



Homeowner electrical wiring guide

(Includes 2021 Canadian Electrical Code amendments)



Required inspections

Homeowner permits may require a minimum of two inspections, rough and final.

- Homeowner Electrical permits may be scheduled through our website at: <https://ijd.ca/request-an-inspection/>
- Access must be arranged by the homeowner and someone 18 years or older must be present.
- Inspections are conducted Monday through Friday between 8 a.m. and 4:30 p.m.

Note: The electrical inspection is separate from plumbing and building permit inspections

Rough-in inspections (when wiring is to be concealed) Call before insulating

- Have all wiring and interior of outlet boxes readily visible.
- All wiring must be strapped / stapled in place. Remove outer sheath of wiring and terminate all wiring into outlet boxes and fixtures.
- Ensure all splices are made and all bonding is complete in Boxes outlet boxes and fixtures.
- Do not secure devices (plugs, switches) to outlet boxes. Leave all wiring and terminations visible.
- Cables may be terminated into the panelboard.
- Never energize exposed wiring.
- Rough and underground inspections should be combined.
- Expose the trench on at least one end to confirm depth. Photos of the u/g showing the type of wiring method and it's depth can be sent to the Inspector to expedite backfilling.

Final inspection (electrical complete)

- Access must be provided to all areas where electrical work has been completed.
- Do not have any exposed live wiring.
- Install all devices, receptacles and light fixtures.
- Any open outlet boxes or unfinished wiring must be properly secured and installed in a junction box with an approved splice cap and a junction box cover.
- Install, terminate and energize all breakers, if safe to do so.
- Complete the panelboard breaker directory, all breakers must be labeled correctly.
- A permit services report will be produced once all inspections are completed. The report summarizes inspection outcomes and explains the resulting permit condition(s). This report is emailed to the permit applicant's and owner's email address as provided on the permit application.

Possible Outcomes

The Electrical Safety Codes Officer will advise of the inspection outcome. There are three possible outcomes:

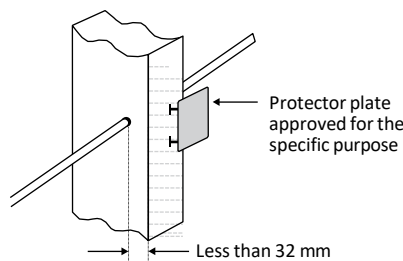
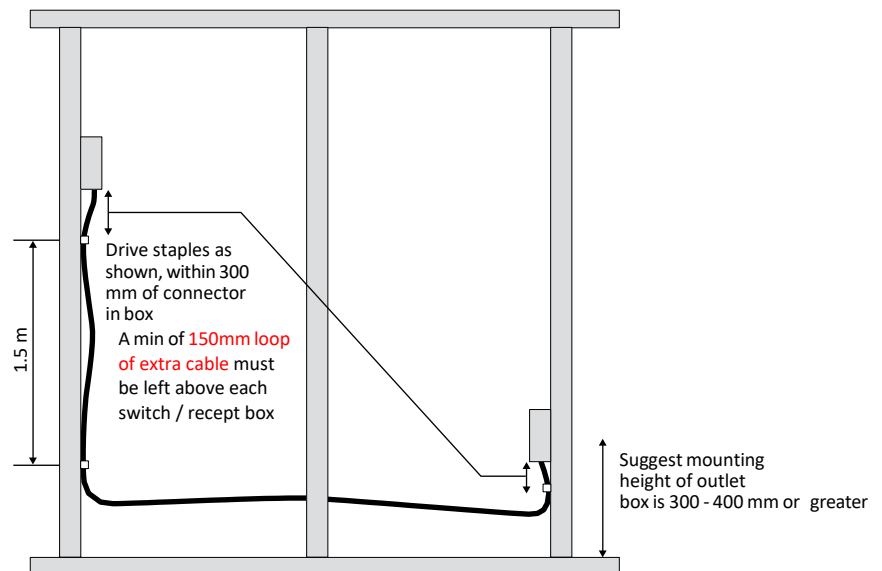
- **Acceptable:** Continue with installation.
- **Verification of compliance (VOC):** Correct deficiencies and return a signed copy permits@ijd.ca – then you may continue with the installation.
- **Not acceptable:** re-inspection will be required before continuing with installation.

