

PRESCRIPTIVE BUILDING PROVISIONS FOR Klickitat County

ONE & TWO FAMILY DWELLINGS & TOWNHOUSES AND THEIR ACCESSORY STRUCTURES 2015 Code Cycle

These provisions are periodically updated to better represent code requirements. Please use the provisions and figures included with your approved plans. Additionally, the Washington State Energy Code website outlines acceptable construction practices and testing criteria that meet the current Washington State Energy Code requirements. Visit www.energy.wsu.edu/code for additional information.



This handout is based on RCW 19.27, known as the "Washington State Residential Code". The handout includes portions of the International Residential Code (IRC), and may include portions of other codes adopted by statute, publications, as well as Klickitat County Ordinance and policies. Any portion of this document presuming to give authority to violate, ignore or cancel the provisions of codes adopted by Klickitat County shall not be valid.

If your property is located in the National Scenic Area, the Columbia River Gorge Commission requires you to comply with all National Scenic Area regulations. They can be contacted at (509) 493-3323.

Section 1

GENERAL INFORMATION

For questions or clarification of Building requirements:

Klickitat County Building Department
228 W. Main Street, MS-CH-20
Goldendale, WA 98620
Telephone: (509) 773-3706 or (800) 583-8078
Fax: (509) 773-2480
Email: Buildingdept@klickitatcounty.org
Website: www.KlickitatCounty.org

To order Code Books:

Washington Association of Building Officials
1217 4th Avenue, Suite 101
PO Box 7310
Olympia, WA 98507
Toll Free: (888) 664-9515
Email: wabo@wabo.org
Website: www.wabo.org

The Washington State Building Code, RCW 19.27, is adopted locally by Klickitat County Code, Title 15. The provisions of this handout typically apply only to construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one and two family dwellings and multiple single family dwellings (townhouses) not more than three stories in height with a separate means of egress and their accessory structures not more than three stories above grade plane in height. It should not be construed that this handout includes all requirements applicable to your project.

DESIGN CRITERIA

Ground Snow Load: Varies from 35 psf to 170 psf in Klickitat County. Contact the Building Department with a Section, Township and Range or parcel number, and one will be provided.

Wind Speed: 110 miles per hour minimum.

Wind Exposure Category: Exposure "B" shall be assumed unless the site meets the definition of another type of exposure, as determined by Klickitat County.

Seismic Design Category: "C". Earthquake load design parameters can be found in Chapter 16 of the International Building Code and at www.USGS.gov.

Frost Line Depth: 18 inches minimum.

Soil Bearing Capacity: Varies. See Section 4.

Buildings and structures shall be designed and constructed to safely support all imposed loads. Construction shall result in a system that provides a complete load path capable of transferring all loads safely to the foundation.

When a building contains structural elements not conforming to the code or otherwise beyond the scope of being able to determine compliance with code provisions, design shall be in accordance with accepted engineering practice and engineering, provided by a professional engineer licensed in the State of Washington, may be required.

Section 2

DEFINITIONS

Accessory Structure: A structure that is accessory to and incidental to that of the *dwelling(s)* and that is located on the same lot.

Air barrier: Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material or a combination of materials.

Alteration: Any construction, retrofit or renovation to an existing structure other than repair or addition that requires a permit. Also, a change in a building, electrical, gas, mechanical or plumbing system that involves an extension, addition or change to the arrangement, type or purpose of the original installation that requires a permit.

Approved: Acceptable to the building official.

Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

Attic: The unfinished space between the ceiling assembly of the top story and the roof assembly.

Attic, Habitable: A conditioned area complying with all of the following requirements:

1. The occupiable floor area is at least 70 square feet, in accordance with Section 3.
2. The occupiable floor area has a ceiling height in accordance with Section 3, and
3. The occupiable space is entirely enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.

A habitable attic is not considered a story.

Basement: A story that is not a story above grade plane. (See "Story above grade plane").

Braced wall line: A straight line through the building plane that represents the location of the lateral resistance provided by the wall bracing.

