Montana Department of
LABOR & INDUSTRY

ELECTRICAL INFORMATION

2017 NEC Edition

Chapter 60

Building Code Standards Part 6

Electrical Installations

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50-60-601. Purpose. The purpose of this part is to protect the health and safety of the people of this state from the danger of electrically caused shocks, fires, and explosions; to protect property from the hazard of electrically caused fires and explosions; to establish a procedure for determining where and by whom electrical installations are to be made; and to insure that the electrical installations and electrical products made and sold in this state meet minimum safety standards.

50-60-602. Exceptions.

(1) This part does not apply to:

(a) the installation, alteration, or repair of electrical signal or communications equipment and traffic signals, street lighting, and other electrical traffic control devices owned or operated by a public utility, city, or county or the state;

(b) electrical installations on the premises of petroleum refineries, except a structure classified under chapter 7, section 701, group B, division 2, and chapter 9, section 901, group H, outside of process units, of the 1991 edition of the Uniform
Building Code;

(c) mines and buildings on mine property regulated under Title 82, chapter 4, and subject to inspection under the Federal Mine Safety and Health Act; or (d) the installation, alteration, or repair of low voltage electrical signal and communications
equipment and optical fiber cable.

(2) The inspection provisions of this part do not apply to regularly employed maintenance electricians doing maintenance work on the business premises of their employer nor do they apply to line work on the business premises of the employer or to ordinary and customary in-plant or onsite installations, modifications, additions, or repairs.

(3) A person who plugs in an electrical appliance where an approved electrical outlet is already installed may not be considered as an installer.

(4) This part does not in any manner interfere with, hamper, preclude, or prohibit any vendor of any electrical appliance from selling, delivering, and connecting any electrical appliance if the connection does not necessitate the installation of electrical wiring of the structure where the appliance is to be connected.

50-60-603. Electrical codes to be adopted by department by rule.

(1) The department of labor and industry shall adopt rules relating to the installation of wires and equipment to convey electrical current and installations of apparatus to be operated by current, except as provided in 50-60-602.

(2) The department may adopt by reference the national fire protection association standard NFPA 70, national electrical code, in whole or in part, and may adopt rules more stringent than those in the national fire protection association standard NFPA 70, national electrical code.

50-60-604. Inspections -- electrical permits -- fees. The department of labor and industry or an authorized representative or a county, city, or town certified to perform an inspection pursuant to 50-60-302 shall inspect electrical installations, issue electrical permits for these installations, and establish and charge a reasonable and uniform fee for the inspections. The fee must be commensurate with the expense of providing the inspection and with appropriations for other

purposes. As part of any inspection, the inspector shall require proof of licensure from any person who is required to be licensed who is involved with or, in the inspector's judgment, appears to be involved with electrical installations if the person is on the site. The inspector shall report any instance of license violation to the inspector's employing agency, and the employing agency shall in turn report the violation to the board of electricians.

50-60-605. Power supplier not to energize installation without electrical permit. Individuals, firms, cooperatives, corporations, or municipalities selling electricity are power suppliers. Except for temporary connections that the department of labor and industry may authorize by rule for a period not exceeding 14 days without a preconnection inspection, power suppliers may not connect with or energize an electrical installation under this part unless the owner or a licensed electrical contractor has delivered to the power supplier an electrical permit covering the installation, issued by the department of labor and industry or a county, city, or town certified to enforce the electrical code pursuant to 50-60-302.

50-60-607. Energizing electrical installation without permit -- misdemeanor. Any person, partnership, company, firm, association, or corporation, other than a power supplier, that energizes an electrical installation under this part for which an electrical permit has not been issued by the department of labor and industry or a county, city, or town certified to enforce the electrical code pursuant to 50-60-302 is guilty of a misdemeanor.

50-60-608. Injunction authorized. The use or installation of wires or equipment conveying electrical current or the use or installation of any apparatus operated by electrical current in violation of any provision of this part or a lawful order of a state or local government building official may be enjoined by a judge in the district court of the judicial district in which the wires, equipment, or apparatus is located.

Electrical Requirements

24.301.401 INCORPORATION BY REFERENCE OF NATIONAL ELECTRICAL CODE

(1) The department adopts and incorporates by reference the National Fire Protection Association Standard NFPA 70, National Electrical Code, 2017 edition referred to as the National Electrical Code, unless another edition date is specifically stated. The National Electrical Code is a nationally recognized model code setting forth minimum standards and requirements for electrical installations.

(2) Subsection 210.12, Arc-Fault Circuit-Interrupter Protection, is amended to delete all references to "kitchen" or "kitchens."

(3) A copy of the National Electrical Code may be obtained from the National Fire Protection Association at www.nfpa.org/NEC.

24.301.402 DEFINITIONS

(1) For the purposes of this subchapter, the following definitions shall apply:

(a) “Maintenance Work” means the ordinary and customary in-plant or onsite installations, modification, additions, or repairs, which shall be limited to: relamping fixtures, replacing ballasts, trouble-shooting motor controls, replacing motors, breakers, magnetic starters, in a kind-for-kind manner. “Maintenance Work” will also include the connection of listed factory assembled equipment that can be directly connected to an existing branch-circuit or panelboard by means of a factory-installed lead. If a new circuit is required to operate the equipment, or if the size of the supply conductors needs to be increased, this will be considered new work and not “Maintenance Work”.

(b) “Permittee” means the property owner that is responsible for the installation of electrical wiring and equipment authorized by an electrical permit, or the license holder named as the “Responsible Licensed Electrician” for an “Electrical Contractor” who is responsible for the installation of electrical wiring and equipment authorized by an electrical permit. On farm and ranch installations used in conjunction with an agricultural or livestock raising operation, the term "Permittee" will mean the owner, owner's agent, and/or person(s) employed by the owner on a full-time basis as a farm or ranch employee(s) at the farm or ranch involved.

