

## **Electrical Inspections for Homeowners Made Easy**

*Information provided by the Minnesota Board of Electricity*

Generally, Minnesota law requires all electrical work to be performed by licensed, bonded and insured electrical contractors and their employees. Homeowners, within limitations, may perform electrical work on premises the person owns and actually occupies as a residence or owns and will occupy as a residence upon completion of construction.

Minnesota Statutes 326.01, Subd. 6e

Electrical Inspections in Spring Lake Park  
are made by  
Kim Sparrow  
(763) 464-3023

Kim Sparrow is available by phone weekdays  
between 7:00 a.m. and 8:30 a.m.

In Spring Lake Park, combination permits are generally issued that include electrical permit fees. Check your building permit to see if it already includes the electrical permit fee.

Minnesota Rules 3800.3770 A ROUGH-IN INSPECTION shall be made before any wiring is covered by insulation, sheetrock, paneling, or other materials. Underground wiring shall be inspected before the trench is backfilled. Except for the final connection to switches, receptacles, and lighting fixtures, all ground wires and other wires in boxes shall be spliced and pigtailed for the rough-in inspection.

A FINAL ELECTRICAL INSPECTION is required when all wiring has been completed and all devices, lighting fixtures, and appliances have been installed and tested.

# PLAN YOUR WIRING PROJECT

*This brochure is only intended to be a general overview of residential electrical requirements. No claim is made that this information is complete or beyond question. Additional information and knowledge will be needed to properly install electrical wiring that is essentially free from fire and electric shock hazard.*

*If you have questions after reading this brochure, please reference authoritative publications based on the 1999 National Electrical Code (the NEC).*

## GENERAL CIRCUITRY

NEC 210-11, 422-12 In addition to the branch circuits installed to supply general illumination and receptacle outlets in dwelling units, the following minimum requirements apply:

- Two 20-amp circuits for the kitchen receptacles
- One 20-amp circuit for the laundry receptacles
- One 20-amp circuit for the bathroom receptacles
- One separate, individual branch circuit for central heating equipment

NEC 210-52 Receptacles installed in the kitchen to serve countertop surfaces shall be supplied by not less than two separate small appliance branch circuits.

NEC 300-3 All conductors of the same circuit, including grounded conductors, shall be contained in the same raceway, cable, or trench.

NEC 384-13 All circuit overcurrent devices shall be legibly identified as to purpose or use on a directory located on the face or inside of the electrical panel doors.

NEC 240-3 The rating of the fuse or circuit breaker generally determines the minimum size of the circuit conductor, per the following table:

| <u>Fuse or<br/>Circuit Breaker Size</u> | <u>Minimum Wire Size</u> |                 |
|---|--------------------------|-----------------|
|   | <u>Copper</u>            | <u>Aluminum</u> |
| 15 amp                                  | 14                       | n/a             |
| 20 amp                                  | 12                       | n/a             |
| 30 amp                                  | 10                       | 8               |
| 40 amp                                  | 8                        | 6               |
| 50 amp                                  | 6                        | 4               |

Note: Conductors that supply motors, air-conditioning units, and other special equipment may have overcurrent protection that exceeds the general limitations in the above chart.

NEC 210-7 Receptacle outlets shall be of the grounding type, be effectively grounded, and have proper polarity.

NEC 210-52 Generally, receptacle outlets in habitable rooms shall be installed so that no point along the floor line (measured horizontally) in any wall space is more than 6 feet from an outlet in that space. An outlet shall be installed in each wall space 2 feet or more in width.

NEC 210-52 At kitchen countertops, receptacle outlets shall be installed so that no point along the wall line (measured horizontally) is more than 24 inches from a receptacle outlet in that space.

NEC 210-52 A receptacle shall be installed at each counter space 12 inches or wider, and at each island counter or peninsular space larger than 12 inches by 24 inches.

NEC 210-52 Receptacles shall not be installed in a “face up” position on work surfaces or countertops.

NEC 210-52 Outdoor receptacles, accessible at grade level and no more than 6½ feet above grade, shall be installed at the front and back of a dwelling.

NEC 210-70 At least one wall switch-controlled lighting outlet shall be installed in every interior stairway, with a switch at each floor level to control the lighting outlet when the difference between floor levels is six steps or more.

### GROUND-FAULT PROTECTION

NEC 210-8 At dwellings, ground-fault circuit-interrupter (GFCI) protection shall be provided for all receptacle outlets installed in bathrooms, garages, grade-level portions of unfinished accessory buildings, crawl spaces, unfinished basements, at kitchen countertops, wet-bar sinks, and outdoors. Receptacles that are not readily accessible could be exempt from the GFCI requirement.

NEC 680-70 A hydromassage bathtub, defined as a permanently installed bathtub with a recirculating piping system, designed to accept, recirculate and discharge water upon each use, and its associated components, shall have ground-fault circuit-interrupter protection.

NEC 680-72 Additionally, all 125-volt receptacles installed within 5 feet of the inside walls of the hydromassage tub shall also be GFCI protected.

