WEBINAR

Wiring for Canadian Homes – Part 2 of 3

March 28, 2023

By: Wissam Geahchan, Applications Engineer

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ATTENTION

AUDIENCE PARTICIPATION

- Questions can be asked at any time using the chat function on the webinar screen
- Any unanswered questions will be followed up through email
- This presentation, a recording of the webinar and a brief survey will be emailed to all registrants

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ABOUT ME

Wissam Geahchan

Applications Engineer, Nexans Canada

- Active member on several industry standards committees
- Experience applying the Canadian Electrical Code in a variety of applications
- Licensed soccer coach

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Fergus, ON

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Started with Canada Wire in Toronto, ON

3 Plants

750+ Products

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Agenda

Introduction
Part 1 -
- Service Installations
- Panel and Service Size
- Branch Circuits

Part 2 - *Today*
- Receptacles
- Lighting

Part 3 -
- Smoke Alarms and CO Detectors
- Major Appliances & Electrical Equip.

Summary
Q&A

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Preface: Nexans Products

Residential

For single and multi-family dwelling units, Nexans manufactures high quality, reliable and innovative solutions that provide ease of installation and increased durability and safety when installed in residential structures.

Nexans - Residential

RESIDENTIAL

SUPERVEX® NMWU

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CANADEX® NMD90 Copper

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Preface: Nexans Products (2)

Utility – Transmission & Distribution

Nexans manufactures a complete line of utility wire and cable for power transmission, distribution and service entrance from the generating station to the residential, commercial or industrial installation.

Nexans - Utility – Transmission & Distribution

UTILITY – TRANSMISSION & DISTRIBUTION

NS75 & NS90

UTILITY – TRANSMISSION & DISTRIBUTION

USEI90

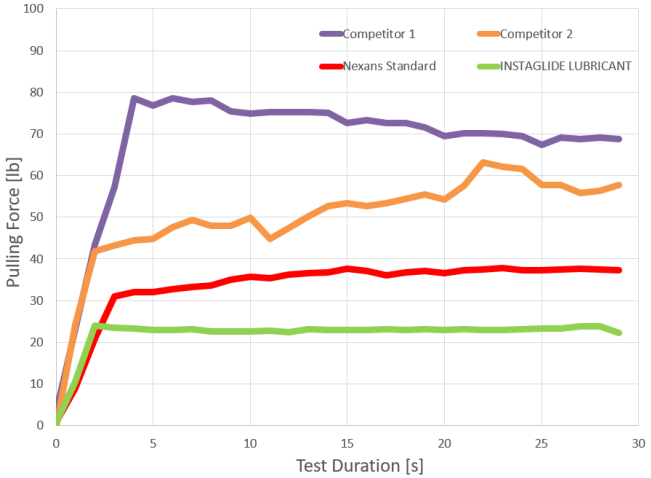
UTILITY – TRANSMISSION & DISTRIBUTION

USEI75

UTILITY – TRANSMISSION & DISTRIBUTION

USEB90

CANADEX® 2.0 NMD90



Instaglide lubricant

Easy-lifting handle

Metre markings

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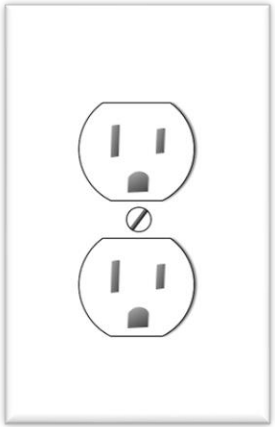
Receptacles

What are the general requirements for receptacles?

In the earliest residential electrical installations, electricity was used only to provide fixed lighting; there was no need for receptacles. As various types of electrical appliances and fixtures came onto the market, it became common to install receptacles.



Receptacles (2)

Agenda for this section

1. Finished Walls
2. Usable Wall Space
3. General Rooms
4. Sleeping Rooms
5. Porches and Balconies
6. Kitchens
7. Kitchen Counter Work Surfaces
    1. Split duplex receptacles
    2. T-slot receptacles
    3. Wheelchair access
8. Kitchen Islands
9. Refrigerators
10. Free-standing electric ranges
11. Microwave Ovens
12. Hallways and Stairways
13. Utility and Laundry Rooms
14. Bathrooms
15. Bathrooms Containing Laundry Facilities
16. Outdoor
17. Unfinished Basements
18. Garage and Carports
19. Unattached Structures or Outbuildings

Receptacles (3)

FINISHED WALLS

A **finished wall** is any wall finished, from ceiling to within **450 mm** of the floor, with drywall, wood, other types of paneling, or finishing materials such as plaster.

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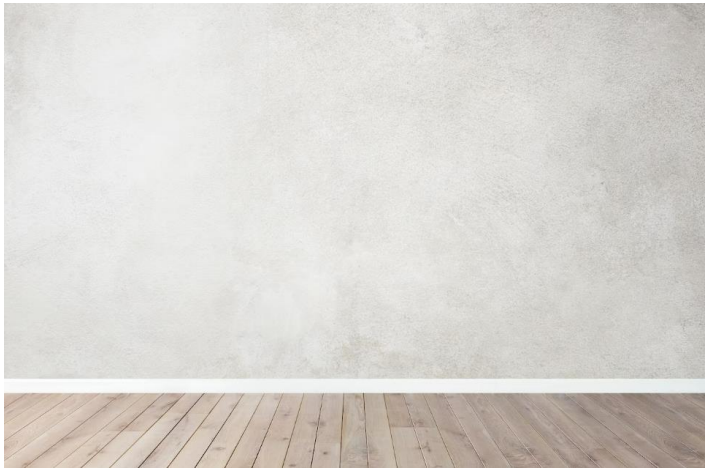
Receptacles (4)

USABLE WALL SPACE

The required number of receptacles depends on the *usable wall space* of a finished wall.

Usable wall space is any wall space 900 mm (36 in) or more in width, measured along the floor line of the finished wall.



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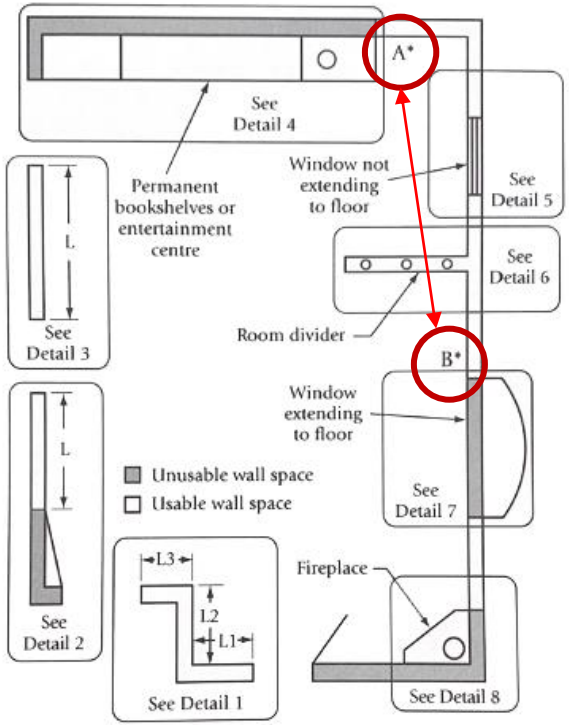
Receptacles (5)

Illustrative examples of USABLE WALL SPACE

*Where the distance between point A and point B is greater than **900 mm (36 in),** measured along the floor line of the wall, the wall space is considered **usable**.



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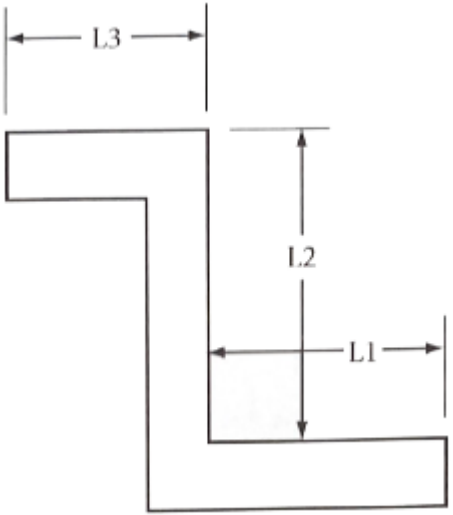
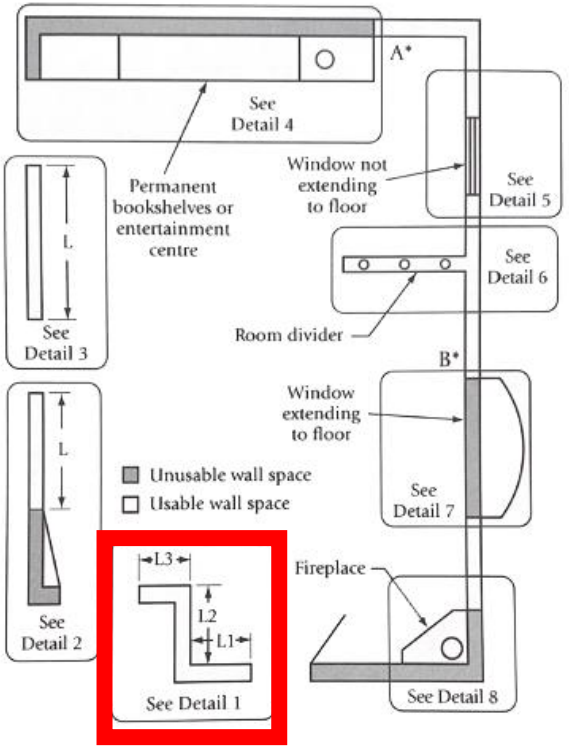
Receptacles (6)

Detail 1





L1 + L2 + L3 = 900 mm (3 ft) or more → **usable wall space**

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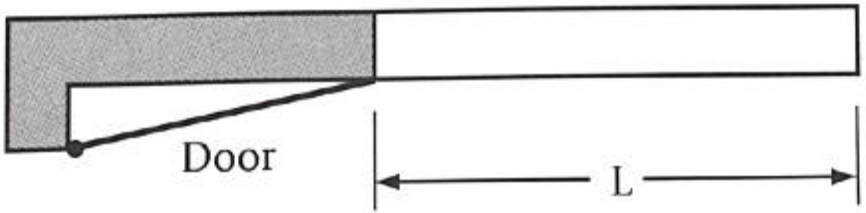
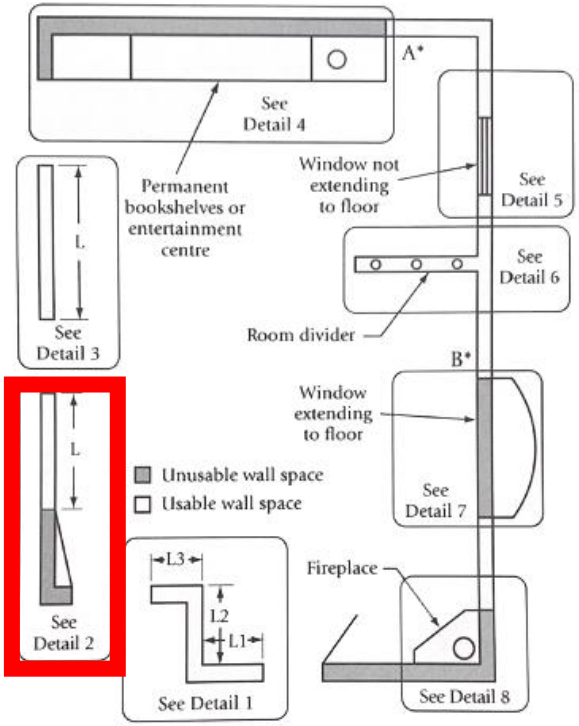
Receptacles (7)

Detail 2





Length of wall behind door → **unusable wall space**
If L is less than 900 mm (3 ft) → **unusable wall space**

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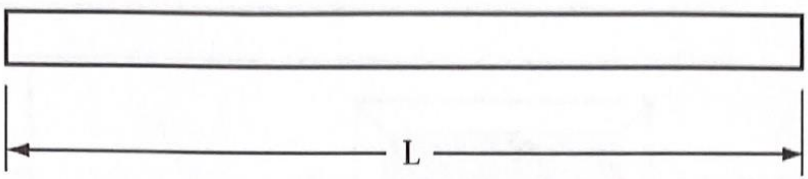
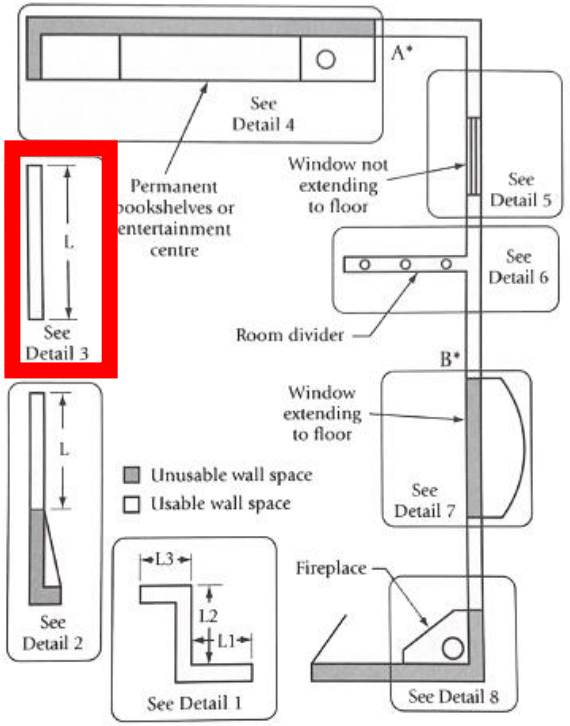
Receptacles (8)