(c) “Provisional Power” means the connection of electrical power to any part of a premises wiring system from any source of energy prior to the final inspection and approval of the installation by the electrical inspector.

(d) “Rental Property” means any property utilized by the owner or any person(s) for other than the owner’s personal use with or without the consideration of compensation for the use.

(e) "State Electrical Code" means the edition of the National Electrical Code or any other model electrical code, which is adopted, and as it may be modified by the department for use as a construction standard in and by Montana's electrical
industry.

24.301.411 WIRING STANDARDS

(1)The National Electrical Code is amended as follows:

(a) NEC Article 110.2 (SUPPLEMENTARY). When requested, complete wiring diagrams shall be provided prior to installation of conductors and equipment indicating the conductor’s and equipment’s intended use.

(b) NEC Article 550.32(A): The allowable distance for service equipment from the exterior wall of a manufactured or mobile home is increased from 30 ft (9.14 m) to 50 ft (15.24 m).

(c) NEC Article 550.33(A): Add the following: It shall be permissible to feed a manufactured (mobile) home with type SER cable when the service equipment is mounted on the exterior of the home. Physical protection of the cable is required by enclosing the cable in an approved raceway where the cable is run on the outside of the home. The cable is to be properly supported and attached per Article 338 where installed under the home.

(d) NEC Article 760.1 (SUPPLEMENTARY) Smoke alarms shall be installed in any building or structure as required under the currently adopted International Building Code or International Residential Code, whichever applies, regardless of whether or not the building or structure is exempt by 50-60-102 MCA.

24.301.421 ELECTRICAL INSPECTORS

(1) Only persons appointed by the department shall act as electrical inspectors to represent the state of Montana.

(2) Inspectors shall give information as to the meaning or application of the code to

contractors, electricians, or owners for whom the inspectors perform compliance inspections. The inspector shall not design circuitry or perform engineering tasks for the permittee.
(3) State electrical inspectors shall not inspect any electrical work in which they have any financial or personal interest, or which they have installed or repaired.
(4) State electrical inspectors shall have powers as are vested in them by the department, including but not limited to the power to make inspections and to ascertain that none of the provisions of Title 50, Chapter 60, Part 6, MCA, the National Electrical Code, as amended from time to time, or the Administrative Rules of Montana, Subchapter 4, Electrical Requirements are being violated.
(5) A state electrical inspector has the right, during reasonable hours while showing proper identification, to enter any building or premise in the discharge of the inspector's official duties to make any inspection or test of electrical equipment that is necessary to protect the public health, safety, and welfare.

24.301.431 ELECTRICAL PERMIT
(1) Except as provided by 50-60-602 MCA, an electrical permit is required for any installation in any new construction or remodeling or repair.
(2) Prior to the commencement of any electrical installation, in an area where the electrical code is enforced by the department, the permittee shall submit an official and complete request for electrical permit to the department in Helena with fee(s) as provided in 24.301.461 ARM. If the permittee fails to obtain a permit for an electrical installation, a "Failure to Permit Investigation Fee" may be required in addition to the standard permit fee. Electrical permit forms will be made available by the department and may also be available at any power supplier or from the electrical inspector.
(3) The term "permittee" listed in 24.301.431(2) ARM applies to the owners doing electrical work on their own residence, farm, or ranch property provided that said property is maintained for their personal, private use. The property or residence shall not be built on speculation of resale or intended as rental property.
(4) A local government certified to enforce the electrical code may require, in addition to the electrical permit required by 50-60-605 MCA, the power supplier be provided with proof of an approved inspection before the power supplier can energize the electrical installation. The local government shall provide the power
supplier with written notice of this requirement if it wishes to enforce this option.
(5) The requirements listed in 50-60-605 MCA, requiring an "electrical permit" before the energizing of an electrical installation by a power supplier means the power supplier may energize said installation with provisional power, before an inspection has been performed by the department, after issuing a power supplier
limited service certificate as allowed in 24.301.472 ARM, or upon receipt of the power supplier's copy of the electrical permit issued by the department.
(6) An individual that energizes an electrical installation without first obtaining an electrical permit for that installation is guilty of a misdemeanor per 50-60-607 MCA. The bureau may require a utility per 50-60-605 MCA to not energize or to remove provisional power from the permittee's electrical system if the permittee connects new wiring to a new or existing power source, thereby causing the utility to energize the electrical installation without first receiving a permit for the connection.
(7) Upon receipt of the application for an electrical permit with the applicable fee(s), the department will issue the official electrical permit covering the installation.

(8) The permittee shall be responsible for all work performed under the electrical permit, and shall ensure that all work meets the requirements of the National Electrical Code, as amended by the version of 24.301.411 ARM in effect at the time the permit was issued. No permittee shall allow any other person to do, or cause to be done, any work under an electrical permit issued to the permittee, except the permittee or the permittee's employees who are licensed as an electrician or registered as an electrical apprentice.
(9) Electrical permits are valid for a period of eighteen months from the date of issuance. One renewal of 18 months may be granted by the department as long as the application for renewal is made not more than 30 days following expiration of the original permit. Original electrical permits expire after 18 months from the date of issuance if not renewed. Renewed electrical permits will expire 18 months after the renewal date.
(10) The electrical permit is transferable with application for permit transfer being made in writing on forms provided by the department and the payment of a $20.00 transfer fee. The permit transfer shall be completed prior to the subsequent permittee commencing work under the transferred permit.
(11) The exception to permit requirements listed in 50-60-602(2) MCA, for regularly employed maintenance personnel doing maintenance work on the business premises applies to personnel on the regular payroll rather than personnel under contract.
(12) No electrical permit shall be issued for a building or structure under the jurisdiction of the department until the building permit has been issued for said building or structure or it has been determined that a building permit is not required or special circumstances exist which make issuance of the permit appropriate.