NEC 680-72 All equipment, motors and controls associated with a hydromassage bathtub shall be accessible without damaging the building structure or finish.

*The insulating value of human skin is drastically reduced when a person is wet. When installed in the water, in pool walls,*

*on pool decks, or adjacent to swimming, wading, therapeutic, and decorative pools, fountains, hot tubs, spas and hydromassage bathtubs, all electrical wiring and equipment shall comply with special requirements in the NEC.*

NEC 680-40 Spas and hot tubs installed outdoors shall comply with the specific grounding and bonding requirements of a permanently installed swimming pool.

### WIRING METHODS

NEC 370-23 All electrical boxes shall be securely supported by the building structure.

NEC 370-27 When boxes are used as the sole support for a ceiling paddle fan, they shall be listed and labeled for such use.

NEC 336-18 & 370-17 Type NM (nonmetallic) cable shall be secured at intervals not exceeding 4½ feet and within 12 inches of each box. However, if a single gang device box without a clamp is used, the cable shall be secured within 8 inches of the box.

NEC 370-17 The outer jacket of NM cable shall extend into the box a minimum of ¼ inch.

NEC 300-14 At all boxes there shall be a minimum wire length of 6 inches, with at least 3 inches outside the box.

NEC 300-4 In both exposed and concealed locations, where cables are installed through bored holes in joists, rafters, or wood framing members, the holes shall be bored so that the edge of the hole is not less than 1¼ inch from the nearest edge of the wood member. Where this distance cannot be maintained, the cable shall be protected from penetration by screws or nails by a steel plate at least 1/16<sup>th</sup> inch thick and of appropriate length and width.

NEC 300-22 Type NM cable shall not be installed in spaces used for cold air returns,

however NM is permitted to pass through perpendicular to the long dimension of such spaces.

NEC 250-134 & 370-4 Metal boxes, cover plates, and plaster rings shall be grounded. Switches, including dimmer switches, shall be grounded and shall provide a means to ground metal plates.

NEC 110-12 & 370-18 Unused openings in boxes shall be effectively closed. If openings in non-metallic boxes are broken out and not used, the entire box shall be replaced.

NEC 110-14 Only one conductor shall be installed under a terminal screw. In boxes with more than one ground wire, the ground wires shall be spliced with a “wire tail” or “pig tail” attached to the grounding terminal screw.

NEC 110-14 & 300-15 All splices, including ground wires, shall be made with an approved splice cap or “wire nut” and shall be made in approved electrical boxes or enclosures.

NEC 370-25 & 410-12 In a completed installation, all outlet boxes shall have a cover, canopy for a lighting fixture, or device with an appropriate plate.

NEC 370-16 The volume of electrical boxes shall be sufficient for the number of conductors, devices, and cable clamps contained within the box. Nonmetallic boxes are marked with their cubic inch capacity. Use the following table to properly calculate box size:

| <u>Conductor Size</u>                | <u>14 gauge</u> | <u>12 gauge</u> |
|--------------------------------------|-----------------|-----------------|
| For each separate insulated wire     | 2 cu in         | 2.25 cu in      |
| All ground wires (combined)          | 2 cu in         | 2.25 cu in      |
| For each device (switch/receptacle)  | 4 cu in         | 4.5 cu in       |
| All internal cable clamps (combined) | 2 cu in         | 2.25 cu in      |

Sample Calculation:

Four “#14/2 w/ground” cables:  
 Eight insulated wires ..... 16 cubic inches  
 All ground wires ..... 2 cubic inches  
 One switch ..... 4 cubic inches  
 One receptacle ..... 4 cubic inches  
 All clamps ..... 2 cubic inches

Total box volume required            28 cubic inches

NEC 370-29 Do not conceal junction boxes in walls, ceilings, or non-accessible attics and under-floor areas.

NEC 410-8 Lighting fixtures installed in a clothes closet shall have the following clearances from the defined storage area (see the definition below):

- 12 inches for surface incandescent fixtures
- 6 inches for recessed incandescent fixtures
- 6 inches for fluorescent fixtures

NEC 410-8 Storage space, as applied to an electrical installation in a closet, is defined in the National Electrical Code as a volume bounded by the sides and back closet walls and planes extending from the closet floor vertically to a height of 6 feet (1.83m) or the highest clothes-hanging rod and parallel to the walls at a horizontal distance of 24 inches (610 mm) from the sides and back of the closet walls respectively, and continuing vertically to the closet ceiling parallel to the walls at a horizontal distance of 12 inches (305mm) or the width of the shelf, whichever is greater.

NEC 410-8 Incandescent fixtures with open or partially enclosed lamps and pendant fixtures or lampholders are not permitted in clothes closets.

NEC 410-66 Recessed lighting fixtures installed in insulated ceilings or installed within ½ inch of combustible material shall be labeled as Type IC (insulation contact). In addition, the Minnesota Energy Code requires recessed lighting fixtures in insulated ceilings to be sealed to prevent leakage of airborne moisture.

