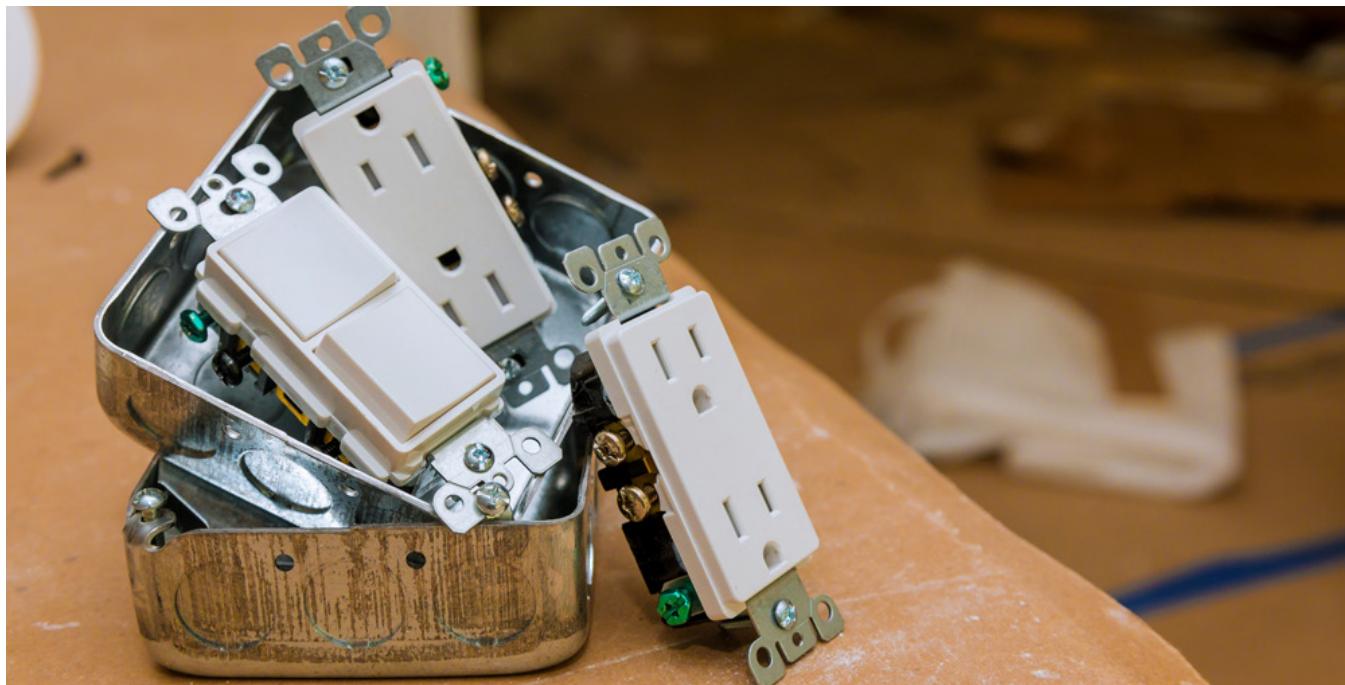


Electrical installations



A homeowner guide to the Winnipeg Electrical By-law requirements for a single-family dwelling, garage, carport or other accessory structure



Permit requirements

The construction, alteration, repair or extension of electrical installations requires an electrical permit as per the Winnipeg Electrical By-law. A permit is not required for the installation of voice/data, or to replace a light fixture, switch or receptacle in a single detached dwelling if they are installed in the same location as the existing equipment and do not require modifications to the existing copper wiring. Refer to the Winnipeg Electrical By-law: winnipeg.ca/electricalcentre

The permit applicant assumes full responsibility for electrical work indicated on the permit and must ensure the work conforms to all requirements of the bylaw.

Electrical permit applicant

An electrical permit may be issued to:

1. A person who holds an applicable electrical contractor's license from the City of Winnipeg authorizing that person to carry out business or trade in the City of Winnipeg, or
2. The owner of a single detached dwelling who is also the occupant. The owner must do the work themselves. The permit would be issued to the owner provided the designated employee is confident the work will be performed competently.

Homeowners may not apply for the following installations:

- renewable energy systems (e.g. solar photovoltaic systems)
- work over 200 Amps,
- electric vehicle chargers
- generators
- transfer switches
- indoor plant growth facilities

Permit expiration

The permit will expire if work is not started within six months from the date of issuance and completed within three years from the date of issuance. In addition, the designated employee has the discretion to cancel any electrical permit if the privileges granted by that permit are being misused.