Panelboards (service and sub-panels)

DO	DO NOT
<ul style="list-style-type: none"> Have 1 m clearance with secure footing in front. Have adequate lighting. Have minimum headroom of 2.2 m. Identify all branch circuits to what they serve. 	<ul style="list-style-type: none"> Put sub-panels in clothes closets, bathrooms or stairways. Have breakers more than 1.7 m above the floor. (if possible)

Non-metallic sheathed cable (NMD90) and Armoured cable (AC-90) branch circuit wiring

- Support cables with approved straps or staples within 300 mm of an outlet box and at intervals of 1.5 m thereafter.
- An approved mechanical protection plate is required where cables are:
 - within 32 mm of the stud/joist face surface, or
 - subject to damage from nails or screws where located behind baseboards or cupboards.
- Exposed cables within 1.5 m of the floor require mechanical protection.
- Cables require a minimum separation of 25 mm from heating ducts.
- Communication (TV, phone, speaker) cables require a minimum separation of 50 mm from power and lighting cables.
- Do not fish NMD90 cable into walls with metal studs.
- NMD90 cable run through metal studs will require approved bushings or grommets, to protect the wire from sharp edges.
- A minimum 150 mm loop of extra conductor length is required @ outlet boxes - between the staple & the box.**
- 240V loads such as electric heating, air conditioners, etc. should use NMD90 cables with a red outer jacket.



Fittings, devices and junction boxes

- Fasten all outlet boxes securely in place.
- Install all outlet boxes flush to the finished wall.
- Ceiling fan outlet boxes shall be marked for fan support.
- Unused openings in boxes and panels shall be closed with approved covers.
- Cable boxes mounted on metal studs must be approved.
- When used with lighting, vapour barriers must be approved for 90°C.
- Hydro-massage bathtubs require removable access panels for maintenance.
- Support grouped outlet boxes and outlet boxes that are greater than 100 mm on two sides.

The maximum number of conductors allowed in outlet boxes.

** Where a box contains a dimmer switch or a GFCI outlet, deduct an additional wire for each.

Box type	Dimensions H x W x D	Box Volume Milliliters	Number of #14 AWG wires (Black, white wires)
Octagon (Light)	4 x 1-1/2 deep	245ml	9 wires with 3 wire nuts
	3 x 2 x 2-1/8 deep	344ml	13 wires with 3 wire nuts
Plug or switch (Device)	3 x 2 x 2 deep	163ml	3 wires with 3 wire nuts and 1 device **
	3 x 2 x 2-1/2 deep	204ml	5 wires with 3 wire nuts and 1 device **
	3 x 2 x 3 deep	245ml	7 wires with 3 wire nuts and 1 device **
	2 gang 2-1/2 deep	409ml	11 wires with 3 wire nuts and 2 devices **
	2 gang 3" deep	491ml	15 wires with 3 wire nuts and 3 devices **
	3 gang 2-1/2 deep	614ml	18 wires with 3 wire nuts and 3 devices **
Plug or switch (Device)	4 x 1-1/2	344ml	14 wires. Deduct for wire nuts.
	4 x 2-1/8	491ml	20 wires. Deduct for wire nuts.

Lighting and fixtures

Bare light bulb

- Do not install fixtures with a bare light bulb in closets.
- Protect light fixtures that are less than 2.1 m high with a guard or by location.

Pot light

- Pot lights **not** marked “TYPE IC” must be at least 13 mm from combustible materials and 76 mm from insulation or in accordance with the manufacturer’s instructions.
- You may be asked to remove a retrofit pot light installed after the rough inspection, to verify the installation.

Three-way switch

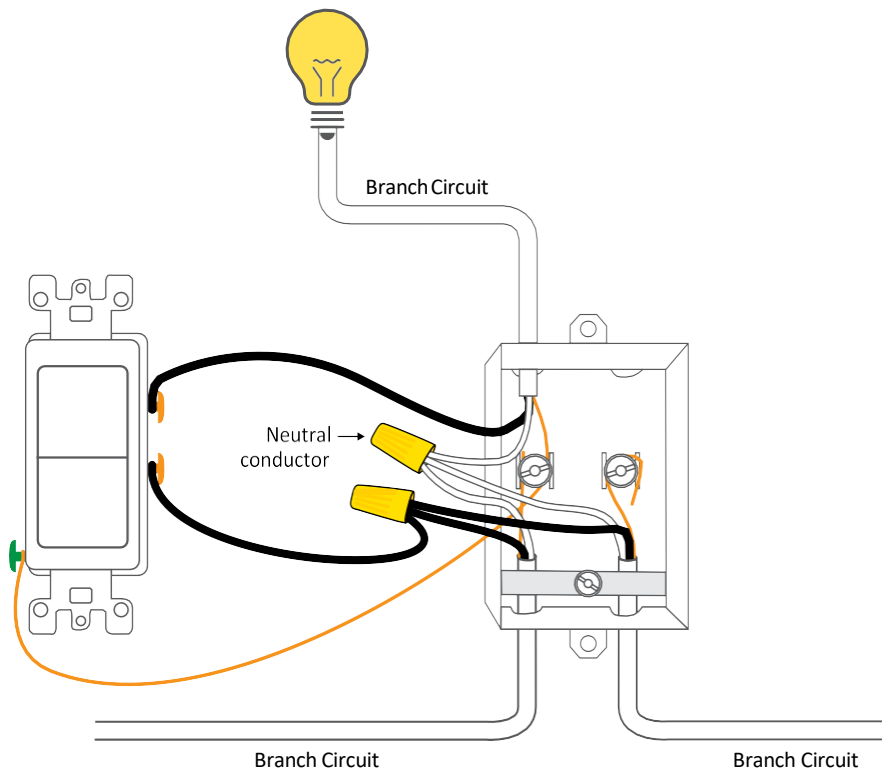
- Three-way switching is required at the top and bottom of stairways with four or more stairs that lead to a finished area or to an outside entrance.