Braced wall line, Continuously sheathed: A braced wall line with structural sheathing applied to all sheathable surfaces including the areas above and below openings.

Braced wall panel: A full-height section of wall constructed to resist in-plane shear loads through interaction of framing members, sheathing material and anchors. The panel's length meets the requirements of its particular bracing method, and contributes toward the total amount of bracing required along its braced wall line in accordance with this code.

Building: Building shall mean any one and two family dwelling or portion thereof, including townhouses, that is used, or designed or intended to be used for human habitation, for living, sleeping, cooking or eating purposes, or any combination thereof, and shall include accessory structures thereto.

Building Drain: The lowest piping that collects the discharge from all other drainage piping inside the house and extends 30 inches in developed length of pipe, beyond the exterior walls and conveys the drainage to the building sewer.

Building-Integrated Photovoltaic Product: A building product that incorporates photovoltaic modules and functions as a component of the building envelope.

Building Official: The officer or other designated authority charged with the administration and enforcement of the code.

Building Sewer: That part of the drainage system that extends from the end of the building drain and conveys its discharge to a public sewer, private sewer, individual sewage-disposal system or other point of disposal.

Building Thermal Envelope: The basement walls, exterior walls, floor, roof and any other building element that enclose conditioned spaces.

Ceiling Height: The clear vertical distance from the finished floor to the finished ceiling.

Clean-out: An accessible opening in the drainage system used for the removal of possible obstruction.

Combustible Material: Any material not defined as noncombustible.

Combustion Air: The air provided to fuel-burning equipment including air for fuel combustion, draft hood dilution and ventilation of the equipment enclosure.

Conditioned Area: That area within a building provided with heating and/or cooling systems or appliances capable of maintaining through design or heat loss/gain, 68 degrees F during the heating season and/or 80 degrees F during the cooling season, or has a fixed opening directly adjacent to a conditioned area.

Conditioned Space: An area, room or space that is enclosed within the building thermal envelope and that is directly heated or cooled or that is indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate thru openings with conditioned spaces by uninsulated walls, floors or ceilings or where they contain uninsulated ducts, piping or other sources of heating or cooling.

Direct Vent Appliance: A fuel-burning appliance with a sealed combustion system that draws all air for combustion from the outside atmosphere and discharges all flue gases to the outside atmosphere.

Dwelling: Any building that contains one or two dwelling units used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

Dwelling Unit: A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation. Dwelling units may also include the following uses:

1. Adult family homes, foster family care homes and family day care homes licensed by the Washington State Department of Social and Health Services.
2. Offices, mercantile, food preparation for off-site consumption, personal care salons or similar uses which are conducted primarily by the occupants of the dwelling unit and are secondary to the use of the unit door dwelling purposes, and which do not exceed 500 square feet.
3. One accessory dwelling unit, which need not be considered a separate dwelling unit, provided:
 - a. The accessory dwelling unit is constructed within an existing dwelling unit.
 - b. Either the accessory dwelling unit or primary dwelling unit is owner-occupied.
 - c. All required smoke alarms in the accessory dwelling unit and the primary dwelling unit are interconnected in such a manner that the actuation of one alarm will activate all alarms in both the primary unit and the accessory dwelling unit.

Emergency escape and rescue opening: An operable exterior window, door or similar device that provides for a means of escape and access for rescue in the event of an emergency.

Engineer, professional: Person licensed to practice in the State of Washington.

Fenestration: Skylights, roof windows, vertical windows (whether fixed or movable); opaque doors; glazed doors; glass block; and combination opaque/glazed doors.

Fireblocking: Building materials or materials approved for use as fire blocking, installed to resist the free passage of flame to other areas of the building through concealed spaces.

Fire-retardant-treated wood: Pressure-treated lumber and plywood that exhibit reduced surface burning characteristics and resist propagation of fire.

Fire Separation Distance: The distance measured from the foundation wall or face of the wall framing, whichever is closer, to one of the following:

1. To the closest interior lot line; or
2. To the centerline of a street, an alley or public way; or
3. To an imaginary line between two buildings on the lot.

