

RESIDENTIAL ELECTRICAL HANDOUT ELECTRICAL PERMIT INFORMATION FOR 1 & 2-FAMILY DWELLINGS

General Permit Information

- ❖ The person performing the work is required to obtain the permit before work is started.
 - A permit can only be issued to a licensed electrical contractor (licensed with the State of Minnesota), or the owner (occupant or will occupy) of the property.
 - An owner can only obtain the permit when they **OWN AND OCCUPY** or **WILL OCCUPY** the residence and the residence **IS NOT/WILL NOT BECOME** a rental or licensed daycare, and that they will personally perform all of the electrical work, including the laying out of such work. The owner will sign an affidavit stating this.
 - Only a licensed electrician can perform work on manufactured homes.
- ❖ It is the responsibility of the permit holder to call for all inspections.
 - The type of inspections depends on the type of work.
 - The rough-in inspection is required after all wiring is in place but before any covering of the walls or concealment of the wiring. All boxes (including junction) need to be in place, all cables need to be routed, all conductors terminated and spliced as needed, all exhaust fans need to be mounted in place and connected.
 - The final inspection is required after all work is completed.
- ❖ Electrical permit application forms (Request for Electrical Inspection) are preprinted, and available only at City Hall.
 - Prices for the electrical permit vary; the prices are printed on the form.

Work Requiring a Permit

- ❖ Electrical permits are needed for any installation, alteration, repair, relocation, replacement, or addition to any wiring, equipment or fixtures associated with the electrical system.
 - Work that consists only of changing out of electrical fixtures, but not the boxes, does not require a permit.
- ❖ Work requiring a permit includes, but is not limited to:
 - Wiring replacement furnaces, A/C units, boilers, etc.
 - Moving electrical fixtures.
 - Wiring additions, garage, basements, etc.

General Circuit Requirements

- ❖ All 125-volt, 15- and 20- amp receptacles installed or replaced in dwelling units shall be listed tamper-resistant. Three exceptions include:
 - Receptacles located 5½-feet or more above the floor;
 - A receptacle in space dedicated for an appliance that is not readily moved;
 - Receptacles that are part of a luminaire. (*NEC 406.4 and 406.12*)
- ❖ All branch circuits supplying 125-volt, 15- and 20- amp outlets or devices in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation

rooms, laundry areas, closets, hallways, or similar areas shall be protected by a listed combination type AFCI device. AFCI protection is also required where branch circuit wiring in the above locations is modified, replaced, or extended. *(NEC 210.12)*

- ❖ 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 branch circuit for central heating equipment
 - One branch circuit for garage receptacles *(NEC 210.11 and 422.12)*
- ❖ Receptacles that are installed or replaced in wet locations shall be listed as weather-resistant and shall have an enclosure that is weatherproof with the cord inserted. Covers shall be marked "extra duty". *(NEC 406.4 and 406.9)*
- ❖ All conductors of the same circuit, including grounding and bonding conductors shall be contained in the same raceway, cable or trench. *(NEC 300.3)*
- ❖ Every circuit and circuit modification shall be legibly identified as to its clear, evident and specific purpose or use in sufficient detail on a directory located on the face or inside of the electrical panel doors. *(NEC 408.4)*
- ❖ Conductors shall be protected in accordance with their ampacity per Table 310.15(B)(16) and 240.4(D). *(NEC 240.4)*
- ❖ Receptacle outlets shall be of the grounding type, be grounded, and have proper polarity. *(NEC 406.3)*

NEC 310.15 Maximum Overcurrent Protection

Fuse of 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 equipment may have overcurrent protection that exceeds the limitations in the above chart.		

