2021 INTERNATIONAL RESIDENTIAL CODE QUICK-CARDS®
Based on the 2021 IRC®
A UNIQUE QUICK-REFERENCE GUIDE
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FOUNDATIONS & FOOTINGS

FOUNDATION ANCHORAGE *(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" (12.7 mm) Min. diameter anchor bolts spaced 6 ft. (1829 mm) Max. o.c. or with equivalent anchors or anchor straps.
- **Bolt extension into concrete or grouted cells of concrete masonry units:** 7" (178 mm) 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" (305 mm) or less than 7 bolt diameters from each end of the plate section.

FOUNDATION DAMPPROOFING *(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" (152 mm) below the top of the basement floor, to the finished grade.

FOOTINGS – DIMENSIONS *(R403.1.1)*

- Footings may not be less than 12"wide (305 mm) & 6" (152 mm) deep.
- Min. width & thickness for concrete footings must be based on the requirements of Table R403.1(1) through R403.1(3), as applicable.
- Footing width must be based on the load-bearing value of soil. See Table R401.4.1
- Footing projections must be 2" (51 mm) Min. & not exceed the thickness of the footing.

FOOTINGS *(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
  - able to transmit the resulting loads to the soil within the limitations of the soil
  - supported on undisturbed natural soils or engineered fill

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

- Exterior footings must be placed a min. of 12" (305 mm) below 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), 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 *(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).

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

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

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	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story–slab-on-grade	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story–with crawl space	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story–plus basement	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story–slab-on-grade	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story–with crawl space	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story–plus basement	22 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6

Note: This is an abridged table. For other footing requirements, see 2021 IRC Table R403.1(1) & R403.1(2)

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

FLOOR FRAMING

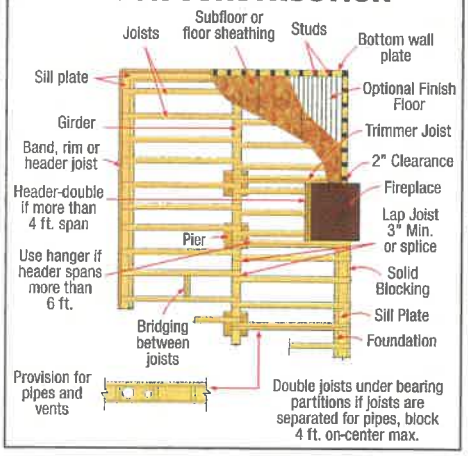
SPANS *(R502.3 & R502.5)*

- **Floor Joist Spans:** Tables R502.3.1(1) & R502.3.1(2).
- **Girders & Headers Spans:** Tables R602.7(1), (2) & (3).

CUTTING, DRILLING & NOTCHING *(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" (102 mm) or more in thickness must not be notched except at the ends.
- **Diameter of bored/cut holes:** 1/3 Max. member depth.
- Holes must not be closer than 2" (51 mm) 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" (51 mm) to the notch.

FLOOR CONSTRUCTION



BEARING *(R502.6)*

- The ends of each joist, beam or girder must have a 1½" (38 mm) Min. bearing on wood or metal and 3" (76 mm) Min. bearing on masonry or concrete or be supported by approved joist hangers.
- Alternatively, the ends of joists must be supported on a 1"x4" (25 mm x 102 mm) ribbon strip and be nailed to the adjacent stud.
- Bearing on masonry or concrete must be direct, or a sill plate 2" (51 mm) thick min. must be put under the joist, beam or girder.
- **Sill Plate Bearing Area:** 48 sq. in. Min.

JOISTS UNDER BEARING PARTITIONS *(R502.4)*

- Joist under parallel bearing partitions must be adequately sized.
- Double joists, adequately sized, & separated to permit piping or vent installation must be: full depth solid blocked with lumber 2" (51 mm) Min. thick spaced a max. of 4 ft. (1219 mm) 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.

WALL FRAMING

BEARING STUDS *(R602.3.3)*

Where joists, trusses or rafters are spaced more than 16" (406 mm) o.c. and the bearing studs below are spaced 24" (610 mm) o.c., such members must bear within 5" (127 mm) of the studs beneath.

