2018 INTERNATIONAL RESIDENTIAL CODE (IRC)® QUICK-CARDS®

Based on the 2018 IRC®

A UNIQUE QUICK-REFERENCE GUIDE

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8001 Canoga Avenue, Canoga Park, CA 91304
1-800-273-7375 • 1- 818-887-7828
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FOUNDATIONS & FOOTINGS

TERM ALERT!

- **Footing:** a foundational support; usually concrete, in a rectangular form wider than the bottom of the foundation wall or pier it supports.

  A footing can be level, stepped level or can follow the contour of the ground.
- **Dead Loads**: the weight of all materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings and stairways.
- **Live Loads:** loads produced by the use and occupancy of the building/structure, do not include construction or environmental loads.

PRESUMPTIVE LOAD-BEARING VALUES OF FOUNDATION MATERIALS *(Based on IRC Table R401.4.1)*

Class of Material	Load Bearing Pressure (lbs. per sq. ft.)
Crystalline bedrock	12,000
Sedimentary and foliated rock	4,000
Sandy gravel and/or gravel (GW & GP)	3,000
Sand, silty sand, clayey sand, silty gravel & clayey gravel (SW, SP, SM, SC, GM & GC)	2,000
Clay, sandy, silty clay, clayey silt, silt & sandy siltclay (CL, ML, MH and CH)	1,500

MIN. SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE *(Based on IRC Table R402.2)*

Type or Location of Concrete Construction	Min. Specified Compressive Strength		
	Weathering Potential		
	Negligible	Moderate	Severe
Basement walls, foundations and other concrete not exposed to the weather	2500	2500	2500
Basement slabs and interior slabs on grade, except garage floor slabs	2500	2500	2500
Basement walls, foundation walls, exterior walls & other vertical concrete work exposed to weather	2500	3000	3000
Porches, carport slabs and steps exposed to the weather and garage floor slabs	2500	3000	3500

FOOTINGS *(Based on R403.1)*

- All exterior walls must be supported on continuous solid footings, fully grouted masonry footings, concrete footings, crushed stone footings, wood foundation or other approved structural systems.
- Footings must:
  - be of sufficient design to accommodate all loads
  - be able to transmit the resulting loads to the soil within the limitations of the soil
  - be supported on undisturbed natural soils or engineered fill

FOOTINGS – DEPTH & FROST PROTECTION *(Based on R403.1.4 & 403.1.4.1)*

- Exterior footings must be placed a min. of 12" below the undisturbed ground surface.
- Foundation walls, piers and other permanent supports of buildings/structures must be protected from frost by: extending below the frost line (see Table R301.2 (1)), erected on solid rock or constructed according to Section R403.3 or ASCE 32.
- Footings must not bear on frozen soil unless the frozen condition is permanent.

FOOTINGS – SLOPE *(Based on R403.1.5)*

- The top surface of footings must be level.
- Bottom surface of footings slope: 1 unit vertical in 10 units horizontal (1:10)(10% slope) Max.
- Footings must be stepped where it is necessary to change the elevation of the top surface of the footings or where the slope of the bottom surface of the footings will exceed 1 unit vertical in 10 units horizontal (1:10) (10% slope).

FOOTINGS – DIMENSIONS *(Based on R403.1.1)*

- The minimum width and thickness for concrete footings must be based on the requirements of Table R403.1(1) through R403.1(3), as applicable.
- The footing width must be based on the load-bearing value of soil. See Table R401.4.1
- Footing projections must be 2" Min. and must not exceed the thickness of footing.

FOUNDATION ANCHORAGE *(Based on R403.1.6)*

- Wood sill plates and wood walls supported directly on continuous foundations must be anchored to the foundation.
- Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of braced wall panels at building interiors on monolithic slabs and all wood sill plates must be anchored to the foundation with ½" Min. diameter anchor bolts spaced 6 ft. Max. o.c. or with equivalent anchors or anchor straps.
- Bolt extension into concrete or grouted cells of concrete masonry units: 7" Min.
- Bolts must be located in the middle third of the width of the plate.
- A nut and washer must be tightened on each anchor bolt.
- There must be a min. of 2 bolts per plate section with 1 bolt located not more than 12" or less than 7 bolt diameters from each end of the plate section.

FOUNDATION DAMPPROOFING *(Based on R406.1)*

Foundation walls that retain earth and enclose interior spaces and floors below grade must be dampproofed from the higher of the top of the footing or 6" below the top of the basement floor, to the finished grade.

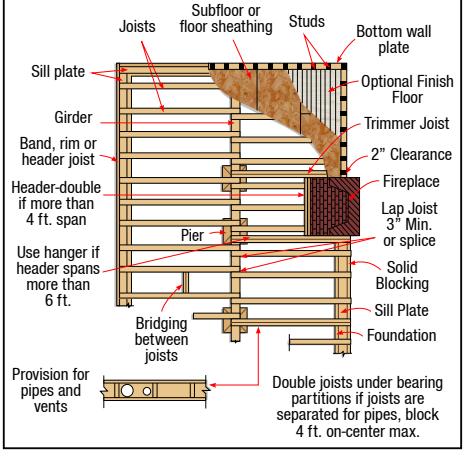
CONCRETE FOOTINGS MIN. WIDTH & THICKNESS – LIGHT-FRAME CONSTRUCTION *(Based on IRC Table R403.1(1))*

Snow Load or Roof Live Load	Story & Type of Structure with Light Frame	Load-Bearing Value of Soil (psf)					
		1500	2000	2500	3000	3500	4000
20 psf	1 story–slab-on-grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story–with crawl space	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story–plus basement	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story–slab-on-grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story–with crawl space	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story–plus basement	22 × 6	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	3 story–slab-on-grade	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story–with crawl space	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story–plus basement	25 × 8	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6

Note: This is an abridged table. For other footing requirements, see 2018 IRC Table R403.1(1) & R403.1(2)

FLOOR FRAMING

FLOOR CONSTRUCTION



BEARING *(Based on R502.6)*

- The ends of each joist, beam or girder must have a 1½" Min. bearing on wood or metal and 3" Min. bearing on masonry or concrete or be supported by approved joist hangers.
- Alternatively, the ends of joists must be supported on a 1" x 4" ribbon strip and be nailed to the adjacent stud.
- Bearing on masonry or concrete must be direct, or a sill plate 2" Min. thick must be provided under the joist, beam or girder.
- Sill plate bearing area: 48 sq. in. Min.