Existing buildings

Recognizing that all requirements of the current bylaw may not be reasonably achievable on electrical projects involving existing buildings and existing electrical systems, the bylaw provides the designated employee special permission to protect the safety of building occupants and property first. These safety components include, but are not limited to: stairway lighting, smoke alarm systems, carbon monoxide alarm systems, arc-fault protection, ground fault protection, system bonding and system grounding. Minimum safety standards will be enforced in areas where electrical work is being installed.

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Note

This guide provides:

1. an outline of some of the more common electrical regulations applicable to electrical installations done by the homeowner
2. information on the extent to which the electrical work must be completed prior to requesting an inspection.

The applicable sections of this guide should be reviewed prior to starting the project. This guide is not intended to cover all electrical regulations for wiring. For complete electrical requirements, refer to the Winnipeg Electrical By-law.

Inspection requirements

Number of inspections

The wiring for projects, such as lower level development, additions, and other similar installations, is normally allotted two inspections.

The first inspection is made prior to covering any of the electrical installation with insulation or wall board. The second inspection is made on completion of the work.

Where additional inspections are found to be necessary, an additional inspection fee may be applied.

Where additional permits are required for the proposed scope of work, additional mandatory inspections may be required during construction. See the Housing Permit Inspections guide at:

winnipeg.ca/ppd/permits/Residential/Resources.stm

Trench inspection (if applicable)

Where there is underground wiring, the trench must be left open for inspection purposes. If mechanical protection is used it must be in position for the inspection.

Rough-in inspection

Before scheduling the first (rough-in) inspection, the following work must be completed:

1. All wiring for lights, switches, and receptacles must be installed in the walls, secured to the structural members and terminated in the outlet boxes.
2. All connections, joints, and bonding in the outlet boxes must be completed, leaving unconnected only the conductors required for the connection of the light, receptacle or switch, except as follows:
 - a. At least one receptacle, light, and switch must be connected to the wiring.
 - b. The wiring and connection of 3-way switches required for stairway lighting must be completed.
 - c. If recessed lighting fixtures will be installed, at least one fixture must be completed.
3. The conductors must be run into the electrical panel with the bonding (bare) conductor terminated under the bond screw and the neutral wire connected to the neutral terminal. The wires must not be connected to the circuit breaker until the wiring is complete.

Once the rough-in installation is complete you must schedule an inspection.

Final inspection

For the final inspection, the electrical installation must be completed, including:

1. All light fixtures, receptacles, switches and cover plates must be installed.
2. Light fixtures and receptacles must be connected to the power supply.
3. All required smoke and carbon monoxide alarms must be installed, connected to power and interconnected with other smoke or carbon monoxide alarms in the dwelling.
4. The electrical circuits in the panel must be clearly identified on the panel directory.

During the final inspection, the inspector may test the operation of breakers, and smoke and carbon monoxide alarms. To prepare for the inspection, ensure that sensitive electronics in the inspection area are disconnected from power and occupants of the house are aware that the smoke and carbon monoxide alarms will be activated.

To schedule inspections, complete the Housing Inspection Request Form at winnipeg.ca/housinginspection (recommended method) or phone 204-986-5300, between 8:30 a.m. and 4 p.m., Monday to Friday.

General installations

Requirements for finished rooms

1. A maximum of 12 outlets (lights and receptacles) may be connected to each 15 Amp branch circuit.
2. The maximum number of conductors permitted in an outlet box is shown in **Table 1**.

Table 1 - Maximum number of conductors allowed in outlet boxes

Box dimensions (inches)		Maximum number of conductors permitted		
		#14	#12	#10
Device	3 x 2 x 1-1/2	5	4	3
	3 x 2 x 2	6	5	4
	3 x 2 x 2-1/4	6	5	4
	3 x 2 x 2-1/2	8	7	5
	3 x 2 x 3	10	8	6
Octagon boxes	4 x 1-1/2	10	8	6
	4 x 2-1/8	14	12	9

1. The bare bonding conductors in cables are not counted.
2. Two conductors must be deducted from the number shown in the table for each switch or receptacle to be installed.
3. One conductor must be deducted for each pair of wire connectors in the device box.
4. A device box typically contains a receptacle or switch.

