PLAN YOUR WIRING PROJECT

01 A rough-in inspection is required before any wiring is concealed by insulation, covering, ceiling covering, trench backfill, etc. If wiring is concealed before inspection, the person responsible for concealing the wiring is responsible for all costs associated with uncovering and replacing the covering material. MN Rules 3801.3770

02 The installer must schedule a final inspection when the electrical work is completed prior to the wiring being utilized and the space occupied MN Rules 3801.3780

GENERAL CIRCUIT REQUIREMENTS

03 **NEC 406.4 and 406.12** All 125 and 250 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 and receptacles that are part of a luminaire.

04 **NEC 210.12** 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.

05 **NEC 210.11 and 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 20- amp circuit for garage receptacles
- One individual branch circuit for central heating equipment. (i.e. furnace)

06 **NEC 406.4 and 406.9** Receptacles that are installed or replaced in wet locations shall be listed as weather-resistant "WR" and shall have an enclosure that is weatherproof with the cord inserted. Covers shall be marked "extra duty."

07 **NEC 300.3** All conductors of the same circuit, including grounding and bonding conductors shall be contained in the same raceway, cable, or trench.

08 **NEC 408.4** 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.

09 **NEC 240.4** Conductors shall be protected in accordance with their ampacity per Table 310.15(B)(16) and 240.4(D)

10 **NEC 200.11 and 406.3** Receptacle outlets shall be of the grounding type, be grounded, and have proper polarity.

NEC 310.15 Maximum Overcurrent Protection

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

11 **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. A receptacle shall be installed in each wall space 2-feet or more in width.

12 **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.

13 **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.

14 **NEC 210.52 & 406.9** 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 cap is inserted.

15 **NEC 210.52** Balconies, decks and porches accessible from inside a dwelling unit shall have at least one receptacle located less than 6½ feet above the floor.

16 **NEC 210.52** In attached and detached garages at least one receptacle shall be installed for and in each car space within 5½ feet from the floor.

GFCI PROTECTION

The ground-fault circuit-interrupter shall be installed in a readily accessible location.

17 **NEC 210.8** 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 Ground-fault circuit-interrupter (GFCI) protection shall be provided for all lighting outlets not exceeding 120-volts installed in crawl spaces.

18 **NEC 680.71** Hydro-massage bathtubs shall be supplied by an individual branch circuit and shall have ground-fault circuit-interrupter protection.

19 **NEC 210.8** Ground-fault circuit-interrupter (GFCI) protection shall be provided for outlets that supply dishwashers.

20 **NEC 680.73** 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.

21 **NEC 680.21(C)** All outlets supplying 125- or 240-volt pool pump motors shall be provided with GFCI protection.

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

22 **NEC 314.23** All electrical boxes shall be rigidly secured to the building structure.

23 **NEC 314.27** A listed fan box shall be installed where a ceiling paddle fan is mounted or where spare conductors are installed to a location acceptable to a ceiling fan.

24 **NEC 334.30** Type NM (nonmetallic) cables shall be secured every 4½-feet and within 12 inches of each box.

25 **NEC 314.17** The outer jacket of type NM cable shall be secured to the box and extend into the box at least ¼ inch.

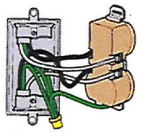
26 **NEC 300.14** The minimum length of conductors including equipment grounding conductors at all boxes shall be 6-inches with at least 3 inches outside the box.

27 **NEC 300.4** 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.

NOTE: Building codes prohibit holes within 2-inches of the top or bottom of a joist or rafter and notches in the center 1/3 of the span.

28 **NEC 300.22** Type NM cable shall not be installed in plenum spaces, but may be installed perpendicular through joist or stud spaces used as such.

29 **NEC 110.14** 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.



30 **NEC 200.7** 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.

31 **NEC 250.134** All non-current carrying metal parts of electrical equipment, including raceways, metal boxes and equipment shall be connected to an equipment grounding conductor.

32 **NEC 110.12** Unused openings in boxes shall be effectively closed. A non-metallic box shall be replaced if cable openings are punched out but not used.

33 **NEC 408.41** Each grounded circuit conductor within a panelboard shall terminate in an individual terminal.

34 **NEC 404.2** Generally, the neutral circuit conductor for the lighting circuit shall be installed at the locations where switches control lighting loads at each switch location unless the wiring is installed in a raceway; the switch box remains accessible or the switch controls a receptacle.

35 **NEC 314.29** Junction boxes shall be accessible without removing any part of the building.

36 **NEC 314.16** 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.