JOISTS UNDER BEARING PARTITIONS *(Based on R502.4)*

- Joist under parallel bearing partitions must be adequately sized.
- Double joists, adequately sized, and separated to permit the installation of piping or vents must be: full depth solid blocked with lumber 2" Min. thick spaced a max. of 4 ft. on center.
- Bearing partitions perpendicular to joists must not be offset from supporting girders, walls or partitions more than the joist depth unless such joists are of sufficient size.

SPANS *(Based on R502.3 & R502.5)*

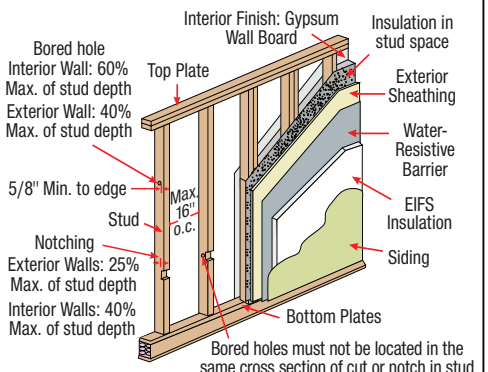
- Floor joist spans: Tables R502.3.1(1) and R502.3.1(2).
- Girders and headers spans: Tables R602.7(1), (2) & (3).

CUTTING, DRILLING & NOTCHING *(Based on R502.8.1)*

- Notches in solid lumber joists, rafters and beams must not exceed 1/6 the depth of the member.
- Notches must not be longer than 1/3 depth of member.
- Notches must not be located in the middle 1/3 of span.
- Notches at ends of member: 1/4 Max. member depth.
- The tension side of members 4" or greater in thickness must not be notched except at the ends of the members.
- Diameter of bored/cut holes: 1/3 Max. member depth.
- Holes must not be closer than 2" to the top or bottom of the member, or to any other hole located in the member.
- Where the member is notched, the hole must not be closer than 2" to the notch.

WALL FRAMING

WALL CONSTRUCTION



NOTCHING OF STUDS *(Based on R602.6)*

Notch Depth in Exterior Walls or Bearing Partitions:
25% Max. the depth of stud width.

Notch Depth in Non-bearing Partitions:
40% Max. the depth of a single stud width.

DRILLING OF STUDS *(Based on R602.6)*

Any stud can be bored or drilled, provided:

- **Hole Diameter:** 60% Max. the stud width.
- **Hole Edge**: 5/8" Max. to the edge of the stud.
- Bored holes must not be located in the same section as a cut or notch.
- Studs located in exterior walls or bearing partitions drilled over 40% and up to 60% must also be doubled with no more than 2 successive doubled studs bored.

SIZE, HEIGHT & SPACING *(Based on R602.3(1))*

The size, height and spacing of studs must be in accordance with Table R602.3(5).

TOP PLATE *(Based on R602.3.2)*

- Wood stud walls must be capped with a double top plate installed to provide overlapping at corners and intersections with bearing partitions.
- End joints in top plates must be offset 24" Min.
- Joints in plates need not occur over studs.
- Plates thickness: 2" Min.
- Plate width: not less than the width of the studs.

BOTTOM (SOLE) PLATE *(Based on R602.3.4)*

Studs must have full bearing on a 2-by or larger plate or sill with a width not less than the width of the studs.

BEARING STUDS *(Based on R602.3.3)*

Where joists, trusses or rafters are spaced more than 16" on center and the bearing studs below are spaced 24" on center, such members must bear within 5" of the studs beneath.

HEADERS *(Based on R602.7.1)*

Single headers must be framed with a single flat 2" member or a wall plate not less in width than the wall studs on the top and bottom of the header and face nailed to the top and bottom of the header with 10d box nails (3" × 0.128") spaced 12" o.c.

TOP PLATE – DRILLING & NOTCHING *(Based on R602.6.1)*

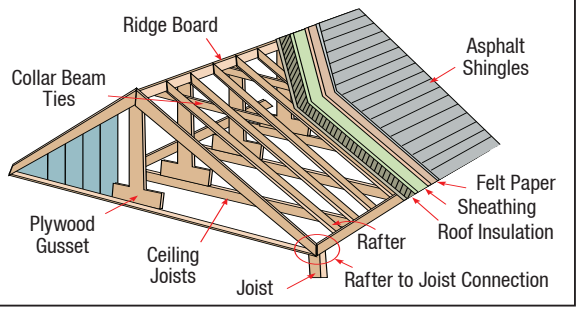
Where piping or ductwork is placed in or partly in an exterior wall or interior load-bearing wall and the top plate is cut, drilled or notched more than 50% of its width, a galvanized metal tie 0.054" Min. thick (16 ga) and 1½" wide must be fastened across and to the plate at each side of the opening with a min. of eight 10d (0.148" dia.) nails having a min. length of 1½" at each side.

SIZE, HEIGHT & SPACING *(Based on IRC Table R602.3(5))*

Stud Size (inches)	Laterally unsupported stud height (feet)	Max. spacing where supporting a roof-ceiling assembly or a habitable attic assembly, only (inches)	Max. spacing where supporting one floor, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Max. spacing where supporting two floors, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Max. spacing where supporting one floor height (inches)	Laterally unsupported stud height (feet)	Max. spacing (inches)
2 × 3	–	–	–	–	–	10	16
2 × 4	10	24	16	–	24	14	24
3 × 4	10	24	24	16	24	14	24
2 × 5	10	24	24	–	24	16	24
2 × 6	10	24	24	16	24	20	24

ROOF FRAMING

ROOF DESIGN



CEILING JOISTS LAPPED *(Based on R802.5.2.1)*

- Ends of ceiling joists must be lapped 3" Min. or butted over bearing partitions or beams and toe nailed to the bearing member.
- Where ceiling joists are used to provide resistance to rafter thrust, lapped joists must be nailed together according to Table R802.5.2 and butted joists must be tied together to resist such thrust.
- Joists that do not resist thrust are permitted to be nailed. See Table R602.3(1).