Detail 3





L1 is 900 mm (3 ft) or more → **usable wall space**

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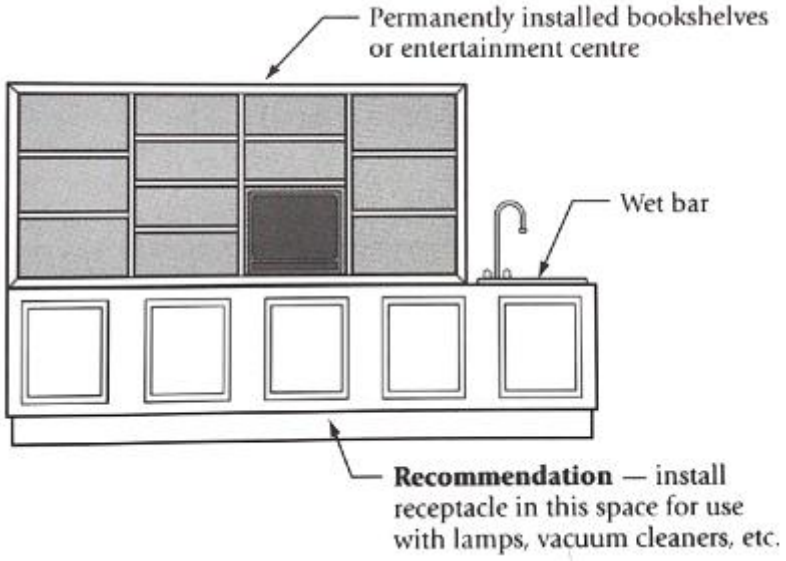
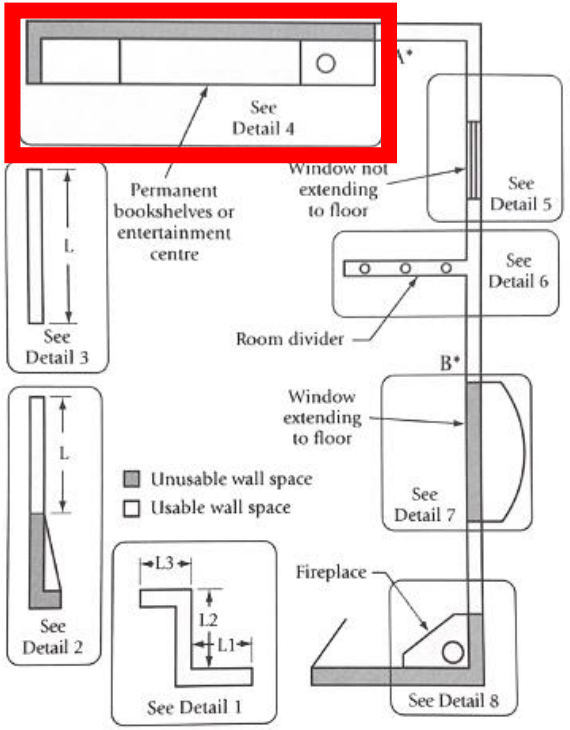
Receptacles (9)

Detail 4





1. Wall length behind these bookshelves or entertainment centre is **unusable**
2. “Permanently installed” means connected to the wall by devices that require a tool to be used to move the item.

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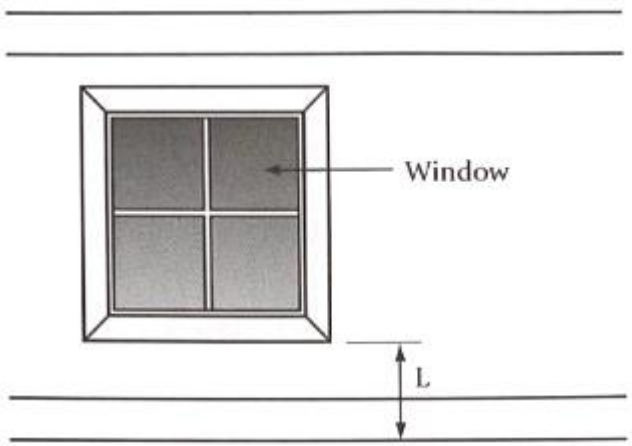
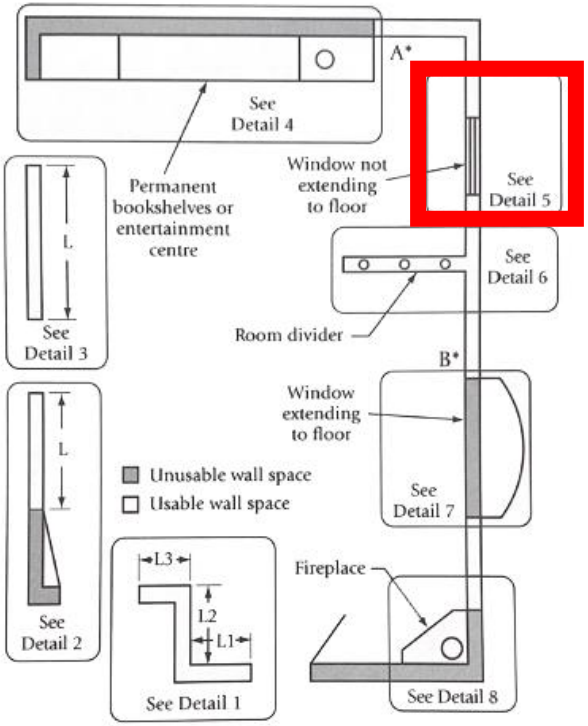
Receptacles (10)

Detail 5





L is more than 300 mm (12 in) → **usable wall space**

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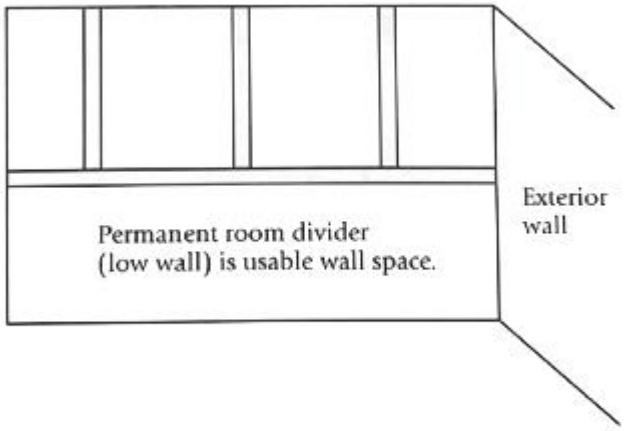
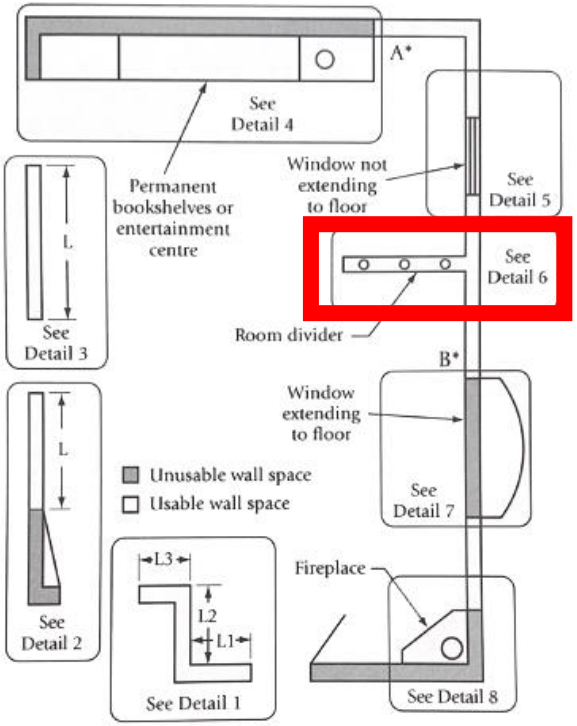
Receptacles (11)

Detail 6





Permanent room divider (low wall) → **usable wall space**

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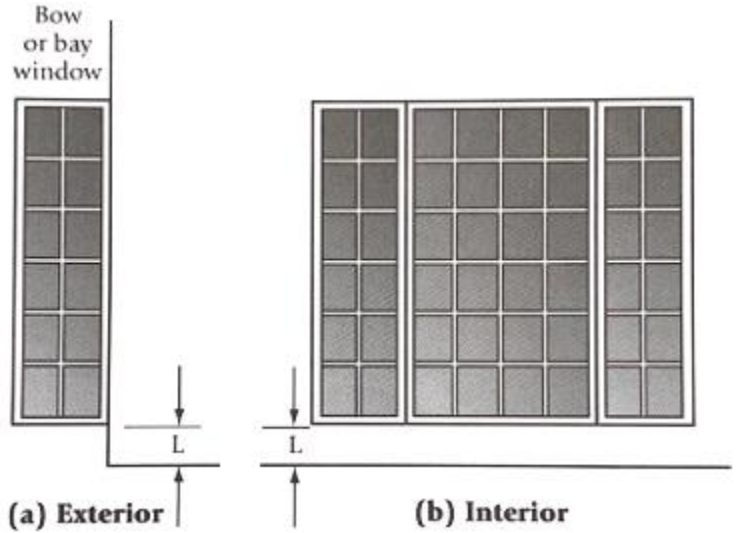
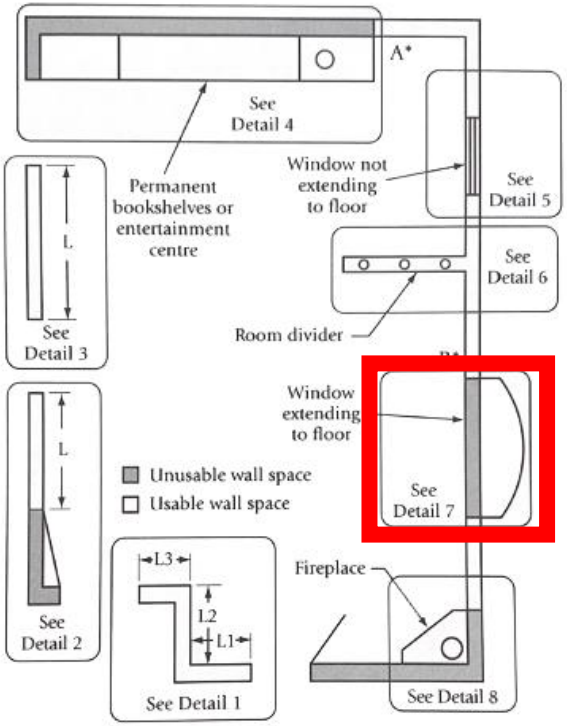
Receptacles (12)

Detail 7





L is 300 mm (12 in) or less → the space below the window is **unusable wall space**

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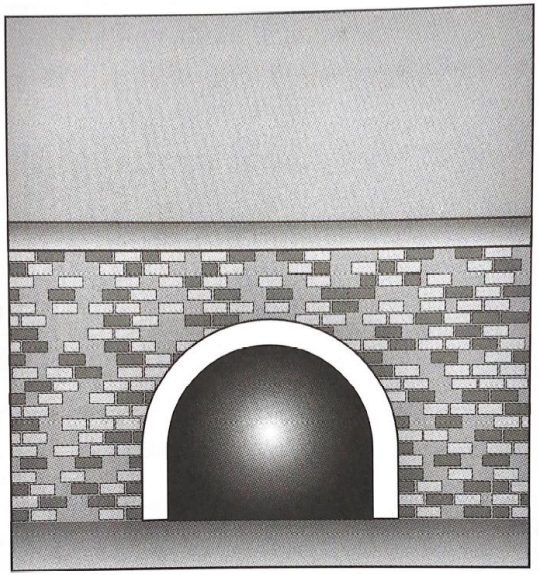
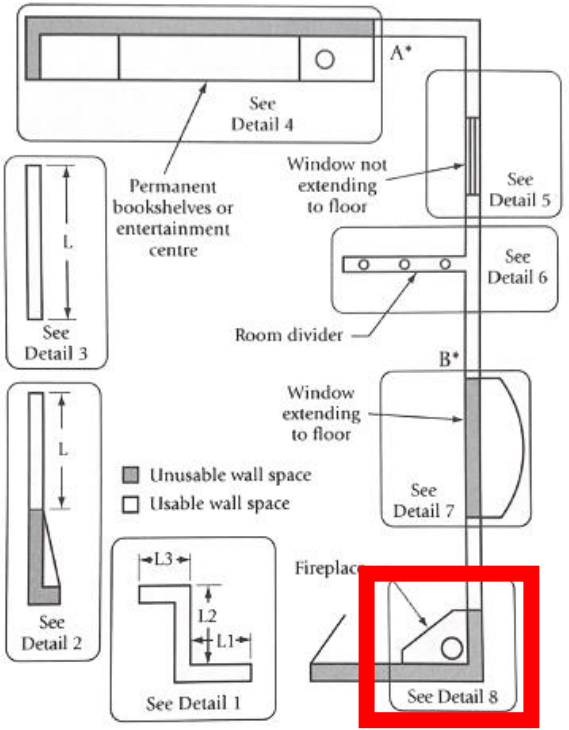
Receptacles (13)

Detail 8





The wall space behind a fireplace is **unusable wall space**

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Receptacles (14)

Method of determining the layout of receptacles in finished walls.

