

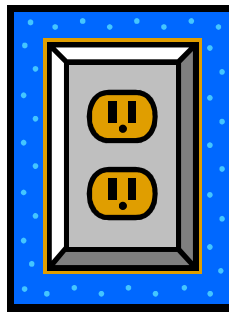
# PLAN YOUR WIRING PROJECT

*This brochure is only intended to be a general overview of the residential electrical requirements in the jurisdiction of WISPECT, LLC. No claim is made that information is complete or beyond question. Additional information and knowledge will be needed to properly install an electrical system that is essentially free from fire and electric shock hazard. If you have any questions after reading this brochure, please reference authoritative publications based on the 2005 National Electrical Code and the Wisconsin Electrical Code Vol. II, s. COMM. 16.*

## General Circuitry

**NEC 210.11** and **422.12** In addition to the branch circuits installed to supply general illumination and receptacle outlets in the dwelling unit(s), the following minimum requirements apply:

- Two (2) 20-amp circuits for kitchen receptacles;
- One (1) 20-amp circuit for the laundry receptacles;
- One (1) dedicated 20-amp circuit for each bathroom receptacle;
- One (1) dedicated 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 (2) separate small appliance branch circuits.

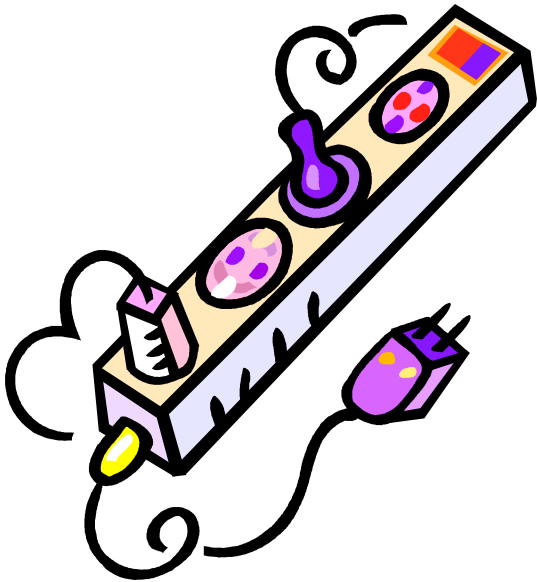
**NEC 300.3** All conductors of the same circuit, including grounding and bonding conductors, shall be contained in the same raceway, cable, or trench.

**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.

**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 over-current protection that exceeds the general limitations in the above chart.



**NEC 406.3** 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 measured horizontally along the floor line in any wall space is more than 1.8 m (6 ft.) from a receptacle outlet. **A receptacle shall be installed in each wall space .6 m (2 ft.) 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 600 mm (24") measured horizontally from a receptacle outlet in that space.

**NEC 210.52** A receptacle outlet shall be installed at each counter space 300 mm (12") or wider and at each island counter or peninsular space 600 mm (24") by 300 mm (12") or larger. Countertop spaces separated by range tops, sinks, or refrigerators are separate spaces.

**NEC 210.52 & 406.8 Outdoor receptacles**, accessible at grade level and no more than 2 m (6 ½') above grade, shall be installed at the front and back of a dwelling.

## 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, kitchen countertops, wet-bar sinks, boathouses, and outdoors. Receptacles that are not readily accessible may be exempt from the GFCI requirements.

**NEC 680.71** A hydro massage bathtub (defined as a permanently installed bathtub with a re-circulating piping system, designed to discharge water upon each use and its associated components) shall have ground-fault circuit-interrupter protection.



**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.

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

**NEC 680.73** Hydro massage bathtub equipment shall be accessible without damaging the building structure or finish.

**NEC 682.33** All circuits not rated more than 60 amps at 120 through 250-volts installed outdoors for equipment in or adjacent to natural and artificial bodies of water shall have GFCI protection.