RIDGE *(Based on R802.3)*

- A ridge board used to connect opposing rafters must be a 1" Min. thick and not less in depth than the cut end of the rafter.
- Where ceiling joist or rafter ties do not provide continuous ties across the structure, a ridge beam must be provided and supported on each end by a wall or girder.

RAFTERS *(Based on R802.4)*

- Rafters must be sized based on the rafter spans in Tables R802.4.1(1) through R802.4.1(8).
- Rafter spans must be measured along the horizontal projection of the rafter.
- Rafters must be framed 1½" Max. offset from each other to a ridge board or directly opposite from each other with a collar tie, gusset plate or ridge strap according to Table R602.3(1).
- Rafters must be nailed to the top wall plates according to Table R602.3(1) unless the roof assembly is required to comply with the uplift requirements of Section R802.11.

CEILING JOISTS *(Based on R802.5)*

- Ceiling joists must be continuous across the structure or securely joined where they meet over interior partitions. See Table R802.5.2.
- Ceiling joists must be sized based on the joist spans in Tables R802.5.1(1) and R802.5.1(2).
- Ceiling joists that run parallel to rafters, must be connected to rafters at the top wall plate. See Table R802.5.2.
- Ceiling joists not connected to the rafters at the top wall plate, must be installed in the bottom third of the rafter height. See Table R802.5.2.
- Where the ceiling joists are installed above the bottom third of the rafter height, the ridge must be designed as a beam.
- Where ceiling joists do not run parallel to rafters, the ceiling joists must be connected to top plates. See Table R602.3(1).
- Each rafter must be tied across the structure with a rafter tie or a 2" × 4" kicker connected to the ceiling diaphragm with nails equivalent in capacity to Table R802.5.2.

EXTERIOR WALL COVERING

WATER-RESISTIVE BARRIER *(Based on R703.2)*

- One layer of No. 15 asphalt felt must be applied over studs or sheathing of all exterior walls.
- No. 15 asphalt felt must be applied horizontally, with the upper layer lapped over the lower layer 2" Min.
- Where joints occur, felt must be lapped 6" Min.
- No. 15 asphalt felt must be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope.
- Other approved materials must be installed according with the manufacturer's installation instructions.

WALL COVERING *(Based on R703.3)*

- The nominal thickness and attachment of exterior wall coverings must comply with Table R703.3(1), the wall covering material reqs. of this section and the manufacturer's installation instructions.
- Nominal material thicknesses in Table R703.3(1)are based on a max. stud spacing of 16" o.c.
- Fasteners for exterior wall coverings attached to wood framing must comply with Section R703.3.3 and Table R703.3(1).

FLASHING *(Based on R703.4)*

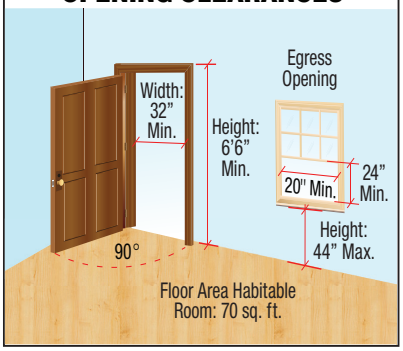
- Approved corrosion-resistant flashing must be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to building structural framing components.
- Flashing must extend to the surface of the exterior wall finish.
- For flashing locations, see Section 703.4.

MAX. WEATHER EXPOSURE FOR WOOD SHAKES & SHINGLES *(Based on IRC Table R703.6.1)*

Length	Exposure for Single Course	Exposure for Double Course
Shingles		
16	7	12
18	8	14
24	10½	16
Shakes		
18	8	14
24	10½	18

INTERIOR DIMENSIONS

OPENING CLEARANCES



MIN. AREAS *(Based on R304)*

Floor Area: 70 sq. ft. in all habitable rooms.
Exception: kitchens

Horizontal Dimensions: 7 ft. Min. in any horizontal dimension.

Height Effect on Room Area: Portions of a room with a sloping ceiling measuring less than 5 ft. or a furred ceiling measuring less than 7 ft. from the finished floor to the finished ceiling do not contributing to the min. required habitable area for that room.

CEILING HEIGHT *(Based on R305.1)*

Habitable Space, Hallways & Portions of Basements Containing These Spaces: 7 ft. Min.

Bathrooms,Toilet Rooms & Laundry Rooms: 6' 8" Min.

Non-habitable Portions of Basements: 6' 8" Min.

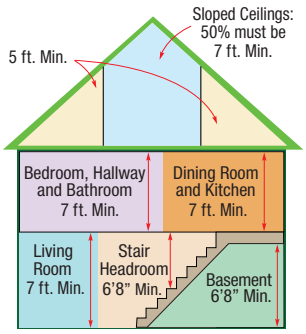
Rooms with sloped ceilings: at least 50% must be 7 ft. Min. and no portion must be less than 5 ft. Min.

HABITABLE ROOM VENTILATION *(Based on R303.1)*

Habitable Rooms Aggregate Glazing Area: 8% Min. of the floor area.

Habitable Rooms Ventilation Openable Area: 4% Min. of the floor area being ventilated.

CEILING HEIGHT



STAIRWAYS

STAIRWAYS *(Based on R311.7.1 – R311.7.5)*

Width: 36" Min. at all points above the permitted handrail height and below the required headroom height.

Width with Handrail Installed on One Side: 31½" Min.

Width with Handrail Installed on Both Sides: 27" Min.

Headroom: 6'8" Min. measured vertically from the sloped line adjoining the tread nosing or from the floor surface of the landing or platform.

Stair Riser Height: 7¾" Max. measured vertically between leading edges of the adjacent treads.

Riser Tolerance: the greatest riser height must not exceed the smallest by more than 3/8".

Riser Slope Angle: vertical or sloped from the underside of the nosing of the tread above at an angle 30° Max.

Open risers: if located more than 30" above floor or grade below, must not permit the passage of a 4" diameter sphere.

Tread Depth: 10" Min. measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge.

Tread Tolerance: greatest tread depth must not exceed the smallest by more than 3/8".

Nosing Radius of Curvature: 9/16" or a bevel ½" Max.

Nosing Projection: ¾" Min. to 1¼" Max.

Nosing Projection Tolerance: the greatest nosing projection must not exceed the smallest by more than 3/8".