The Code requires that no point along the floor line of the wall space be more than **1.8 m (6 ft) horizontally** from a receptacle in that wall space or an adjoining space, with the distance measured along the floor line of the wall spaces involved.

This requirement is often called the

"six foot, twelve foot, six foot" rule.

Receptacles (15)

The rule is applied as follows:

Step 1	Step 2	Step 3	Step 4	Step 5
Identify any unusable wall spaces around the perimeter of the room or area.	Measure the first 1.8 m from the start of a finished wall at the floor line along the perimeter of the usable wall space to determine where the first receptacles should be.	From the location of the first receptacle, measure 3.6 m along the floor line of the wall perimeter. The second receptacle can be located anywhere within the 3.6 m distance from the first receptacle.	Repeat Step 3 until the end of the perimeter of the finished wall has been reached.	The last receptacle in the series must be within 1.8 m of the end of the finished wall.

Receptacles (16)

FINISHED WALLS

For finished walls other than those in sleeping rooms, **general-purpose receptacles** are required.

Each receptacle is one of the 12 outlets permitted on a 15 A, 120 V, two-wire general-purpose circuit.

A maximum of **12** receptacles and lighting outlets may be installed on a general-purpose circuit protected by a 15 A overcurrent device.

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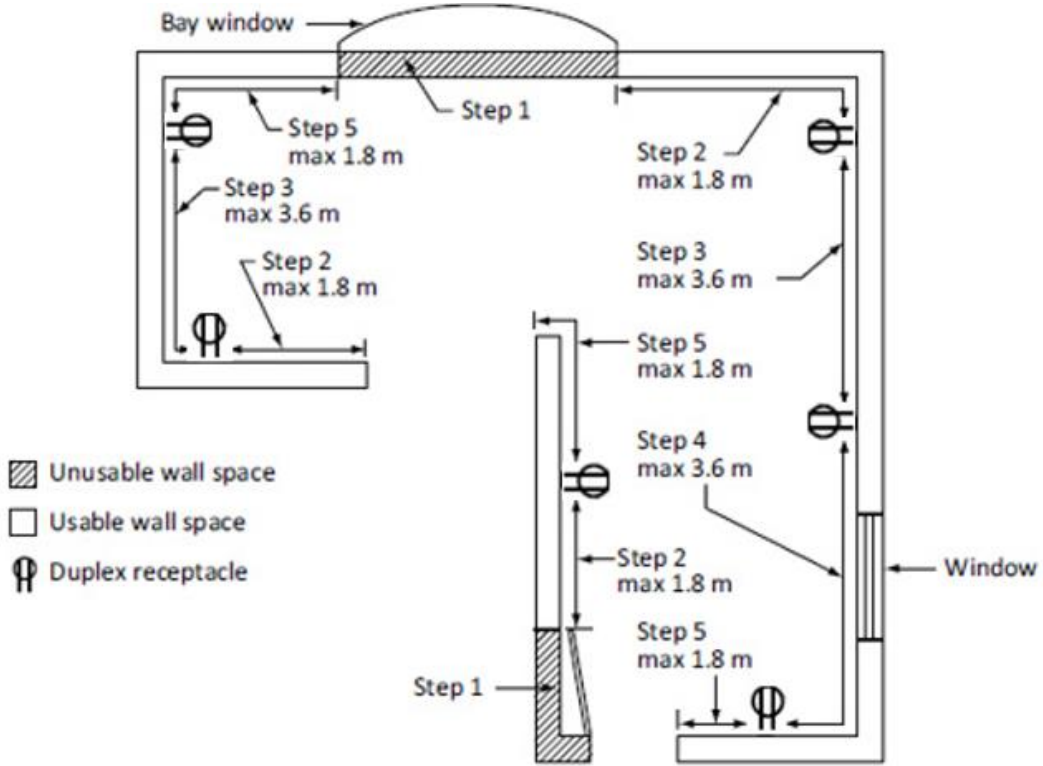
Receptacles (17)



Typical receptacle layout – Living and dining room

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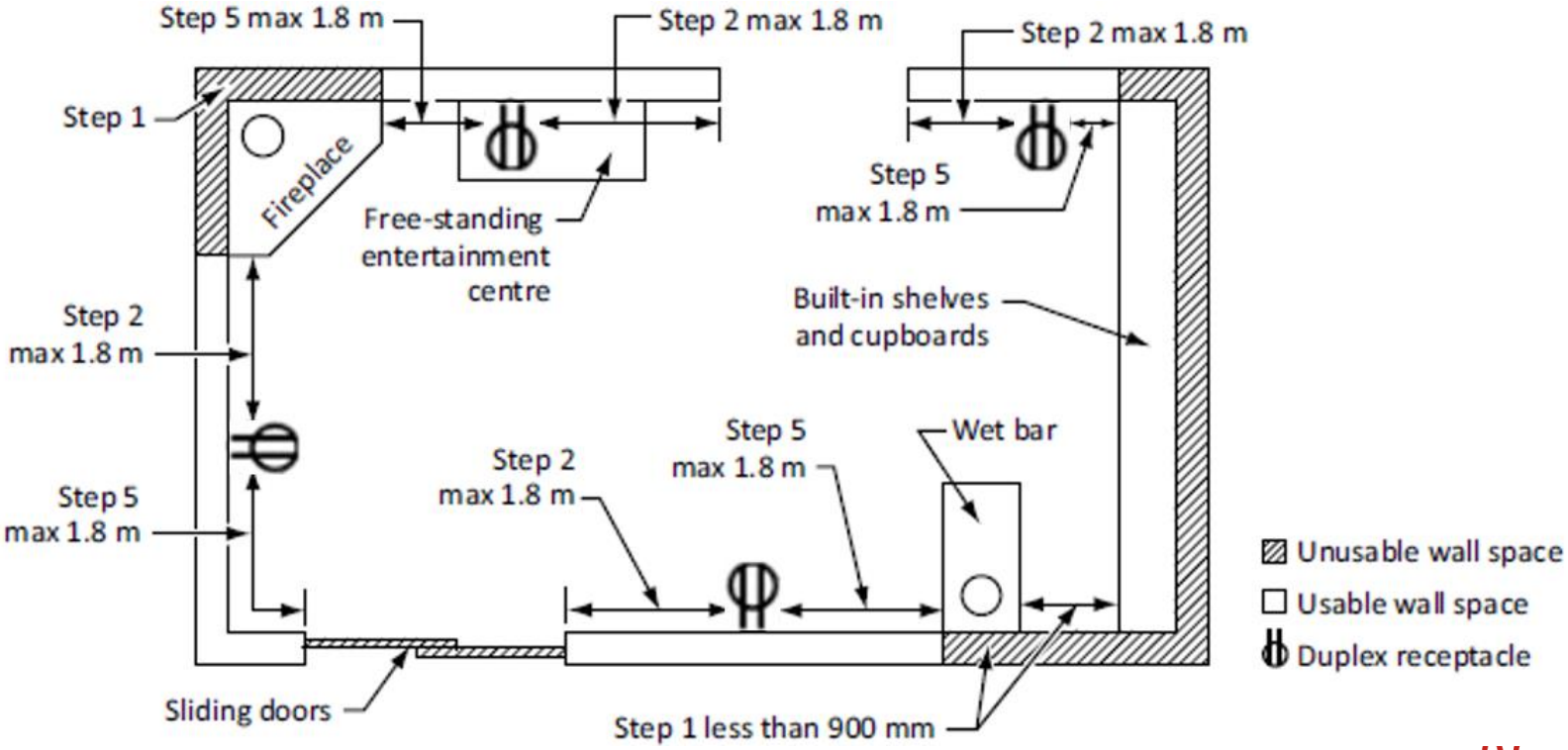
Receptacles (18)



Typical receptacle layout – Recreational room

Receptacles (19)

SLEEPING ROOMS

Receptacles in sleeping rooms/areas must be provided with an **arc fault circuit interrupter (AFCI)**.

Statistical data have shown that in dwellings, risks from fires ignited by persistent electrical arcing are highest in sleeping areas.

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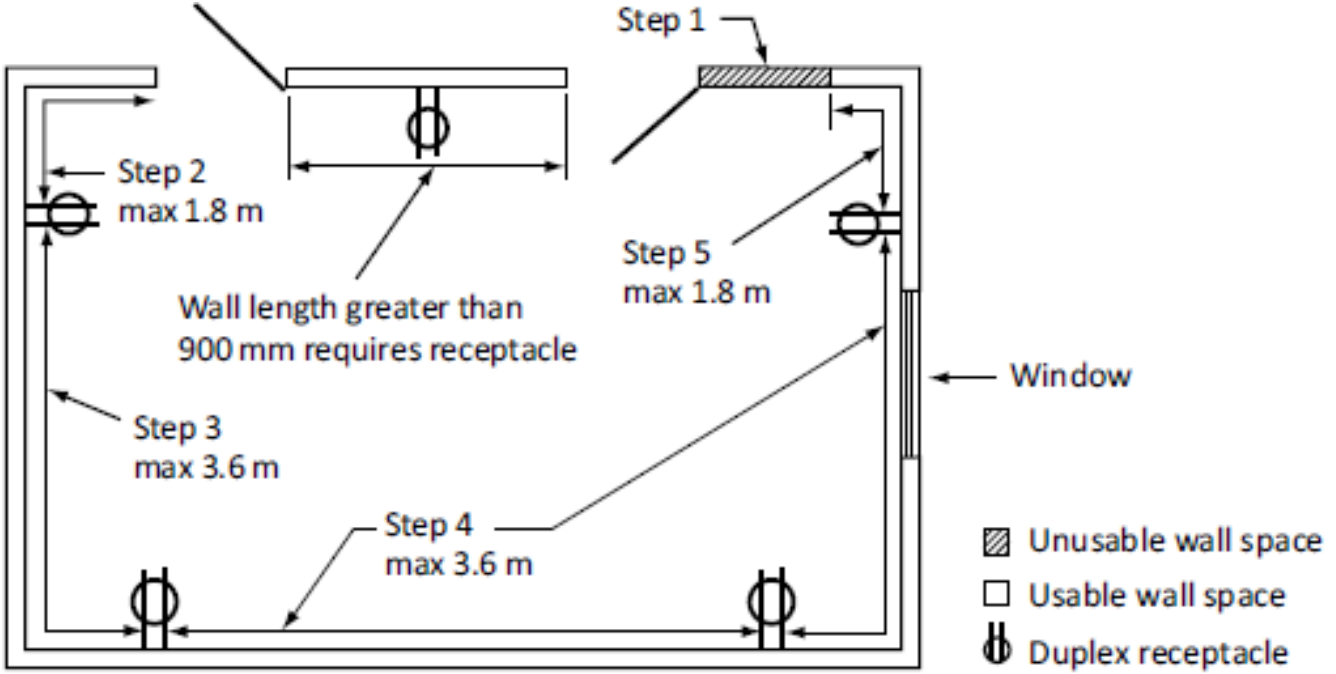
Receptacles (20)



Typical receptacle layout – Bedrooms

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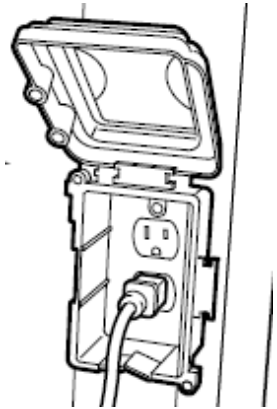
Receptacles (21)

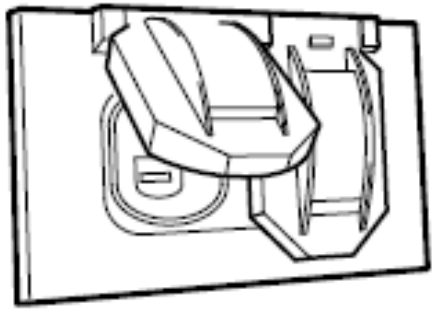
PORCHES AND BALCONIES

The Code requires that at least **one duplex** receptacle be installed in porches and balconies.

If the duplex receptacle is exposed to the weather, it must be provided with **weatherproof cover** plates.

The Code also requires that the receptacles be protected by a **GFCI** unless they are installed at least 2.5 m above ground level.