The distance shall be measured at a right angle from the wall.

Habitable Space: A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

Ignition Source: A flame, spark or hot surface capable of igniting flammable vapors or fumes. Such sources include appliance burners, burner ignitions and electrical switching devices.

Kitchen: Kitchen shall mean an area used, or designated to be used, for the preparation of food.

Labeled: Equipment, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates that the equipment, material or product meets identified standards or has been tested and found suitable for a specific purpose.

Listed: Equipment, materials, products or services included in a list published by an organization acceptable to the code official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specific purpose.

Living Space: Space within a dwelling unit utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

Means of Egress: A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a public way. A means of egress consists of three separate and distinct parts: the exit access, the exit and exit discharge.

Mezzanine Loft: An intermediate level or levels between the floor and ceiling of any story.

Multiple Station Smoke Alarm: Two or more single station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate.

Nailable Substrate: A product or material such as framing, sheathing or furring, composed of wood or wood-based materials, or other materials and fasteners providing equivalent fastener withdrawal resistance.

Non-Combustible Material: Materials that pass the test procedure for defining noncombustibility of elementary materials set forth in ASTM E 136.

Nonconditioned Space: A space that is not a conditioned space by insulated walls, floors or ceilings.

Nosing: The leading edge of treads of stairs and of landings at the top of stairway flights.

Pan Flashing: Corrosion-resistant flashing at the base of an opening that is integrated into the building exterior wall to direct water to the exterior and is premanufactured, fabricated, formed or applied at the job site.

Repair: The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.

Shall: The term, when used in the code, is construed as mandatory.

Slope: The fall (pitch) of a line of pipe in reference to a horizontal plane. In drainage, the slope is expressed as the fall in units vertical per units horizontal (percent) for a length of pipe.

Source Specific Ventilation System: A mechanical ventilation system including all fans, controls, and ducting, which is dedicated to exhausting contaminant-laden air to the exterior of the building from the room or space in which the contaminant is generated.

Stair: A change in elevation, consisting of one or more risers.

Stairway: One or more flights of stairs, either interior or exterior, with the necessary landings and platforms connecting them to form a continuous and uninterrupted passage from one level to another within or attached to a building, porch or deck.

Story: That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above.

Story Above Grade Plane: Any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is:

1. More than 6 feet above grade plane; or
2. More than 12 feet above the finished ground level at any point.

Townhouse: A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof and with a yard or public way on at least two sides.

Whole House Ventilation System: A mechanical ventilation system, including fans, controls, and ducts, which replaces, by direct or indirect means, air from the habitable rooms with outdoor air.

Wood/Plastic Composite: A composite material made primarily from wood or cellulose-based materials and plastic.

Section 3

BUILDING PLANNING

R301.2.2.3.1 Height limitations. Wood-framed buildings shall be limited to three stories above grade plane or the limits given in Table R602.10.3(3). Cold-formed, steel-framed buildings shall be limited to less than or equal to three stories above grade plane in accordance with AISI S230. Mezzanines that comply with Section R325 shall not be considered as stories. Structural insulated panel buildings shall be limited to two stories above grade plane.

R302 FIRE-RESISTANT CONSTRUCTION (LOCATION ON LOT) - SEE FIGURE 1

R302.1 Exterior Walls. Construction, projections, openings and penetrations of exterior walls of dwellings and accessory buildings shall comply with Table R302.1(1).

Exceptions:

1. Walls, projections, openings and penetrations in walls perpendicular to the line used to determine the fire separation distance.
2. Walls of dwellings and accessory structures located on the same lot.
3. Detached tool sheds and storage sheds, playhouse and similar structures exempted from permits are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line.
4. Detached garages accessory to a dwelling located within 2 feet of a lot line are permitted to have roof eave projections not exceeding 4 inches.
5. Foundation vents installed in compliance with this code are permitted.