Example

A 3 x 2 x 2 in. box allows 6 - #14 conductors. If a receptacle will be installed, two conductors must be deducted from the number shown in Table 1 (6 - 2 = 4). Note that now only four conductors are allowed in the 3 x 2 x 2 in. box with a receptacle. Therefore, one 2-conductor cable may enter the outlet box and one 2-conductor cable may leave the outlet box.

Receptacles

1. Receptacles must be located so that no point on the wall is more than 1.8 m (6'-0") horizontally from a receptacle (measured along the floor line). Walls longer than 900 mm (3'-0") require receptacles spaced not more than 3.6 m (12'-0") apart.

Do not count wall space occupied by:

- Doorways and the area occupied by doors when fully opened
- Windows that extend to within 450 mm (1'-6") of the floor
- Other permanent installations that would limit the use of the wall space (fireplaces, clothes closets, etc.).

These receptacles are normally installed 300- 400 mm (1'-0" to 1'-3") above finished floor.

2. Item 1 is not applicable in washrooms, bathrooms, hallways, laundry rooms or closets, but must be installed in basement walls that are finished with drywall, paneling, etc. to within 450 mm (1'-6") of the basement floor.
3. At least one receptacle, supplied by a separate branch circuit, must be provided in each utility room.
4. At least one receptacle must be provided in any unfinished basement area.
5. Where a complete piped system for a cord-connected central vacuum system is installed, a receptacle supplied by a separate branch circuit must be provided.
6. One single receptacle, labelled "Sump Pump Only", supplied by a separate branch circuit, must be provided for a sump pump.
7. All 5-15 R and 5-20 R receptacles must be the tamper-resistant (TR) type unless they are dedicated for stationary appliances and rendered inaccessible or located more than 2 m (6'-6") above the floor.
8. All 125 Volt 15 and 20 Amp receptacle circuits must be protected by a combination arc fault circuit interrupter (AFCI) with the exception of branch circuits supplying:
 - a single receptacle for a sump pump
 - receptacles in detached garages or other out-buildings
 - receptacle(s) for bathroom and washroom with a wash basin(s)
 - kitchen refrigerator receptacle(s)
 - kitchen counter(s), island and peninsula receptacles

Lighting

1. A switch controlling a light fixture must be installed for every room except for living room(s) and bedroom(s) where a switched split duplex receptacle may be installed instead.
2. The maximum rating of circuit breaker permitted for any circuit supplying light fixtures is 15 Amps.
3. Every stairway must be illuminated. A light fixture that illuminates a stair having four or more risers must be controlled by 3-way switches located at the landing levels at the top and bottom of the stairs. If the lower level is not finished, the light fixture is permitted to be controlled by a single switch located at the head of the stairs and provisions for 3-way switching must be installed.
4. A neutral is required at all single switch locations.

Recessed light fixture installations

Recessed light fixtures must not be installed in an insulated ceiling unless specifically approved and marked for such use. In addition, recessed fixtures marked as suitable for installation on a non-combustible surface may only be installed on non-combustible surfaces.

Refer to manufacturer's installation recommendations for minimum clearances to thermal insulation and combustible materials.

Recessed light fixtures installed in insulated ceilings require vapour barriers. For insulated ceilings in new construction, vapour barrier boxes must be supported on all four sides. All slim LED recessed fixtures require a vapour barrier when installed in an unheated area, such as an attic. Vapour barrier used for pot lights must be marked as 90-degree Celcius for use with pot lights; standard 6 mil poly is not acceptable.

Bathrooms and washrooms

1. A receptacle must be installed within 1 m (3'-3") of a wash basin located in a bathroom or washroom. Where there are two wash basins, more than one receptacle may be required.
2. Receptacles and switches installed in bathrooms must be located at least 1 m (3'-3") from a bathtub or shower stall.
3. Receptacles installed within 1.5 m (5'-0") of a wash basin, bathtub or shower stall must be protected by a Class A type GFCI.
4. If there is no central exhaust or HRV, bathrooms and washrooms must have an electrically wired mechanical exhaust fan venting directly to the outdoors.
5. Electrical equipment associated with "jetted" (i.e. hydromassage) bathtubs must be protected with a Class A GFCI that is readily accessible.
6. All heating devices installed in a bathroom/washroom within 1.8 m (6'-0") of the floor and 1 m (3'-3") of a wash basin, tub or shower must be GFCI protected.