HANDRAILS *(R311.7.8; R311.8.3, R311.7.8.3)*

Location: 1 side min. on each flight of stairs with 4 or more risers.
Height: 34" Min. to 38" Max. measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope.
Handrail Projection: 4½" Max. on either side of the stairway.
Continuity: continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight.
Ends: returned or terminated in newel posts or safety terminals.
Clearance: 1½" Min. between the wall and the handrail.
Circular Cross Section: 1¼" Min. to 2" Max. outside diameter.
Non-Circular Perimeter: 4" Min. to 6¼" Max.
Non-Circular Cross Section: 2¼" Max.
Edge Radius: 0.01"

GUARDS *(Based on R312.1.1 –R312.1.3)*

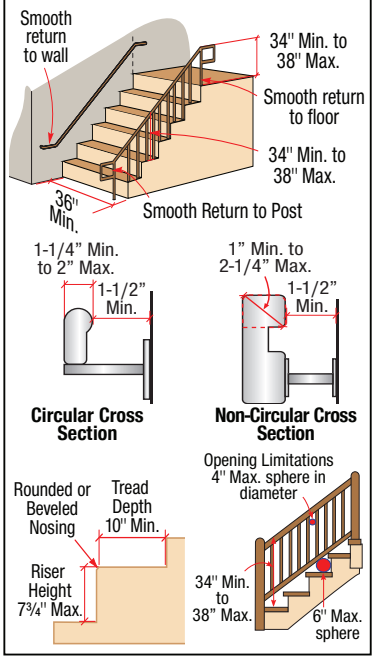
Location: open-sided walking surfaces, including stairs, ramps and landings, that are located more than 30" measured vertically to the floor or grade below at any point within 36" horizontally to the edge of the open side.

Height of Guard: 36" min. measured vertically above the adjacent walking surface or the line connecting the nosings.

Opening Limitations: guards must not have openings from the walking surface to the required guard height that allow the passage of a sphere 4" in diameter.

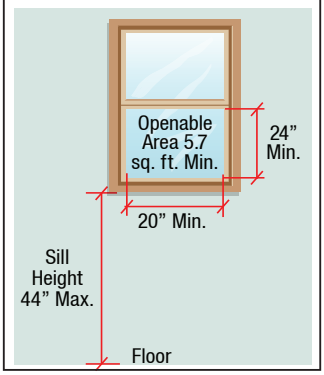
Triangular Openings: triangular openings at the open side of stair, formed by the riser, thread and bottom rail of a guard, must not allow passage of a sphere 6" in diameter.

STAIR DIMENSIONS



MEANS OF EGRESS

OPENINGS



EMERGENCY & RESCUE OPENINGS *(Based on R310.2.1 – R310.2.2)*

Net Clear Opening: 5.7 ft² Min.
Net Clear Opening Height: 24" Min.
Net Clear Opening Width: 20" Min.
Window Sill Height: 44" Max. above the floor.

BARS, GRILLES, COVERS *(Based on R310.4)*

Bars, grilles, covers, screens or similar devices placed over emergency escape and rescue openings, area wells or window wells must be releasable or removable from the inside without the use of a key, tool, special knowledge or force greater than that required for the normal operation of the escape and rescue opening.

WINDOW WELLS *(Based on R310.2.3)*

- **Horizontal Area:** 9 ft² Min.
- **Horizontal Projection and Width:** 36 Min.
- The area must allow the emergency escape and rescue opening to be fully opened.
- Window wells with a vertical depth more than 44" must be equipped with a permanently affixed ladder or steps usable with the window in the fully open position.
- **Ladders or rungs inside width:** 12" Min.
- **Ladders or rungs projection:** 3" Min. from the wall.
- **Ladders or rungs spacing:** 18" Max. on center vertically for the full height of the window well.

EGRESS DOOR *(Based on R311.2; R311.3)*

Number of egress doors: 1 Min. per dwelling unit.

Door Style: side-hinged

Clear Width: 32" Min. measured between the face of the door and the stop, with the door open 90°

Clear Height: 78" Min. measured from the top of the threshold to the bottom of the stop.

Operation: must be able to be opened from the inside of the dwelling without use of a key or special knowledge or effort.

Landings: each side of each exterior door.

SMOKE ALARMS

CARBON MONOXIDE ALARMS *(Based on R315)*

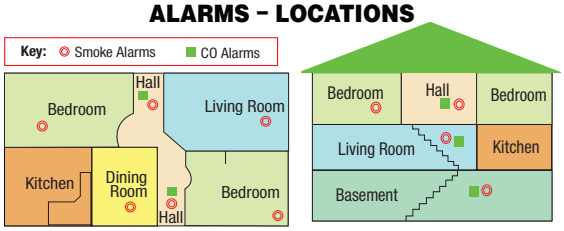
- Carbon monoxide alarm must be installed outside of each separate sleeping area in immediate vicinity of bedrooms.
- For new construction, carbon monoxide alarms must be provided in dwelling units that:
  - contain a fuel-fired appliance.
  - have an attached garage with an opening that communicates with the dwelling unit.
- Alterations, repairs or additions that require a permit must comply with new construction requirements.

SMOKE ALARM *(Based on R314.3)*

Smoke alarms installation locations:

- In each sleeping room.
- Outside each separate sleeping area in the immediate vicinity of the bedrooms.
- On each additional story of the dwelling, including basements and habitable attics.
- 3 ft. horizontally from the door or opening of a bathroom with a bathtub or shower.

ALARMS – LOCATIONS



HVAC – APPLIANCE LOCATION & CLEARANCES

APPLIANCE ACCESS *(Based on M1305.1)*

- Appliances must be located to allow access for inspection, service, repair and replacement without removing permanent construction, other appliances, or any other piping or ducts not connected to the appliance being inspected, serviced, repaired or replaced.
- A level working space must be provided in front of the control side to service an appliance.
- Level working space dimensions: 30" Min. deep x 30" Min. wide

APPLIANCES IN ROOMS *(Based on M1305.1.1)*

- Appliances installed in a compartment, alcove, basement or similar space must be accessed by an opening or door and an unobstructed passageway measuring 24" Min. wide and large enough to allow removal of the largest appliance in the space.
- There must be a level service space a min. of 30" deep x the height of the appliance, but not less than 30", at the front or service side of the appliance with the door open.