NEC article 680 contains the specific requirements for the installation of electrical wiring for, or adjacent to swimming pools, spas, hot tubs, and fountains. These criteria were developed to help protect against the hazards of electricity and conductive pool water and **they exceed standard wiring requirements.**

## Wiring Methods

**NEC 314.23** All electrical boxes shall be securely supported by the building structure.

**COMM 16.325 Outlet boxes (NEC 314.27).** This is a department rule in addition to the requirements of 314.27 (A): In a dwelling unit, a ceiling outlet box installed for use as a lighting fixture in a habitable room or kitchen and located where a ceiling fan could be installed shall be a type listed for ceiling fan support.

**NEC 334.30** Type NM (nonmetallic) cable shall be secured at intervals not exceeding 1.4 m (4.5') and within 300 mm (12") of each box.

**COMM 16.32 Conductors entering boxes, conduit bodies, or fittings (NEC 314.17).** This is a department exception in addition to the requirements of NEC 314.17 B and C: Exception: Non-metallic sheathed cable shall not be required to be secured to the box or cabinet where it is enclosed within a raceway for mechanical protection providing the cable is secured within 12 inches of where it leaves the raceway. The raceway shall be at least 12 inches in length and sealed to prevent entrance of foreign materials.

**NEC 313.17** The outer jacket of NM cable shall extend into the box a minimum of ¼ inch.

**NEC 300.14** The minimum length of conductors, including grounding conductors, at all boxes shall be 150 mm (6"). At least 75 mm (3") shall extend outside the box.

**NEC 300.4** Where cables are installed through bored holes in joists, rafters, or wood framing members, the holes shall be bored so that edge of the hole is not less than 1 ¼ inches 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 1.6 mm (1/16") thick and of appropriate length and width.

**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.

**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.

**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 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 of the device.

**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.

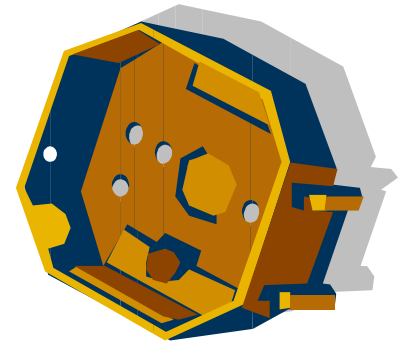
**NEC 314.25 & 410.12** In a completed installation, all outlet boxes shall have a cover, lamp-holder, canopy for a luminaires, or device with an appropriate cover plate.

**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.

**NEC 314.16** The volume of the electrical boxes shall be sufficient for the number of conductors, devices, and clamps, and cable clamps contained within the box. Nonmetallic boxes are marked with their cubic inch capacity.

**NEC 410.8** Luminaires (lighting fixtures) installed in clothes closets shall have the following minimum clearances from the defined storage area (see definition below):

- 300 mm (12") for surface incandescent fixtures
- 150 mm (6") for recessed incandescent fixtures
- 150 mm (6") for fluorescent fixtures.

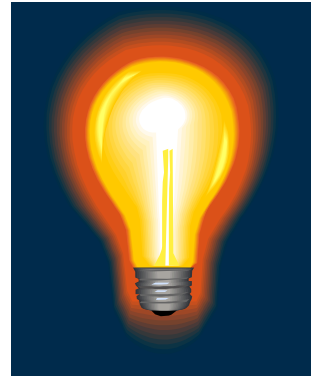


**Wisconsin's Uniform Dwelling Code, COMM 21.08 (3) (b),** Penetrations of a required separation by electrical components shall be firmly packed with a non-combustible material or shall be protected with a listed through-penetration fire-stop system with a rating of at least one hour.

**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 1.8 m (6 ft.) or the highest clothes-hanging rod and parallel to the walls at a horizontal distance of 300 mm (12") or the shelf width, whichever is greatest.