- ❖ 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. A receptacle 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 is more than 24-inches measured horizontally from a receptacle outlet in that space. Countertop spaces separated by range tops, sinks or refrigerators are separate spaces. *(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 greater than 24-inches by 12-inches. Receptacles shall be located not more than 20-inches above the countertop, or not more than 12-inches below the countertop. *(NEC 210.52)*
- ❖ At least one receptacle accessible from grade shall be installed at the front and back of a dwelling with an extra duty cover that is weatherproof whether or not an attachment plug is inserted. *(NEC 210.52 & 406.9)*
- ❖ Balconies, decks and porches accessible from inside a dwelling unit shall have at least one receptacle located less than 6½ feet above the floor. *(NEC 210.52)*

- ❖ In attached and detached garages at least one receptacle shall be installed for each car space. *(NEC 210.52)*

GFCI Protection

- ❖ Ground-fault circuit-interrupter (GFCI) protection shall be provided for all 125-volt, 15 and 20 amp receptacle outlets installed outdoors, in boathouses, crawl spaces, unfinished basements, laundry areas, garages, accessory buildings, bathrooms, at kitchen countertops, and within 6-feet of the outside edge of all sinks, bathtubs and shower stalls. *(NEC 210.8)*
- ❖ Hydro-massage bathtubs shall be supplied by an individual branch circuit and shall have ground-fault circuit-interrupter protection. *(NEC 680.71)*
- ❖ Ground-fault circuit-interrupter (GFCI) protection shall be provided for outlets that supply dishwashers. *(NEC 210.8)*
- ❖ Hydro-massage bathtub equipment shall be accessible without damaging the building structure or finish. When accessible through an access panel, the receptacle shall be within 1-foot of and face the opening. *(NEC 680.73)*
- ❖ All outlets supplying 125- or 240- volt pool pump motors shall be provided with GFCI protection. *(NEC 680.21(C))*
- ❖ An equipotential bonding grid to mitigate step and touch voltage potential shall be installed at outdoor swimming pools, spas and hot tubs and at electrical equipment installed outdoors adjacent to natural and artificially made bodies of water.

Wiring Methods

- ❖ All electrical boxes shall be rigidly secured to the building structure. *(NEC 314.23)*
- ❖ A listed fan box shall be installed where spare conductors are installed to a location acceptable to a ceiling fan. *(NEC 314.27)*
- ❖ Type NM (nonmetallic) cables shall be secured every 4½-feet and within 12-inches of each box. *(NEC 334.30)*
- ❖ The outer jacket of type NM cable shall be secured to the box and extend into the box at least 1/4-inch. *(NEC 314.17)*
- ❖ The minimum length of conductors including equipment grounding conductors at all boxes shall be 6-inches with at least 3-inches outside the box. *(NEC 300.14)*
- ❖ Cables and raceways shall be protected from damage. Where installed through holes in wood framing, the edge of the hole shall be not less than 1¼-inch from the nearest edge of the wood or shall be protected by a 1/16-inch steel plate. *(NEC 300.4)*
 - The Minnesota State Building Code has requirements of where holes and notches can be placed in joists, plates and studs. The following is an excerpt from the Minnesota State Building Code *(R502.8.1)*:
 - Notches in solid lumber joists, rafters, and beams shall not exceed one-sixth of the depth of the member, shall not be longer than one-third of the depth of the member, and shall not be located in the middle one-third of the span. Notches at the ends of the members shall not exceed one-fourth the depth of the member. The tension side of members 4-inches or greater in nominal thickness shall not be notched except at the ends of the members.
 - The diameter of holes bored or cut into members shall not exceed one-third of the depth of the member. Holes shall not be closer than 2-inches to the top or bottom of the member, or any other hole located in the member. Where the member is also notched, the hole shall not be closer than 2-inches to the notch.
- ❖ Type NM cable shall not be installed in plenum spaces, but may be installed perpendicular through joist or stud spaces used as such. *(NEC 300.22)*
- ❖ Terminals for more than one or for aluminum conductors shall be identified. Where there is more than one grounding wire they shall be tied together with a "pigtail" attached to the grounding terminal of the device. *(NEC 110.14)*