24.301.441 COVER (ROUGH-IN) INSPECTIONS

(1) Cover (rough-in) inspections are made by a state electrical inspector wherever possible. Insulation and wallboard shall not be applied prior to inspection unless 48 hours, excluding Saturdays, Sundays and holidays, have expired after the electrical installation is complete and notice to inspect has been received.
(2) The permittee of record, whether an electrical contractor or a homeowner, shall notify the area electrical inspector when the electrical installation is ready for cover (rough-in) inspection, whether or not an inspection is subsequently performed.
(3) Whenever violations are found upon inspection, the inspector will notify the permittee verbally, with a written inspection report, or a written compliance order as to the nature of the violations.
(4) Provisional power may be removed from the installation if the code violations discovered during the cover (rough-in) inspection are of such a nature to be considered an immediate threat of fire to the structure or shock hazard.

24.301.451 FINAL INSPECTION

(1) The permittee of record, whether an electrical contractor or a homeowner, shall notify the area electrical inspector when the electrical installation is ready for final inspection and provide access to the installation for inspection or furnish the necessary information as to who can provide access to the installation.
(2) Upon completing final inspections, state inspectors will date and sign the inspection reports. Inspectors will apply a green “approved” tag when installations have been inspected and approved by the department. Inspectors will apply an orange “conditionally approved” tag to those

installations that violate the cover inspection provision as provided in 24.301.441 ARM. Upon approval, the department will remove the provisional power designation.

(3) If the installation is disapproved, inspectors will provide the permittee with notice of the reasons for disapproval. After correcting the cause for disapproval, the permittee must make a request for reinspection to the department. Failure to make corrections or request the final reinspection may cause the department to cancel the provisional power. When the inspector approves the corrected installation as identified on the permit and inspection documents, the inspector will apply the proper final inspection tag to the installation and the department will remove the "provisional power" designation.

24.301.461 ELECTRICAL INSPECTIONS FEES

(1) The following is the schedule of electrical inspection fees as charged by the department. As provided in 24.301.203 ARM local governments certified to enforce the electrical code may establish their own electrical permit fees.

Type of Installation	**Permit Fee**
(a) single-family dwellings or cabins (includes attached garage if wired at the same time as the house or cabin) A cabin is a structure designed for use for overnight stays that may not meet the definition of a dwelling unit.)	
(i) up to 200 amp service	$200.00
(ii) 201 to 400 amp service	$380.00
(iii) 401 to 600 amp service	$600.00
(iv) 601 and up amp service	$800.00
(b) private property accessory buildings (includes new service or upgrade of existing service for supply of power to garages, barns, sheds, etc.)	
(i) up to 200 amp panel	$80.00
(ii) 201 to 300 amp panel	$150.00
(iii) 301 or more amp panel	$250.00
(c) multi-family dwellings (duplex through 12 units) per bldg*	
(i) up to 200 amp service	$180.00
(ii) 201 to 400 amp service	$380.00
(iii) 401 to 600 amp service	$580.00
(iv) 601 and up	$780.00

*Plus $60 per unit, up to and including 12 units.

*For buildings containing more than 12 units, use the commercial schedule that follows.

(d) multi-family dwellings (duplex through 12 units) rewire or remodel only - per dwelling unit	$100.00
(e) single family dwelling interior/exterior wiring/rewiring	
(i) more than three circuits and change of service and/or interior panelboard	$120.00
(ii) more than three circuits only, (does not include change of service or panelboard)	$100.00
(iii) two or three additional circuits or pieces of equipment only	$70.00

(iv) one additional circuit or piece of equipment (hot tub, air conditioner, etc) $45.00

(f) change of service

(i) exterior meterbase and interior/exterior main disconnect only $45.00

(ii) exterior meterbase and interior/exterior main disconnect with feeder and distribution panelboard replacement $75.00

(g) modular homes, mobile homes, and recreational vehicles

(i) wiring to a mobile or modular home with wiring of a basement and/or addition at the same time $120.00

(ii) wiring to a mobile, modular, or RV only on privately owned property $80.00

(iii) wiring to a mobile or RV on rental space at a licensed court with previously existing electrical service $40.00

(h) mobile home courts and/or recreational vehicle parks (new, rewire or addition)

(i) first 3 spaces (1-3 spaces) $45.00

(ii) additional spaces over 3 spaces installed at the same time (per space) $5.00

(i) New service and wiring for utilization equipment such as livestock well, residential irrigation well, etc. $50.00

(j) agricultural irrigation pumps or machines on a common service

(i) one pump or one pivot) $50.00

(ii) multiple pumps or pivots $50 for first pump or pivot plus $25 for each additional piece of equipment supplied by a common service. (Note: A separate permit is required for each service installed supplying either a single piece of equipment or a combination of equipment.)

(k) permit renewal fee $60.00

(l) refund/credit fee $25.00

(m)) permit transfer fee $20.00

(n) failure to permit investigation fee $45.00/Hr

(o)) Renewable energy system: net metering system or off-grid electrical generating system (photovoltaic (PV) system, wind generator, hydro turbine, etc.)

(i) Commercial or residential installations $65

(p) all other installations (commercial, industrial, institutional, or for public use). Fees are based on total cost to the owner of all labor and materials to complete the electrical project. Electrical materials furnished by the owner must be included in the total electrical project cost:

Cost of Electrical Installation	**Fee**
$ 0 - $1,000	$45 for 1st $500 + 6% of balance over $500
$ 1,001 - $10,000	$75 for 1st $1000 + 2% of balance over $1000
$10,001 - $50,000	$255 for 1st $10,000 + 0.5% of balance
$50,001 or more	$455 for 1st $50,000 + 0.3% of balance

(q) Provisional construction service $60.00 (Note: A provisional construction service permit may only be closed *when the permit expires and power is removed or upon the permittee obtaining a new permit applicable for the wiring*

of the structure being built. *The utility power supplier shall be ordered by the inspector to remove power from a "Provisional construction service" upon expiration of the permit*, if no additional permit has been obtained.