Utility room

- Utility room lights shall be controlled by a wall switch at the entrance.

Bathtub/Shower stall

- Light switches must be more than 1 m away horizontally from a bathtub or shower stall. If not possible, they shall be at least 500 mm away and protected by a Ground Fault Circuit Interrupter (GFCI).
- The furnace disconnect switch must be accessible. Often when a basement is developed, the existing switch will need to be relocated (typically near the entrance to the utility room). This location is for emergency purposes, so access to the furnace disconnect switch must be reachable without passing the front of the furnace.
- A neutral (white) conductor shall be installed at every light switch outlet box.



Receptacles (outlets)

- Any outlet installed within 2 m from the floor must be tamper resistant.
- Outlets must be no more than 3.6 m apart in every open room and no more than 1.8 m from a door or closet. Any wall space of 900 mm or more in width requires an outlet.
- Outlets must be no more than 4.5 m apart in a hallway.
- No more than 12 outlets shall be on a branch circuit.
- In order to be included in the minimum outlet spacing requirements (shown in the diagram to the right), outlets must be installed no higher than 1.7m.

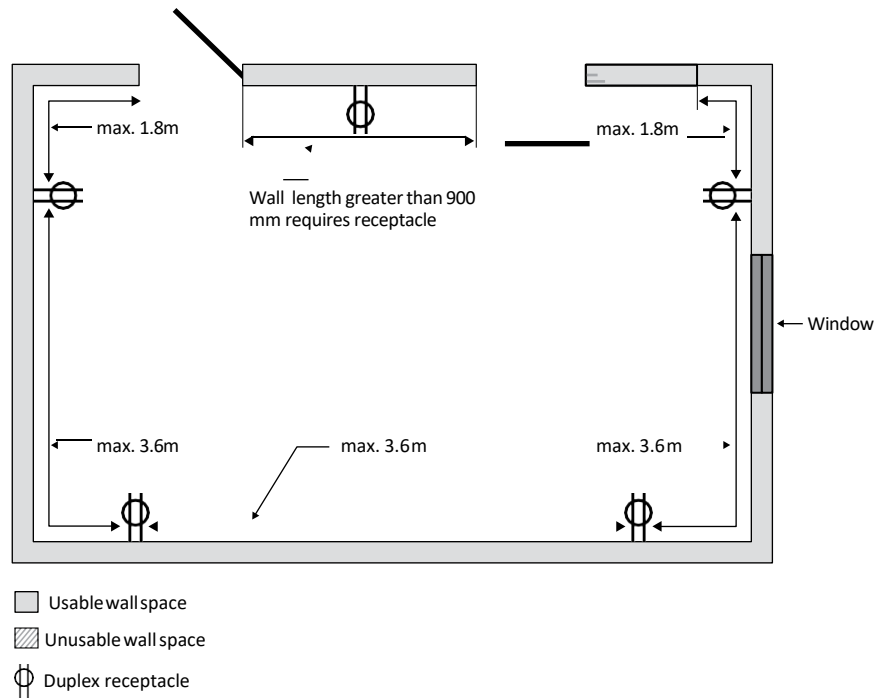
Kitchen

- Outlets must be no more than 1.8 m apart measured along the wall behind a counter top, and no more than 900 mm from a sink, stove or end point.
- Each fixed kitchen island or peninsula larger than 600 mm x 300 mm requires at least one outlet (15A split or 20A T-slot).
- Each gas stove requires a 120V outlet not more than 130 mm from the floor and as near midpoint as possible.
- A 14-50R stove outlet with #8 AWG wire must not exceed 130 mm to the center from the floor and as near midpoint as possible, with the U ground slot at the side.
- Do not place outlets in a cupboard, cabinet or similar enclosure, except where the outlet is for a specific type of appliance that is suitable for installation within the enclosure (i.e. a microwave).

Bathroom/washroom

- Install one outlet protected by a Class A Ground Fault Circuit Interrupter (GFCI) within 1m of the bathroom or washroom wash basin.

Bedroom Layout Example



Laundry area

- Each laundry area requires an outlet, in addition to the washing machine.
- Dryer outlets are type 14-30R with #10/3 AWG cables.

Garage

- An outlet is required to be installed within 1 m of a garage door opener.
- Each car space in a garage requires one outlet.

Outdoor

- Outdoor outlets require covers approved for wet locations and must be marked extra duty.