Kitchens

1. Kitchen counter receptacles must be located on the wall behind the counter work surface so that no point along the wall is more than 900 mm (3'-0") from a receptacle. This generally requires that receptacles be spaced 1.8 m (6'-0") apart.
2. Sinks, built-in equipment and isolated work surfaces less than 300 mm (1'-0") long at the wall do not need to be included when calculating the spacing of counter receptacles.
3. At least one receptacle must be provided at each permanently fixed island counter and on each peninsular counter space that is 300 mm x 600 mm (1'-0" - 2'-0") or larger. An island counter is considered to be permanently fixed unless it is mounted on wheels. An additional receptacle may be required if the counter space is interrupted by a sink or cooktop.
4. Kitchen counter receptacles must be either 15 Amp split-fed or 20 amp T-slot.
5. A receptacle, supplied by a separate branch circuit, must be installed for each refrigerator. An outlet for a recessed clock may also be connected to this circuit.
6. Receptacles installed within 1.5 m (5'-0") of sinks must be protected by a ground fault circuit interrupter (GFCI).

Outdoor/garage

1. All receptacles located outdoors and within 2.5 m (8'-0") of ground or grade level must be protected by a GFCI.
2. At least one receptacle, supplied by a separate branch circuit, must be provided outdoors for the use of electric appliances.
3. At least one receptacle, supplied by a separate branch circuit, must be provided for each driveway, parking pad and other similar locations where there is provision for vehicle parking.
4. At least one light fixture must be provided in a garage.
5. At least one receptacle must be provided for each car space in a garage or carport. At least one separate branch circuit must be provided for the receptacle(s), garage/carport lighting and garage door opener(s).
6. A receptacle must be installed for garage overhead door openers even if no opener is installed.
7. Conductors and cables installed between the house and any outbuildings, such as detached garages, must be run underground.
8. Receptacles exposed to the weather must be provided with an in-use cover plate marked as "Extra Duty".
9. Soffit receptacles must be provided with weatherproof covers.
10. Arc fault protection is not required for detached structures.
11. All receptacles located within 2 m (6'-0") of grade must be tamper resistant.

Smoke and carbon monoxide alarms

Smoke alarms must be installed on or near the ceiling in each dwelling. There must be at least one smoke alarm on each floor level, including lower levels, one in each bedroom, and one in a location between bedrooms and the exit. Where there is a hallway that serves the bedrooms, it should be installed there.

Smoke alarms shall not be located less than 1 m (3'-3") from the centre of doorways to bathrooms or laundry rooms and not less than 3 m (10'-0") from a fixed cooking appliance.

Smoke alarms must have battery backup and must be permanently connected to a 120V electric lighting circuit with no disconnect switch between the overcurrent device (breaker or fuse) and the smoke alarm.

Where a dwelling contains a fuel burning appliance (e.g. gas furnace, fireplace, wood stove, gas hot water tank, gas appliance, etc.) or has an attached garage, a carbon monoxide alarm must be installed inside each bedroom or outside of each bedroom within 5 m (16'-0") of the bedroom door, measured following corridors and doorways. Where a dwelling contains a solid fuel burning appliance (e.g. wood, fireplace, wood stove), a carbon monoxide alarm is also required within the same room the appliance is installed.

Carbon monoxide alarms that are supplied by a 120V circuit must have no disconnect switch between the overcurrent device (breaker or fuse) and the carbon monoxide alarm.

Installers should refer to the manufacturer's installation instructions.

Smoke and carbon monoxide alarms must be interconnected so that the activation of one alarm causes all alarms within the dwelling to sound.

Alarms may be connected to a GFCI or AFCI circuit as long as they have battery backup and are not interconnected to a heat sensor.

For secondary suites, alarms must be installed in the primary and secondary units and in ancillary/common spaces not within the dwelling units.

For existing dwellings where electrical work is being performed in areas where alarms are required, interconnected alarms must be installed in accordance with the Manitoba Building Code.

Garages, carports and other accessory structures

Electrical equipment in a garage

A panelboard is not required in a garage however, if one will be installed, the ampacities (current rating) of the larger conductor sizes that may be required to supply this panelboard are listed in **Table 2**.

Electrical equipment in garages, such as panelboards and EV chargers, must be surface mounted with 6 mil poly vapour barrier installed behind it and solidly secured (e.g. on 20 mm (3/4 in.) backer board).

Overhead supply conductors

Overhead supply conductors must be maintained at least 1 m (3'-3") above a peaked roof, and at least 2.5 m (8'-2") above the highest point of a flat roof or roof that can be readily walked upon. For more information, contact Manitoba Hydro.