- ❖ Where permanently re-identified at each location where it is visible and accessible, the conductor with white colored insulation in type NM cable may be used as an ungrounded conductor. The re-identified conductor shall not be used as the return conductor from a switch to an outlet. *(NEC 200.7)*
- ❖ All non-current carrying metal parts of electrical equipment, including raceways, metal boxes and equipment shall be connected to an equipment grounding conductor. *(NEC 250.134)*
- ❖ Unused openings in boxes shall be effectively closed. A non-metallic box shall be replaced if cable openings are punched but not used. *(NEC 110.12)*
- ❖ Each grounded circuit conductor within a panelboard shall terminate in an individual terminal. *(NEC 408.41)*
- ❖ Generally, for lighting circuits for habitable the grounded conductor shall be provided at each switch location unless the wiring is installed in a raceway; the switch box remains accessible or the switch controls a receptacle... *(NEC 404.2)*
- ❖ Junction boxes shall be accessible without removing any part of the building. *(NEC 314.29)*
- ❖ The number of conductors and devices to be contained within electrical boxes determine the box size. Nonmetallic boxes are marked with their cubic inch capacity. *(NEC 314.16)*

Cubic Inches Required for Boxes			
Conductor Size	14 AWG	12 AWG	10 AWG
Each Insulated Wire	2	2.25	2.5
All Grounding Wires Combined	2	2.25	2.5
Each Switch or Receptacle	4	4.5	5
All Internal Cable Clamps	2	2.25	2.5

AWG = American Wire Gauge

EXAMPLE: A box with four 14/2 w/ground type NM cables

<i>8 Insulated Wires</i>	<i>= 16 cubic inches (in³)</i>
<i>All 4 Ground Wires</i>	<i>= 2 cubic inches</i>
<i>1 Switch</i>	<i>= 4 cubic inches</i>
<i>1 Receptacle</i>	<i>= 4 cubic inches</i>
<i>All Cable Clamps</i>	<i>= 2 cubic inches</i>
<i>Minimum Box Volume</i>	<i>= 28 cubic inches</i>

- ❖ Luminaires in clothes closets shall have the following minimum clearances from the storage space:
 - 12-inches for totally enclosed surface mounted incandescent or LED luminaries.
 - 6-inches for recessed totally enclosed incandescent, fluorescent or LED luminaries.
 - 6-inches for surface mounted or recessed fluorescent luminaries.
 Surface mounted fluorescent or LED luminaries listed for installation within the defined storage space are permitted. *(NEC 410.16)*
- ❖ Closet storage space extends from the floor to a height of 6-feet or the highest clothes-hanging rod and out 24-inches from the sides and back of the closet walls and continuing to the ceiling at 12-inches or the shelf width, whichever is greater. *(NEC 410.2)*
- ❖ Incandescent luminaries with open or partially enclosed lamps and pendant fixtures or lamp-holders are not permitted in clothes closets. *(NEC 410.16)*

- ❖ Luminaries installed in wet or damp locations shall be installed so that water cannot enter or accumulate and shall be marked as suitable for use in wet or damp locations, correspondingly. *(NEC 410.10)*
- ❖ The Minnesota Energy Code requires that all penetrations through an exterior wall air barrier be sealed. Sealing of the openings applies to all penetrations including the service entrance, conduit, cables, panels, recessed luminaires and electrical boxes.

Equipment Listing and Labeling

- ❖ All electrical equipment, including luminaries, devices and appliances used as part of or in connection with an electrical installation shall be listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) as having been tested and found suitable for a specific purpose. *(Minnesota Rules 3800.3620)*
- ❖ Listed electrical equipment shall be installed and used in accordance with the listing requirements and manufacturer's instructions. *(NEC 110.3)*

Electrical Services

- ❖ The 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 230.70)*
- ❖ Conductor Sizes for 120/240-Volt 3-wire, Single-Phase, Dwelling Services and Feeders. *(NEC 310.15)*

Copper	Aluminum	Service Rating
4 AWG	2 AWG	100 amps
1 AWG	2/0	150 amps
2/0	4/0	200 amps
400 kcmil	600 kcmil	400 amps