**TABLE R302.1(1)
EXTERIOR WALLS**

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	(Fire-resistance rated)	1-hour tested in accordance with ASTM E 119 or UL 263 with exposure from both sides	< 5 feet
	(Not fire-resistance rated)	0 hours	≥ 5 feet
Projections	Not allowed	N/A	< 2 feet
	(Fire-resistance rated)	1 hour on the underside ^{a,b}	≥ 2 feet to < 5 feet
	(Not fire-resistance rated)	0 hours	≥ 5 feet
Openings in walls	Not allowed	N/A	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet

- a. Roof eave fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave if fire blocking is provided from the wall top plate to the underside of the roof sheathing.
- b. Roof eave fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave provided that gable vent openings are not installed.

R303 LIGHT, VENTILATION AND HEATING

R303.1 Natural Light. All habitable rooms shall have an aggregate glazing area of not less than 8 percent of the floor area of such rooms.

Exception: The glazed areas need not be installed in rooms where artificial light is provided capable of producing an average illumination of 6 footcandles (65 lux) over the area of the room at a height of 30 inches above the floor level.

R303.2 Adjoining Rooms. For the purposes of determining light requirements, any room shall be considered as a portion of an adjoining room when at least one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room but not less than 25 square feet.

Exception: Openings required for light shall be permitted to open into a sunroom with thermal isolation or a patio cover, provided there is an openable area between the adjoining room and the sunroom or patio cover of not less than one-tenth of the floor area of the interior room but not less than 20 square feet.

R303.4 Minimum Ventilation Performance. Dwelling units shall be equipped with local exhaust and whole house ventilation systems designed and installed as specified in Section M1507. (See WSEC and Ventilation Handout).

Exception: Additions with less than 500 square feet of conditioned floor area are exempt from the requirements in this code for Whole House Ventilation Systems.

R303.5 Opening location. Outdoor intake and exhaust openings shall be located in accordance with Sections R303.5.1 and R303.5.2.

R303.5.1 Intake openings. Mechanical and gravity outdoor air intake openings shall be located a minimum of 10 feet from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots and loading docks, except as otherwise specified in this code. For the purpose of this section, the exhaust from dwelling unit toilet rooms, bathrooms and kitchens shall not be considered as hazardous or noxious,

Exceptions:

1. The 10-foot separation is not required where the intake opening is located 3 feet or greater below the contaminant source.
2. Vents and chimneys serving fuel-burning appliances shall be terminated in accordance with the applicable provisions of Chapters 18 and 24.
3. Clothes dryer exhaust ducts shall be terminated in accordance with Section M1502.3.

R303.5.2 Exhaust openings. Exhaust air shall not be directed onto walkways. All exhaust ducts shall terminate outside the building. Terminal elements shall have at least the equivalent net free area of the duct work.

R303.5.2.1 Exhaust Ducts. Exhaust ducts shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4.

R303.7 Interior Stairway Illumination. Interior stairways shall be provided with an artificial light source to illuminate the landings and treads. Stairway illumination shall receive primary power from the building wiring. The light source shall be capable of illuminating treads and landings to levels not less than 1 foot-candle (11 lux) measured at the center of treads and landings. There shall be a wall switch at each floor level to control the light source where the stairway has six or more risers.

Exception: A switch is not required where remote, central or automatic control of lighting is provided.

R303.8 Exterior Stairway Illumination. Exterior stairways shall be provided with an artificial light source located at the top landing of the stairway. Stairway illumination shall receive primary power from the building wiring. Exterior stairways providing access to a basement from the outdoor grade level shall be provided with an artificial light source located at the bottom landing of the stairway.

Ventilation. See Section 11.

R303.9 Required heating. Every dwelling unit shall be provided with heating facilities capable of maintaining a minimum room temperature of 68 degrees F at a point 3 feet above the floor and 2 feet from exterior walls in all habitable rooms. ***The installation of one or more portable heaters shall not be used to achieve compliance with this section.***

Exception: Unheated recreational tents or yurts not exceeding 500 square feet provided it is not occupied as a permanent dwelling.