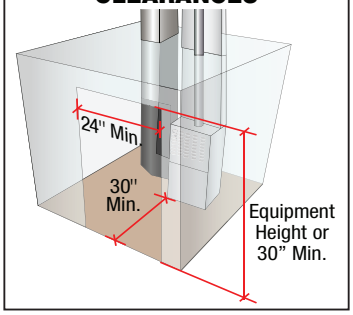
APPLIANCES INSTALLED IN ATTICS *(Based on M1305.1.2)*

- Attics containing appliances must be provided with an opening and a clear and unobstructed passageway large enough to allow removal of the largest appliance.
- Unobstructed Passageway: 30" Min. high, 22" Min. wide and 20 ft. Max. long measured along the centerline of the passageway from the opening to the appliance.
- A level service space a min. of 30" deep x 30" wide must be present along all sides of the appliance where access is required.
- Clear access opening dimensions: 20" Min. x 30" Min. and large enough to allow removal of the largest appliance.

APPLIANCES UNDER FLOORS *(Based on M1305.1.3)*

- Underfloor spaces containing appliances must be provided with an unobstructed passageway large enough to remove the largest appliance.
- Unobstructed Passageway: 30" Min. high, 22" Min. wide and 20 ft. Max. long measured along the centerline of the passageway from the opening to the appliance.
- Level working space dimensions: 30" deep x 30" wide at the front or service side of the appliance.
- If the depth of the passageway or the service space exceeds 12" below the adjoining grade, the walls of the passageway must be lined with concrete or masonry extending 4" above the adjoining grade.
- Rough-framed Access Opening Dimensions: 22" Min. x 30" Min. and large enough to remove the largest appliance.

WORKING SPACE & CLEARANCES



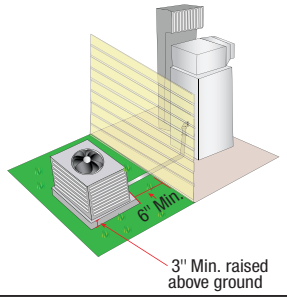
GROUND CLEARANCES *(Based on M1305.1.3.1)*

Ground Supported Appliances & Equipment: must be level and firmly supported on a concrete slab or other approved material extending 3" Min. above the adjoining ground.

Suspended Appliances: must have a clearance of 6" Min. from the ground.

HVAC – VENTILATION & EXHAUST SYSTEMS

AIR CONDITIONING OUTDOOR CLEARANCES



EXHAUST OPENINGS *(Based on M1504.3, R303.5.2)*

Air exhaust opening termination:

- 3 ft. Min. from property lines.
- 3 ft. Min. from gravity air intake openings, operable windows and doors.
- 10 ft. Min. from mechanical air intake openings except where opening is located 3 ft. Min. above the air intake opening.
- Exhaust air must not be directed onto walkways.

MECHANICAL VENTILATION SYSTEM *(Based on M1505.4.1)*

- Whole-house ventilation system must have:
  - one or more supply or exhaust fans or a combination of such.
  - associated ducts and controls.
  - local exhaust or supply fans can serve as such a system.
- Outdoor air ducts connected to the return side of an air handler must be considered to provide supply ventilation.
- Whole-house systems must be have controls that enable manual override.

MECHANICAL VENTILATION SYSTEM AIRFLOW RATE (CONTINUOUS)

(Based on IRC Table M1505.4.3(1))

Dwelling Unit Floor Area (square feet)	Number of Bedrooms Continuous Airflow in CFM				
	0-1	2-3	4-5	6-7	>7
< 1,500	30	45	60	75	90
1,501 – 3,000	45	60	75	90	105
3,001 – 4,500	60	75	90	105	120
4,501 – 6,000	75	90	105	120	135
6,001 – 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

HEATING & COOLING EQUIPMENT *(Based on M1401.2, M1401.4 & M1305.1.3.1)*

- Heating and cooling equipment and appliances must permit maintenance, servicing and replacement.
- Clearances must be maintained to permit cleaning of heating and cooling surfaces; replacement of filters, blowers, motors, controls and vent connections, lubrication of moving parts and adjustments.
- Equipment and appliances installed outdoors must be listed and labeled for outdoor installation.
- Supports and foundations must prevent excessive vibration, settlement or movement of the equipment.
- **Ground Supported Appliances & Equipment:** must be level and firmly supported on a concrete slab or other approved material extending 3" Min. above the adjoining ground.
- **Suspended Appliances:** must have a clearance of 6" Min. from the ground.

OUTSIDE OPENING PROTECTION *(Based on R303.6)*

- Air exhaust and intake openings that terminate outdoors must be protected with corrosion-resistant screens, louvers or grilles.
- Openings: 1/4" Min. and 1/2" Max.
- Openings must be protected against local weather conditions.
- Outdoor air exhaust and intake openings must meet the provisions for exterior wall opening protectives.

RECIRCULATION OF AIR *(Based on M1505.2)*

- Exhaust air from bathrooms and toilet rooms must not be recirculated within a residence or circulated to another dwelling unit and must be exhausted directly to the outdoors.
- Exhaust air from bathrooms, toilet rooms and kitchens must not discharge into an attic, crawl space or other inside areas.

MECHANICAL VENTILATION RATE *(Based on M1505.4.3)*

Wholehouse mechanical ventilation system must provide outdoor air at a continuous rate as determined by this equation:

Ventilation rate in cubic feet per minute = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)]

MECHANICAL VENTILATION RATE FACTORS (INTERMITTENT)

(Based on IRC Table M1505.4.3(2))

Run-Time % in each 4 hr. segment	25%	33%	50%	66%	75%	100%
Factor	4	3	2	1.5	1.3	1.0

DOMESTIC COOKING EXHAUST DISCHARGE *(Based on M1503.3)*

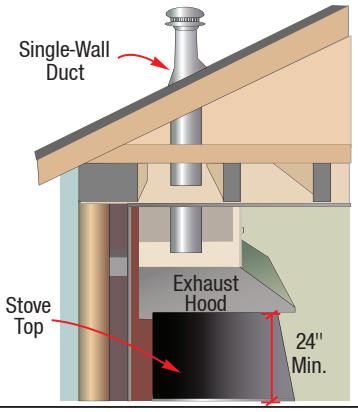
- Domestic cooking exhaust equipment must discharge to the outdoors through a duct.
- The duct must have a smooth interior surface, must be air tight, must be equipped with a backdraft damper and must be independent of all other exhaust systems.
- Ducts serving domestic cooking exhaust equipment must not terminate in an attic or crawl space or areas inside the building.