(1) A requested inspection is limited to the inspection of existing electrical installations that the owner or occupant may wish to have inspected. The fee for a requested inspection is payable prior to or at the time of the inspection. The fee for a requested electrical inspection is $60.00, provided that such service including all time spent preparing all paperwork furnished as documentation by the inspector regarding the inspection is not in excess of one hour in duration, and then $30.00 for each 30 minutes or fractional part thereof in excess of one hour. Travel and per diem will also be charged at the rates established under Title 2, chapter 18, part 5, MCA, when considered by the department to be applicable for the situation.

4.301.481 CARNIVALS, FAIRS, OUTDOOR CONCERTS AND SIMILAR AMUSEMENT ESTABLISHMENTS AND OTHER PUBLIC ASSEMBLIES OF A TEMPORARY NATURE

(1)) Temporary electrical power and lighting installations may be permitted for a period not to exceed 30 days. The installation must comply with Article 525 of the National Electrical Code.
(2) The electrical inspection fee for each temporary installation shall be $45 for the entirety of the temporary installation, provided that such inspection can be completed within one hour. If additional inspection time is required, it will be charged at the rate of $25 for each additional 30 minutes or fractional parts thereof.
(3) Each time a temporary amusement or public assembly electrical installation is erected or relocated, another electrical inspection will be required.

24.301.491 REFUNDS OR CREDITS
(1) No permit fee shall be refunded nor credit issued for a permit if the value of the permit does not exceed $25.
(2) A permit with a value which exceeds $25 may be refunded or credited, at the discretion of the department, less the $25 refund/credit fee.
(3) A refund or credit issued for a permit fee on a project, which was inspected by the department, shall have the refund or credit prorated at the rate of $45 per required inspection performed, in addition to the $25 refund/credit fee.
(4) No refund or credit for permit fees shall be issued for duplicate permits, when the permittee failed to transfer the original permit pursuant to 24.301.431(10) ARM and a subsequent permit was obtained for the same project.
(5) The department may suspend or revoke a permit when the permit was issued in error or issued on the basis of incorrect information. Suspended or revoked permits shall not be issued a refund or credit.

Clarification of NEC Interpretations and Requirements Based on the 2017 NEC

1. **Poles/Pedestals as Structures – Article 225.31 and 225.32.** When the service from a power supplier is mounted on a pole or delivered to a pedestal containing an overcurrent device and disconnecting means, the pole or pedestal is considered to be a structure and the service point. The wires between the pole or pedestal and the other structures on the property are feeders and a disconnect is required on each structure (Article 225.31). The point of entry may be in a crawl space provided the cable is properly buried in conduit (Article 300.5(C)) beneath the structure. The panel is to be located as close as practicable to the point of entry on the first floor level, directly above the point of entry in the crawl space. Panel placement shall meet all other applicable code requirements. Concrete encasement is not a requirement for protection of a feeder. All grounding and bonding requirements shall apply (see Article 250).

2. **Six (6) Disconnect Rule – Article 230.71(A) and 225.33(A).** The six (6) disconnect rule shall apply to a structure as well as the service when multiple structures are on the property. The removal of extra bussing in an enclosure is not required even though more than six (6)

disconnects could be installed. If six (6) or fewer disconnects are installed, the installation may be approved. When future installations are connected to the panelboard, creating more than six (6) disconnects, a panel main disconnect shall be installed.

3. **Feeders from Service Point – Article 240.4.** Conductors are to be protected at their allowable ampacities per Article 310.15, unless otherwise permitted or required in Article 240.4(A) through (G). When a pole or pedestal is used as a service point, all wiring beyond this point on the property is a branch circuit or feeder.

4. **Multiple Structure Grounding – Article 250.32.** An equipment grounding conductor 4th wire (green insulated or bare copper for other than agricultural buildings) shall be installed with the feeder between multiple structures fed from a common service located on the same property (250.32(B)). A grounding electrode system is required at each structure, unless the structure supply is a single branch circuit (Article 250.32(A) Exception).

5. **Grounding of Ranges and Clothes Dryers - Articles 250.134 and 250.138.** All new installations for electric ranges and clothes dryers shall utilize an equipment grounding conductor to ground the frames of the equipment. This will require the installation of 4-wire receptacles when the appliance is cord connected. The bonding jumper in the appliance must be removed when the appliance is connected to the electrical system.

6. **Bonding of Service Equipment – Article 250.92.** All metallic raceways and enclosures of the service shall be bonded together by methods listed in section 250.92(B). The service equipment ends at the enclosure that contains the service disconnect. A raceway used to enclose a feeder or branch circuit is not required to meet the service enclosure bonding requirements (Article 250.96).

7. **Bonding of Water Piping and Exposed Structural Steel – Article 250.104(A) and (C)**. The metallic water piping system and any exposed structural steel inside a building shall be bonded with a conductor sized per Table 250.66 when the service is mounted on the building. In a building fed by a feeder, the conductor shall be sized per Table 250.66 based on the size of the feeder. Due to the various types of water piping materials in use today, both the hot and cold water piping systems shall be bonded together.

8. **Metal Gas Piping and Other Metallic Piping Systems – Article 250.104(B).** An equipment grounding conductor sized per Table 250.122 shall bond all other metallic piping inside the building. The equipment grounding conductor run with the branch circuit to the equipment may be used for the bonding purpose.

9. **Second Grounding Electrode – Article 250.53**. Due to the varied soil conditions found in Montana, a single grounding electrode does not insure that a "25 ohms or less" to ground is established. The installer may perform and furnish written test results (including Test diagrams), acceptable to the electrical inspector, in lieu of installing a second grounding electrode. This requirement is only applicable when electrodes described in Article 250.52 (A) (5) or (6) (rod, pipe, or plate) are the sole electrodes used. Electrodes described in

Article 250.52(A)(1),(2),(3),(4) (intentionally grounded steel, ground ring, rebar in footing, or water pipe with two (2) supplemental electrodes) do not require the above referenced verification.