HEADERS *(R602.7.1)*

Single headers must be framed with a single flat 2" (51 mm) 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 *(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" (1.37 mm) Min. thick (16 ga) and 1½" (38 mm) 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" (38 mm) at each side.

SIZE, HEIGHT & SPACING *(R602.3.1)*

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

TOP PLATE *(R602.3.2)*

- Wood stud walls must be capped with a double top plate installed to provide overlapping at corners & 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" (51 mm) Min.
- **Plate width:** not less than the width of the studs.

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

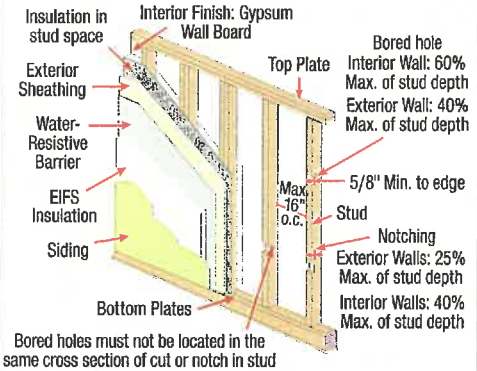
Studs must have full bearing on a 2-by or larger plate or sill with a width not less than the width of the studs.

NOTCHING OF STUDS *(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.

WALL CONSTRUCTION



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

DRILLING OF STUDS *(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.

ROOF FRAMING

RAFTERS *(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 each other with a collar tie, or ridge strap to comply with Section R802.4.6, or a gusset plate 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.

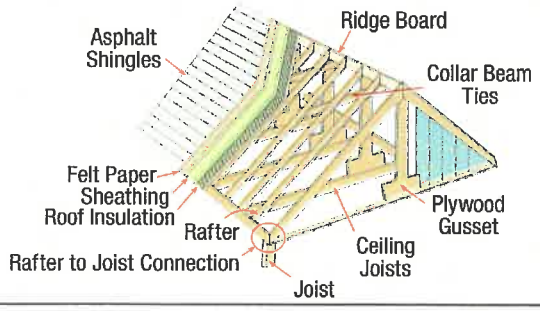
RIDGE *(R802.3)*

- A ridge board used to connect opposing rafters must be a 1" (25 mm) 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 or wall must be provided and supported on each end by a wall or girder.

CEILING JOISTS *(R802.5)*

- Ceiling joists must be continuous across the structure or securely joined where they meet over interior partitions. See Section R802.5.2.1.
- 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(1).
- Ceiling joists not connected to the rafters at the top wall plate, must be installed in the bottom third of the rafter height. See Figure R802.4.5.
- Where the ceiling joists are installed above the bottom third of the rafter height, the ridge must be designed as a beam. See Section R802.3.
- Where ceiling joists do not run parallel to rafters, the rafters must be tied across the structure with a rafter tie. See Section R802.5.2.2.
- If rafters are not tied across the structure, then the ridge must be designed as a beam in accordance with Section R802.3

ROOF DESIGN



CEILING JOISTS LAPPED *(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 provide a continuous tie across the building, lapped joists must be nailed together according to Table R802.5.2(1) and butted joists must be tied together with equal capacity.
- Joists that do not provide such a tie are permitted to be nailed. See Table R602.3(1).

EXTERIOR WALL COVERING

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

FLASHING *(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.

WATER-RESISTIVE BARRIER *(R703.2)*

- At least one layer must be applied over studs or sheathing of all exterior walls with flashing. See Section R703.4
- Barrier must be continuous to tops of walls and terminate at penetrations and appendages in a way meeting the requirements of the exterior wall envelope. See Section R703.1
- Water resistive barriers must be:
  - No. 15 felt complying with **ASTM D226**. Type I;
  - **ASTM E2568**, Type 1 or 2
  - **ASTM E331** complying with Section R703.1.1
  - Other approved materials.

WALL COVERING *(R703.3)*

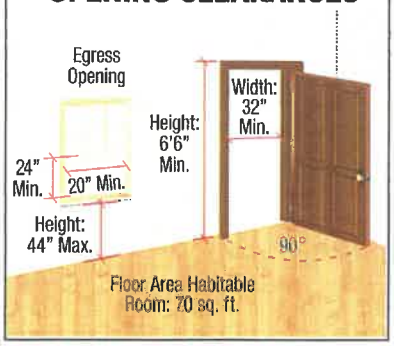
- The nominal thickness and attachment of exterior wall coverings must comply with Table R703.3(1), the wall covering material reqs. of this section and the manufacturer's installation instructions.
- Nominal material thicknesses in Table R703.3(1) are based on a max. stud spacing of 16" (406 mm) o.c.
- Fasteners for exterior wall coverings attached to wood framing must comply with Section R703.3.3 and Table R703.3(1).

