



## **RESIDENTIAL ELECTRICAL REQUIREMENTS**

(REVISED 3/28/2008)

### **PERMIT REQUIREMENTS:**

- ❑ Signed completed Electrical Permit application form.
- ❑ Minnesota law requires all electrical work is to be performed by licensed, bonded and insured electrical contractors and their employees. Homeowners, within strict limitations, are exempt from electrical licensing.

*An owner is a natural person who physically performs 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*

- ❑ It is illegal for an owner to install electrical wiring in mobile home or recreational vehicle parks, or on property that is rented, leased, or occupied by others.

### **GENERAL CIRCUITRY:**

1. NEC 210.11 and 422.12 In addition to the branch circuits installed to supply generally 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
2. NEC 210.52 Receptacles installed in the kitchen to serve countertop surfaces shall be supplied by not less than two separate 20 amp small appliance branch circuits.
3. NEC 300.3 All conductors of the same circuit, including grounding and bonding conductors, shall be contained in the same raceway, cable, or trench.
4. NEC 408.4 All circuits and circuit modifications shall be legibly identified as to purpose or use on a directory located on the face or inside of the electrical panel doors.
5. NEC 210.52 Receptacle outlets in habitable rooms shall be installed so that no point measured horizontally along the floor line in any wall space is more than 6 feet from a receptacle outlet (less than 12 foot spacing). A receptacle shall be installed in each wall space 2 feet or more in width.
6. NEC 210.52 At kitchen countertops, receptacle outlets shall be installed so that no point along the wall line is more than 24 inches measured horizontally from a receptacle.

7. NEC 240.3 The rating of the fuse or circuit breaker generally determines the minimum size of the circuit conductor, per the following table:

Fuse or Circuit Breaker Size	Minimum Wire Size	
	Copper	Aluminum
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.

8. NEC 406.3 Receptacle outlets shall be of the grounding type, be effectively grounded, and have proper polarity.
9. NEC 406.4 Receptacles shall not be installed in the face-up position in countertops or similar work surfaces.
10. NEC 210.52 A receptacle outlet shall be installed at each counter space 12 inches or wider, and at each island counter or peninsular space 24 inches by 12 inches or larger. Countertop spaces separated by range tops, sinks or refrigerators are separate spaces.
11. NEC 210.52 Outdoor receptacles, accessible at grade level and no more than 6.5 feet above grade, shall be installed at the front and back of a dwelling.
12. NEC 210.12 All branch circuits supply 125-volt, 15 and 20 amp outlets in dwelling unit bedrooms shall be protected by a listed arc-fault circuit interrupter device.

**GROUND-FAULT PROTECTION:**

13. 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, kitchen countertops, wet-bar sinks, boathouses and outdoors. Receptacles that are not readily accessible may be exempt from the GFCI requirement.
14. NEC 680.71 A hydro-massage bathtub that has a re-circulating piping system designed to discharge water upon each use, and its associated components shall be GFCI protection. Clamp #8 ground wire to the cold water pipe then connect to the ground lug on the tub in order to bond metal parts of the tub.
15. NEC 680.71 All 125 volt receptacles not exceeding 30 amperes installed within 5 feet of the inside walls of the hydro-massage bathtub shall be GFCI protected.
16. NEC 406.8 15 and 20 amp, 125 and 250 volt receptacles installed outdoors in a wet location shall have an enclosure that is weatherproof whether or not the attachment plug is inserted.

17. NEC 680.71 All equipment associated with a hydro-massage bathtub shall be accessible without damaging the building structure or finish.