LOCAL EXHAUST RATES FOR ONE- AND TWO-FAMILY DWELLINGS

(Based on IRC Table M1505.4.4)

Area to be exhausted	Exhaust Rates
Kitchens	100 cfm intermittent or 25 cfm continuous
Bathrooms-Toilet Rooms	Mechanical exhaust capacity of 50 cfm intermittent or 20 cfm continuous

OVERHEAD EXHAUST HOOD



ELEVATION OF IGNITION SOURCE *(Based on M1307.3)*

- Appliances that have an ignition source must be elevated so that the ignition source is 18" Min. above garage floor.
- Rooms or spaces that are not part of the living space of a dwelling unit and communicate with a private garage are considered to be part of the garage.

LOCAL EXHAUST RATES *(Based on M1505.4.4)*

- Local exhaust systems must be designed to have the capacity to exhaust the min. airflow rate determined in Table M1505.4.4.
- Table M1505.4.4 specifies the min. required local exhaust rates for one and two-family dwellings.

OPEN-TOP BROILER EXHAUST *(Based on M1503.2.1)*

- Domestic open-top broiler units must have a metal exhaust hood having a min. thickness of 0.0157-inch (No. 28 gage).
- Hood Clearance:
  - 1/4" Min. between the hood and the underside of combustible material and cabinets.
  - 24" Min. between the cooking surface and combustible material and cabinets.
- Hood width: at least as wide as the broiler unit and extend over the entire unit.

PLUMBING

TRENCHING & BEDDING *(Based on P2604.1)*

- Where trenches are excavated and the bottom of the trench forms the bed for the pipe, solid and continuous load-bearing support must be provided between joints.
- Where over-excavated, the trench must be backfilled to the proper grade with compacted earth, sand, fine gravel or similar granular material.
- Piping must not be supported on rocks or blocks.
- Rocky or unstable soil must be over-excavated by two or more pipe diameters and brought to the proper grade with suitable compacted granular material.

BACKFILLING *(P2604.3)*

- Pipe must be covered 12" min. of tamped earth.
- Backfill must be free from:
  - discarded construction material and debris
  - rocks, broken concrete and frozen chunks
- Backfill must be placed evenly on both sides of the pipe and tamped to retain proper alignment.
- Loose earth must be carefully placed in the trench in 6" layers and tamped in place.

PROTECTION OF FOOTINGS *(Based on P2604.4)*

- Trenching installed parallel to footings and walls must not extend into the bearing plane of a footing or wall.
- The upper boundary of the bearing plane is a line that extends downward, at an angle of 45° from horizontal, from the outside bottom edge of the footing or wall.

PIPE SUPPORT *(Based on P2605)*

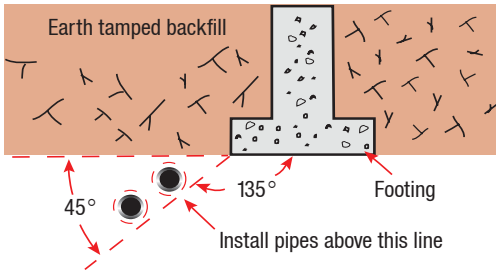
- Piping must be supported to:
  - ensure alignment
  - prevent sagging
  - allow movement associated with the expansion and contraction of the piping system.
- Piping in the ground must be laid on a firm bed for its entire length, except where support is otherwise provided.
- Hangers and anchors must be of sufficient strength to maintain their proportional share of the weight of pipe and contents and of sufficient width to prevent distortion to the pipe.
- Hangers and strapping must be of approved material that does not promote galvanic action.
- Where horizontal pipes 4" and larger convey drainage or waste, and where a pipe fitting changes the flow direction greater than 45°, rigid bracing or other rigid support arrangements must be installed to resist movement of the upstream pipe in the direction of flow.
- A change of flow direction into a vertical pipe must not require the upstream pipe to be braced.
- Piping must be supported at distances not exceeding those indicated in Table P2605.1.

HORIZONTAL DRAINAGE PIPING SLOPE *(Based on P3005.3)*

Min. slopes of pipes with diameter 2-1/2" or less: ¼ unit vertical in 12 units horizontal (¼:12) (2% slope).

Min. slopes of pipes with diameter 3" or greater: ⅛ unit vertical in 12 units horizontal (⅛:12) (1% slope).

FOOTINGS & PIPE LOCATION



WASTE RECEPTORS *(Based on P2706)*

- For other than hub drains that receive only clear-water waste and standpipes, a removable strainer or basket must cover the waste outlet of waste receptors.
- Waste receptors must not be installed in concealed spaces, plenums, attics, crawl spaces or interstitial spaces above ceilings and below floors.
- Waste receptors must be readily accessible.
- Hub drains must be in the form of a hub or a pipe that extends 1" Min. above a water-impervious floor.
- Standpipes must extend 18" Min. and 42" Max. above the trap weir.
- Where a laundry tray waste line connects into a standpipe for an automatic clothes washer drain, the standpipe must extend 30" Min. above the standpipe trap weir and must extend above the flood level rim of the laundry tray.
- The outlet of the laundry tray must be 30" Max. horizontally from the standpipe trap.
- Plumbing fixtures that are used for washing or bathing must not be used to receive the discharge of indirect waste piping.

OUTLETS *(Based on P2711.3; P2713.1; P2714.1; P2708.2)*

Lavatory Waste Outlets: 1¼" Min. in diameter. A strainer, pop-up stopper, crossbar or other device must be provided to restrict the clear opening of the waste outlet.

Sink Waste Outlets: 1½" Min. in diameter. A strainer, crossbar or other device must be provided to restrict the clear opening of the waste outlet.

Bathtub Outlets: 1½" Min. in diameter. The waste outlet must be equipped with a water-tight stopper.

Bathtub Overflows: 1½" in diameter.

Shower Drains Outlet Size: 1½" in diameter.