INTERIOR DIMENSIONS

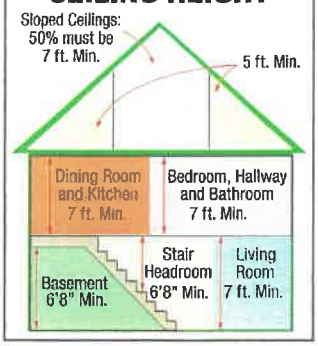
MIN. AREAS *(R304)*

Floor Area: 70 sq. ft. (6.5 m2) in all habitable rooms.
Exception: kitchens
Horizontal Dimensions: 7 ft. (2134 mm) Min. in any horizontal dimension.
Height Effect on Room Area: Portions of a room with a sloping ceiling measuring less than 5 ft. (1524 mm) or a furred ceiling measuring less than 7 ft. (2134 mm) from the finished floor to the finished ceiling do not contributing to the min. required habitable area for that room.

OPENING CLEARANCES



CEILING HEIGHT



HABITABLE ROOM VENTILATION *(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 *(R305.1)*

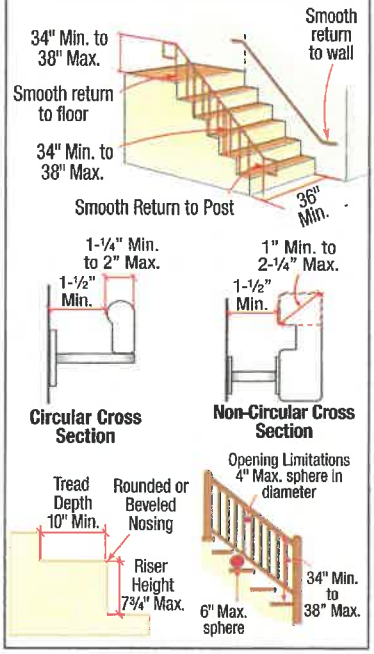
Habitable Space, Hallways & Parts of Basements Containing These Spaces: 7 ft. (2134 mm) Min.
Bath,Toilet & Laundry Rooms: 6' 8" (2032 mm) Min.
Non-habitable Parts of Basements: 6' 8" (2032 mm) Min.
Rooms with sloped ceilings: at least 50% must be 7 ft. (2134 mm) Min. and no portion must be less than 5 ft. (1524 mm) Min.

STAIRWAYS

STAIRWAYS *(R311.7.1 – R311.7.5)*

Width: 36" (914 mm) Min. at all points above the permitted handrail height and below the required headroom height.
Width with Handrail on One Side: 31½" (787 mm) Min.
Width with Handrail on Both Sides: 27" (698 mm) Min.
Headroom: 6'8" (2032 mm) 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" (196 mm) 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" (9.5 mm).
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" (762 mm) above floor or grade below, must not permit the passage of a 4" (102 mm) diameter sphere.
Tread Depth: 10" (254 mm) 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" (9.5 mm).
Nosing Radius of Curvature: 9/16" (14 mm) or a bevel 1/2" (12.7 mm) Max.
Nosing Projection: 3/4" (19 mm) Min. to 1-1/4" (32 mm) Max.
Nosing Projection Tolerance: the greatest nosing projection must not exceed the smallest by more than 3/8" (9.5 mm).

STAIR DIMENSIONS



GUARDS *(R312.1.1 – R312.1.3)*

Location: open-sided walking surfaces, including stairs, ramps and landings, that are located more than 30" (762 mm) measured vertically to the floor or grade below at any point within 36" (914 mm) 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" (102 mm) 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" (152 mm) in diameter.