Table 2 - Typical copper conductor ampacities and over-current protection

NMWU conductor type for direct earth burial			NMD-90 conductor type for indoor use only		
Wire size (AWG)	Ampacity (60°C)	Breaker or fuse size	Wire size (AWG)	Ampacity (75°C)	Breaker or fuse size
14	15	15 Amp	14	20	15 Amp
12	20	20 Amp	12	25	20 Amp
10	30	30 Amp	10	35	30 Amp
8	40	40 Amp	8	50	50 Amp
4	70	60 Amp	6	65	60 Amp
1	110	100 Amp	3	100	100 Amp
0	125	125 Amp	1	130	125 Amp

Wire trenching requirements

The required minimum installation depths for underground wiring are listed in **Table 3**. For a typical underground wiring plan, see **Figure 1**.

The trench for direct buried power conductors can be used for other conductors or services but, a minimum horizontal separation of not less than 300 mm (1'-0") must be provided:

1. between the direct buried power conductors and any gas, water or sewer line, and
2. between the direct buried power conductors and any unshielded VDVA (cable TV or communication cable).

Notice:

Precautions should be taken to avoid gas service lines from being enclosed in or under buildings as per CSA Z184 Gas Pipelines Systems Standards. Additionally, care should be taken when excavating to avoid disturbing other underground service lines including telephone cables and electrical power cables.

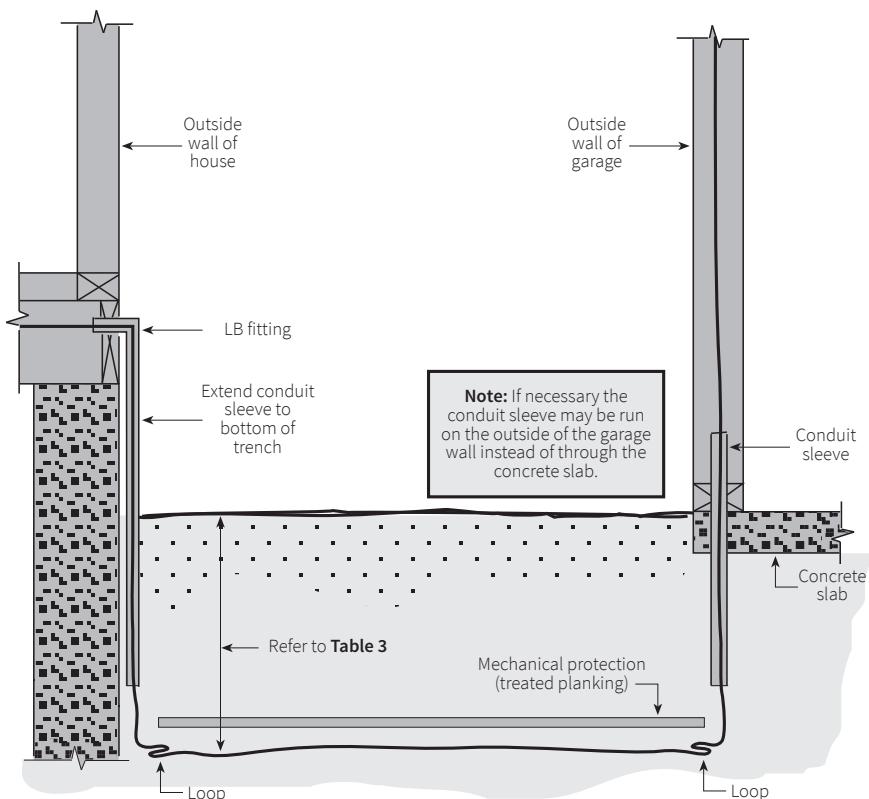
Before proceeding with construction or any underground excavation, contact: clickbeforeyoudigmb.com

Table 3 - Minimum installation depths for underground wiring to garage, carport or other accessory structure

Method	Non-vehicular area		Vehicular area	
	No mechanical protection	With mechanical protection ⁽¹⁾	No mechanical protection	With mechanical protection ⁽¹⁾
Conductors or cable ⁽⁵⁾ without metal sheath or armour such as NMWU or USEI	600 mm (2'-0")	450 mm (1'6")	900 mm (3'-0")	750 mm (2'-6")
Conductors or cable ⁽⁵⁾ with metal sheath or armour such as Teck or ACWU	450 mm (1'-6")	300 mm (1'-0")	600 mm (2'-0")	450 mm (1'-6")
Raceway ⁽²⁾⁽⁴⁾ such as rigid metal or rigid PVC conduit	450 mm (1'-6")	300 mm ⁽³⁾ (1'-0")	600 mm (2'-0")	450 mm ⁽³⁾ (1'-6")