TAIL PIECES *(Based on P2703)*

Fixture tail pieces for sinks, dishwashers, laundry tubs, bathtubs and similar fixtures: 1½" Min. in diameter.

Fixture tail pieces for bidets, lavatories and similar fixtures: 1¼" Min. in diameter.

SHOWER COMPARTMENTS *(Based on P2708)*

Interior Cross-Sectional Area: 900 sq. in. Min.

Dimension: 30" Min. measured from the finished interior dimension of the shower compartment, exclusive of fixture valves, shower heads, soap dishes and safety grab bars or rails.

Access and Egress Opening Width: 22" Min. Hinged shower doors must open outward.

High Limit Stop Water Temperature: 120°F Max.

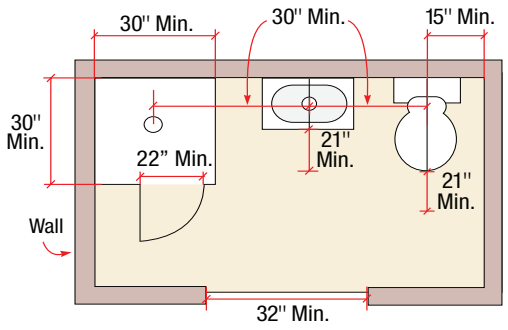
Other Shower Clearances:

- The wall area above built-in tubs must form a water-tight joint with each other and with either the tub, receptor or shower floor.
- The min. required area and dimension must be measured from the finished interior dimension at a height equal to the top of the threshold and at a point tangent to its center line and be continued to a height of 70" Min. above the shower drain outlet.
- Water supply risers from shower valve to showerhead outlet must be attached to the structure using support devices designed for use with the specific piping material or fittings anchored with screws.

SLIP-JOINT CONNECTIONS *(Based on P2704.1)*

- Slip-joint connections must be installed only for tubular waste piping and only between the trap outlet of a fixture and the connection to the drainage piping.
- Slip-joint connections must be made with approved elastomeric sealing gasket.

BATHROOM FIXTURES – CLEARANCES



BATHROOM CLEARANCES *(Based on P2705.1)*

Clearance for Water Closets, Lavatories and Bidets: 15" Min. from its center to side wall, partition or vanity.

Clearances between adjacent fixtures: 30" Min. center-to-center.

Clearance in Front of Water Closet: 21" Min.

Clearance in Front of Lavatory or Bidet: 21" Min. The location of piping, fixtures or equipment must not interfere with the operation of windows or doors.

INSTALLATION *(Based on P2705.1)*

Floor-outlet or floor-mounted fixtures: must be secured to the drainage connection and to the floor, by screws, bolts, washers, nuts and similar fasteners of copper, copper alloy or other corrosion-resistant material.

Wall-hung fixtures: must be rigidly supported so that strain is not transmitted to the plumbing system.

Water Tight Contact Area: where fixtures come in contact with walls and floors, the contact area must be water tight.

Functionality: plumbing fixtures must be usable.

Location: The location of piping, fixtures or equipment must not interfere with the operation of windows or doors.

Flood Hazard: In flood hazard areas as established by Table R301.2(1), plumbing fixtures shall be located or installed in accordance with Section R322.1.6.

REQUIRED CAPACITIES AT POINT OF OUTLET DISCHARGE *(Based on IRC Table P2903.1)*

Fixture Supply Outlet Serving	Flow Rate (gpm)	Flow Pressure (psi)
Bathtub, balanced-pressure, thermostatic or combination	4	20
Bidet, thermostatic mixing valve	2	20
Dishwasher	2.75	8
Laundry tray	4	8
Lavatory	0.8	8
Shower, balanced-pressure, thermostatic or combination	2.5	20
Sillcock, hose bibb	5	8
Sink	1.75	8
Water closet, flushometer tank	1.6	20
Water closet, tank, close coupled	3	20
Water closet, tank, one-piece	6	20

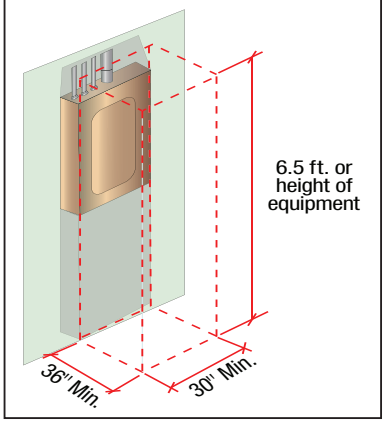
MAX. FLOW RATES & CONSUMPTION FOR PLUMBING FIXTURES & FIXTURE FITTINGS *(Based on IRC Table P2903.2)*

Plumbing Fixture or Fixture Fitting	Max. Flow Rate
Lavatory Faucet	2.2. gpm at 60 psi
Shower Head	2.5 gpm at 80 psi
Sink Faucet	2.2 gpm at 60 psi
Water Closet	1.6 gallons per flushing cycle

a. A handheld shower spray is considered to be a shower head.

ELECTRICAL

WORKING SPACE CLEARANCES



WORKING SPACE & CLEARANCES *(Based on E3405.1 - E3405.2)*

Access and working space must be provided and maintained around all electrical equipment.

The work space must be clear.

Working Space Depth: 36" Min. in the direction of access to panelboards and live parts of other equipment.

Work Space Width: 30" Min. in front of the electrical equipment and not less than the width of such equipment.

Work Space Height: 6.5 ft. or the height of the equipment, whichever is greater, measured from the floor or platform.

Measuring Distance:

Exposed Parts: distances must be measured from the energized parts

Enclosed Parts: distances must be measured from enclosure front or opening

Equipment Doors or Hinged Panels: 90° Min. opening

Associated Equipment located above or below the electrical equipment: 6" Max. beyond the front of the electrical equip.

Artificial Illumination: in all working spaces for service equipment and panelboards installed indoors. Must not be controlled by automatic means only.

Additional lighting outlets are not required where the work space is illuminated by an adjacent light source.

LIMITED ACCESS WORKING SPACE *(Based on E3405.2)*

Equipment installed above a lay-in ceiling: opening must be a min. of 22" by 22"

Equipment installed in a crawl space: opening must be a min. of 22" x 30"

Working Space Width: 30" Min. or width of equipment enclosure, whichever is greater.