R303.9.3 Solid fuel burning devices. No new or used solid fuel burning device shall be installed in new or existing buildings unless such device is United States Environmental Protection Agency (EPA) certified or exempt from certification by the United States Environmental Protection Agency and conforms with RCW 70.94.011, 70.94.450, 70.94.453 and 70.94.457.

Exceptions:

1. Wood cook stoves.
2. Antique wood heaters manufactured prior to 1940.

R304 MINIMUM ROOM AREAS

R304.1 Minimum area. Habitable rooms shall have a floor area of not less than 70 square feet.

Exception: Kitchens.

R304.2 Minimum dimensions. Habitable rooms shall be not less than 7 feet in any horizontal dimension.

Exception: Kitchens

R304.3 Height effect on room area. Portions of a room with a sloping ceiling measuring less than 5 feet or a furred ceiling measuring less than 7 feet from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required habitable area for that room.

R305 CEILING HEIGHT

R305.1 Minimum height. Habitable space, hallways and portions of basements containing these spaces shall have a ceiling height of not less than 7 feet. Bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 8 inches.

Exceptions:

1. For rooms with sloped ceilings, the required floor area of the room shall have a ceiling height of not less than 5 feet and not less than 50 percent of the required floor area shall have a ceiling height of not less than 7 feet.
2. The ceiling height above bathroom and toilet room fixtures shall be such that the fixture is capable of being used for its intended purpose. A shower or tub equipped with a showerhead shall have a ceiling height of not less than 6 feet 8 inches above an area of not less than 30 inches by 30 inches at the showerhead.
3. Beams, girders, ducts or other obstructions in basements containing habitable space shall be permitted to project to within 6 feet 4 inches of the finished floor.

R305. 1.1 Basements. Portions of basements that do not contain habitable space or hallways shall have a ceiling height of not less than 6 feet 8 inches.

Exception: At beams, girders, ducts or other obstructions, the ceiling height shall be not less than 6 feet 4 inches from the finished floor.

R306 SANITATION

R306.1 Toilet facilities. Every dwelling unit shall be provided with a water closet, lavatory, and a bathtub or shower.

R306.2 Kitchen. Each dwelling unit shall be provided with a kitchen area and every kitchen area shall be provided with a sink.

R306.3 Sewage disposal. Plumbing fixtures shall be connected to a sanitary sewer or to an approved private sewage disposal system.

R306.4 Water supply to fixtures. Plumbing fixtures shall be connected to an approved water supply. Kitchen sinks, lavatories, bathtubs, showers, bidets, laundry tubs and washing machine outlets shall be provided with hot and cold water.

R307. TOILET, BATH AND SHOWER SPACES

R307.1 Space required. Fixtures shall be spaced per Figure 2 and in accordance with the requirements of the Plumbing Code.

R307.2 Bathtub and shower spaces. Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a nonabsorbent surface. Such wall surfaces shall extend to a height of not less than 6 feet above the floor.

R308 GLAZING

This section prescribes performance and construction requirements for window and door installations. Windows and doors shall be installed and flashed in accordance with the fenestration manufacturer's written installation instructions. Written installation instructions shall be provided by the fenestration manufacturer for each window or door. Window and door openings shall be flashed in accordance with Section 7.

Glazing subject to human impact as defined and depicted in Figure 3 must pass the test requirements of part 1201 of the Consumer Product Safety Commission's Architectural Glazing Standard, Code of Federal Regulations (16CFR), also known as "Safety Glazing". Each pane of glass installed in hazardous locations must have a label on the glass, which is acid-etched, sand blasted, ceramic fired, embossed, or such that, once applied, cannot be removed without being destroyed. There are very few exceptions to these requirements. Contact the Building Department for specific exceptions. See Figure 3 for a list of hazardous locations and related depictions. For skylights and sloped glazing, please contact the Building Department for specific requirements.