### **WIRING METHODS:**

18. NEC 314.23 All electrical boxes shall be securely supported by the building structure.
19. NEC 314.27 Boxes used as the sole support for a ceiling paddle fan shall be listed and labeled for such use.
20. NEC 334.30 and 334.17 Type NM (nonmetallic) cable shall be secured at intervals not exceeding 4.5 feet and within 12 inches of each box. When a single gang box 2-1/4" x 4" or smaller is used without a cable clamp, the cable shall be secured within 8" measured along the sheath.
21. NEC 314.17 The outer jacket of NM cable shall extend into the box a minimum of 1/4 inch.
22. NEC 300.14 The minimum length of conductors, including grounding conductors, at all boxes shall be 6" with at least 3" outside the box.
23. NEC 300.4 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 1-1/4" from the nearest edge of the wood member. Where this distance cannot be maintained, or where screws or nails are likely to penetrate the cable, it shall be protected by a steel plate at least 1/16" thick and of appropriate length and width.
20. NEC 300.22 Type NM cable shall not be installed in spaces used for environmental air, however NM is permitted to pass through perpendicular to the long dimension of such spaces.
21. NEC 250.134; 314.4; 404.9 All electrical equipment, metal boxes, cover plates, and plaster rings shall be grounded. All switches, including dimmer switches, shall be grounded.
22. NEC 110.12 & 314.17 Unused openings in boxes shall be effectively closed. When openings in non-metallic boxes are broken out and not used, the entire box must be replaced.
23. 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.
24. NEC 110.14 & 300.15 Splices shall be made with an approved splice cap or "wire nut" and shall be made in approved electrical boxes or enclosures. Wire splicing means for direct burial shall be identified for such use.

25. NEC 314.25 & 410.12 In a completed installation, all outlet boxes shall have a cover, lamp holder, canopy for a luminaire, or device with an appropriate cover plate.
26. NEC 314.19 Junction boxes shall be installed so that the wiring contained in them can be rendered accessible without removing any part of the building
27. NEC 314.16 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

Item	Conductor Size	
	14 gauge	12 gauge
For each separate insulated wire	2 inches	2.25 inches
All ground wires (combined)	2 inches	2.25 inches
For each device (switch/receptacle)	4 inches	4.5 inches
All internal cable clamps (combined)	2 inches	2.25 inches

#### SAMPLE CALCULATION

Four “#14/2 w/ground” cables:  
 Eight insulated wires ..... 16 cu in  
 All ground wires..... 2 cu in  
 One switch..... 4 cu in  
 One receptacle..... 4 cu in  
All clamps..... 2 cu in  
 Total box volume required..... 28 cu in

28. NEC 410.8 Luminaires (lighting fixtures) installed in clothes closets shall have the following minimum clearances from the defined storage area (see the definition below):
  - 12” for surface incandescent fixtures
  - 6” for recessed incandescent fixtures
  - 6” for fluorescent fixtures
29. NEC 410.8 Storage space, as applied to an electrical installation in a closet, is the volume bounded by the sides and back closet walls and planes extending from the closet floor vertically to a height of 6 ft or the highest clothes-hanging rod and parallel to the walls at a horizontal distance of 24” 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” or the width of the shelf, whichever is greater.
30. NEC 410.8 Incandescent luminaries with open or partially enclosed lamps and pendant fixtures or lamp holders are not permitted in clothes closets.
31. NEC 410.66 Recessed lighting fixtures installed in insulated ceilings or installed within 1/2” of combustible material shall be approved for insulation contact and labeled Type IC. ***The Minnesota Energy Code, part of the State Building Code, required penetrations into exterior walls and ceilings to be sealed to prevent the leakage of airborne moisture into unheated spaces.***

**EQUIPMENT LISTING AND LABELING:**

- 32. Minnesota Rules 3800.3620 All electrical equipment, including luminaries, devices, and appliances shall be LISTED AND LABELED by a nationally recognized testing laboratory as having been tested and found suitable for a specific purpose. Underwriters Laboratories (UL) and the Canadian Standards Association (CSA) are two of the recognized agencies.
- 33. NEC 110.3 All electrical equipment shall be installed and used in accordance with the listing requirements and manufacturer’s instructions.