Equipment Doors or Hinged Panels: 90° Min. opening

Space in Front of Enclosure: Table 110.26(A)(1) of NFPA 70.

Working Space Height: height necessary to install the equipment in the limited space.

A horizontal ceiling structural member or access panel is permitted in this space.

ELECTRICAL CONDUCTORS *(Based on E3406.2 - E3406.5)*

Conductor material: copper or aluminum

Conductor Size (Min.): 14 AWG copper and 12 AWG aluminum.

Stranded Conductors: conductors 8 AWG and larger installed in raceways must be stranded.

Insulated Conductors:

- Current-carrying conductors must be insulated.
- Insulation types: RHH, RHW, RHW-2, THHN, THHW, THW, THW-2, THWN, THWN-2, TW, UF, USE, USE-2, XHHW or XHHW-2.

LENGTH OF CONDUCTOR FOR SPLICE OR TERMINATION *(Based on E3406.11.3)*

- Where conductors are to be spliced, terminated or connected to fixtures or devices, a min. length of 6" of free conductor must be provided at each outlet, junction or switch point.
- The required length must be measured from the point in the box where the conductor emerges from its raceway or cable sheath.
- Where the opening to an outlet, junction or switch point is less than 8" in any dimension, each conductor must be long enough to extend at least 3" outside of such opening.

LIGHTING OUTLETS *(Based on E3903.2 – E3903.4)*

At least 1 wall switch-controlled lighting outlet must be installed in:

- every habitable room, kitchen and bathroom.
- hallways, stairways, attached garages and detached garages with electric power.
- exterior side of each outdoor egress door having grade level access, including outdoor egress doors for attached garages and detached garages with electric power.
- interior stairways, at each floor level and landing level that includes an entryway to control the lighting outlets where the stairway between floor levels has six or more risers.

CABLE PROTECTION *(Based on E3802.3.2; E3802.3.3)*

- Where subject to physical damage, cables must be protected by rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC conduit, RTRC-XW or other approved means.
- Where passing through a floor, the cable must be enclosed in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC conduit RTRC-XW or other approved means extending a min. of 6" above the floor.
- Where exposed to sunlight, conductors and cables must be listed or listed and marked as "sunlight resistant" or be covered with insulating material listed "sunlight resistant."

SURFACE & UNDERGROUND INSTALLATION *(Based on E3802.3.1; E3803.1)*

Surface Installation: Must closely follow the surface of the building finish or running boards.

Underground Installation

- Underground service conductors that are not encased in concrete and that are buried 18" or more below grade must have their location identified by a warning ribbon that is placed in the trench 12" min. above the underground installation.
- Direct buried conductors and cables emerging from the ground must be protected by enclosures or raceways extending from the min. cover distance below grade to a point at least 8 ft. above finished grade.
- Conductors entering a building must be protected to the point of entrance.

AMPACITY *(Based on E3602.1)*

Ungrounded Service Conductors: no less than the load served

One-Family Dwellings Underground Conductors: 100 amperes, 3 wire

All Other Installations of Ungrounded Conductors: 60 Min. amperes

CONDUCTOR IDENTIFICATION *(Based on IRC E3407)*

Insulated grounded conductors 6 AWG or smaller	• a continuous white or gray outer finish or • 3 continuous white or gray stripes on other than green insulation along the entire length of the conductors
Conductors 4 AWG or larger	• a continuous white or gray outer finish or • 3 continuous white or gray stripes on other than green insulation along its entire length or at the time of installation by a distinctive white or gray marking at its terminations.
Equipment grounding conductors 6 AWG and smaller	• a continuous green color or • a continuous green color with one or more yellow stripes on the insulation or covering, except where bare.
Ungrounded Conductors	• a continuous color other than white, gray and green.

BRANCH-CIRCUIT SUMMARY *(Based on IRC Table E3702.14)*

	Circuit Rating		
	15 amp	20 amp	30 amp
Conductors: Min. size (AWG) circuit conductors	14	12	10
Max. overcurrent protection device rating Ampere rating	15	20	30
Outlet devices: Lampholders permitted Receptacle rating (amperes)	Any Type 15 Max.	Any Type 15 or 20	N/A 30
Max. Load (amperes)	15	20	30

RECEPTACLES/OUTLETS *(E3901.2.1; 3901.4 – E3901.10)*

Receptacle Location/Spacing: 6 ft. Max. distance from any point measured horizontally along the floor line of any wall space.

Countertop and similar work surface Receptacles Outlets: 1 at each wall countertop/work surface space 12" or wider; no point must be more than 24" from the receptacle outlet serving that space. Receptacle outlets must be located not more than 20" above the countertop or work surface.

Island & Peninsular Countertop Outlets: 1 Min. when the dimension of the island is equal or greater than 24" long x 12" short. Measured from the connected perpendicular wall.

Appliance Receptacle Outlets: installed within 6 ft. of the intended location of the specific appliance. Ex. laundry equipment.

Bathroom Receptacle Outlets: 1 Min.; located within 36" of the outside edge of each lavatory basin on a wall or partition that is adjacent to the lavatory basin location, located on the countertop, or installed on the side or face of the basin cabinet 12" Max. below the top of the basin.

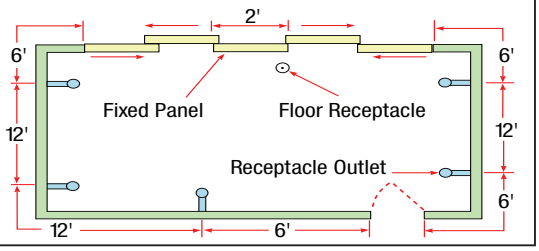
Outdoor Receptacle Outlets: 1 Min.; installed outdoors at the located 6'6" max. above grade installed at front and back of each dwelling unit having direct access to grade level.

Balconies, Decks and Porches Receptacle Outlets: 1 Min.; installed within the perimeter of the balcony, deck or porch; located 6'6" Max. above balcony, deck, or porch surface.

Basements and Garages Receptacle Outlets: 1 Min. in each separate, unfinished portion of a basement in addition to required specific appliance receptacle outlets.

Hallways Receptacle Outlet: 1 Min. if the hallway is 10 ft. or greater in length.

RECEPTACLES OUTLETS



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