Branch Circuit wiring requirement

DO	DO NOT
<ul style="list-style-type: none"> ▪ Have separate branch circuit for refrigerators and microwaves. ▪ Have electrical heat on a dedicated circuit. ▪ Have outdoor outlets on a separate circuit. ▪ Install smoke and carbon monoxide alarms (with battery backup) on a hard wired 120V circuit with at least one light. Only a Building Safety Codes Officer can determine acceptable locations. ▪ Have at least one outlet on its own breaker for utility rooms. ▪ Have a separate circuit provided solely to supply power to each central vacuum system. 	<ul style="list-style-type: none"> ▪ Have more than 12 outlets on a circuit. ▪ Have more than two kitchen outlets on a 2 pole 15A circuit breaker or single pole 20A circuit breaker. ▪ each recept or light fixture box counts as 1 outlet. When installing LED lighting - count the number or recepts on the circuit. Each recept counts as 100 watts with a max of 1200 watts for the circuit. As an example if you have 8 recepts (800 watts) - you can then add 400 watts of LED lighting to the circuit

Ground fault protection (GFCI)

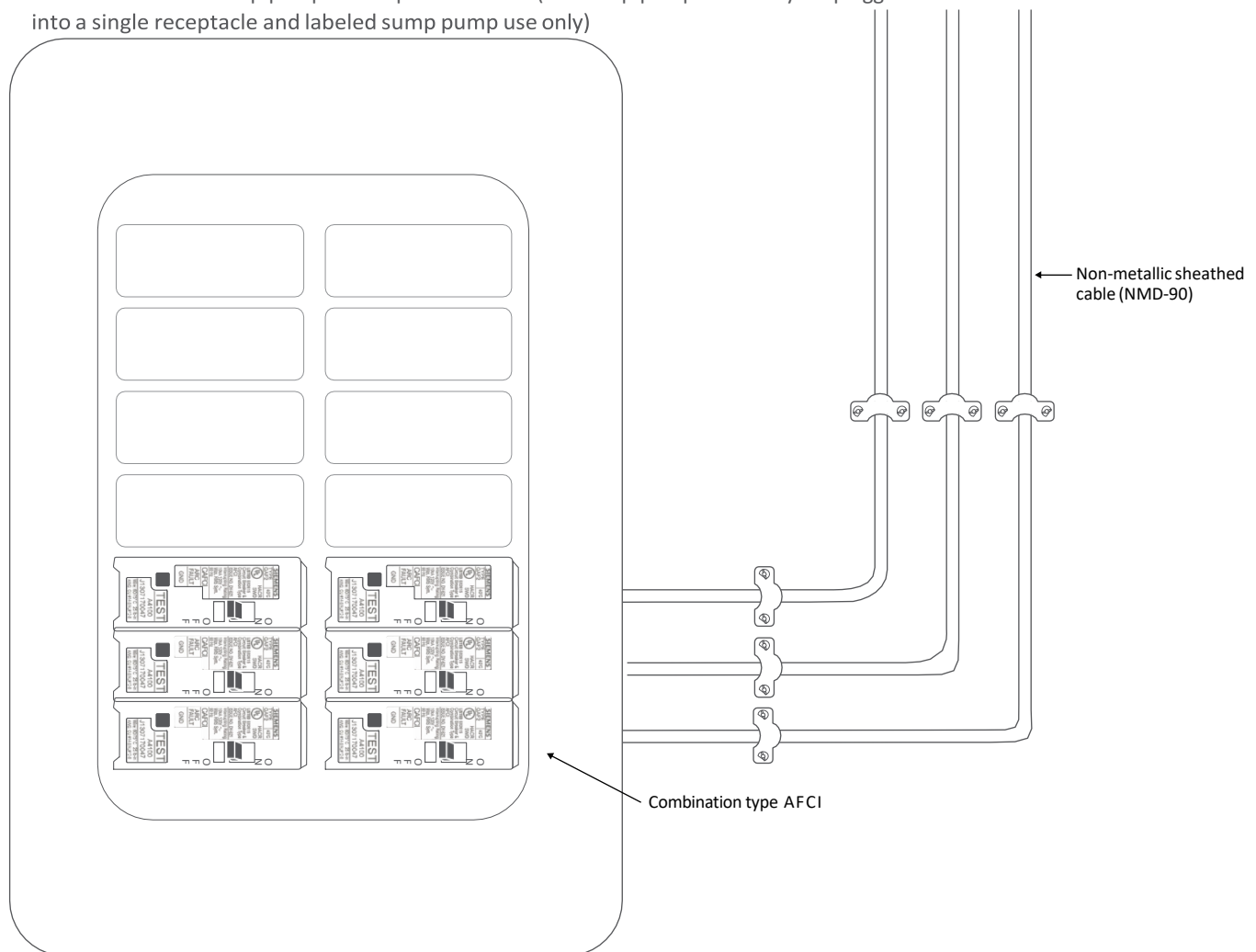
- 15A and 20A outlets installed within 1.5 m of a sink, bathtub or shower must be GFCI protected.
- Exterior outlets within 2.5 m of finished grade must be GFCI protected (automotive heater and charging outlets are exempt).
- Hydro-massage and hot tubs must be Class A ground fault protected. If cord connected an AFCI is required.
- Ground fault circuit interrupters must be installed in a location that will facilitate testing. They cannot be closer than 3 m to a hot tub and not closer than 1.5 m to a hydro-massage bathtub.
- Light switches (including fan and heat controls) located between 500 mm and 1 m horizontally from a sink, bathtub or shower stall shall be protected by a GFCI.
- Heating devices (i.e. baseboard heater/towel warmer) located less than 1.8 m above the floor and less than 1 m from a bathtub or shower stall shall be protected by a GFCI. Heating devices shall not be located closer than 500 mm to a bathtub or shower stall.
- A manually operated control (i.e. thermostat) for a heating device shall be permitted to be less than 1m from a sink (wash basin complete with a drainpipe) and not less than 500mm from a tub or shower stall, provided that it is protected by a ground fault circuit interrupter of the Class A type or supplied by an extra-low-voltage Class 2 circuit.