1. Mechanical protection must consist of 50 mm (2 in.) nominal preserved wood planking or other suitable material that extends 2 in. beyond either side of the conductors or cable.
2. Conductors or cables installed in underground conduits must be approved for wet locations e.g. TW, RW.
3. Raceways installed at a depth of 300 mm (1'-0") to 450 mm (1'-6") in non-vehicular areas or at 450 mm (1'-6") to 600 mm (2'-0") in vehicular areas must have mechanical protection described in Note 1. above.
4. Where conductors are drawn into a complete conduit system, consideration for settlement in the form of expansion joints may be required.
5. Where a cable is direct buried, consideration for settlement in the form of a loop at each end of the trench may be required.

Figure 1 - Wiring plan for underground cable to garage, carport or other accessory structure



This is a diagram of an acceptable installation of NMWU underground cable between the house and a garage, carport or other accessory structure. Note that the cable, when installed at a depth of 450 mm (1'-6"), must be protected in the ground by planking at least 50 mm (2 in.) nominal thickness, which is treated with a wood preservative other than creosote. Where the conductors emerge from the trench, they must be protected against mechanical damage by a piece of rigid metal conduit or rigid PVC conduit. The cable loops at each end of the trench are to prevent damage from ground movement. These loops should be installed whenever a cable emerges from a conduit into direct contact with the earth.

Electrical service changes

Service change

Before proceeding with any electrical service change, it is imperative that you contact Manitoba Hydro to obtain a service point and to confirm the acceptability of your proposed meter location. Having determined the service point, the installation of the service must comply with the applicable requirements of the Winnipeg Electrical By-law.

Manitoba Hydro will normally limit metering installations to one meter of the same voltage and service characteristic per residential customer/tenant area.

Arranging for electrical power disconnect, inspections and power reconnect for a service

Prior to starting any work, contact Manitoba Hydro to arrange to have the electrical power disconnected. Note that they will not reconnect the new service until it has been inspected by a City of Winnipeg electrical inspector.

You are encouraged to schedule an inspection for the time you expect to be finished. An electrical service inspection can be pre-arranged by completing the Housing Inspection Request Form at winnipeg.ca/housinginspection (recommended method) or by calling 204-986-5300, between 8:30 a.m. and 4 p.m., Monday to Friday.

Service inspection

To be ready for an electrical service inspection, the following work must be completed:

1. The meter socket and service conduit must be completed, secured, and adequately braced.
2. All service conductors must be installed and properly terminated.
3. The grounding conductor must ground all of the service entrance equipment, the neutral bar in the service and the service conduit (if metal), and continue to the street side of the water meter or other acceptable grounding electrode.
4. At least one branch circuit from the old service must be connected to the new panel so the inspector can determine if this is being done correctly.

Minimum electrical installation requirements for electrical service changes and/or new installations

The typical requirements for an overhead or underground residential service are as indicated in Table 4.