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

Example: a box with four 14/2 w/ground type NM cables:

8 insulated wires	**= 16 cubic inches**
All 4 grounding wires	= 2 cubic inches
1 switch	= 4 cubic inches
1 receptacle	= 4 cubic inches
All cable clamps	= 2 cubic inches
Minimum Box Volume	= 28 cubic inches

37 **NEC 410.16** Luminaires in clothes closets shall have the following minimum clearances from the storage space

- 12 inches for totally enclosed surface mounted incandescent or LED luminaires
- 6 inches for recessed totally enclosed incandescent, fluorescent or LED luminaires
- 6 inches for surface mounted or recessed fluorescent luminaires

38 **NEC 410.2** 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.

39 **NEC 410.16** Incandescent luminaires with open or partially enclosed lamps and pendant fixtures or lamp-holders are not permitted in clothes closets.

40 **NEC 410.10** Luminaires 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.

The Minnesota Energy Code requires that all penetrations through an exterior wall air barrier be sealed. Sealing of the opening applies to all penetrations including the service entrance, conduit, cables, panels, recessed luminaires and electrical boxes.

EQUIPMENT LISTING AND LABELING

41 **Minnesota Rules 3800.3620** All electrical equipment, including luminaires, 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.

42 **NEC 110.3** Listed electrical equipment shall be installed and used in accordance with the listing requirements and manufacturer's instructions.

ELECTRICAL SERVICES

43 **NEC 230.70** 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.

44 **NEC 310.15 Conductor Sizes For 120/240-Volt 3-Wire, Single-Phase, Dwelling Services And Feeders**

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

45 **NEC 110.14** Conductors of dissimilar metals shall not be intermixed unless the device is listed for the purpose.

46 **NEC 300.7** 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.

47 **NEC 230.54** Service entrance and overhead service conductors shall be arranged so that water will not enter the service enclosure.

48 **NEC 300.9** The interior of raceways installed in wet 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 locations above grade shall be considered a wet location.

49 **NEC 300.4** Conductors 4 AWG or larger shall be protected by a bushing when entering an enclosure through a raceway.

50 **NEC 230.70** Service disconnecting means shall not be located in a bathroom

51 **NEC 240.24** Overcurrent devices shall be readily accessible and not located in bathrooms or in the vicinity of easily ignitable materials such as clothes closets.

52 **NEC 408.36** Back-fed overcurrent devices that are shall be secured by an additional approved device.

53 **NEC 110.26** 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 6½-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.

54 **NEC 110.26** Illumination shall be provided for the working space about service equipment and panelboards.

GROUNDING AND BONDING

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

56 **NEC 250.32** 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.

57 **NEC 250.50** All grounding electrodes that are present at each building or structure shall be bonded together to form the grounding electrode system.

58 **NEC 250.52** 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

59 **NEC 250.53** A metal underground water pipe electrode shall be supplemented by an additional electrode.

60 **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 other than an underground water pipe..

61 **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.

62 **NEC 250.64** 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

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

UNDERGROUND WIRING

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

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.

64 **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.

65 **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.

66 **NEC 110.14** Wire splicing devices for direct burial conductors shall be listed for such use.

67 **NEC 300.5** Conductors emerging from underground shall be installed in rigid metal conduit, intermediate metal conduit, or Schedule 80 rigid nonmetallic conduit from 18" below grade or the minimum cover distance up to the point of termination above ground.

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This is a general overview of residential electrical requirements and no claim is made that this information is complete or beyond question.

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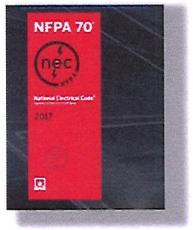
www.dli.mn.gov/CCLD/ElectricalInspect.asp

Electrical Inspection Checklist for Dwellings



Based on the
2017 National Electrical Code® (NEC®).

An owner (i.e. homeowner) who files a Request for Electrical Inspection form with the Department of Labor & Industry or other electrical inspection authority is signing an affidavit that they own and occupy the residence and they will personally perform all of the electrical work, including the planning and laying out.

The term "owner" is defined as 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. Owner and homeowner are synonymous.

A separate permit with the required fees must be submitted to the Department at or before the start of any electrical work that is required to be inspected.

A homeowner is exempt from having to possess a personal electrical license. It is illegal for unlicensed homeowners to install electrical wiring in two-family dwellings, apartment buildings, condominium buildings, certain townhouse buildings, manufactured homes in parks, recreational vehicles in parks, floating buildings on public waterways, or in or on any property that is rented, leased, or occupied by others.

All wiring including underground cable and conduit must be inspected before it is concealed by insulation, sheet-rock, paneling, or other materials. Except for the final connection to switches, receptacles, and lighting fixtures, all ground wires and other wires in boxes must be spliced and pigtailed for the rough-in inspection.

The installer must notify the inspector for final inspection when the wiring is complete, before the wiring is utilized and the space occupied.