Arc-fault protection

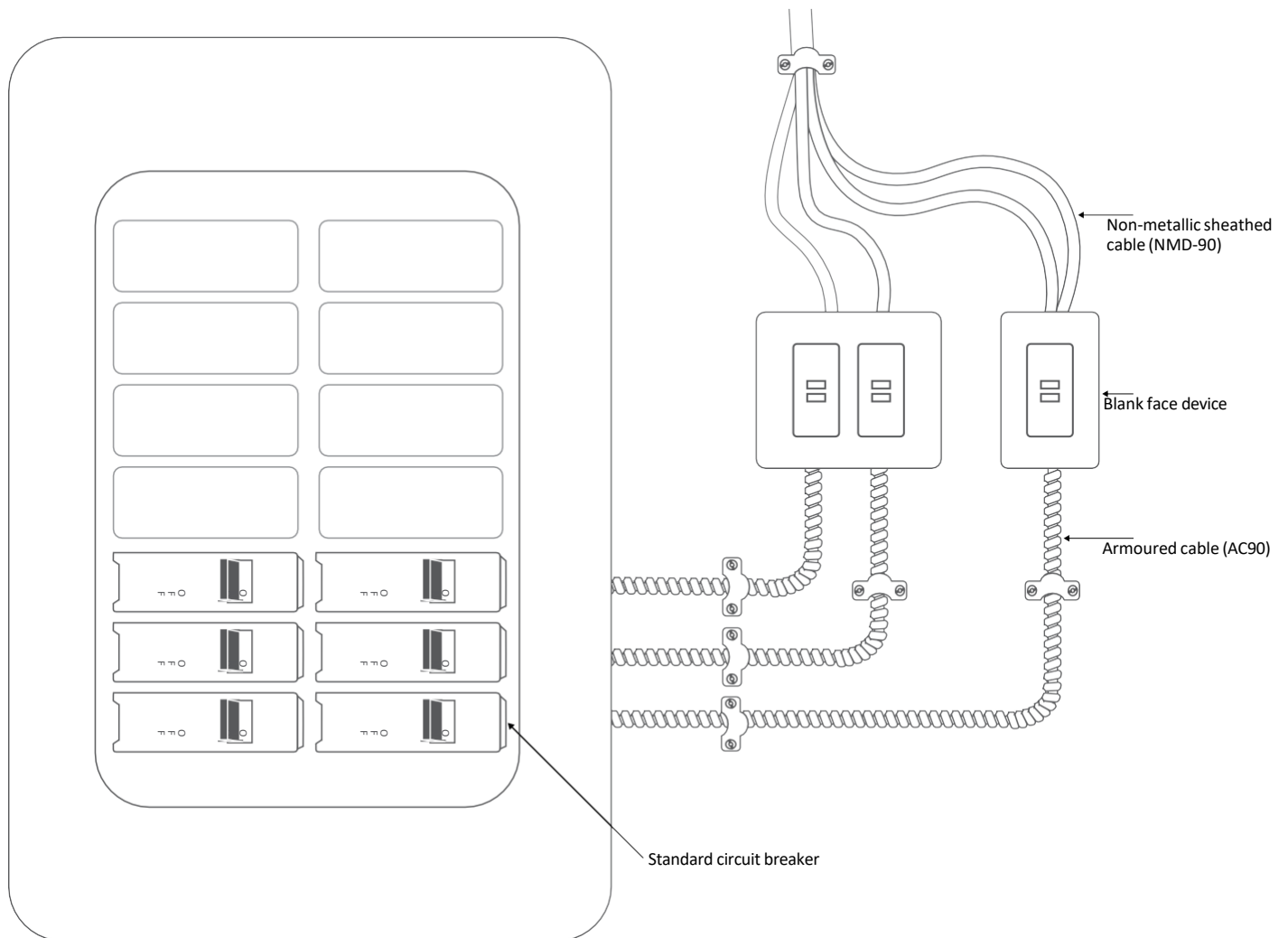
ALL Receptacles in a dwelling (125V outlets rated 20A or less) are to be protected by a combination-type arc-fault circuit interrupter (AFCI). This includes an attached garage and any exterior recepts