10. **Bonding of Electrode Enclosures – Article 250.64(E).** Metallic raceways enclosing grounding electrode conductors shall be bonded at both ends to the grounding electrode conductor or the buss or electrode to which it is connected. This will eliminate an electrical choke effect. We suggest that you use PVC or staple a #6 or larger copper conductor directly to the surface of the structure.

11. **Free Conductor at Outlets – Article 300.14**. Six (6) inches of free conductor shall be left at each outlet, junction, or switch point. The measurement shall be from the point at which the conductor enters the box and there shall be at least three (3) inches of conductor extending outside the box.

12. **Box Fill – Article 314.16.** The numbers of conductors allowed in a box (box fill) shall be calculated in accordance with the guidelines set forth in this article. Box fill (capacity) is established in relation to the cubic inches in the box, conductor quantity, conductor size, fittings in the box, and the device used. The wire count(s) placed inside the box normally do not include the equipment grounds and devices.

13. **Appliance and Electric Heat Disconnects – Article 422.30 and 424.19.** A Branch circuit disconnect may be used for the required disconnect when in sight of the appliance (not more than 50 feet from) or equipped with an individual lockout, otherwise, a disconnect shall be at the appliance location. A double pole disconnect with a lockout provision permanently installed is required for electric heat of various types.

14. **Disconnect at Dispensing Equipment – Article 514.11**. (A)A switch or circuit breaker is required to disconnect simultaneously all conductors of all circuits leading to or passing through classified fuel dispensing equipment. This includes lighting circuits, sign circuits, or other conductors passing through the dispenser, including the grounded conductors. (B)An emergency disconnect is required not more than 100 feet from the dispenser(s) at an attended self-fueling station. (C)An emergency disconnect located between 20 and 100 feet from the dispenser(s) and an additional emergency disconnect on each island or group of dispensers are required at an unattended self-fueling station.

15. **Wiring methods for Fire Rated Buildings – Article 518.4.** The selection of a wiring method for places of assembly is not determined solely by the "100 or more occupancy" criteria. Article 518.4(B) allows for the use of romex and other wiring methods in areas that are not firerated. Certain buildings with occupancy of up to 300 persons may not be required to be fire-rated. The building code official having the jurisdiction shall establish the type of occupancy and construction for each building or structure. These assigned ratings will need to be considered in choosing a wiring method that will meet the code requirements.

16. **Size of Manufactured (Mobile) Home Feeders – Article 550.** Feeders to manufactured homes are to be installed per Article 550.10 and 550.32. 20

17. **Manufactured (Mobile) Home Skirting – Feeder Protection – Articles 550 and 300.5(D).** The feeder under a manufactured (mobile) home shall be protected from physical damage. The "skirting" of a manufactured home is not a raceway or electrical enclosure. Where not specifically addressed in Article 550, the underground feeder to a manufactured home is governed by the general rules in Chapters 1-4 of the National Electrical Code. Conductor raceways and enclosures are required under a manufactured home the same as required on any other emerging underground conductors.

18. **Manufactured (Mobile) Home Panel – Additional Equipment – Article 550.32(D).** The manufactured (mobile) home service equipment shall contain a means for connecting accessory buildings, structures, or electrical equipment located outside the home by a fixed wiring method. This does not prohibit the connection of additional exterior equipment to a manufactured Home interior electrical panel. Additional loads connected to the home panel shall be calculated to insure the panel and feeder have the capacity to supply the additional loads. The requirements found in Article 550 shall supersede the requirements found in other parts of this code.

19. **Bonding of Pools – Article 680.26.** All portions of a pool required to be bonded shall be bonded using "listed" pressure connectors or clamps of stainless steel, brass, copper, or copper alloy/

20. **Spas and Hot Tubs – Article 680.44**. A ground-fault circuit interrupter for personnel shall protect all spas and hot tubs.

Questions and Answers

The following is a general guide for the homeowner who is wiring his/her own single family dwelling. It is not intended to take the place of or cover all the possibilities allowed by the 2008 National Electrical Code. For further assistance contact your local inspector.

The Electrical Service

1. What does the owner provide for an overhead electrical service? The owner provides a weatherhead, mast, and hub attaching the mast to the meter/main panel and three (3) conductors properly sized for amperage. The mast needs to be of rigid conduit if it supports the Power Company supply line (drop) or extends above the roof. Check with your power supplier for their required size and type of conduit to be used for the mast. In addition, ground rods, ground wire and clamps are required.

2. What are the required clearances for an overhead service? The power company supply line (drop) shall be a minimum of 8' over flat roofs, 10' over pedestrian walk areas, 12' over other residential property, and 18' over alleys, public streets, and swimming pools. In addition, the drop shall be at least 10' laterally from the edge of the swimming pool and 3' laterally from a window used for egress, or a balcony.

3. What does the owner provide for an underground service? The owner provides an underground meter/main panel and schedule 80 PVC electrical conduit. The PVC conduit with connectors, locknut, and bushings at each end, extends 18" into a 24" deep trench. The underground wire is buried a minimum of 24". In addition, ground rods, ground wire, and clamps are required.

4. Where can the service equipment be located? Check with your power supply company to determine the direction your power company supply line (drop or lateral) will come from. The meter can be in the yard or on a building, even possibly a mobile home. According to most utility standards, the meter will need to be located between 5' and 6' from the ground level.

Table A – Service and Feeder Sizes

AMPERAGE	WIRE SIZE	PIPE SIZE
COPPER THWN		
100	4	1"
125	2	1"
150	1	1 1/4"
200	2/0	1 1/2"
ALUMINUM THWN		
100	2	1"
125	1/0	1 1/4"
150	2/0	1 1/2"
200	4/0	2"

Meters and Mains

1. Where should the main disconnect be located? The main disconnect needs to be located on the outside of the building or at the point where the conductors enter the building.