Table 4 – Residential service requirements

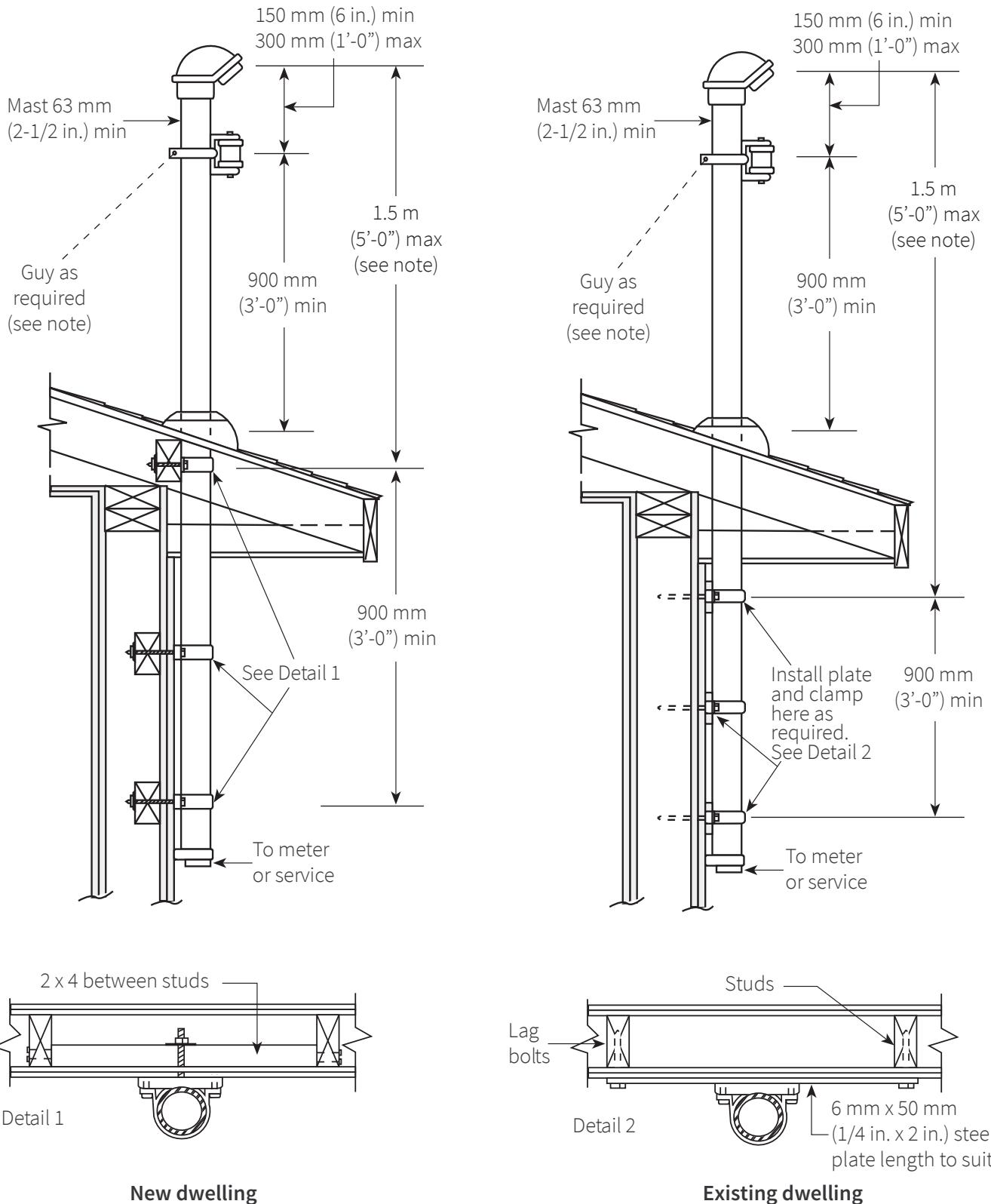
Conductor	100 Amps	200 Amps
Copper	27 mm (1 in.) EMT or PVC conduit containing two #3 R90 copper conductors and one #6 bare copper neutral	35 mm (1-1/4 in.) EMT or 41 mm (1-1/2 in.) PVC conduit containing two #3/0 R90 copper conductors and one #6 bare copper neutral
Aluminum	27 mm (1 in.) EMT or 35 mm (1-1/4 in.) PVC conduit containing two #1 R90 aluminum conductors and one #6 bare copper neutral	53 mm (2 in.) EMT or PVC conduit containing two #250 kcmil R90 aluminum conductors and one #4 bare copper neutral

1. Both 100 Amp and 200 Amp residential services require one #6 copper grounding conductor connected to a suitable grounding electrode, i.e. the street side of the water meter.
2. a. The service head height must not be less than 3.5 m (11'-6") nor more than 9 m (29'-0") above grade.
b. The service head must be installed within 600 mm (24 in.) horizontally of the point of attachment.
c. The service head and point of attachment must be located on the same side of the building.
3. The meter base must be located not less than 1.2 m (4'-0") nor more than 1.8 m (6'-0") to centre above finished grade or deck. See **Figure 3**.