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" (864 mm) Min. to 38" (965 mm) Max. measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope.
Handrail Projection: 4½" (114 mm) 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" (38 mm) Min. between the wall and the handrail.
Circular Cross Section: 1¼" (32 mm) to 2" (51 mm) Max. outside diameter.
Non-Circular Perimeter: 4" Min. (102 mm) to 6¼" (160 mm) Max.
Non-Circular Cross Section: 2¼" (57 mm) Max.
Edge Radius: 0.01" (0.25 mm)

MEANS OF EGRESS

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

Number of egress doors: 1 Min. per dwelling unit.
Door Style: side-hinged
Clear Width: 32" (813 mm) Min. measured between the door face & the stop, with the door open 90°
Clear Height: 78" (1981 mm) Min. measured from the top of the threshold to the bottomof the stop.
Operation: must be able to be opened from inside the dwelling without use of a key or special knowledge or effort.
Landings: each side of each exterior door.

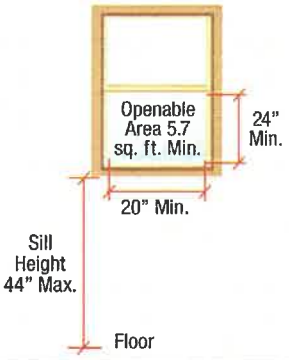
BARS, GRILLES, COVERS *(R310.4.4)*

Bars, grilles, covers, screens or similar devices placed over emergency escape and rescue openings, such devices 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.

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

Net Clear Opening: 5.7 ft² (0.530 m²)Min.
Net Clear Opening Height: 24" (610 mm) Min.
Net Clear Opening Width: 20" (508 mm) Min.
Window Sill Height: 44" (1118 mm) Max. above the floor.

OPENINGS



WINDOW WELLS *(R310.4)*

- **Horizontal Area:** 9 ft² (0.9 m²) Min.
- **Horizontal Projection & Width:** 36"(914 mm) Min.
- The area must allow the emergency escape and rescue opening to be fully opened.
- Window wells with a vertical depth more than 44" (1118 mm) 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"(305 mm) Min.
- **Ladders or rungs projection:** 3" (76 mm) Min. from the wall.
- **Ladders or rungs spacing:** 18" (457 mm) Max. on center vertically for the full height of the window well.
- Ladders must be permanently affixed & approved.

SMOKE & CARBON MONOXIDE ALARMS

SMOKE ALARM *(R314.3)*

Smoke alarms installation locations:

- In each sleeping room.
- Outside separate sleepings area in the immediate vicinity of the bedrooms.
- On each additional story of the dwelling, including basements and habitable attics.
- 3 ft. (914 mm) horizontally from the bathroom opening or door with a bathtub or shower.
- In hallways where room ceilings are over 24" (610 mm) higher than the hallway.

ALARMS – LOCATIONS

CARBON MONOXIDE ALARMS *(R315)*

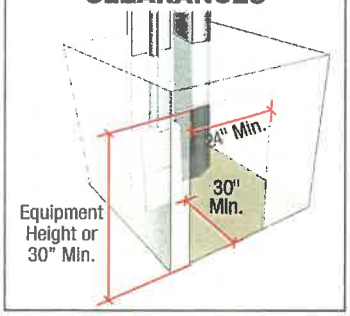
- Carbon monoxide alarm must be installed outside of each separate sleeping area in immediate vicinity of bedrooms.
- For new construction, carbon monoxide alarms must be provided in dwelling units that:
  - contain a fuel-fired appliance.
  - have an attached garage with an opening that communicates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

HVAC — APPLIANCE LOCATION & CLEARANCES

GROUND CLEARANCES (M1305.1.3.1)

Ground Supported Appliances & Equipment: must be level and firmly supported on a concrete slab or other approved material extending 3" (76 mm) Min. above adjoining ground.
Suspended Appliances: must have clearance of 6" (152 mm) Min. from the ground.

WORKING SPACE & CLEARANCES



APPLIANCES IN ROOMS (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" (610 mm) 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" (762 mm) deep x the height of the appliance, but not less than 30" (762 mm), at the front or service side of the appliance with the door open.

