

Step 7: Convert the total per-phase and line-to-neutral power loads to the equivalent per-phase and line-to-neutral currents as follows:

$$1. \quad I_{(L3-N)} = 5670 \text{ W} / 120 \text{ V} = 47.25 \text{ A}$$

2. $I_{(L2-N)} = 3915 \text{ W} / 120 \text{ V} = 32.63 \text{ A}$
3. $I_{\phi A} = 9971 \text{ W} / 240 \text{ V} = 41.55 \text{ A}$
4. $I_{\phi B} = 10471 \text{ W} / 240 \text{ V} = 43.63 \text{ A}$
5. $I_{\phi C} = 10171 \text{ W} / 240 \text{ V} = 42.38 \text{ A}$

Step 8:..... Determine the line currents using equations (1), (2) and (3):

$$\begin{aligned}
 I_{L1} &= (43.63 + 41.55) \times M_1, \text{ So,} & I_{L1} &= 85.18 \times M_1, \text{ Amperes.} \\
 I_{L2} &= [(42.38 + 32.63) + 43.63] \times M_2, \text{ So,} & I_{L2} &= 118.64 \times M_2, \text{ Amperes.} \\
 I_{L3} &= [(42.38 + 47.25) + 41.55] \times M_3, \text{ So,} & I_{L3} &= 131.18 \times M_3, \text{ Amperes.}
 \end{aligned}$$

Step 9:..... Determine the M_1, M_2, M_3 unbalanced multiplying factors using equations (4), (5) and (6) as follows:

$$\begin{aligned}
 M_1 &= I_{\phi B} / I_{\phi C} = 43.63 / 41.55 \approx 1.05 \\
 M_2 &= [(I_{\phi C} + I_{(L2-N)}) / I_{\phi B}] = (42.38 + 32.63) / 43.63 = 75.01 / 43.63 \approx 1.72 \\
 M_3 &= [(I_{\phi C} + I_{(L3-N)}) / I_{\phi A}] = (42.38 + 47.25) / 41.55 = 89.63 / 41.55 \approx 2.16
 \end{aligned}$$

Step 10: From Table 2 choose the multiplying factor for unbalance loads based on the ratio determined in Step 9. The multiplying factors will be as follows:

1. For $M_1 \approx 1.05$,..... use multiplying factor 0.87
2. For $M_2 \approx 1.81$,..... use multiplying factor 0.88
3. For $M_3 \approx 2.16$,..... use multiplying factor 0.89

Step 11: Substitute M_1, M_2, M_3 values found in Step 10 in line current values determined in Step 8 to find the line current magnitudes as follows:

1. $I_{L1} = (85.18) \times M_1 = 85.18 \times 0.87 \approx 74.11 \text{ A}$
2. $I_{L2} = (118.64) \times M_2 = 118.64 \times 0.88 \approx 104.40 \text{ A}$
3. $I_{L3} = (131.18) \times M_3 = 131.18 \times 0.89 \approx 116.76 \text{ A}$

The service entrance conductor, service equipment, feeders and panel board ampacity shall be not less than **116.76 A**.

The following solution is based on Method II:

Alt-Step 6:..... Following Steps 1 through 7 in method I the per-phase and line-to-neutral current values ($I_{\phi A}, I_{\phi B}, I_{\phi C}, I_{(L2-N)}$ and $I_{(L3-N)}$ in amperes) are found to be:

$$I_{\phi A} = 41.55 \quad I_{\phi B} = 43.63 \quad I_{\phi C} = 42.38 \quad I_{(L2-N)} = 32.63 \quad I_{(L3-N)} = 47.25$$

Alt-Step 7:..... Substitute the value of the per-phase and line-to-neutral currents ($I_{\phi A}, I_{\phi B}, I_{\phi C}, I_{(L2-N)}$ and $I_{(L3-N)}$) in equations (7), (8) and (9) to find the magnitude of the line currents I_{L1}, I_{L2} and I_{L3} as follows:

$$\begin{aligned}
 I_{L1} &= \sqrt{(41.55)^2 + (43.63)^2 + (41.55 \times 43.63)} = 73.78 \text{ A} \\
 I_{L2} &= \sqrt{(43.63)^2 + (42.38 + 32.63)^2 + (43.63) \times (42.38 + 32.63)} = 103.94 \text{ A} \\
 I_{L3} &= \sqrt{(42.38 + 47.25)^2 + (41.55)^2 + (42.38 + 47.25) \times (41.55)} = 116.12 \text{ A}
 \end{aligned}$$

Alt-Step 8:..... The service entrance conductor, service equipment, feeders and panel board ampacity shall be sized based on the largest line current magnitude **116.12 A**.