Notes:

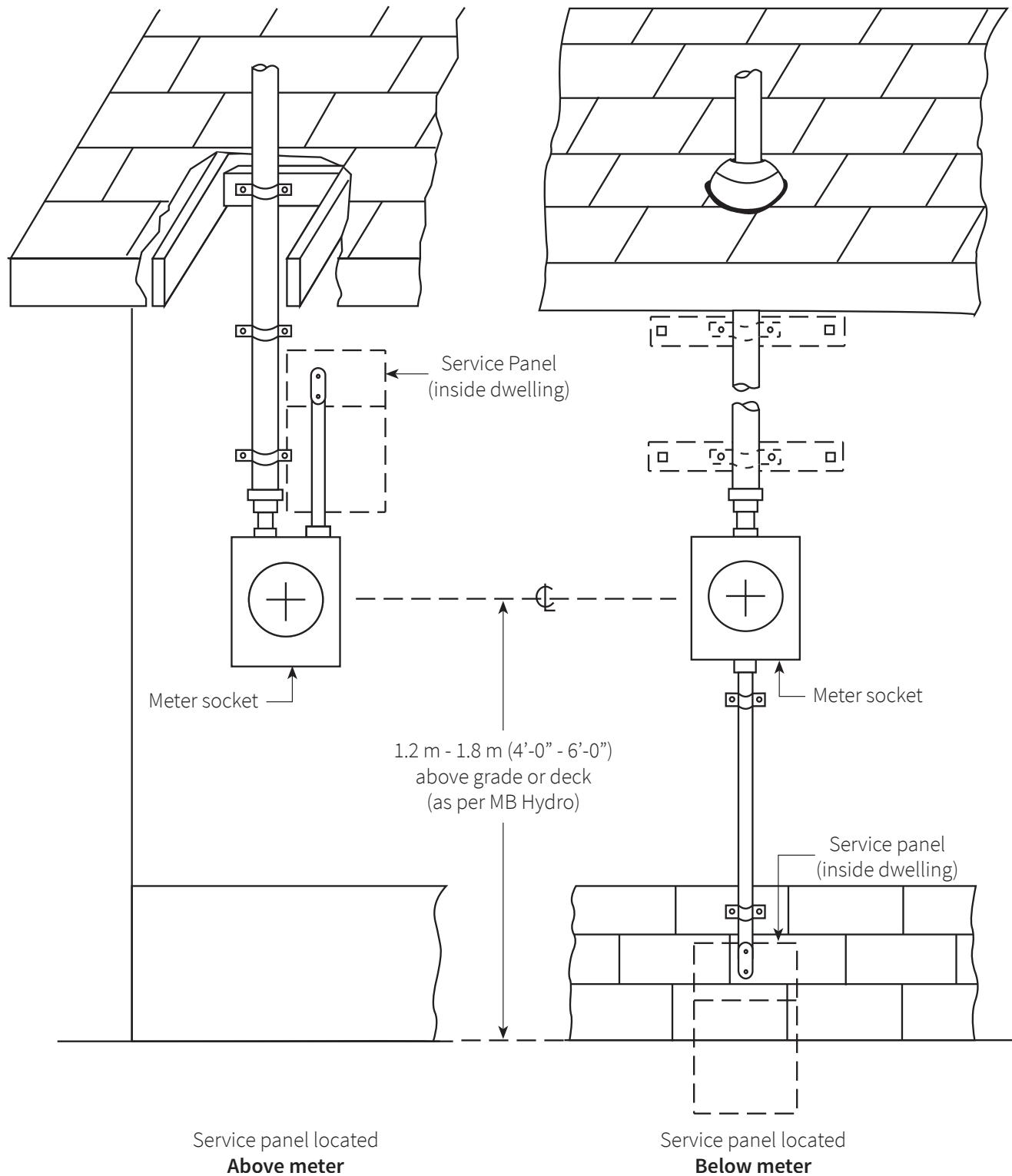
1. The service conduit must not enter the top of the service box unless drained outdoors in an approved manner.
2. Where the service conduit enters the building, the LB fitting must be filled with a compound that does not absorb moisture to prevent condensation.
3. To meet the minimum height requirements, a service mast may be required on single storey buildings.
4. See **Figures 2 and 3** for typical service mast and meter installation methods.
5. Exposed service conductors or cables that are not higher than windows, doors and porches shall have a clearance of 1 m (3'-3").
6. Exposed conductor drip loop may not extend down below the top of the window when it is located above the window.

Figure 2 – Typical service mast installation



Note: Maximum unguyed projection above top clamp not to exceed 1.5 m (5'-0") where required.

Figure 3 – Typical service meter installation





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Every effort has been made to ensure the accuracy of information contained in this publication. However, in the event of a discrepancy between this publication and the governing City of Winnipeg By-law, the bylaw will take precedence.