2. Do I need a main disconnect at each building if I have a meter/main in the yard? Yes, you still need a main disconnect at each building. If the house panel is not on an outside wall, you may bury PVC conduit 18" deep in the crawl space before coming straight up into the panel on the first floor level. If URD or USE conductors are used they need to be buried 24" deep outside the house. Do not run the feeder conductors in piping horizontally through the crawl space area without the disconnect being mounted on the outside of the structure.

3. What are the requirements for the feeder wires from the meter/main on the outside of the house to the breaker panel inside? The feeder size needs to match the amperage on the breaker. The four (4) conductors shall be in conduit or a SER cable. Connectors, locknuts, and bushings are required at each end. The feeder requires support every 4' and within 12" of a connector. The

SER cable shall be installed in a wall or ceiling for protection. All aluminum wire requires coating with a deoxidizing agent at all terminals and connections.

Grounding and Bonding

1. Where do the ground and neutral wires get bonded together? The ground wires and neutral wires are bonded together at the service disconnect only. An equipment grounding conductor is required to be run with all feeder and branch circuit conductors beyond the service disconnect. The grounded conductor (Neutral) can no longer be used as a grounding means for equipment.

2. What is the most commonly used grounding electrode system? The best grounding electrode is the rebar in the footing that is placed below frost level. A number 4 copper wire can be attached with a rebar clamp and enclosed in the concrete up to the service panel. In addition, a ground wire also attaches to the metal water piping system that has direct contact with the earth for a minimum of 10'. The connection is made within the first 5' of where the water piping enters the home. Refer to item 9 of "Interpretations and Requirements" for supplemental requirements if you have only the water pipe. A ground wire is attached with an acorn shaped clamp to a driven (5/8 X 8') ground rod. In the event of no metal water piping system or rebar connection, two driven ground rods shall be installed at least 6' apart and then connected with a #6 copper wire.

3. In addition to the grounding electrode system, what other bonding is required? The hot and cold metal water piping inside the home is to be bonded to the service or building disconnects. Well casings and pumps shall be bonded with approved lugs or clamps by the equipment ground wire in the branch circuit feeding them. All other metal piping systems inside the home are to be bonded by the branch circuit equipment grounding conductor feeding the appliance they are connected to.

4. What size grounding wires do I use?

Table B – Neutral and Ground Wire Sizes

Location To:	**Copper Aluminum**			
Amperage	**100**	**125**	**150**	**200**
Service Neutral	**6/4**	**4/2**	**3/1**	**1/00**
Ground Rod*	**8**	**8**	**6**	**6**
Ext. Water Piping	**8/6**	**8/6**	**6/4**	**4/2**
Rebar*	**8**	**8**	**6**	**4**
Int. Water Piping	**8/6**	**8/6**	**6/4**	**4/2**
Sub-Panel Ground	**8/6**	**8/6**	**8/6**	**6/4**
Sub-Panel Neutral	**6/4**	**4/2**	**3/1**	**1/00**
Service Bond Bushing	**8/6**	**8/6**	**6/4**	**4/2**

***Must use "Copper" only**

5. When shall electrical receptacles be grounded? All new electrical receptacles are to be grounded. If non-grounded receptacles are replaced in locations requiring GFCI protection (i.e. bathroom, near kitchen sink, garages, exterior outlets, etc., see GFCI list near back of booklet) a GFCI shall be installed on the non-grounded circuit.

Breaker Panels

1. Where can breaker panels be located? The panel has to be accessible and can not be located in a closet, cupboard, or bathroom. Panels require a 30 inches wide by 36 inches in front of clearance from the floor to the top of the panel (6 foot, 6 inches minimum).

2. When is a separate grounding bar required in a panel? The grounded conductors (white neutral wires) need to be isolated from the equipment grounding wires (green or bare metal) in breaker panels that do not contain the service disconnect. A separate grounding bar must be installed in these panels.

Installation of Wiring

1.What is required to protect Romex (NM-B) wiring? Stapled wires and bored holes for wiring shall be not less than 1 ¼ inches from the nearest edge of surfaces. When this clearance cannot be maintained, "nail plates" shall be installed.

2. What are the support requirements for Romex (NM-B) wires? Wires are considered supported when run through bored holes. Other wiring shall be stapled or secured every 4 foot 6 inches and within 12 inches of every box which has a connector or within 8 inches of a box without connectors.

3. How much wire should be left in a box to make connections to a device? Six inches of free conductor shall be left in the box, a minimum of three inches extending past the front of the box, with ¼ inch of the sheathing extending into the box.

4. How many wires and devices (conductors) will fit in a box for switches and outlets? Some manufacturers print the fill capacity on the back or bottom of the box (plastic). The fill capacity table in the box normally gives the total number of wire counts allowed in the box.

Cubic Inch requirements for Boxes by Wire Size

Cubic Inches for each	#10	#12	#14
Switch	5	4.5	4
Outlet	5	4.5	4
Wire	2.5	2.25	2
All Grounds	1.5	2.25	2

Example #12 wires:

1 Switch..... 4.50
All Grounds 2.25
2- 12 /2 NM- W/ground 9.00
1- 12/3 NM- W/ground 6.75
Total Cubic Inches Required…. .22.50

5. What are the requirements for installing boxes for lights, switches, outlets, and junctions? Boxes are required to be securely fastened and flush with the final (finished) surface. Junction boxes require covers and shall be accessible. Metal boxes require cable clamps and grounding.

6. Can outlet boxes be installed in the floor? Only those outlet boxes that are listed for floor installation may be put in the floor.

7. Is there a special box to be used with ceiling (paddle) fans? The box used to install a ceiling (paddle) fan is a special "listed" box and shall be securely fastened to a strong ceiling joist.

8. How many Romex can be placed in a bored hole? Bored (drilled) holes may contain no more than three (3) Romex cables that do not fill more than 50% of the hole.