Receptacles (22)

KITCHENS

- require several branch circuits because of the large number of appliances that are installed and used
- the design and layout of equipment vary enormously
- crucial to have the plans for the kitchen layout finalized by the builder or owner before installation the electrical

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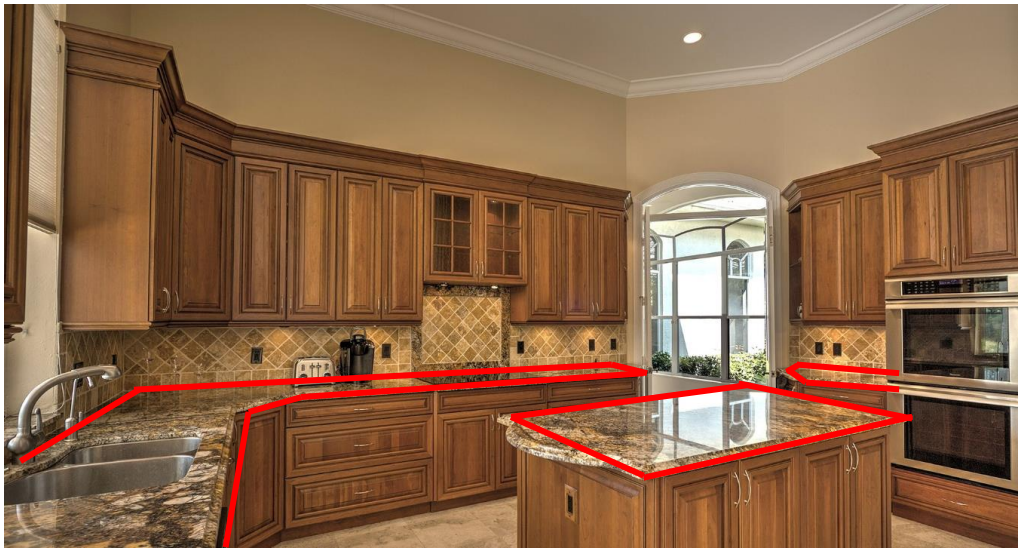
Receptacles (23)

KITCHEN COUNTER WORK SURFACES

- areas where several portable appliances may be connected to receptacles and used at the same time

- If 2-3 appliances are all on the same circuit, the overcurrent device may trip because of the overload

Which is why we need to define *usable space on a kitchen counter work surface*.



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Receptacles (24)

Method of determining the minimum # of receptacles for kitchen counters

The code requires that no point measured along the wall behind usable counter space be more than 900 mm from a receptacle.

The first receptacle in the wall behind the counter must be located no more than 900 mm from the beginning of the counter; each following receptacle must be a maximum of 1800 mm from the previous receptacle; and the last receptacle must be a maximum of 900 mm from the end of the work surface.

All measurements are taken along the perimeter of the counter work surface at the wall line.

The rule is applied as follows:

Receptacles (25)

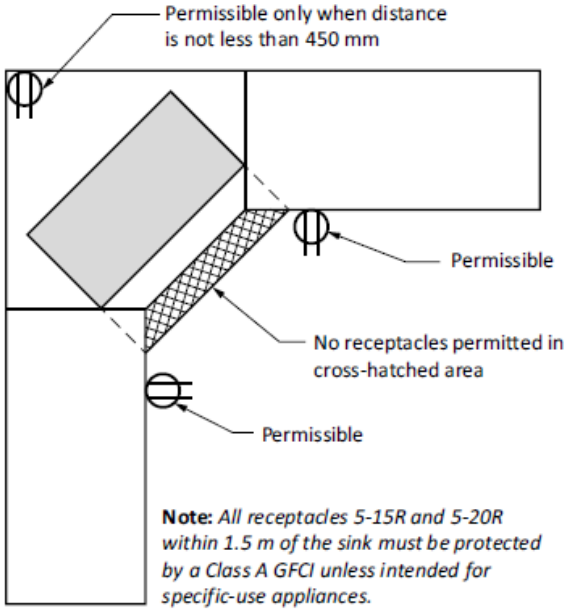
Step 1

Determine any unusable wall space along the wall line of the kitchen counter work surface.

Note - The Code that receptacles installed within 1.5 m of sinks, cannot be located on the counter area directly in front of the sink. They also cannot be located on the wall area directly behind the sink, except where the distance between the wall and the inside edge of the sink is more than 450 mm (such as where there is a corner sink).

Step 2

Measure the first 900 mm from the beginning of the counter work surface at the wall line, along the perimeter of the counter. The first receptacle can be located anywhere within this 900 mm length.



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Receptacles (26)

Step 3

From the first receptacle, measure 1800 mm along the counter at the wall line. The next receptacle can be located anywhere within this 1800 mm distance from the first receptacle.

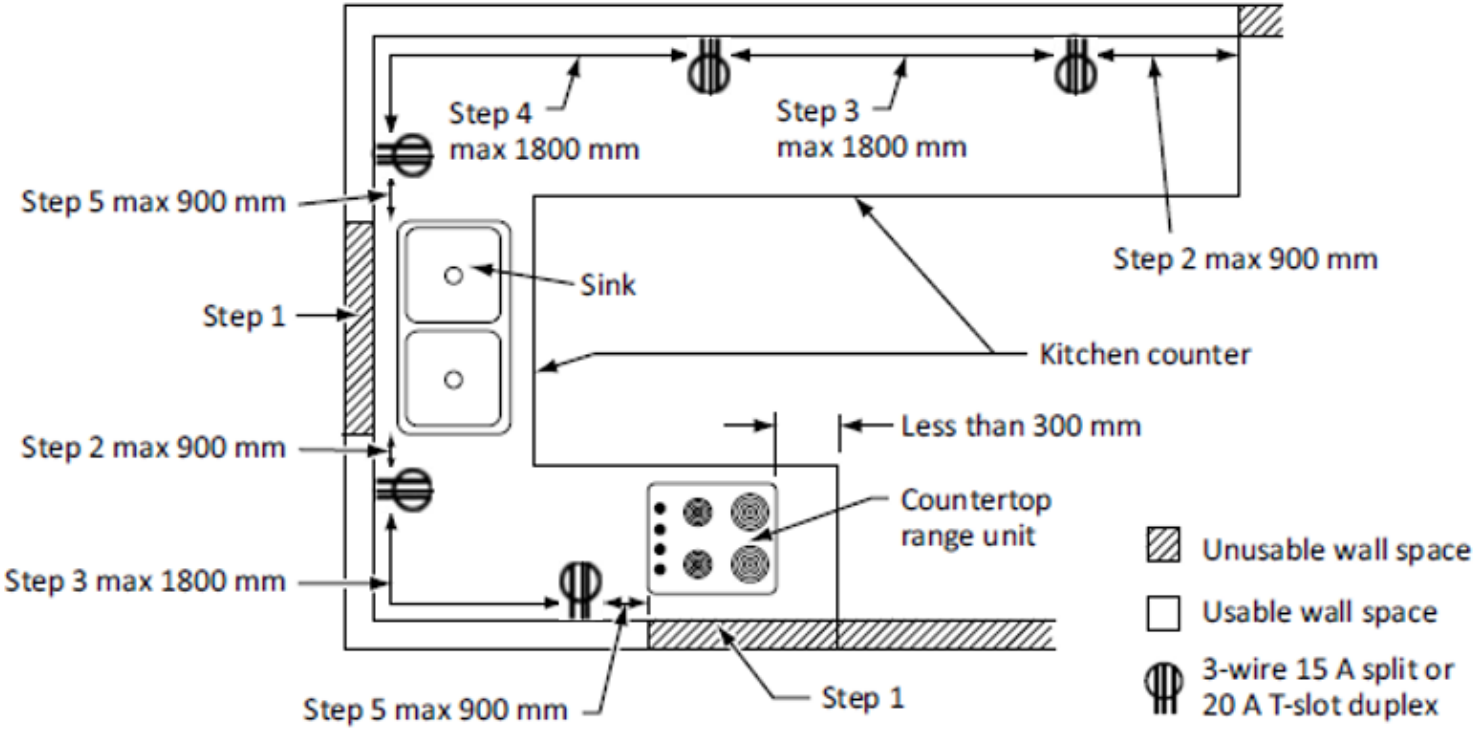
Step 4

Repeat Step 3 until the end of the perimeter of the counter work surface is reached. (It should be noted, however, that few kitchens have an uninterrupted usable wall space greater than 3.6 m. In most cases, one can proceed directly to Step 5.)

Step 5

The last receptacle, as located in accordance with Step 3 or Step 4, must be within 900 mm of the end of the counter.

Receptacles (27)



Typical receptacle layout – Kitchen

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Receptacles (28)

Receptacle and circuit requirements

Two types of receptacles are approved for use at kitchen counter work surfaces

1. A **5-15R split-duplex receptacle** supplied by a 15A multi-wire (or three-wire) branch circuit; and
2. A **5-20R duplex receptacle** (also called a 20 A T-slot receptacle) supplied with a 20 A two-wire circuit.

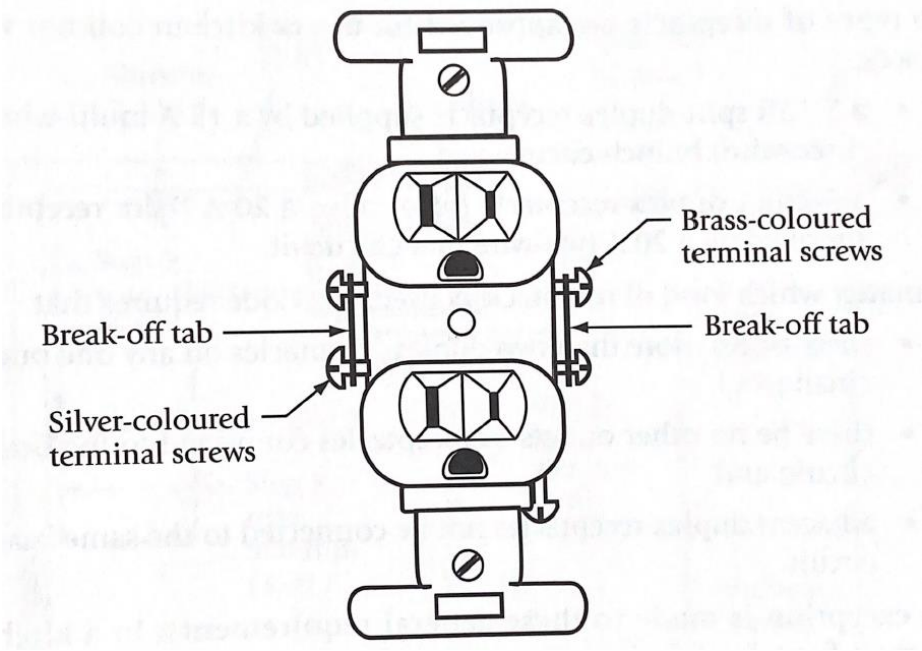
One exception is made in a kitchen designed for wheelchair access, where one split-duplex receptacle that is installed in the front of a kitchen counter may be connected to a branch circuit that supplies two split-circuit receptacles located on the wall behind the counter work surface..

Receptacles (29)

Split-duplex receptacles

Used on a multi-wire branch circuit is a standard duplex receptacle, which is manufactured with a break-off tab between the two line terminals (the brass-coloured screws) and the two neutral terminals (the silver-coloured screws).

On a split-duplex receptacle, the tab between the line terminals is removed, allowing each half of the receptacle to be on a different 15 A, 120V branch circuit.



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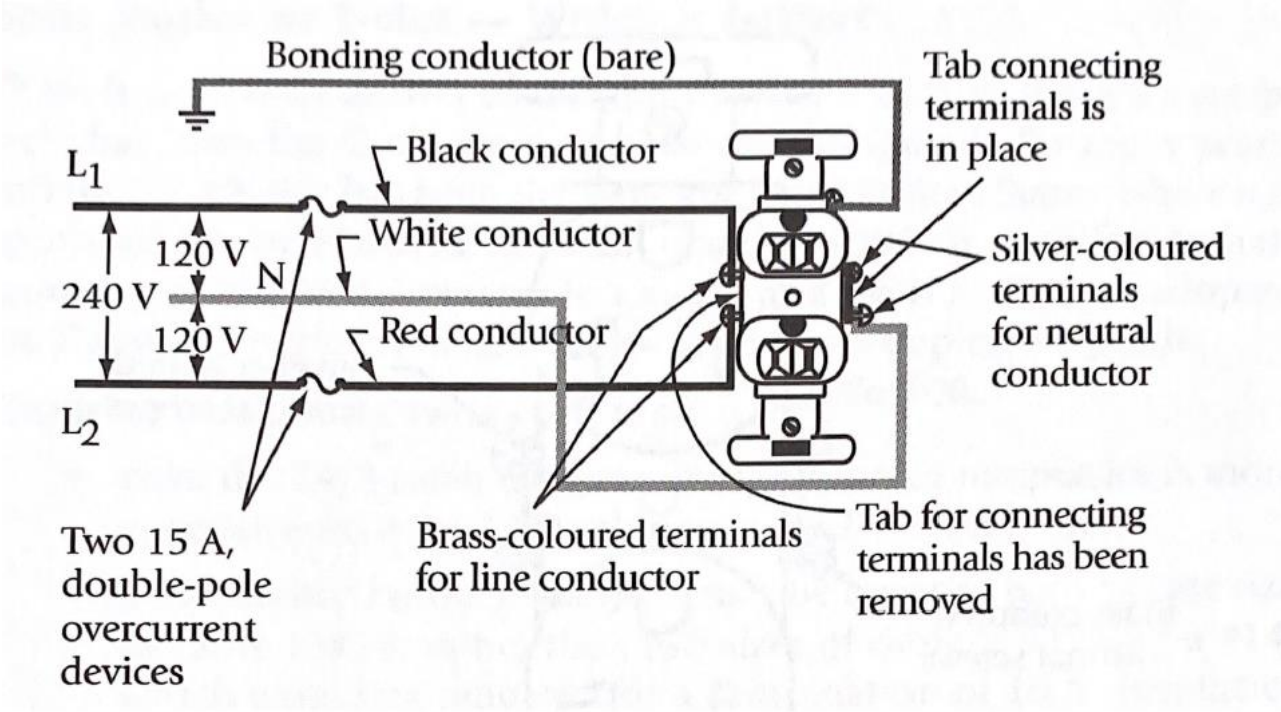
Receptacles (30)