Only the following 15A or 20A outlets are excluded:

- Kitchen counter, island and peninsula recepts
- Kitchen refrigerator recept
- Deep Freeze (on separate circuit)
- Bathroom GFCI recepts - that do not have any other recepts on the circuit that require AFCI protection.
- A cord connected sump pump on a separate breaker (the sump pump must only be plugged into a single receptacle and labeled sump pump use only)



Armoured cable



Circuit breakers are required to be approved for use in the panelboard in which they will be installed. Combination type AFCI breakers are not available for many older panelboards and the wiring method described below is required.

The branch circuit wiring from the panelboard to the blank face device or first outlet must be armoured cable (AC90) or approved electrical tubing. This is to add additional protection to the branch circuit wiring where breakers are not used.

Where combination AFCI breakers are not used, blank face protectors and outlets are permitted with some restrictions.

Each application has a preferred installation method based on level of protection and practicality.

Underground installations

Click before you dig: www.albertaonecall.com/homeowners

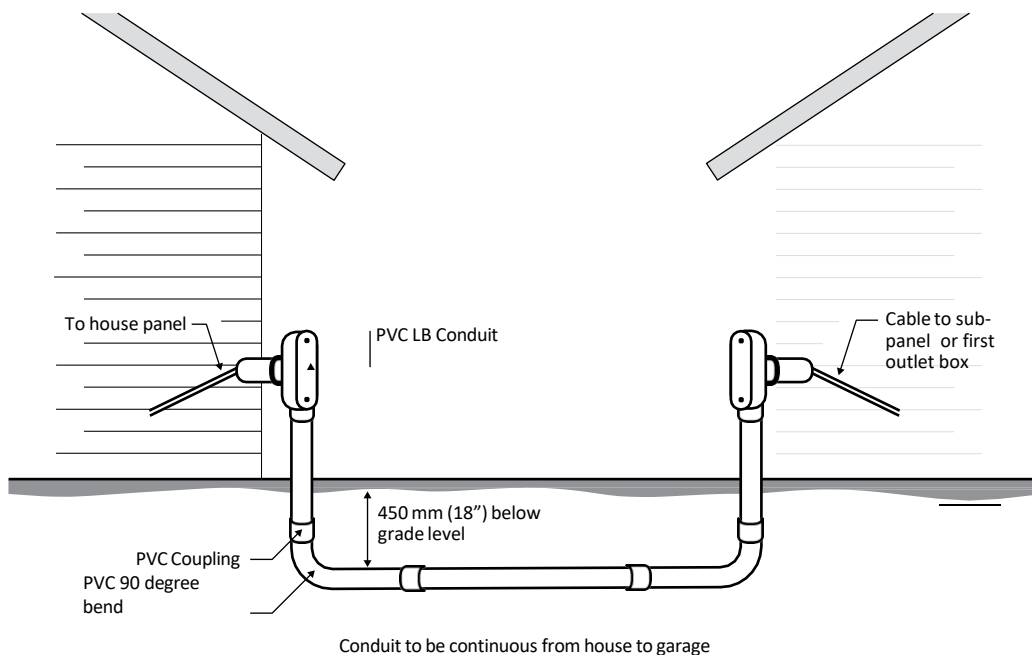
Direct buried conductors, cables or raceways must be installed to meet the minimum cover requirements. Distance measured is between finished grade and top of conduit or cable.

Wiring type	Non vehicle areas	Under vehicle traffic
Type NMWU direct buried **	600mm	900mm
Type NMWU in rigid PVC	450mm	600mm
Armoured cable (TECK90) ACWU	450mm	600mm

**Screened sand or screened backfill required.

Cables or conductors installed underground in a PVC conduit must be acceptable for use in wet locations (NMD90 is not acceptable).

- Protect cables exiting from underground from mechanical damage by location or by rigid PVC conduit.
- To prevent damage to the conductors or the electrical equipment, use a conduit expansion joint where underground PVC conduits or cables could be affected by settlement or frost.
- Do not place backfill containing large rock, paving materials, cinders, large or sharply angular substances or corrosive material where it may damage or corrode cables or conduits and prevent adequate compaction of the soil.



NOTE: Other underground wiring methods are accepted by the Canadian Electrical Code. NMD 90 cable is not acceptable for underground installations.