Outlets, Switches, Lights, and Devices

Receptacles outlets

1. What is considered a wall space? A wall space is an area along the floor line that is not broken by doorways, sliding wall panels, or fireplaces. A fixed glass panel in a wall or an open railing area in a loft that is used as a wall in the room, will be considered as wall space for the purposes of determining the spacing of outlets.

2. Are tamper-resistant receptacles required? In every bathroom, laundry room, basement, garage, hallway, kitchen, pantry, breakfast room, family room, dining room, living room, parlor, library, den, sunroom, bedroom, recreation room, or similar room or area of a dwelling unit and outdoors, all 125-volt, 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

3. Where are general electrical outlets required? Every kitchen, dining room, bedroom, living room, family room, and similar location shall have a receptacle outlet located so that no point along the floor line is more than six (6) feet measured horizontally from an outlet, with no more than twelve (12) feet allowed between outlets. Any wall space longer than two (2) feet requires a receptacle outlet.

4. Can electrical outlets be located above electrical baseboard heaters? No, electrical outlets cannot be located above electric baseboard heaters. The outlets on these walls need to be arranged to meet the spacing requirements for receptacles. Outlets must be fed from circuits that do not feed the heaters. Most manufacturers make replacement end caps for their heaters with outlets built into them.

5. What is required for bathroom outlets? In dwelling units, all bathroom receptacles shall be GFCI protected. At least one receptacle outlet shall be installed within three (3) feet of the outside edge of each basin location. One or more 20 amperes dedicated branch circuits (no other items on these bathroom receptacle circuits), or a 20 amperes dedicated branch circuit supplying only items in a single bathroom, may supply these receptacles.

6. What are the wiring requirements for kitchen outlet circuits? A minimum of two (2) 20 amperes dedicated circuits are required for the counter space receptacle outlets for small appliance use in the kitchen. These circuits may also feed dining and pantry area receptacles or a clock outlet in the room. No lights, hoods, or other room or outside outlets may be on these circuits. All receptacles in the kitchen serving the countertop are required to be GFCI protected.

7. Where are the receptacles required to be located for the kitchen counter? Electrical outlets are required to be spaced so that no point along the counter wall line is more than two (2) feet from an outlet. They shall be located no more than eighteen (18) inches above the countertop. A counter space twelve (12) inches or greater requires an outlet. Peninsular counter spaces of more than twelve (12) inches in length from the connecting edge require at least one receptacle outlet for each work area. Island countertops of more than twelve (12) inches in length require at least one receptacle for each work area. Outlets shall not be located more than twelve (12) inches down from the countertop surface.

8. Can I connect a refrigerator to the kitchen counter outlet circuits? You may supply a receptacle outlet for the refrigerator from the kitchen countertop outlet circuits. An individual branch circuit that feeds only a refrigerator may be installed with a 15 amperes breaker.

9**.What are the laundry area requirements?** You are required to install a dedicated 20 amperes circuit for the laundry equipment. There can be no other outlets or lights on this circuit. Outlets for the electric iron or gas dryer are allowed as part of this circuit. If the laundry room has a utility sink, all receptacles within 6 feet from the outside edge of the sink are required to be GFCI and Arc Fault protected. If the laundry is located in the bathroom, GFCI and Arc Fault protection is required for the laundry receptacle(s) as well as all other receptacles in the room. A bathroom is an area including a basin and one or more of the following: a toilet, a tub, or a shower.

10. What are the outdoor outlet requirements? At least one receptacle outlet shall be located on the front and the back of the house. All regular use outdoor outlets are required to be GFCI protected regardless of their location. Ground Fault Protection of Equipment (GFPE) shall be provided for outlets used solely for snow melting equipment. This is a different device than what is used for personnel protection (GFCI).

11. What are the requirements for garages? A minimum of one GFCI protected outlet and one light on a switch shall be installed in a garage that is attached or furnished with electrical power. Any additional receptacles installed for use with hand tools or portable equipment shall be GFCI protected. Single opening receptacles or duplex receptacles are not required to be GFCI protected when all openings are utilized for stationary permanently connected appliances.

12. What are the requirements for basements? Finished areas of a basement are to meet all the requirements for receptacle placement and lighting as required for other finished portions of the home. A minimum of one light on a wall switch and one GFCI protected outlet, in addition to any provided for laundry equipment, shall be located in an unfinished basement. GFCI protection is required on all receptacles in unfinished areas of the basement not intended as habitable rooms and limited to storage areas, work areas, and the like.

13.What are the hallway requirements? At least one receptacle outlet shall be installed in any hallway longer than ten (10) feet in length.

Lighting Requirements

1. Where is exterior lighting required? Exterior lighting is required at all entrances or exits, except vehicle garage doors. All exterior lighting shall be controlled by a local wall switch. Additional remote, central, or automatic switching may be installed.

2. NEC 404.2(C) Switches Controlling Lighting Loads. The grounded circuit conductor (neutral) shall be provided at the location where switches control lighting loads that are supplied by a grounded general purpose branch circuit. See exceptions.

3. When is three-way switching required? At least one switch is required to operate one lighting fixture or one switched receptacle in each habitable room. When there are more than six (6) steps separating levels of the home, a three-way is required at the top and bottom.

4. What's required in an attic or crawl space? In attics or crawl spaces used for storage or that contain equipment that require servicing, at least one light on a switch and one receptacle shall be installed. GFCI protection is required for outlets located in crawl spaces.

5. What are the clearances for a light located in a closet? The storage area in a clothes closet is the area directly above a shelf to the ceiling, and the area the clothing hangs in below a shelf. A surface mounted enclosed incandescent fixture must be at least twelve (12) inches from this storage area. Recessed fixtures with lenses and surface mounted fluorescent fixtures must be at least six (6) inches from this storage area.