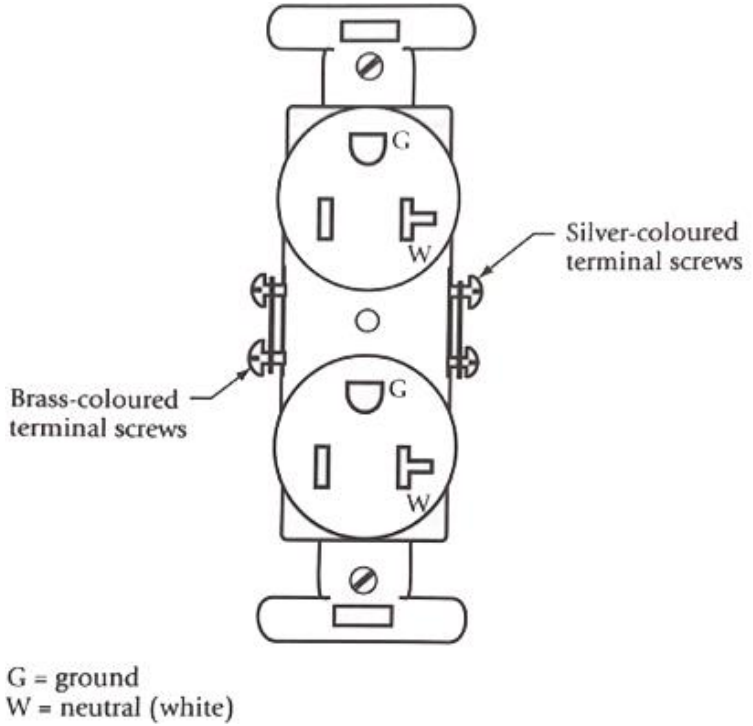


Typical wiring for a split-circuit receptacle

Receptacles (31)

T-slot receptacles

A 20 A T-slot (or 5-20R duplex) receptacle gets its name from the neutral slot, which has the shape of the letter “T” on its side when the receptacle is in the vertical position.

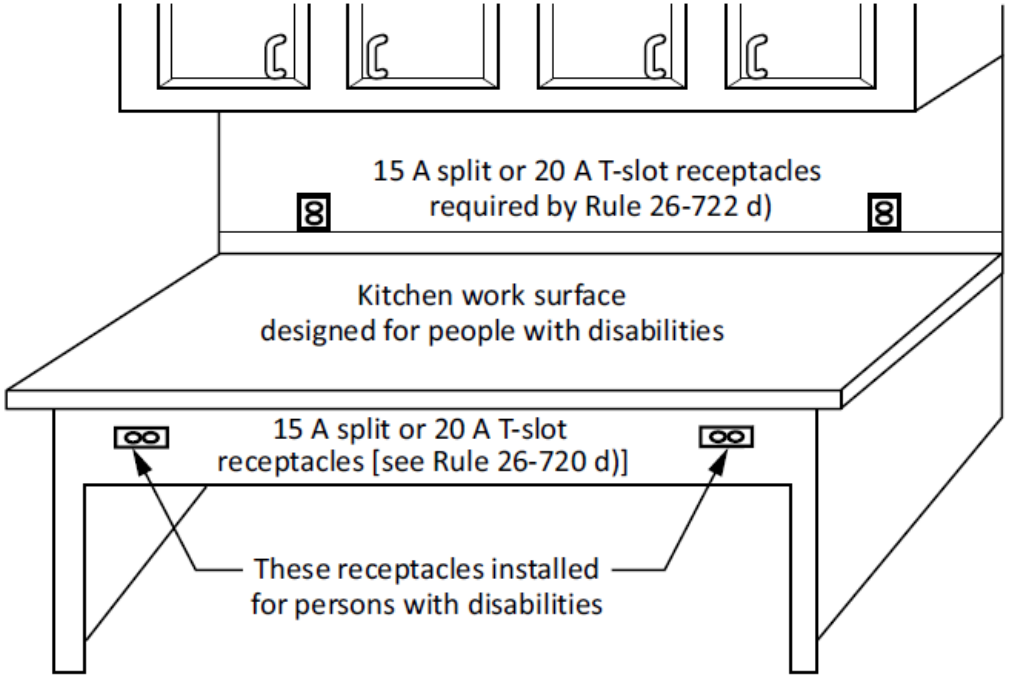


Receptacles (32)

Kitchen counter work surfaces designed for WHEELCHAIR ACCESS?

Convenient to install receptacles on the front of a counter work surface.

Provided in addition to those required for the usable counter space in accordance with the Code and are not intended to replace the receptacles that must be located on the wall behind the work surface.

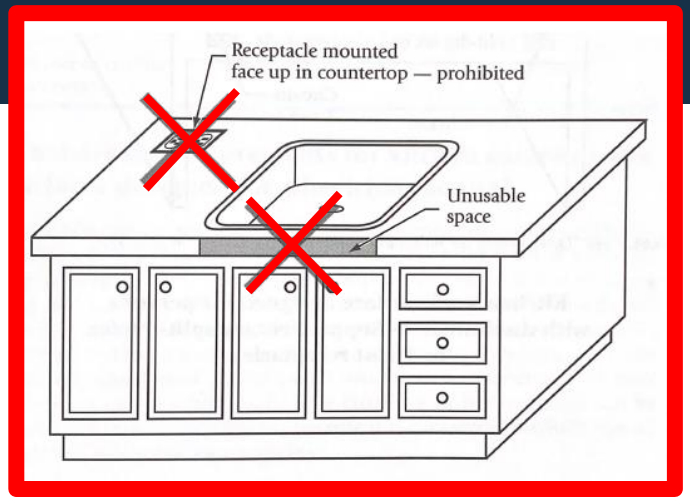


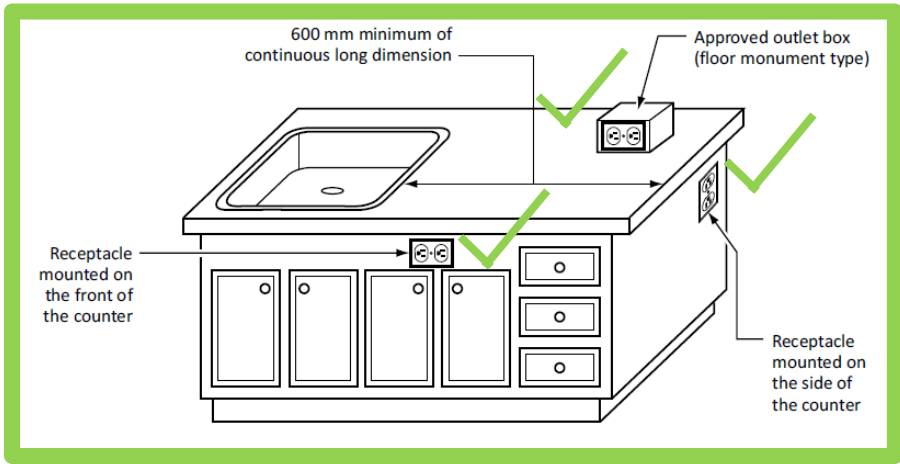
Receptacles (33)

KITCHEN ISLANDS

At least one receptacle (5-15R split or 5-20R) installed at each permanently fixed island counter space or peninsular counter space with a continuous long dimension of 600 mm or greater and a short dimension of 300 mm or greater.

- Must not be mounted facing up
- Must not be installed directly in front of any sink

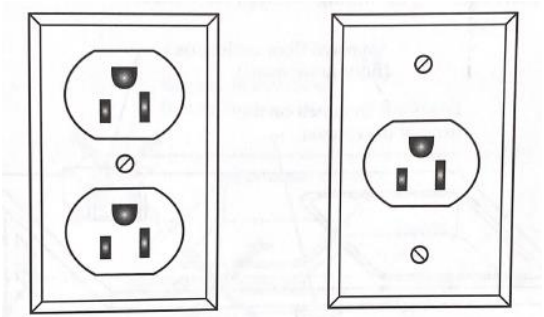




Receptacles (34)

REFRIGERATOR

In a dwelling, the Code requires that kitchens have one receptacle that is used for the refrigerator only.



Duplex receptacle **Single receptacle**

The Code requires that the refrigerator receptacle be supplied by a separate branch circuit that has no other outlets connected to it, *with the permitted exception of a recessed clock outlet.*

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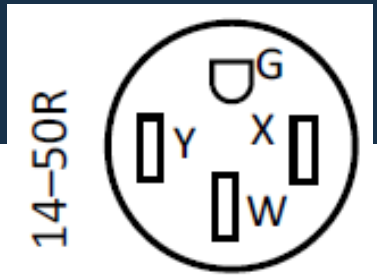
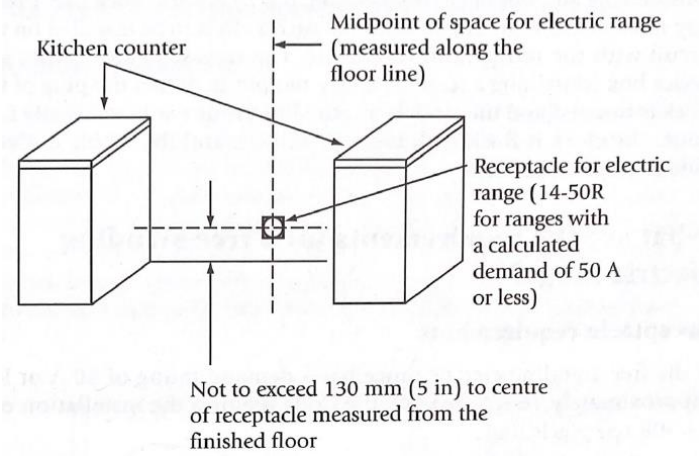
Receptacles (35)



FREE-STANDING ELECTRIC RANGE

If the free-standing electric range has a demand rating of 50 A or less (approx. 16 kW or less), the Code requires the installation of a 14-50R receptacle that:

1. Is rated 125/250V, 50A;
2. Is mounted in the centre of the wall space for the range, 130mm (5in) to the centre of the receptacle above the finished floor



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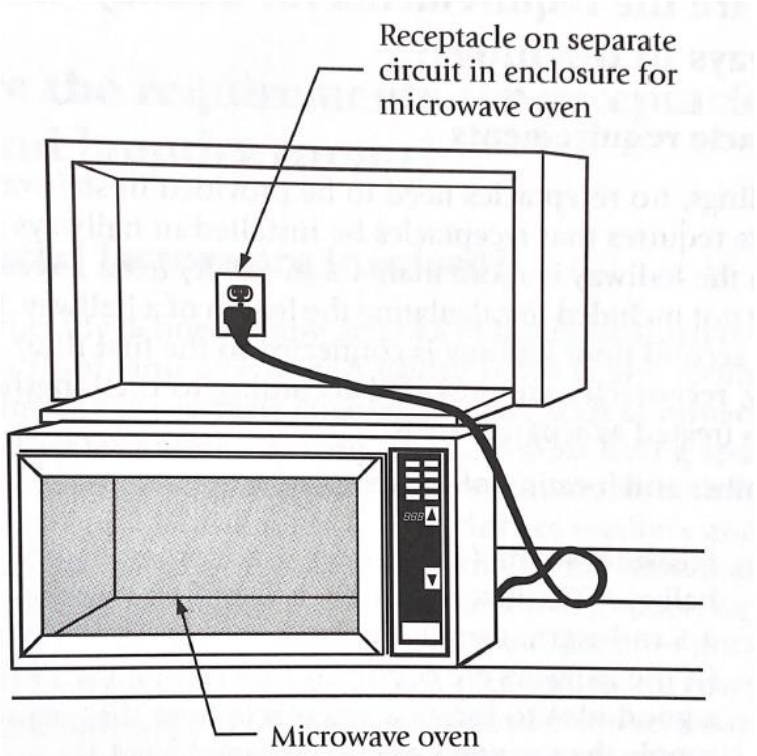
Receptacles (36)

MICROWAVE OVEN

In general, receptacles should not be placed in cupboards, cabinets, or similar enclosures.

However, the Code permits receptacles to be installed in these types of enclosures if the receptacle is energized only when the enclosure door is in the fully opened position.