R312.2.1 Window sills. In dwelling units, where the top of the sill of an operable window opening is located less than 24 inches above the finished floor and greater than 72 inches above the finished grade or other surface below on the exterior of the building, the operable window shall comply with one of the following:

1. Operable windows with openings that will not allow a 4 inch diameter sphere to pass through the opening where the opening is in its largest opened position.
2. Operable windows that are provided with window fall prevention devices that comply with ASTM F 2090.
3. Operable windows that are provided with window opening control devices that comply with Section R312.2.2. (See Figure 3)

GARAGES AND CARPORTS - See Figure 4

R302.5.1 Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1 $\frac{3}{8}$ inches in thickness, solid or honeycomb core steel doors not less than 1 $\frac{3}{8}$ inches thick, or 20-minute fire-rated doors, equipped with a self-closing device.

R302.5.2 Duct penetration. Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage sheet steel or other approved material and shall not have openings into the garage.

R302.6 Dwelling/garage fire separation. The garage shall be separated from the residence and its attic area by not less than $\frac{1}{2}$ inch gypsum board applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than $\frac{5}{8}$ inch Type X gypsum board or equivalent. Where the separation is a floor-ceiling assembly, the structure supporting the separation shall be protected by not less than $\frac{1}{2}$ inch gypsum board or equivalent. ***Garages located less than 3 feet from a dwelling unit on the same lot shall be protected with not less than $\frac{1}{2}$ inch gypsum board applied to the interior side of exterior walls that are within this area.*** Openings in these walls shall be regulated by Sections R302.5.1 through R302.5.3 of the International Residential Code. This provision does not apply to garage walls that are perpendicular to the adjacent dwelling unit wall. (See Table R302.6)

**TABLE R302.6
DWELLING/GARAGE SEPARATION**

SEPARATION	MATERIAL
From the residence and attics	Not less than ½ inch gypsum board or equivalent applied to the garage side
From habitable rooms above the garage	Not less than 5/8 inch Type X gypsum board or equivalent
Structure(s) supporting floor/ceiling assemblies used for separation required by this section	Not less than ½ inch gypsum board or equivalent
Garages located less than 3 feet from a dwelling unit on the same lot	Not less than ½ inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area

R309.1 Floor surface. Garage floor surfaces shall be of approved noncombustible material. The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

R309.2 Carports. Carports shall be open on not less than two sides. Carport floor surfaces shall be of approved noncombustible material. Carports not open on two or more sides shall be considered to be a garage and shall comply with the provisions of this section for garages.

Exception: Asphalt surfaces shall be permitted at ground level in carports. The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

R309.3 Flood hazard areas. For buildings located in flood hazard areas, garage floors shall be:

1. Elevated to or above the design flood elevation; or
2. Located below the design flood elevation provided they are at or above grade on at least one side, are used solely for parking, building access or storage, meet the requirements of Section R322 (Flood-resistant Construction) and are otherwise constructed in accordance with this code.

R309.4 Automatic garage door openers. Automatic garage door openers, if provided, shall be listed and labeled in accordance with UL 325.

R310 EMERGENCY ESCAPE AND RESCUE OPENINGS - See Figure 5 and Figure 6.

R310.1 Emergency escape and rescue opening required. Basements, habitable attics and every sleeping room shall have not less than one operable emergency escape and rescue opening. Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room. Emergency escape and rescue openings shall open directly into a public way, or to a yard or court that opens to a public way.

Exception: Storm shelters and basements used only to house mechanical equipment not exceeding a total floor area of 200 square feet.

R310.1.1 Operational constraints and opening control devices. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys, tools or special knowledge. Window opening control devices complying with ASTM F 2090 shall be permitted for use on windows serving as a required emergency escape and rescue opening.

R310.2 Emergency escape and rescue openings. Emergency escape and rescue openings shall have minimum dimensions as specified in this section.

R310.2.1 Minimum opening area. Emergency and escape rescue openings shall have a net clear opening of not less than 5.7 square feet. The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. The net clear height opening shall be not less than 24 inches and the net clear width shall be not less than 20 inches.