Quick Reference for various installations

Installation type	Breaker size	Cable size	Size of conduit underground
Single circuit 120 Volt	15 Amp	14/2 NMWU	3/4" (21mm) Rigid PVC
240 Volt - 30 Amp Sub panel	2 pole 30 Amp	10/3 NMWU	1" (27mm) Rigid PVC
240 Volt - 40 Amp Sub panel	2 pole 40 Amp	8/3 NMWU	1-1/4" (35mm) Rigid PVC
240 Volt - 60 Amp	2 pole 60 Amp	6/3 NMWU	1-1/4" (35mm) Rigid PVC

Use of approved electrical equipment

Electrical products and equipment must be approved by a Certification body, recognized by the Standards Council of Canada. Refer to the Alberta Electrical Safety STANDATA (LEG-ECR-2) found on the Alberta Municipal Affairs website.

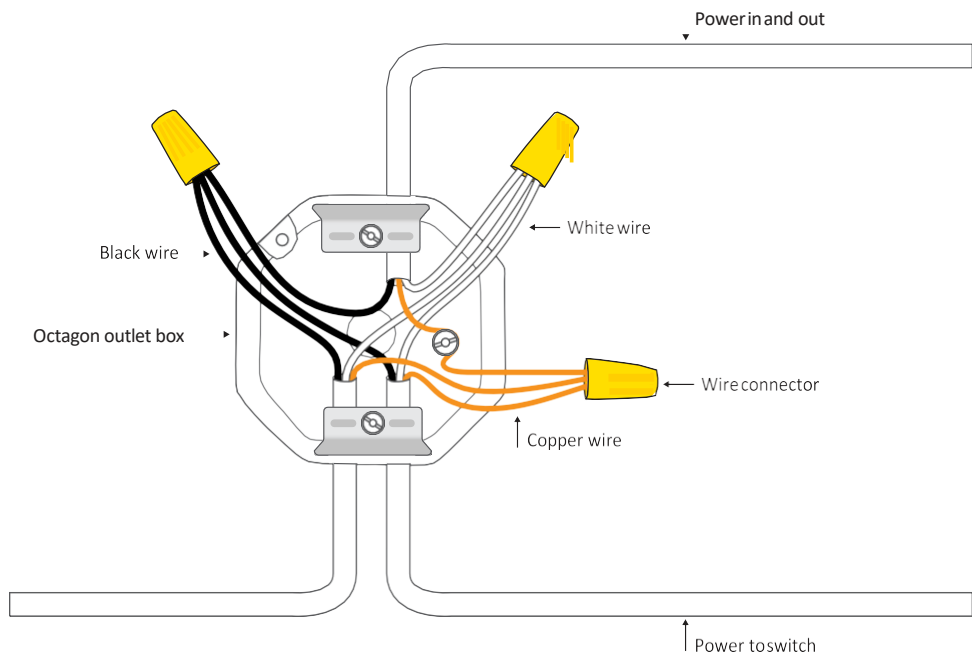
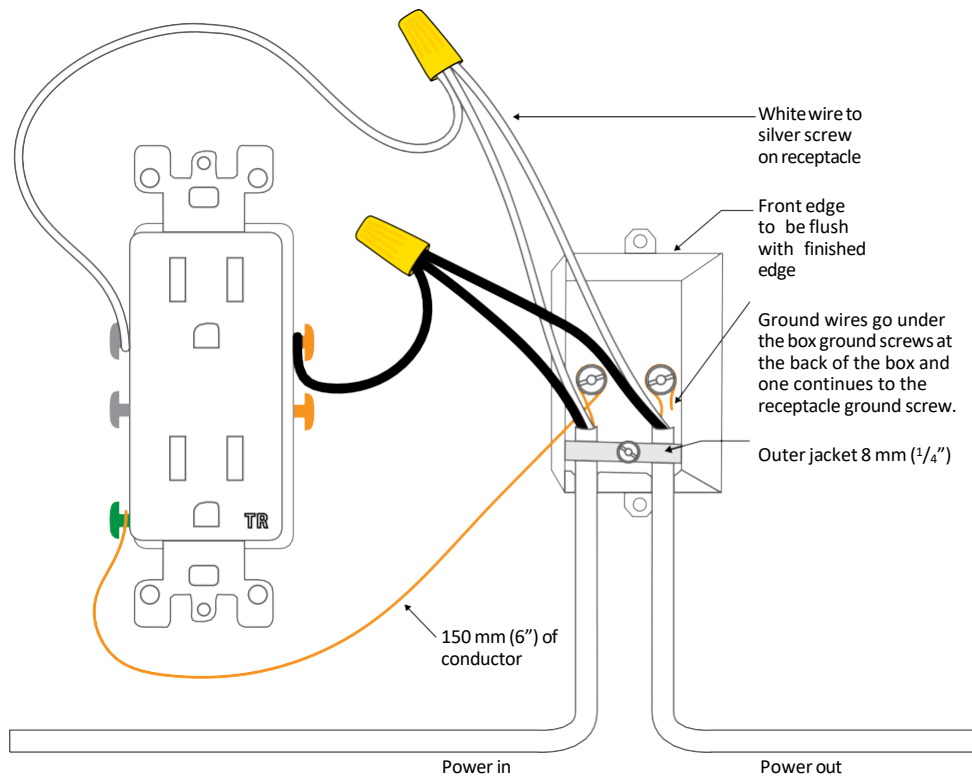
Certification Mark Examples