## EQUIPMENT LISTING AND LABELING

Minnesota Rule 3800.3620 all electrical equipment, including light fixtures, devices, and appliances shall be LISTED AND LABELED by a nationally recognized testing laboratory (i.e. Underwriter's Laboratories, Canadian Standards Association, etc.) as having been tested and found suitable for a specific purpose. All electrical equipment shall be installed and used in accordance with the listing requirements and manufacturer's instructions.

## UNDERGROUND WIRING

NEC 300-5 Generally, cables approved for direct burial shall have a minimum cover of 24 inches. When wiring is installed at dwellings in approved non-metallic raceways, the minimum cover can be reduced to 18 inches.

NEC 300-5 When a GFCI protected residential branch circuit is rated 20 amps or less and 120 volts or less, the minimum cover can be reduced to 12 inches.

NEC 300-5 Conductors emerging from underground shall be installed in rigid metal conduit, intermediate metal conduit, or Schedule 80 rigid nonmetallic conduit to provide protection from physical damage. This protection shall extend from 18 inches below grade or the minimum cover distance, above, to the point of termination above ground.

## ELECTRICAL SERVICES

NEC 300-5 Underground service laterals shall have their location identified by a warning ribbon that is placed in the trench at least 12 inches above the underground installation.

NEC 110-3 & 110-14 Anti-oxidant compound shall be used on all aluminum conductor terminations.

NEC 230-8 & 230-54 Service entrance conduits shall be raintight, arranged to drain, and sealed to prevent moisture condensation.

### Conductor Sizes for 120/240 Volt Single-Phase Dwelling Services NEC 310-15

| <u>Copper</u> | <u>Aluminum</u> | <u>Service Rating</u> |
|---------------|-----------------|-----------------------|
| 4 AWG         | 2 AWG           | 100 amps              |
| 1 AWG         | 2/0             | 150 amps              |
| 2/0           | 4/0             | 200 amps              |

NEC 370-17 Raceways containing ungrounded conductors No. 4 or larger enter a cabinet, box, or enclosure, the conductors shall be protected by a conduit bushing providing a smoothly rounded insulating surface.

NEC 230-70 The electrical service disconnecting means shall be installed at a readily accessible location either outside a building or structure or inside nearest the point of entrance of the service-entrance conductors.

NEC 240-24 Electrical panels shall be readily accessible and shall not be located in bathrooms or in the vicinity of easily ignitable materials such as in clothes closets.

NEC 110-26 The depth of working space in the direction of access to live parts, when the voltage to ground does not exceed 150 volts, shall be a minimum of 3 feet. The minimum width of working space in front of electrical equipment shall be the width of the equipment or 30 inches, whichever is greater. This workspace shall be clear and extend from the floor to a height of 6 ½ feet, and shall not be used for storage. All workspaces shall be provided with illumination.

## GROUNDING

NEC 250-50 A premise's electrical service shall be connected to a grounding electrode system consisting of a metal underground water pipe in direct contact with earth for 10 feet or more, if available on the premises, *and* a supplemental electrode (a rod, pipe, or plate electrode.)

An additional electrode shall supplement the buried water pipe electrode.

NEC 250-66 The size of the unspliced grounding electrode conductor is determined by the equivalent size of the service-entrance conductors, per the following chart:

| Equivalent Size of Service<br>Entrance Conductor |          | Size of the Grounding<br>Electrode Conductor |          |
|--|----------|--|----------|
| Copper   | Aluminum | Copper                                       | Aluminum |
| 4 AWG  | 2        | 8  | 6        |
| 1 AWG  | 2/0      | 6  | 4        |
| 2/0  | 4/0      | 4  | 2        |

That portion of the grounding electrode conductor that is the sole connection to a made electrode (ground rod) is not required to be larger than #6 copper.

## REPLACEMENT RECEPTACLES

NEC 210-7 where a grounding means does not exist in the receptacle enclosure, the installation shall comply with (a), (b), or (c),

- a) a non-grounding type receptacle may be installed;
- b) a ground-fault circuit-interrupter receptacle may be installed and shall be marked "No Equipment Ground." [An equipment grounding conductor shall NOT be connected from the GFCI receptacle to any outlet supplied from the GFCI;]
- c) a grounding type receptacle may replace a non-grounding type receptacle when supplied through a ground-fault circuit-interrupter receptacle. Grounding type receptacles supplied by a GFCI shall be marked "GFCI Protected" and "No Equipment Grounded."

If more information is needed to complete your project, there are many books available at your local Home Improvement Center that are designed to help homeowners.

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## NOTICE OF CHANGE IN ELECTRICAL CODE

Effective January 1, 2002, Section 210-12 of the 1999 National Electrical Code requires arc-fault circuit-interrupter (AFCI) protection be provided for all branch circuits that supply 125-volt, single phase, 15- and 20-ampere receptacle outlets installed in dwelling unit bedrooms.

This requirement will be enforced by the board of electricity on all projects inspected after January 1, 2002. The board of electricity will not require AFCI protection on existing branch circuits unless they are extended into or within a bedroom after January 1, 2002.