Exception: Grade floor or below grade openings shall have a net clear opening of not less than 5 square feet.

R310.2.2 Window sill height. Where a window is provided as the emergency escape and rescue opening, it shall have a sill height of not more than 44 inches above the floor; where the sill height is below grade, it shall be provided with a window well in accordance with Figure 6.

R310.2.3 Window wells. The horizontal area of the window well shall be not less than 9 square feet, with a horizontal projection and width of not less than 36 inches. The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

Exception: The ladder or steps as required shall be permitted to encroach not more than 6 inches into the required dimensions of the window well.

R310.2.3.1 Ladder and steps. Window wells with a vertical depth greater than 44 inches shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or steps required by this section shall not be required to comply with Sections R311.7 and R311.8. Ladders or rungs shall have an inside width of not less than 3 inches from the wall and shall be spaced not more than 18 inches on center vertically for the full height of the window well.

R310.2.3.2 Drainage. Window wells shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section R405.1 or by an approved alternative method.

Exception: A drainage system for window wells is not required where the foundation is on well-drained soil or sand-gravel mixture soils in accordance with the United Soil Classification System, Group I Soils, as detailed in Table R405.1.

R310.2.4 Emergency escape and rescue openings under decks and porches. Emergency escape and rescue openings shall be permitted to be installed under decks and porches provided that the location of the deck allows the emergency escape and rescue openings to be fully opened and provides a path not less than 36 inches in height to a yard or court.

R310.3 Emergency escape and rescue doors. Where a door is provided as the required emergency escape and rescue opening, it shall be permitted to be a side-hinged door or a slider. Where the opening is below the adjacent ground elevation, it shall be provided with a bulkhead enclosure.

R310.3.1 Minimum door opening size. The minimum net clear height opening for any door that serves as an emergency and escape rescue opening shall be in accordance with Section R310.2.1.

R310.3.2 Bulkhead enclosures. Bulkhead enclosures shall provide direct access from the basement. The bulkhead enclosure shall provide the minimum net clear opening equal to the door in the fully open position.

R310.3.2.1 Drainage. Bulkhead enclosures shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section R405.1 or by an approved alternative method.

Exception: A drainage system for bulkhead enclosures is not required where the foundation is on well-drained soil or sand-gravel mixture soils in accordance with the United Soil Classification System, Group I Soils, as detailed in Table R405.1.

R310.4 Bars, grilles, covers and screens. Bars, grilles, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosures, or window wells that serve such openings, provided that the minimum net clear opening size complies with Sections R310.1.1 to R310.2.3, and such devices shall be releasable or removable from the inside without the use of a key, tool, special knowledge or force greater than required for the normal operation of the escape and rescue opening.

R310.5 Dwelling additions. Where dwelling additions occur that contain sleeping rooms, an emergency escape and rescue opening shall be provided in each new sleeping room. Where dwelling additions occur that have basements, an emergency escape and rescue opening shall be provided in the new basement.

Exceptions:

1. An emergency escape and rescue opening is not required in a new basement that contains a sleeping room with an emergency escape and rescue opening.
2. An emergency escape and rescue opening is not required in a new basement where there is an emergency escape and rescue opening in an existing basement that is accessible from the new basement.

R310.6 Alterations or repairs of existing basements. An emergency escape and rescue opening is not required where existing basements undergo alterations or repairs.

Exceptions: New sleeping rooms created in an existing basement shall be provided with emergency escape and rescue openings in accordance with Section R310.1.

R311 MEANS OF EGRESS

R311.1 Means of egress. Dwellings shall be provided with a means of egress in accordance with this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the dwelling to the required egress door without requiring travel through a garage. The required egress door shall open directly into a public way or to a yard or court that opens to a public way.