APPLIANCE ACCESS (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 must be:** 30" Min. deep x 30" Min. wide (762 mm x 762 mm)

APPLIANCES UNDER FLOORS (M1305.1.3)

- Underfloor spaces containing appliances must be provided with an unobstructed passageway large enough to remove the largest appliance.
- **Unobstructed Passageway:** 30" (762 mm) Min. high, 22" (559 mm) Min. wide and 20 ft. (6096 mm) Max. long measured along the centerline of the passageway from the opening to the appliance.
- **Level working space dimensions:** 30" (762 mm) deep x 30" (762 mm) wide at the front or service side of the appliance.
- If the depth of the passageway or the service space exceeds 12" (305 mm) below the adjoining grade, the walls of the passageway must be lined with concrete or masonry extending 4" (102 mm) above the adjoining grade.
- **Rough-framed Access Opening Dimensions:** 22" (559 mm) Min. x 30" (762 mm) Min. and large enough to remove the largest appliance.

APPLIANCES INSTALLED IN ATTICS (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" (762 mm) Min. high, 22" (559 mm) Min. wide and 20 ft. (6096 mm) Max. long measured along the centerline of the passageway from the opening to the appliance.
- A level service space a min. of 30" (762 mm) deep x 30" (762 mm) wide must be present along all sides of the appliance where access is required.
- **Clear access opening dimensions:** 20" (508 mm) Min. x 30" (762 mm) Min. and large enough to allow removal of the largest appliance.

HVAC — VENTILATION & EXHAUST SYSTEMS

LOCAL EXHAUST RATES (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.

RECIRCULATION OF AIR (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.

EXHAUST OPENINGS (M1504.3, R303.5.2)

Air exhaust opening termination:

- 3 ft. (914 mm) Min. from property lines.
- 3 ft. (914 mm) Min. from gravity air intake openings, operable windows and doors.
- 10 ft. (3048 mm) Min. from mechanical air intake openings except where opening is located 3 ft. (914 mm) Min. above the air intake opening.
- Exhaust air must not be directed onto walkways.

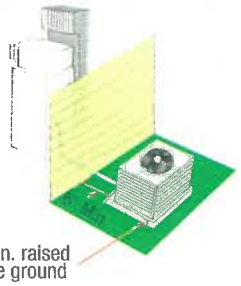
OUTSIDE OPENING PROTECTION (R303.6)

- Air exhaust and intake openings that terminate outdoors must be protected with corrosion-resistant screens, louvers or grilles.
- **Openings:** 1/4" (6 mm) Min. and 1/2" (13 mm) Max.
- Openings must be protected against local weather conditions.
- Outdoor air exhaust and intake openings must meet the provisions for exterior wall opening protectives.

HEATING & COOLING EQUIPMENT (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 & cooling surfaces; replacement of filters, blowers, motors, controls & vent connections, lubrication of moving parts & adjustments.
- Equipment & appliances installed outdoors must be listed and labeled for outdoor installation.
- Supports & 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" (76 mm) Min. above the adjoining ground.
- **Suspended Appliances:** must have a clearance of 6" (152 mm) Min. from the ground.

AIR CONDITIONING OUTDOOR CLEARANCES



ELEVATION OF IGNITION SOURCE (M1307.3)

- Appliances that have an ignition source must be elevated so that the ignition source is 18" (457 mm) 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.

MECHANICAL VENTILATION SYSTEM (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 with text or symbols showing function.

MECHANICAL VENTILATION RATE (M1505.4.3)

Wholehouse mechanical ventilation system must provide outdoor air at a continuous rate as determined by Table M1505.4.3(1) or this equation:
Ventilation rate in cubic feet per minute = *(0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)]*

DOMESTIC COOKING EXHAUST DISCHARGE (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.

OPEN-TOP BROILER EXHAUST (M1503.2.1)

- Domestic open-top broiler units must have a metal exhaust hood having a min. thickness of 0.0157-inch (0.3950 mm) (No. 28 gage).
- **Hood Clearance:**
  - 1/4" (6.4 mm) Min. between the hood & the underside of combustible material & cabinets.
  - 24" (610 mm) Min. between the cooking surface & combustible material & cabinets.
- **Hood width:** at least as wide as the broiler unit & extend over the entire unit.