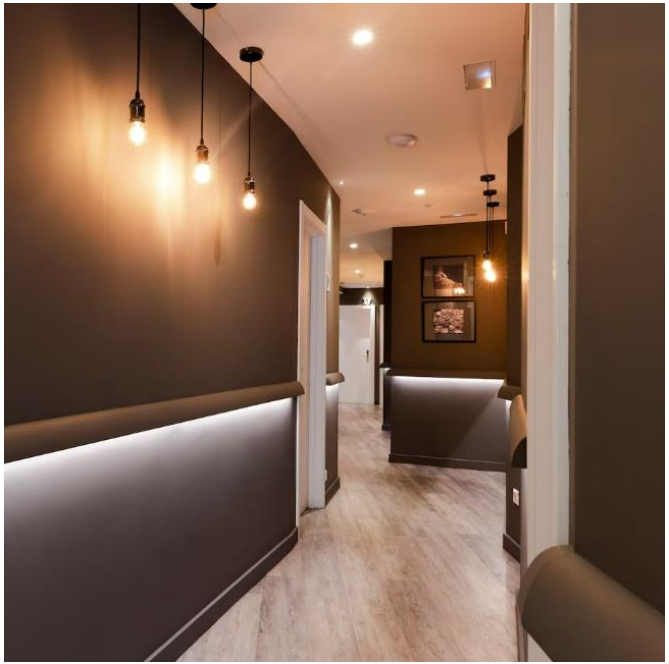
Receptacles (37)

HALLWAYS AND STAIRWAYS

In dwellings, hallways and stairways serve mainly as corridors that allow occupants to move from room to room.

Only a limited need for receptacles for such things as cleaning equipment, communication devices, and table lamps.

In dwellings, no receptacles need to be provided in stairways.



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Receptacles (38)

The number and location of the receptacles are determined as follows:

Step 1
Measure 4.5 m (15ft) from the corner of one end of the hallway.

Step 2
Measure 9 m (30 ft) from the first receptacle; the next receptacle can be located anywhere within this range. If the end of the hallway is less than 4.5 m (15 ft) from the first receptacle, no other receptacle is required.

Receptacles (39)

UTILITY AND LAUNDRY ROOMS

A **utility room** is any room or area designed primarily to segregate large equipment, such as furnaces, water heaters, and water softeners, from the common living spaces of a dwelling.

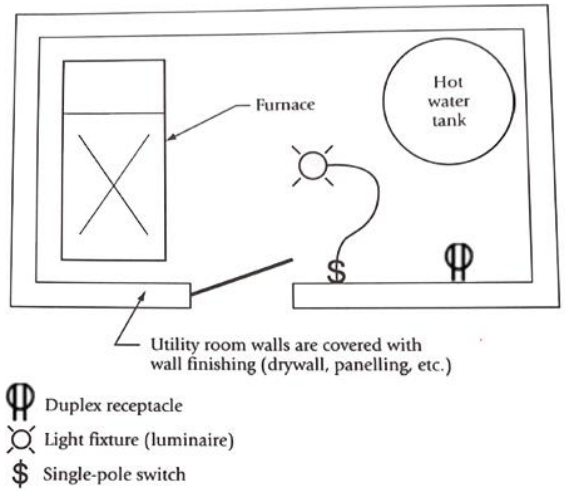
A **laundry room** is a room or area intended mainly for the installation of large equipment such as clothes washers and dryers.

For the purpose of receptacle requirements, the Code does not consider these rooms to have finished walls, even if the walls are covered with drywall, wood, or other types of paneling, or other surface finished.

Receptacles (40)

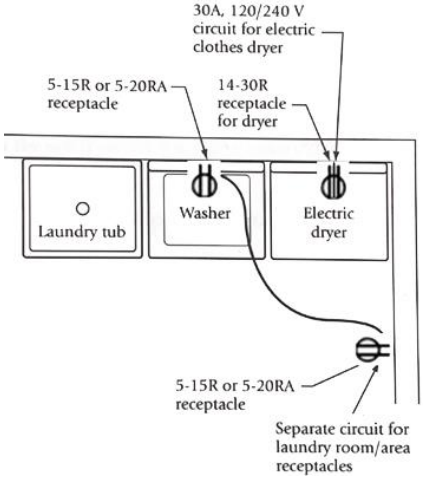
UTILITY ROOMS

The Code requires that at least one duplex receptacle be supplied by a separate branch circuit.



LAUNDRY ROOMS

At least two duplex receptacles are required in laundry rooms or areas, one for a washing machine and one (or more) for appliances such as clothes irons and gas dryers.



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Receptacles (42)

BATHROOMS

The Code requires at least one duplex receptacle to be located adjacent to the sink, no farther away than 1m (3 ft).

The Code also requires that the duplex receptacle be located at least 1m (3 ft) away from the bathtub or shower stall.

The Code allows an exception where it is simply not possible to place a receptacle at least 1 m (3 ft) away from the tub or shower. However, a minimum distance of 500 mm (20 in) is still required.

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Receptacles (43)

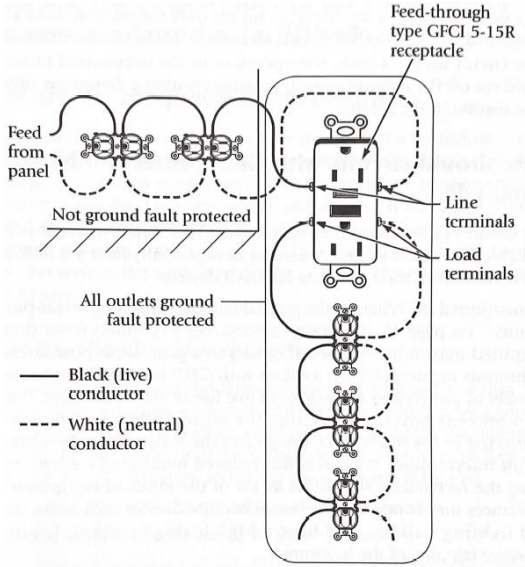
In the case of bathrooms, a **Class A GFCI** is required which trips the circuit connected to it when it detects a leakage current.

GFCI protection is provided either by a GFCI circuit breaker in the panel or by a GFCI incorporated in the receptacle...

Two kinds of receptacles incorporate a GFCI:

1. **Stand-alone type**: provides ground fault protection only to devices and appliances that are plugged into it, and

2. **Feed-through type:** provides ground fault protection to devices and appliances that are plugged into it and to any other outlets or receptacles that are connected to its load terminals.

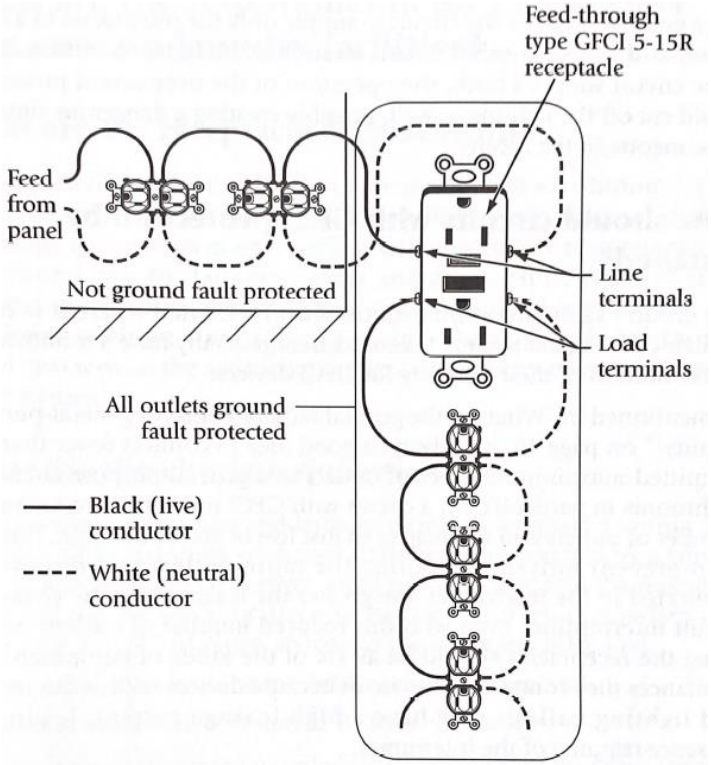


Receptacles (44)

Two kinds of receptacles incorporate a GFCI:

1. The stand-alone type, which provides ground fault protection only to devices and appliances that are plugged into it, and

2. The feed-through type, which provides ground fault protection to devices and appliances that are plugged into it and to any other outlets or receptacles that are connected to its load terminals.

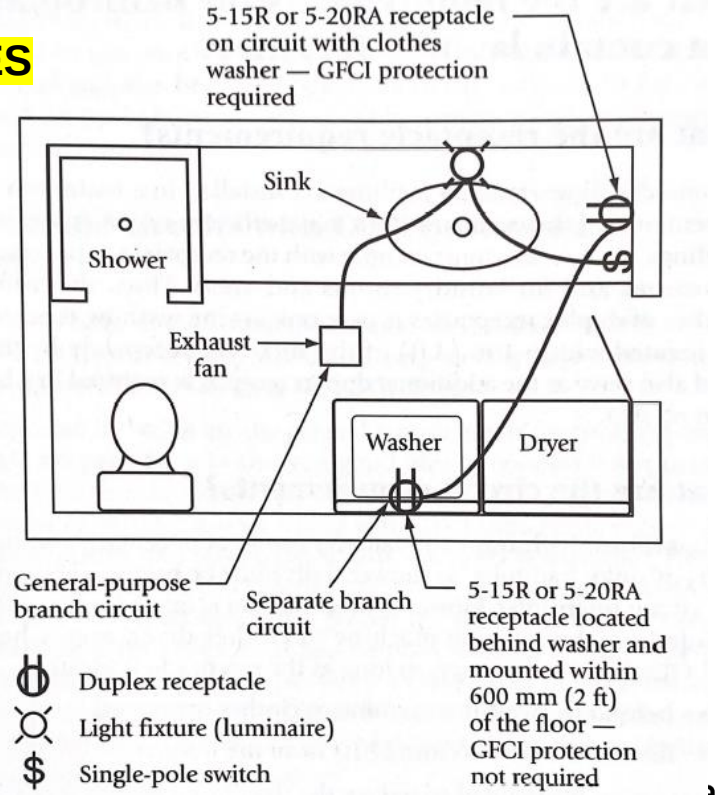


Receptacles (45)

BATHROOMS CONTAINING LAUNDRY FACILITIES

In some dwellings, laundry facilities are installed in a bathroom for the convenience of the occupant or to make efficient use of space.

These rooms must comply with the receptacle requirements for bathrooms and for laundry rooms and areas.



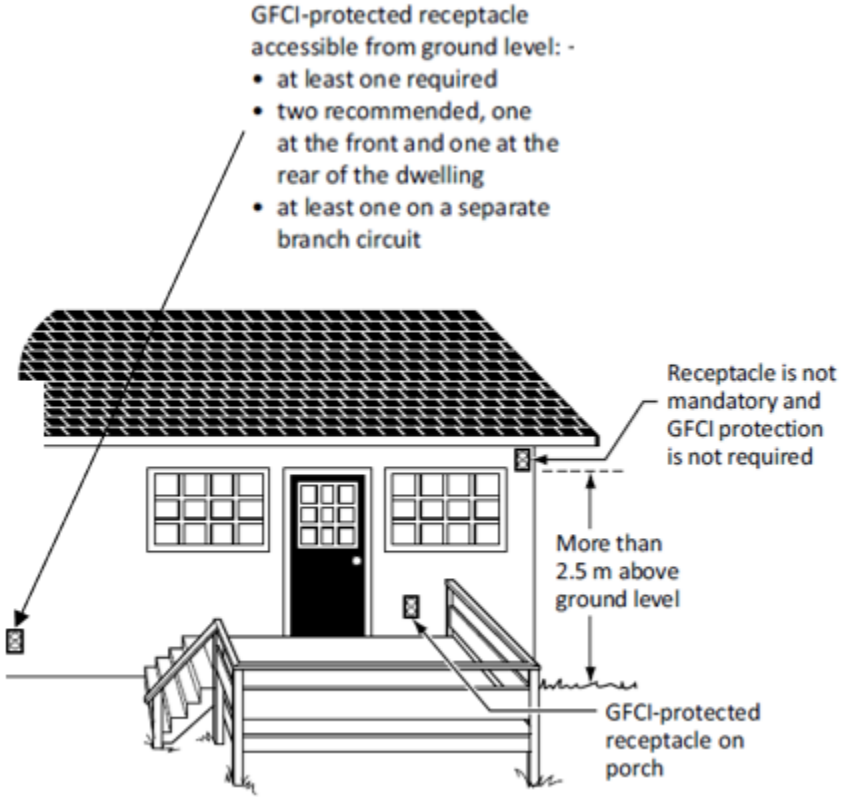
Receptacles (46)

OUTDOOR RECEPTACLES

Intended for outdoor appliances and equipment, such as electric lawn and garden appliances, cooking appliances, etc.

In single dwellings only, the Code requires that at least **one** duplex receptacle be installed outdoors, in such a way that it can be reached from the ground or ground level without:

- The use of portable ladders, etc.; and
- Having to climb over or remove obstacles.



Receptacles (45)

UNFINISHED BASEMENTS

Because the basements in many dwellings do not contain finished walls, a specific rule in the Code provides the requirements for these areas.