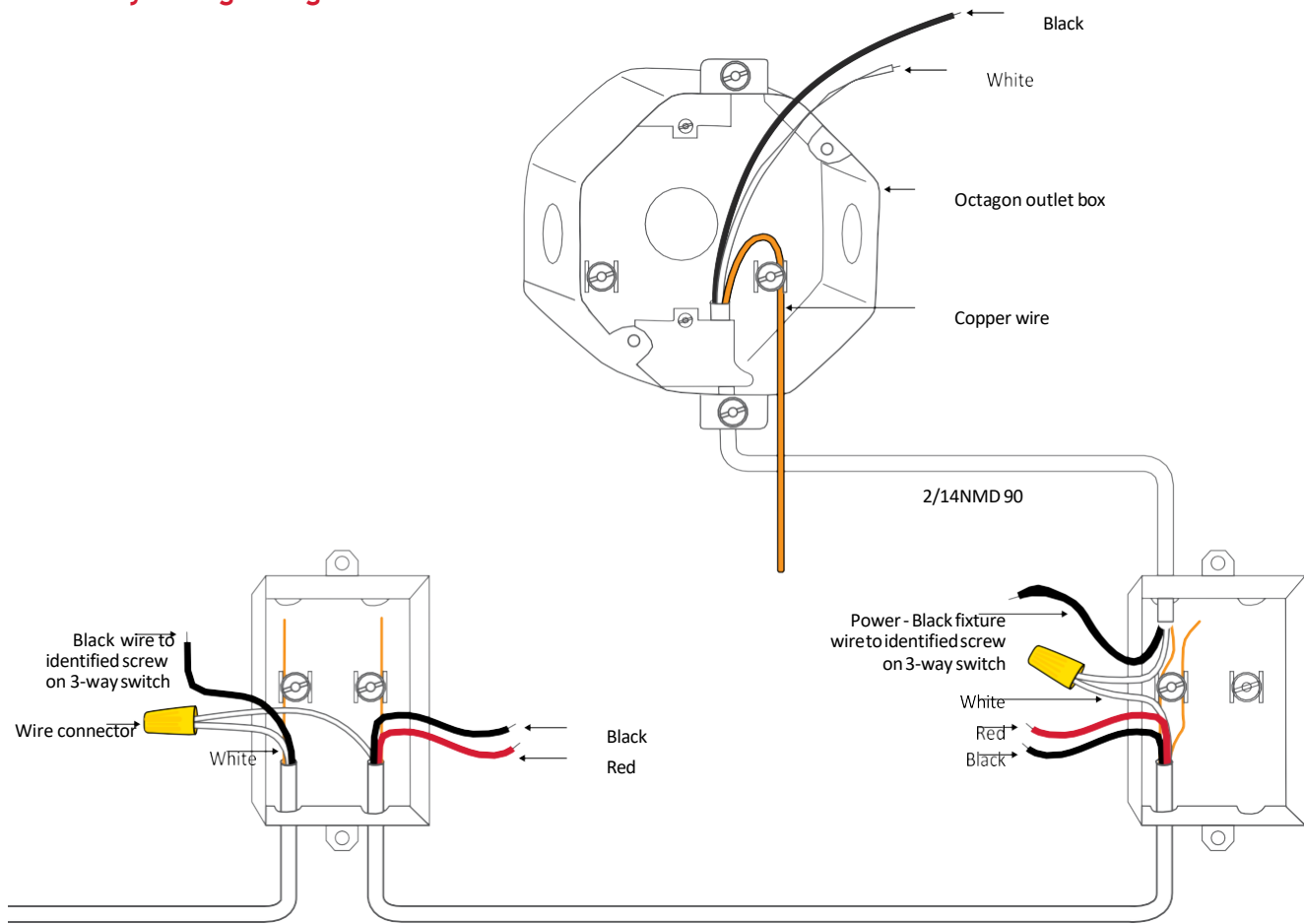
Inspection Label Examples



Three-way wiring configuration



Three-way wiring configuration



In-floor heating raceway requirements

The non-heating leads of an in-floor heating device set are required to be run in a raceway. The raceway is required to be installed from the box that will house the thermostat, to the floor. The raceway is required to terminate no more than 50mm from the ground where the non-heating leads are contained within a wooden base plate and effectively protected from mechanical damage. A box that will accept a connector is required to be installed for the thermostat. The manufacturer's installation instructions are to be followed and provided for inspection.