WHOLE-HOUSE 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

WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS (INTERMITTENT)

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

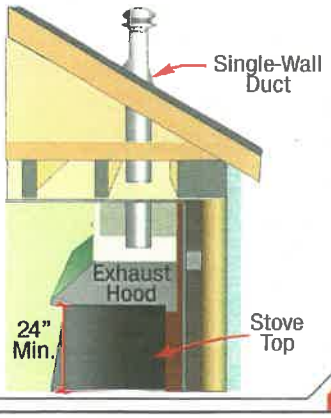
Run-Time % in each 4 hr. segment	25%	33%	50%	66%	75%	100%
Factor	4	3	2	1.5	1.3	1.0

MIN. REQUIRED LOCAL EXHAUST RATES FOR ONE- & 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



PLUMBING

BATHROOM CLEARANCES *(P2705.1)*

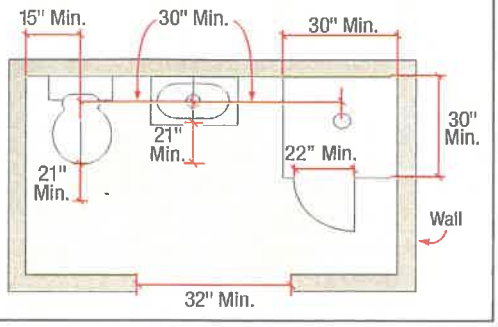
Clearance for Water Closets, Lavatories and Bidets: 15" (381 mm) Min. from center to side wall, partition or vanity.

Clearances between adjacent fixtures: 30" (762 mm) Min. center-to-center.

Clearance in Front of Water Closet: 21" (533 mm) Min.

Clearance in Front of Lavatory or Bidet: 21" (533 mm) Min. The location of piping, fixtures or equipment must not interfere with the operation of windows or doors.

BATHROOM FIXTURES – CLEARANCES



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 [a]	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.

INSTALLATION *(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

SHOWER COMPARTMENTS *(P2708)*

Interior Cross-Sectional Area: 900 in.^{2} (0.6m^2) Min.

Dimension: 30" (762 mm) 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" (559 mm) Min. Hinged shower doors must open outward.

High Limit Stop Water Temperature: 120°F Max. (49°C)

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.

WASTE RECEPTORS *(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, interstitial spaces or crawl 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 extending 1" (25.4 mm) Min. above a water impervious floor.
- Standpipes must extend 18" (457 mm) Min. and 42" (1067 mm) 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" (762 mm) 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" (762 mm) 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 *(P2711.3; P2713.1; P2714.1; P2708.2)*

Lavatory Waste Outlets: 1¼" (32 mm) 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" (38 mm) Min. in diameter. A strainer, crossbar or other device must be provided to restrict the clear opening of the waste outlet.

Bathtub Outlets: 1½" (38 mm) Min. in diameter. The waste outlet must be equipped with a water-tight stopper.

Bathtub Overflows: 1½" (38 mm) in diameter.

Shower Drains Outlet Size: 1½" (38 mm) in diameter.

TAIL PIECES *(P2703)*

- **Fixture tail pieces for sinks, dishwashers, laundry tubs, bathtubs and similar fixtures:** 1½" (38 mm) Min. diameter.
- **Fixture tail pieces for bidets, lavatories and similar fixtures:** 1¼" (32 mm) Min. diameter.

SLIP-JOINT CONNECTIONS *(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.

PIPE SUPPORT *(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" (102 mm) and larger convey drainage or waste, and where a pipe fitting changes the flow direction greater than 45°, rigid bracing or other rigid support 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 *(P3005.3)*

Min. slopes of pipes with diameter 2-1/2" (64 mm) or less: ¼ unit vertical in 12 units horizontal (¼:12) (2% slope).

Min. slopes of pipes with diameter 3" (76 mm) or greater: ⅛ unit vertical in 12 units horizontal (⅛ :12) (1% slope).

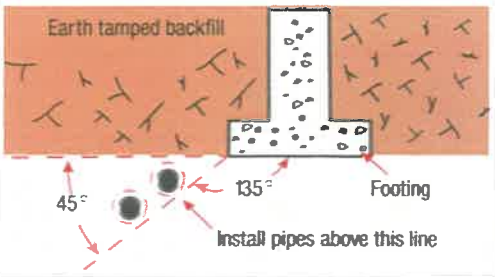
BACKFILLING *(P2604.3)*

- Pipe must be covered with a minimum of 12" (305 mm) 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 pipe and tamped to retain proper alignment.
- Loose earth must be carefully placed in the trench in 6" (152 mm) layers and tamped in place.