**NEC 410.8** Incandescent luminaires with open or partially enclosed lamps and pendant fixtures or lamp-holders are not permitted in the clothes closets.

**NEC 410.66** Recessed lighting fixtures installed in insulated ceilings or installed with 13 mm (½ ") of combustible material shall be approved for insulation contact and labeled Type IC.



### **Equipment Listing and Labeling**

**COMM 16.18 Installation and Use (NEC 110.3)** Substitute the following wording for NEC 110.3 (B): Listed or labeled equipment shall be installed or used, or both, in accordance with any instructions included in the listing or labeling, provided the instructions, listing or labeling do not conflict with this chapter.

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

### **Smoke Detectors**

**COMM 21.09 (1)** A listed and labels multiple-station smoke alarm with battery backup shall be installed in all the following locations:

(a) An alarm shall be installed inside each sleeping room.

(b) On floor levels that contain one or more sleeping areas, an alarm shall be installed outside of the sleeping rooms, in the vicinity of each sleeping area.

(c) On floor levels that do not contain a sleeping area, an alarm shall be installed in a common area on each floor level.

**COMM 21.09 (2)** Smoke detectors required by this section shall be continuously powered by the house electrical service and shall be interconnected so that activation of one detector will cause activation of all detectors.

## Electrical Services



### NEC 310.15 CONDUCTOR SIZES FOR 120/240 VOLT 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

**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 conductors terminations, unless information from the device manufacturer specifically states that it is not required.

**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.

**NEC 230.54** Where exposed to weather, service entrance conductors shall be rain-tight and arranged to drain.

**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.

**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 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 closet.

**COMM 16.25** This is a department rule in addition to NEC 230.70 (A): COMM 16.25 (4) (a) Except as provided in par. (b), raceways containing service conductors or cables, or service entrance cable not contained within a raceway, shall not extend longer than 8 feet into a building to the service disconnect or the first service disconnect of a group of disconnects as permitted by NEC 270.71. The raceways or conductors shall be considered to have entered the building at the point where they pass through the outer surface of the building exterior, except as permitted by NEC 230.6.

**NEC 110.26** Sufficient working space shall be provided around electrical equipment. When the voltage to ground does not exceed 150 volts, the depth of that space in the direction of access to live parts, shall be a minimum of 900 mm (3'). The minimum width of that space in front of electrical equipment shall be the width of the equipment of 750 mm (30') whichever is greater. This workspace shall be clear and extend from the floor to a height of 2 m (6 ½ '). This space shall not be used for storage.

**NEC 110.26** Illumination shall be provided for all working spaces about service equipment and panelboards.

## Grounding

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

**NEC 250.50** Permitted electrodes include: 1. Metal underground water pipe in direct contact with earth for 10 feet or

more. 2. Metal frame of building or structure. 3. Concrete encased electrodes. 4. Ground Ring. 5. Rod or pipe electrode. 6. Plate electrode. 7. Other metal underground systems or structures.

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

**NEC 260.64** The grounding electrode conductor shall be continuous, securely fastened, and protected from physical damage.

**AN ADDITIONAL ELECTRODE MUST SUPPLEMENT THE BURIED PIPE ELECTRODE.**

**NEC 250.66** The size of the grounding electrode conductor shall be determined by the size of the service-entrance conductors, per the following chart:

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

**NEC 250.28** a main bonding jumper or 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.

**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**

**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)
600 mm (24")	150 mm (6")	450 mm (18")

*NOTE: The above table does not apply to underground wiring supplying outdoor pools, spas, or tubs.*

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 300 mm (12").

**NEC 300.5**

Underground service laterals shall have their location identified by a warning ribbon placed in the trench at least 300 mm (12") above the under installation.

**NEC 300.5** Where subject to movement, direct buried cable or raceways shall be arranged to prevent damage to the enclosed conductors or equipment.

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

**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 450 mm (18") below grade or the minimum cover distance to the point of termination above ground.