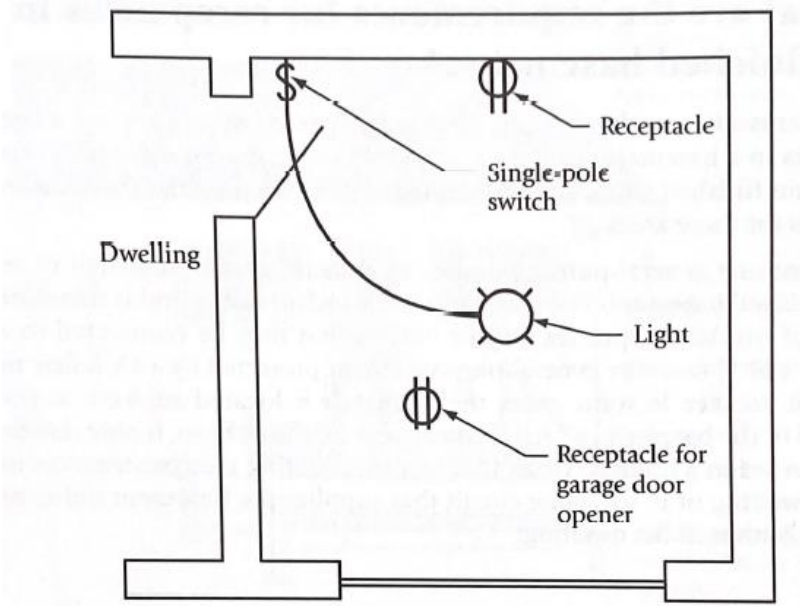
At least **one general-purpose duplex receptacle** must be installed in an unfinished basement.

Receptacles (48)

GARAGES AND CARPORTS

The Code requires one duplex receptacle for each car space in a garage or carport. The garage or carport receptacle(s) and lights must be connected to a separate branch circuit.

In areas with colder climates, where receptacles are needed for more than one vehicle equipped with a block heater or interior car warmer, it may be necessary to provide a separate circuit for each receptacle, depending on the service rating of the devices.



Note – Receptacles and lighting in single-car, attached garages and carports may be connected to the same circuit.

Receptacles (49)

UNATTACHED STRUCTURES OR OUTBUILDINGS

In addition to the main dwelling, many properties include unattached structures or outbuildings such as a detached garage, garden shed, boathouse, wood or storage shed, etc. These structures usually obtain electrical energy from a panel in the main dwelling.

For most of these structures, the Code has no requirements for receptacles. Receptacles are installed as convenience for the particular application for which the structure is being used.

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Receptacles (50)

The following are key considerations in planning the installation of receptacles in such structures:

- Is the receptacle going to create a fire hazard?
- Is the receptacle or the device plugged into the receptacle going to create a shock hazard?
- Will it be possible to maintain the receptacle?
- Is the receptacle protected from damage caused by the environment and physical setting?

Outbuildings or unattached structures are often not built to the requirements of the National Building Code of Canada for foundations and structural integrity. This means that the structure may move b/c of environmental conditions such as weather, frost, ice and water levels. The structure may also be used only intermittently.

Lighting

GENERAL REQUIREMENTS

Adequate illumination is an important safety issue in and around a dwelling. Sufficient lighting is needed both inside and outside to ensure that people have sure footing and can identify objects that could cause them to stumble or fall.

Outdoor lighting, while making entry and exit from the residence safer, is also considered a good burglar deterrent and helps people be sure that no one is lurking in the vicinity of the residence.

Requirements for illumination of dwellings are set out in Article 9 of the NBC.

Lighting (2)

ENTRANCES

The Code requires that lights (or luminaires) be provided at each entrance to a dwelling, with a control inside the dwelling that permits the lighting to be switched on and off.

This requirement applies to any entrance, including sliding patio doors, French doors, and exterior doors to basements. The Code does not require illumination at the vehicle entrance to a garage, but it does require a light at the doorway leading from the garage to the dwelling.

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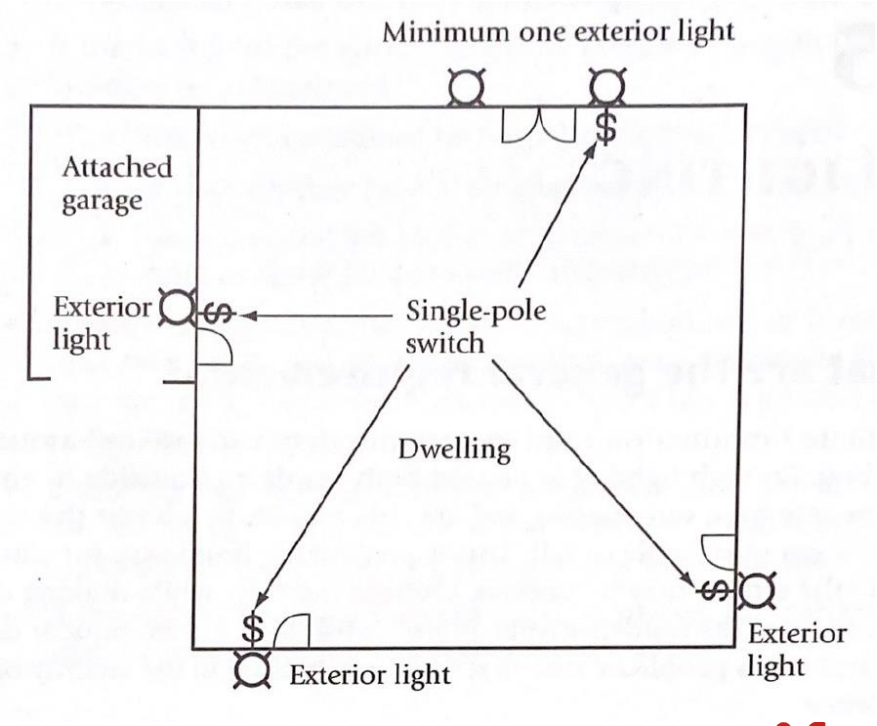
Lighting (3)

Entrance lights are controlled by conventional wall switches inside the dwelling. In some installations, lights are also controlled by built-in dusk-to-dawn light sensors and/or motion sensors, in addition to the inside switch.

Entrance lighting can also be controlled by electronic programmable switches that turn the lights on between certain hours, varying on and off times at random.



Lighting (4)

INSIDE DWELLINGS

The Code sets out some basic requirements for lighting in the finished areas inside a dwelling. Kitchens, bedrooms, living rooms, utility rooms, dining rooms, bathrooms, vestibules, and hallways must each have a light controlled by a wall switch. The light may be located on the ceiling of the room or on a wall.

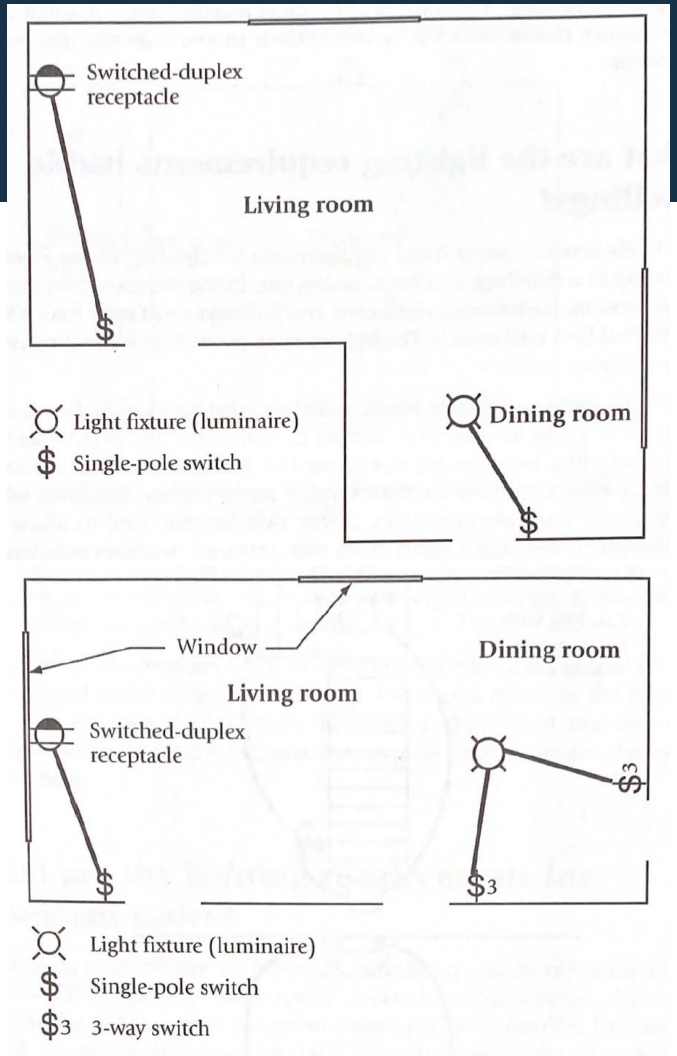
The Code does not specify where switches must be located, but it is an accepted practice for installers, designers, and inspection departments to make sure that switches are not located so that a person must cross a room or area to turn on the light for that room or area.

Similarly, where an area has multiple entrances, 3-way switches are used to allow the operation of the area's lights from any entrance, without requiring a person to move about the area in the dark.

Lighting (5)

In **bedrooms** and **living rooms** that have a receptacle controlled by a wall switch, the requirement for a ceiling or wall light is waived, on the assumption that the room will be sufficiently illuminated by a lamp plugged into the receptacle.

Where a duplex receptacle operated by a wall switch (or a “switched-duplex receptacle”) is used instead of light outlet and fixture, the receptacle may be included as one of the wall-mounted receptacles required in the usable space of a finished wall, provided that only half the receptacle is controlled by the wall switch.

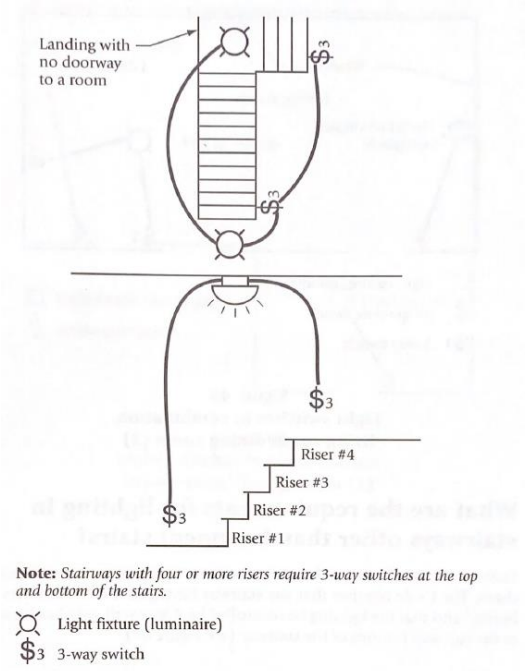


Lighting (6)

STAIRWAYS other than basement stairs?

Stairs must be illuminated to help to ensure the safety of people using them.

The Code requires that any stairway having four or more risers be lighted and that the lighting be controlled by 3-way wall switches located at the top and bottom of the stairway.



Lighting (7)

Stairways with fewer risers are excluded to take into account sunken living rooms or recreation rooms and other minor changes in the floor level, where the existing area lighting is adequate.

The number and location of lights needed to provide the required illumination is left to the designer or installer.

In general, however, the lighting arrangement should illuminate the stairs at their head and foot and along their entire length, without shadows, to help to ensure the safety of the users.

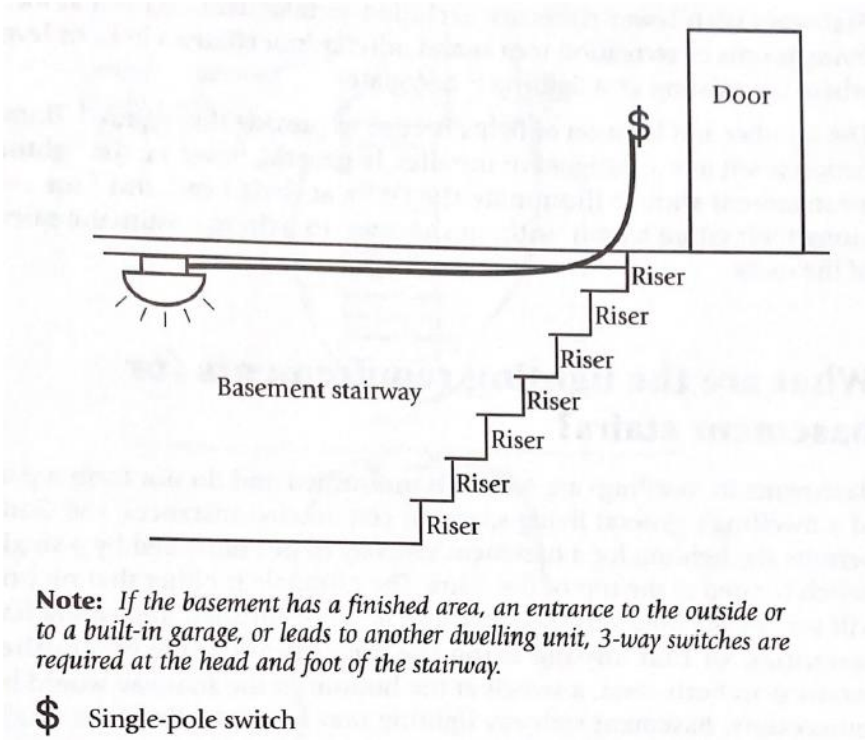
Lighting (8)

BASEMENT STAIRS

Basements in dwelling are often left unfinished and do not form a part of a dwelling's living space. In certain circumstances, the Code permits the lighting for a basement stairway to be controlled by a single switch located at the top of the stairs.