PROTECTION OF FOOTINGS *(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.

FOOTINGS & PIPE LOCATION



TRENCHING & BEDDING *(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.

ELECTRICAL

AMPACITY *(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

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

Conductor material: copper, aluminum or copper-aluminum

Conductor Size (Min.): 14 AWG copper 12 AWG aluminum. or copper-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 *(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.

SURFACE & UNDERGROUND INSTALLATION *(E3802.3.1; E3803.1-2)*

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" (457 mm) or more below grade must have their location identified by a warning ribbon that is placed in the trench 12" (305 mm) 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. (2438 mm) above finished grade.
- Conductors entering a building must be protected to the point of entrance.

CABLE PROTECTION *(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" (152 mm) 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."

LIGHTING OUTLETS *(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.

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

Receptacle Location/Spacing: 6 ft. (1829 mm) Max. distance from any horizontal point along the floor line of any wall space.

Countertop and similar work surface Receptacles Outlets: 1 at each wall countertop/work surface space 12" (305 mm) or wider; no point must be more than 24" (610 mm) from the receptacle outlet serving that space. Receptacle outlets must be located not more than 20" (508 mm) above the countertop or work surface.

Island & Peninsular Countertop Outlets: 1 Min. for each 9 ft² (0.84 m²) or fraction thereof, of countertop or work space. 1 more for each 18 ft² (1.7 m²). 1 min. within 2 ft (600 mm) of the outer end.

Appliance Receptacle Outlets: installed within 6 ft. (1829 mm) of the intended location of the specific appliance. Ex. laundry equipment.

Bathroom Receptacle Outlets: 1 Min.; located within 36" (914 mm) 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" (305 mm) Max. below the top of the basin.

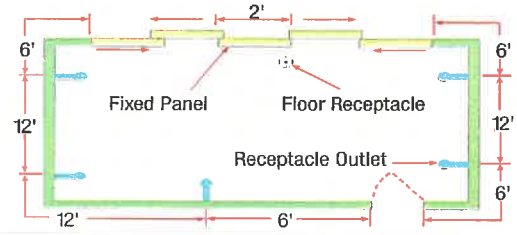
Outdoor Receptacle Outlets: 1 Min.; installed outdoors located 6'6" (1981 mm) max. above grade installed at front and back of each dwelling unit having direct access to grade level.

Balconies, Decks and Porches Receptacle Outlets: 1 Min.; installed within the perimeter of a balcony, deck or porch; up to 6'6" (1981 mm) 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. (3048 mm) or greater in length.

RECEPTACLES OUTLETS



CONDUCTOR IDENTIFICATION *(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

LIMITED ACCESS WORKING SPACE *(E3405.2)*

Equipment installed above a lay-in ceiling: opening must be at least 22" by 22" (559 mm x 559 mm) min.

Equipment installed in a crawl space: opening must be 22" x 30" (559 x 762 mm) min.

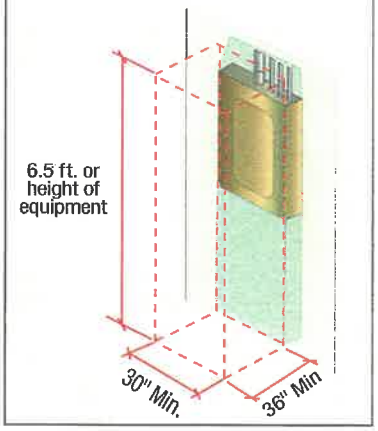
Working Space Width: 30" (762 mm) wide Min. or width of equipment enclosure, whichever is more.

Equipment Doors or Hinged Panels: 90° Min. opening

Space in Front of Enclosure: Table 110.26(A)(1) of **2020 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.

WORKING SPACE CLEARANCES



WORKING SPACE & CLEARANCES *(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. (914 mm) in the direction of access to panelboards and live parts of other equipment.

Work Space Width: 30" (762 mm) Min. in front of the electrical equipment and not less than the width of such equipment.

Work Space Height: 6.5 ft. (1981 mm) 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" (152 mm) 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.

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