**ELECTRICAL SERVICES:**

- 40. NEC 310.15 Conductor Sizes for 120/240-Volt Single-Phase Dwelling Services and Feeders:

<b>Copper</b>	<b>Aluminum</b>	<b>Service Rating</b>
4 AWG	2 AWG	100 Amps
1 AWG	2/0	150 Amps
2/0	4/0	200 Amps

- 41. NEC 230.7 Conductors other than service conductors shall not be installed in the same service raceway or cable.
- 42. NEC 110.14 Conductors of dissimilar metals shall not be intermixed in a terminal or splicing device unless the device is listed for the purpose. Listed anti-oxidant compound shall be used on all aluminum conductor terminations, unless information from the device manufacturer specifically states that it is not required.
- 43. NEC 300.7 Portions of raceways and sleeves subject to different temperatures (where passing from the interior to the exterior of a building) shall be sealed with an approved material to prevent condensation from entering the service equipment.
- 44. NEC 230.54 Where exposed to weather, service entrance conductors shall be rain-tight and arranged to drain.
- 45. NEC 300.4 Where 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.
- 46. 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.
- 47. NEC 230.70 & 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 clothes closets.

48. 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 6-1/2 feet. This space shall not be used for storage.
49. NEC 110.26 Illumination shall be provided for all work spaces about electrical service equipment.

**GROUNDING:**

50. NEC 250.50 A premises electrical service shall be connected to a grounding electrode system consisting of a metal underground water pipe in direct contact with earth for 10' or more, if available on the premises, and supplemented by a rod, pipe, or plate electrode.  
*An additional electrode must supplement the buried water pipe electrode.*
51. NEC 250.64 & 250.66 The grounding electrode conductor shall be unspliced. The size is determined by the size of the service-entrance conductors, per the following chart:

<b>Equivalent size of service entrance conductor</b>		<b>Size of the grounding electrode conductor</b>	
<b>Copper</b>	<b>Aluminum</b>	<b>Copper</b>	<b>Aluminum</b>
4 AWG	2	8	6
1 AWG	2/0	6	4
2/0 or 3/0	4/0 or 250	4	2

Note: The grounding electrode conductor that is the sole connection to a rod, pipe or plate electrode is not required to be larger than #6 copper.

52. NEC 250.28 A main bonding jumper or the green bonding screw provided by the panel manufacturer shall be installed in the service panel to electrically bond the grounded service conductor and the equipment grounding conductors to the service enclosure.
53. NEC 250.104 The interior metal water piping and other metal piping that may become energized shall be bonded to the service equipment with a bonding jumper sized the same as the grounding electrode conductor.

**UNDERGROUND WIRING:**

54. NEC 300.5 Direct buried cable or conduit or other raceways shall meet the following minimum cover requirements:

<b>Direct burial cable</b>	<b>Rigid or intermediate metal conduit</b>	<b>Non-metallic raceway (PVC)</b>
24 inches	6 inches	18 inches
Residential branch circuits rated 20 amps or less at 120 volts or less and with GFCI protection at their source are allowed a minimum cover of 12".		

Note: the above table does not apply to underground wiring supplying outdoor pools, spas or hot tubs

55. NEC 300.5 Underground service conductors shall have their location identified by a warning ribbon placed in the trench at least 12” above the underground installation.
56. NEC 300.5 Where subject to movement, direct buried cables or raceways shall be arranged to prevent damage to the enclosed conductors or connected equipment.
57. 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” below grade or the minimum cover distance to the point of termination above ground.

#### **REQUIRED INSPECTIONS:**

- **Roughin:** Before any wiring is covered by insulation, sheetrock, paneling, or other materials, Underground wiring must be inspected to assure the minimum burial depth. Where wiring is concealed before inspection, the person responsible for concealing the wiring shall be responsible for all costs resulting from uncovering and replacing the covering material.
- **Final:** When all wiring has been completed and all devices, lighting fixtures, and appliances have been installed and tested.

#### **GENERAL NOTES:**

- The stamped, City approved Plan and Survey shall be kept on the job site until the final inspection has been made and approved.
- The Inspection Record Card shall be posted until the final inspection has been made and approved. Cards should be protected from the weather.
- **Call 952-985-4440 between 8:00 A.M. and 4:30 P.M. to schedule an inspection. Provide at least 24-hour advance notice and permit number at time of scheduling.**