Panel B		125 A - Main lug	120/240 V - 3 ϕ , 4W			
CKT. NO.	CB/POLE	DESCRIPTION	ϕ_A (L ₃ -L ₁)	ϕ_B (L ₁ -L ₂)	ϕ_C (L ₂ -L ₃)	
			Watts	Watts	L ₃ -N	N-L ₂
1	20/1	LIGHTS			1800	
2	20/1	RECEPTACLES				1260
3	20/2	COPIER		3500		
4						
5	20/2	COFFEE MAKER	3000			
6						
7	30/3	5 HP - 15.2 A 3 ϕ A/C UNIT	2116			
8				2116		
9						2116
10	40/3	10 HP - 28 A 3 ϕ LATHE MACHINE	3884			
11				3884		
12						3884
13	20/1	LIGHTS			1440	
14	20/1	LIGHTS				1260
15	20/1	RECEPTACLES			1620	
16	20/1	RECEPTACLES				1080
11	20/2	DRINKING FOUNTAIN				
12						3200
SUBTOTAL L-N: LOAD:					4860	3600
SUBTOTAL LOAD:			9000	9500	9200	
LCL L-N LOADS:					810	315
LML 3 ϕ LOADS:			971	971	971	
TOTAL L-N W/LCL:					5670	3915
TOTAL 3 ϕ W/LML:			9971	10471	10171	

Panel Schedule B

$I_{L1} = 0.87 (43.63 + 41.55) = 74.11 \text{ A}$
 Required Ampacity = 116.76 A

ϕ_A LOADS:
 3200 W
 2116 W
 3884 W
 (971 LML W)
 Total: 41.55 A

ϕ_B LOADS:
 3500 W
 2116 W
 3884 W
 (971 LML W)
 Total: 43.63 A

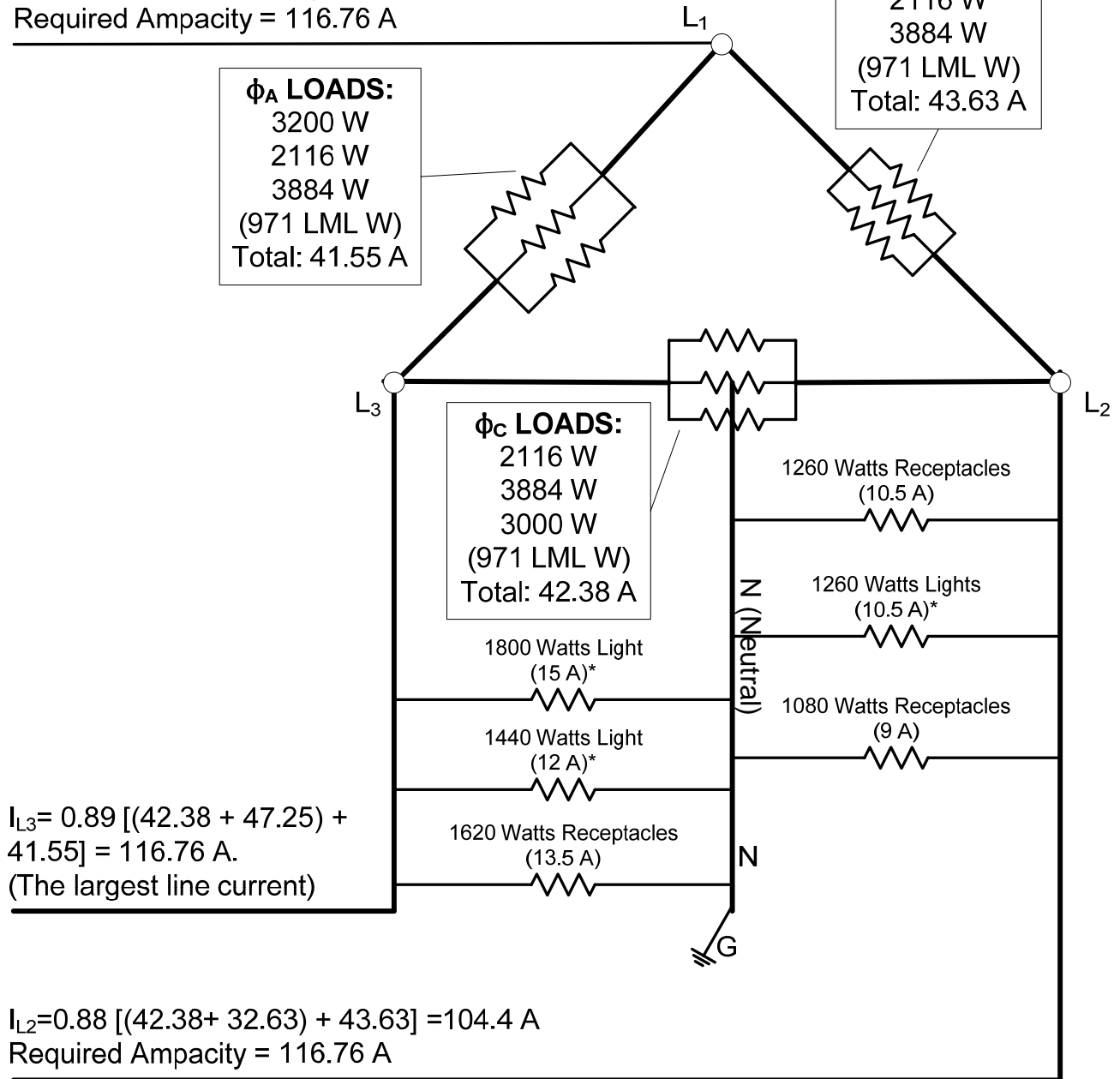


Figure B

* These loads are considered as Long Continuous Loads (LCL).