GFCI and Arc Fault Protection

1. Where is GFCI protection required? GFCI protection is required on all power feeds to a spa or hot tub and for all outlets:
1. serving kitchen counters
2. within six (6) feet of laundry, utility, wet bar sinks, bathroom sinks, or shower stalls.
3. in bathrooms
4. in crawl spaces
5. in work or storage areas in unfinished basements
6. in garages
7. outdoors
8. in detached storage or work shops
9. in boathouses

2. How is GFCI protection provided? GFCI protection shall be provided by a GFCI breaker or the installation of a GFCI receptacle in the first receptacle on the circuit or individually at each location where GFCI protection is required. Note: Do not use feedthrough method of wiring when installing at each individual location.

3. Where is arc-fault protection required? All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit:
a. family rooms,
b. dining rooms,
c. living rooms,
d. parlors,
e. libraries,
f. dens,

h. bedrooms,
i. sunrooms,
j. recreation rooms,
k. closets,
l. hallways,
m. Laundry area
n. or similar rooms or areas
shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit.

Definition: Outlet - A point on the wiring system at which current is taken to supply utilization equipment.
Author's Note to installers: For the purposes of this section, an "outlet" is considered to be a receptacle box, a lighting box, a smoke alarm box, a fan box, a 120 volt heater supply box, or any other location on the wiring system where utilization equipment is connected.

Hot Tubs and Spas

1. Does a hot tub or spa require an electrical outlet be located near it? A spa or hot tub shall have at least one (1) GFCI protected outlet located near it. For indoor locations, the outlet is to be located a minimum of six (6) feet away from and a maximum of ten (10) feet away from the tub. For outdoor locations, the outlet is to be located a minimum of six (6) feet away from and a maximum of twenty (20) feet away from the tub. All additional outlets within the distances described above are required to be GFCI protected.

2. What are the requirements for a light or fan above a spa or hot tub?
Indoors: The light or fan within five (5) feet of the side of an indoor spa or hot tub shall be at least 12' above the water line or protected by GFCI and be at least 7'6" above the water line.
Outdoors: A light or fan within five (5) feet of the side of an outdoor spa or hot tub shall be at least 12' above the water line. There are some exceptions that may apply to lighting mounted less than 7'6" above the water line. Consult with your inspector before installing.

3. What are the requirements for a hydromassage bathtub? A hydromassage bathtub and the associated equipment shall be protected by GFCI. All 125 volt receptacles not exceeding 30 amperes and located within 5' of the inside wall of the hydromassage bathtub shall be GFCI protected.

Smoke Alarm Requirements

316.1 Smoke alarms required. Smoke alarms shall be installed in each sleeping room, outside of each separate sleeping area in the immediate vicinity of the bedrooms, and on each additional story of the dwelling, including basements and cellars, but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels, a smoke alarm needs to be installed only on the upper level, provided the lower level is less than one full story below the upper level, except that if there is a door between levels, then the alarm is required on each level.

All alarms shall be interconnected such that the actuation of one alarm will actuate all the alarms in the individual unit and the alarm shall be audible in all sleeping areas. All alarms shall be approved and listed and shall be installed in accordance with the manufacturer's instructions.

316.1.1 Alterations, repairs, and additions. When alterations, repairs, or additions requiring a permit occur for an area where smoke detectors are required, in existing dwellings, the entire building shall be provided with smoke alarms located as required for new dwellings. The smoke alarms are not required to be interconnected, unless other remodeling considerations require removal of the appropriate wall and ceiling coverings to facilitate concealed interconnected wiring.

316.2. Power source. Required smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection. Smoke alarms may be battery operated when installed in buildings without commercial power.

Summary
1. In each sleeping room
2. In general area outside of sleeping rooms
3. Electrically powered on Arc-Fault protected circuit
4. Battery backup
5. Interconnected (simultaneous alarm)
6. Minimum of one on each floor level

1.Are Smoke alarms required to be on a separate circuit?

No, they can be placed on any general wiring circuit. They are not to be placed on any of the required dedicated circuits.

2. How are electric smoke alarms to be wired?
Electric smoke alarms shall be wired in a series with power to the first unit. Three (3) conductor cable with ground will be run from it to the remaining units. Follow the manufacturer's instructions.

Branch Circuit Table

Notes for Special Requirements
1. Tamper resistant receptacle
2. Separate dedicated circuit
3. GFCI protection required
4. Arc-fault protection required
5. GFCI protection required within six (6) feet
6. See manufacturer's instructions
7. Disconnect is required near appliance or lock-out in breaker panel. Disconnect may be a cord connection where allowed.
8. In use type weatherproof receptacle cover required in wet locations.

9. GFCI required if located within 6’ of the outside edge of a utility or laundry sink or in a bathroom

Note: Maximum number of outlets or lights on a 15-amp circuit is 10. Maximum number of outlets or lights on a 20-amp circuit is 13.

Branch Circuit Table

Equipment and Location	Breaker	Wire	Special
Kitchen Counter Outlets	20 amp	12	1,2,3,
Dishwasher	15/20	14/12	1,3,6
Garbage Disposal	15/20	14/12	1,3,6
Range Hood	15/20	14/12	5
Microwave	20	12	1,5,6
Stove	40/50	8/6	2,6,7
Double Oven	40/50	8/6	2,6,7
Single Oven	30	10	2,6,7
Cooktop	30	10	2,6,7
Washer (laundry)	20	12	1,2,4,6,8
Dryer	30	10	2,6,7
Water Heater	20/30	12/10	2,6,7
Furnace	15/20	14/12	1,2,5,6,7
Electric baseboard heat	15/20/30	14-10	6,7
Pump	15/20	14/12	6,7
Hot tub or spa	15-50	14-6	6,7
Exhaust fan	15/20	14/12	3,4,5
General Purpose Outlets	15/20	14/12	1,3,4
General Purpose Lights	15/20	14/12	4
Wet bar sink outlets	15/20	14/12	1,4,5
Bathroom outlets	20	12	1,2,3
Garage outlets	15/20	14/12	1,2,3
Bedrooms	15/20	14/12	1,4
Outside outlets	15/20	14/12	1,3
Unfinished basement outlets	15/20	14/12	1,2,3