Basement lighting may be controlled by a single switch located at the top of the stairs, provided that the basement does not:

- Contain a finished area;
- Lead to an outside entrance;
- Lead to a built-in garage; or
- Serve more than one dwelling unit.



Note: *If the basement has a finished area, an entrance to the outside or to a built-in garage, or leads to another dwelling unit, 3-way switches are required at the head and foot of the stairway.*

$ Single-pole switch

Lighting (9)

UNFINISHED BASEMENTS

The Code requires one light for each 30 m^2 of floor area (or fraction thereof) in an unfinished basement:

Minimum number of lights = total floor area in m^2 / 30

Round any fraction up to the next whole number.

For example, if the floor area of an unfinished basement is 163 m^2:

Minimum number of lights = 163 / 30 = 5.46

Therefore, at least 6 lights are required for the basement.

Lighting (10)

When the light that provides the required illumination of the basement stairs is located on the ceiling of the unfinished basement and controlled by the wall switch at the top of the stairs, it may be counted as only of the lights required for the unfished basement area.

While basement lights can be controlled by light switches, the lights installed in unfinished areas are usually controlled individually by pull-chain switches. This makes it easier to finish areas of the basement later and rearrange the wiring as required.

Lighting (11)

STORAGE ROOMS

The Code requires that a light be installed in a storage room, such as a fruit cellar, wine cellar, or pantry.

The light may be a pull-chain fixture or controlled by a wall switch.

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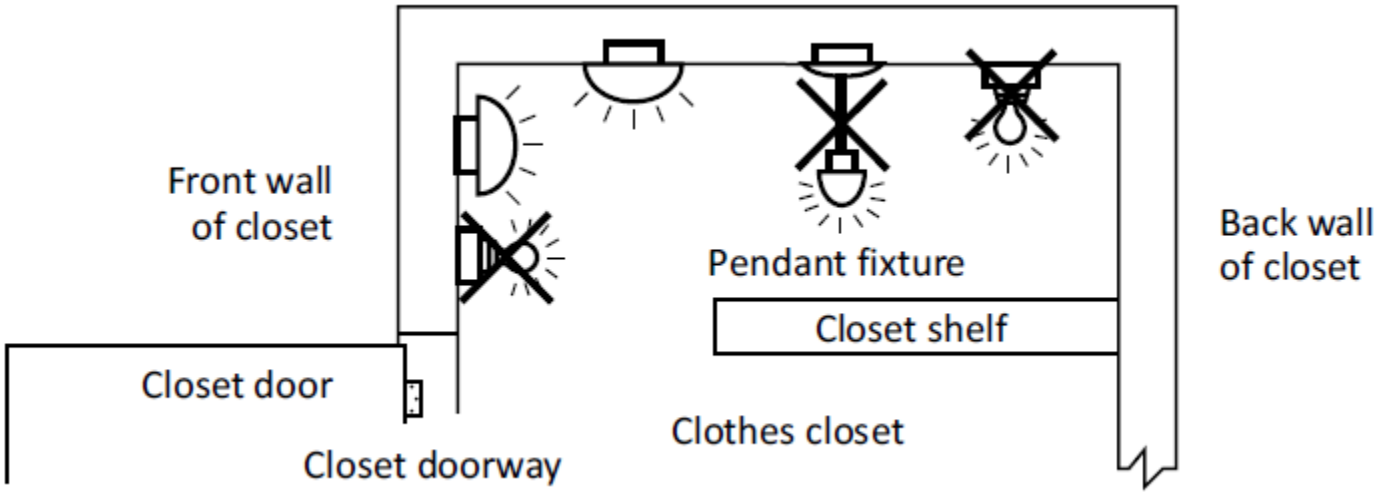
Lighting (12)

CLOTHES CLOSETS

The Code does not require that lighting fixtures be installed in clothes closets. However, when illumination is installed in a clothes closet, a fire hazard can be created if combustible material on the shelves is piled too close the closet light fixture. This is especially dangerous if the fixture is the bare bulb type, that is, without a globe or enclosure surrounding the light bulb.

To avoid a fire hazard in a closet, the Code requires that light fixtures installed in a clothes closet be located on the ceiling or on the front wall of the closet above the door. The light fixture must not be located above the shelf, to avoid contact with combustibles. Where a light fixture is located on the trim or sidewall of the closet doorway, it must be a type of light specifically approved for this location. Pendant light fixtures, as well as fixtures without a globe or enclosure surrounding the bulb, must not be used.

Lighting (13)



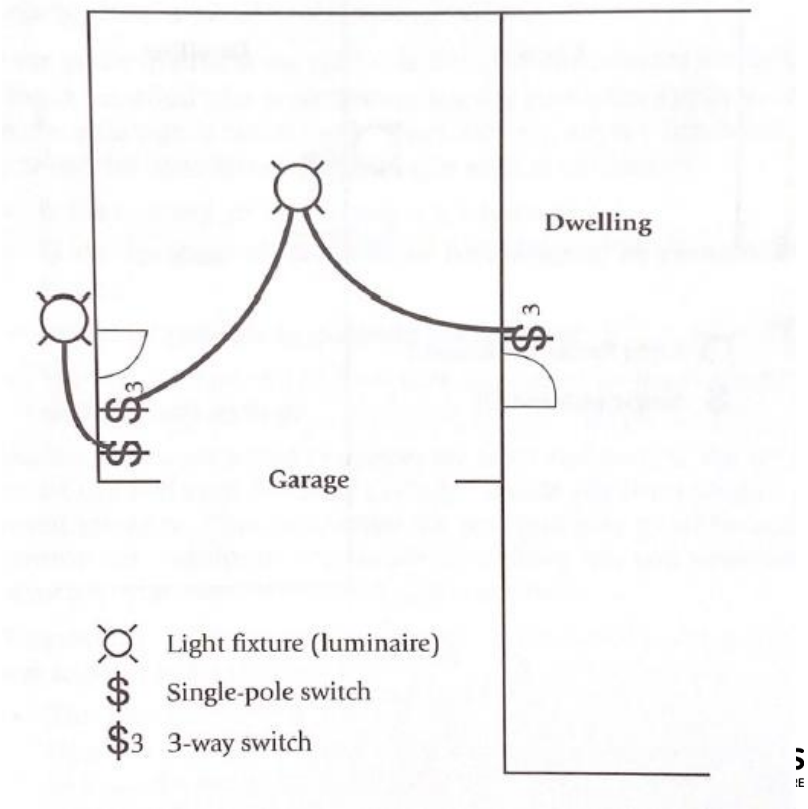
Lights in a clothes closet

Lighting (14)

GARAGES AND CARPORTS

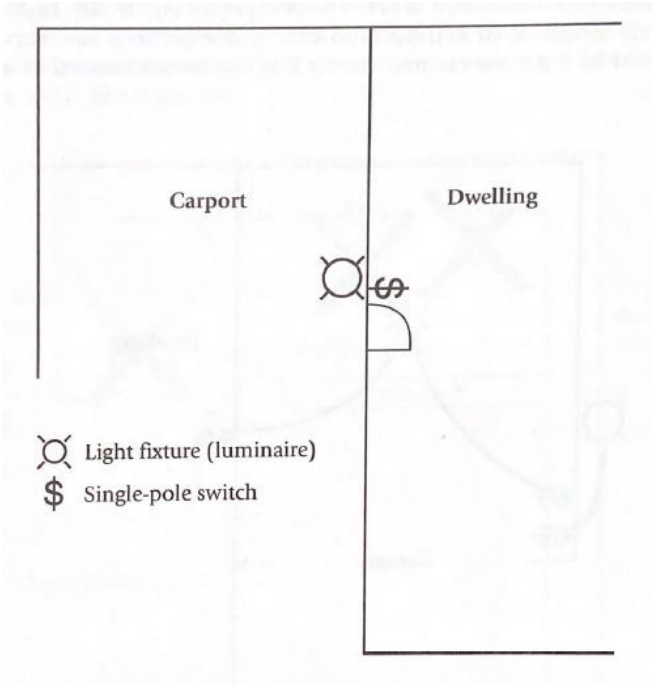
Any attached, built-in, or detached garage or carport must have a light controlled by a wall switch near the doorways.

Lights that are wall-mounted or ceiling-mounted above an area not normally occupied by a parked car may have a built-in switch instead of a wall switch.



Lighting (15)

In dwellings with carports, if the dwelling's entrance lighting also illuminates the carport, no additional carport lighting is required.



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Lighting (16)

UNATTACHED STRUCTURES OR OUTBUILDINGS

As is the case for receptacles, for most of these structures, the Code has no requirements for lighting.

Lighting is installed as a convenience for the particular application for which the structure is being used.

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Lighting (17)

The following are key considerations in planning the installation of lighting in such structures:

- Is the lighting going to create a fire hazard?
- Is the location of the bulb or fixture going to create a shock hazard?
- Will it be possible to maintain the lighting?
- Is the fixture protected from damage caused by the environment and physical setting?

Outbuildings or unattached structures are often not built to the requirements f the NBC for foundations and structural integrity. This means that the structure may move because of the environmental conditions such as weather, frost, ice, and water levels. The structure may also be used only intermittently.

Lighting (18)

The following are some recommendations for the installation of lighting fixtures in these type of structures:

- The circuits feeding the lighting fixtures should have clearly labelled and conveniently located switches or circuit breakers that can de-energize the circuits during periods when the lighting is not in use.
- If the wiring for the circuits from the main dwelling to the outbuilding is overhead, it must:
  - Have the appropriate ground clearances;
  - Use the appropriate type of conductor; and
  - Use approved overhead support equipment at both ends.
- If the wiring for the circuits from the main dwelling to the outbuilding is underground:
  - The conductors must be buried at the proper depth;
  - The appropriate type of conductor must be used; and
  - Slack must be left in the cable where it enders both structures to allow for movement caused by frost.

Lighting (19)

- If the light fixture is on the exterior of an outbuilding or is used in structures near water, such as boathouses, pool equipment sheds, etc., the fixture must be protected by a Class A ground fault circuit interrupter.
- If rodents, such as mice, chipmunks, squirrels, etc., have access to the wiring for the light fixtures, a conduit or metal armoured cables should be used to protect the wiring from damage.

Key Takeaways

In Part 1, learned about:

- requirements and considerations for Service Installations from both supply and consumer perspectives;
- components and purpose of a Panel and the Service Size considerations;
- different types of Branch Circuits; and

Today, we discussed:

- requirements for Receptacles in various locations in a house
- requirements for Lighting in various locations in a house

In **Part 3**, we will finish with:

- requirements for Smoke Alarms and Carbon Monoxide Detectors
- more detailed wiring requirements for Major Appliances and Electrical Equipment

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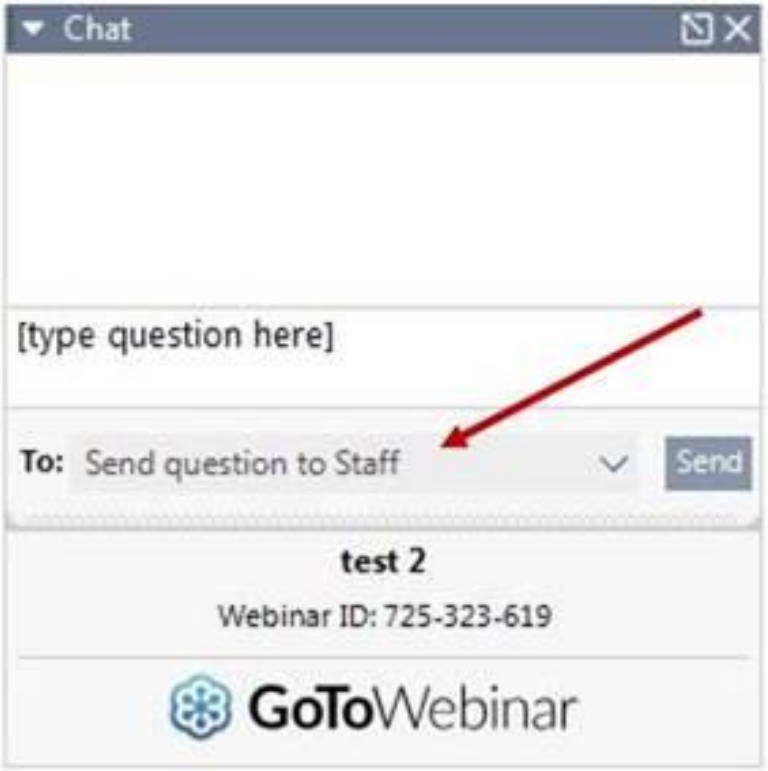
Q & A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