- ❖ Conductors of dissimilar metals shall not be intermixed unless the device is listed for the purpose. Listed anti-oxidant compound shall be used on all aluminum conductor terminations unless the device manufacturer's instructions state that it is not required. *(NEC 110.14)*
- ❖ Portions of raceways or sleeves passing from the interior to the exterior of a building or subject to different temperatures shall be filled with an approved material to prevent condensation from entering equipment. *(NEC 300.7)*
- ❖ Service entrance and overhead service conductors shall be arranged so that water will not enter the service enclosure. *(NEC 230.54)*
- ❖ The interior of raceways installed in wet locations above grade shall be considered wet locations. *(NEC 300.9)*
- ❖ Conductors 4 AWG or larger shall be protected by a bushing when entering an enclosure through a raceway. *(NEC 300.4)*
- ❖ Service disconnecting means shall not be located in a bathroom. *(NEC 230.70)*
- ❖ Overcurrent devices shall be readily accessible and not located in bathrooms or in the vicinity of easily ignitable materials such as clothes closets. *(NEC 240.24)*
- ❖ Back-fed overcurrent devices shall be secured by an additional approved device. *(NEC 408.36)*
- ❖ Working space shall be a minimum of 3-feet in the direction of access to live parts and the width of the equipment or 30-inches, whichever is greater, extending from the floor to 6 ½-feet and shall not be used for storage. The space below and above the panel from the floor to the ceiling is dedicated for electrical wiring and no piping, ducts, or apparatus shall be in this zone. *(NEC 110.26)*
- ❖ Illumination shall be provided for the working space about service equipment and panelboards. *(NEC 110.26)*

Grounding and Bonding

- ❖ Buildings supplied by a feeder or branch circuit shall have an equipment grounding conductor run with the supply conductors and connected to the grounding electrode system at the building. *(NEC 250.32)*
- ❖ All grounding electrodes that are present at each building or structure shall be bonded together to form the grounding electrode system. *(NEC 250.50)*
- ❖ Acceptable grounding electrodes include a metal underground water pipe, a metal frame of a building or structure, a rod, pipe or plate electrode, a concrete encased electrode and a ground ring. *(NEC 250.50)*
- ❖ A metal underground water pipe electrode shall be supplemented by an additional electrode. *(NEC 250.53)*
- ❖ Unless a rod, pipe and plate electrode has a resistance to ground of 25 ohms or less, it shall be supplemented with another acceptable electrode. *(NEC 250.53)*
- ❖ The conductor that is the sole connection to a rod, pipe or plate electrode is not required to be larger than #6 AWG copper. *(NEC 250.66)*
- ❖ The grounding electrode conductor shall be continuous, securely fastened and protected from physical damage. Grounding electrode conductors are not required to comply with the minimum cover requirements in 300.5 *(NEC 250.64)*

Equivalent Size of Service Entrance Conductor		Size of the Grounding Electrode Conductor	
Copper	Aluminum	Copper	Aluminum
4 AWG	2	8	6
1 AWG	2/0	6	4
2/0 or 3/0	4/0 or 250	4	2

- ❖ The main bonding jumper – generally the green bonding screw provided by the panel manufacturer – shall be installed in the main service panel. *(NEC 250.28)*
- ❖ 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. *(NEC 250.104)*

Underground Wiring

- ❖ Direct buried cable or conduit or other raceways shall meet the following minimum cover requirements: *(NEC 300.5)*

Direct Burial Cable	Rigid or Intermediate Metal Conduit	Non Metallic Raceway (PVC)
24-inches	6-inches	18-inches
The minimum cover for 120-volt residential branch circuits rated 20 amps or less and provided with GFCI protection at their source is permitted to be 12-inches.		

- ❖ Underground wiring is not permitted under pools or within 5-feet horizontally from the walls of the pool, unless supplying permitted pool equipment. *(NEC 680.10)*

- ❖ Underground service laterals shall have their location identified by a warning ribbon placed in the trench at least 12-inches above the underground installation. *(NEC 300.5)*
- ❖ Where subject to ground movement, direct buried cables and raceways shall be installed with expansion capability to prevent damage to the enclosed conductors or to the connected equipment. *(NEC 300.5)*
- ❖ Wire splicing devices for direct burial conductors shall be listed for such use. *(NEC 110.14)*
- ❖ Conductors emerging from underground shall be installed in rigid metal conduit, intermediate metal conduit, or Schedule 80 rigid nonmetallic conduit from 18-inches below grade or the minimum cover distance up to the point of termination above ground. *(NEC 300.5)*

**The information in this handout is just an overview.
See the 2014 NEC and Minnesota Rules 3800 for complete information.**