R311.2 Egress Door. Not less than one egress door shall be provided for each dwelling unit. The egress door shall be side-hinged, and shall provide a clear width of not less than 32 inches where measured between the face of the door and the stop, with the door open 90 degrees. The clear height of the door opening shall be not less than 78 inches in height measured from the top of the threshold to the bottom of the stop. Other doors shall not be required to comply with these minimum dimensions. Egress doors shall be readily openable from inside the dwelling without the use of a key or special knowledge or effort.

R311.3 Floors and landings at exterior doors. See Figure 8. There shall be a landing or floor on each side of each exterior door. The width of each landing shall not be less than the door served. Every landing shall have a minimum dimension of 36 inches measured in the direction of travel. The slope at exterior landings shall not exceed $\frac{1}{4}$ unit vertical in 12 units horizontal (2 percent).

Exception: Exterior balconies less than 60 square feet and only accessible from a door are permitted to have a landing less than 36 inches measured in the direction of travel.

R311.3.1 Floor elevations at the required egress doors. Landings or finished floors at the required egress door shall not be more than $1\frac{1}{2}$ inches lower than the top of the threshold.

Exception: The landing or floor on the exterior side shall not be more than $7\frac{3}{4}$ inches below the top of the threshold provided the door does not swing over the landing or floor.

Where exterior landings or floors serving the required egress door are not at grade, they shall be provided with access to grade by means of an approved ramp or stairway.

R311.3.2 Floor elevations for other exterior doors. Doors other than the required egress door shall be provided with landings or floors not more than $7\frac{3}{4}$ inches below the top of the threshold.

Exception: A top landing is not required where a stairway of not more than two risers is located on the exterior side of the door, provided that the door does not swing over the stairway..

R311.3.3 Storm and screen doors. Storm and screen doors shall be permitted to swing over all exterior stairs and landings.

R311.4 Vertical egress. Egress from habitable levels including habitable attics and basements not provided with an approved egress door shall be by an approved ramp or stairway.

Exception: Stairs or ladders within an individual dwelling unit used for access to areas of 200 square feet or less, and not containing the primary bathroom or kitchen.

R311.5.1 Attachment. Exterior landings, decks, balconies, stairs and similar facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces or shall be designed to be self-supporting. Attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

R311.6 Hallways. The minimum width of a hallway shall be not less than 3 feet.

STAIRWAYS - For the purpose of this section all dimensions and dimensioned surfaces shall be exclusive of carpets, rugs or runners.

R311.7.1 Width. Stairways shall not be less than 36 inches in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4 ½ inches on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31 ½ inches where a handrail is installed on one side and 27 inches where handrails are provided on both sides.

Exception: The width of spiral stairways shall be in accordance with Figure 11.

R311.7.2 Headroom. The headroom in stairways shall be not less than 6 feet 8 inches measured vertically from the sloped line adjoining the tread nosing or from the floor surface of the landing or platform on that portion of the stairway.

Exceptions:

1. Where the nosings of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall be allowed to project horizontally into the required headroom not more than 4 ¾ inches.
2. The headroom for spiral stairways shall be in accordance with Figure 11.

R311.7.3 Vertical rise. A flight of stairs shall not have a vertical rise larger than 147 inches between floor levels or landings. See Figure 7.

R311.7.4 Walkline. The walkline across winder treads shall be concentric to the curved direction of travel through the turn and located 12 inches from the side where the winders are narrower. The 12 inch dimension shall be measured from the widest point of the clear stair width at the walking surface of the winder. If winders are adjacent within the flight, the point of the widest clear stair width of the adjacent winders shall be used. See Figure 11.

R311.7.5.1 Risers. The riser height shall be not more than 7 ¾ inches. The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than ¾ inch. Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees from the vertical. Open risers are permitted provided that the openings located more than 30 inches, as measured vertically, to the floor or grade below do not permit the passage of a 4-inch-diameter sphere.

Exceptions:

1. The opening between adjacent treads is not limited on spiral stairs.
2. The riser height of spiral stairways shall be in accordance with Figure 11.

R311.7.5.2 Treads. The tread depth shall be not less than 10 inches. The tread depth shall be measured horizontally between the vertical planes of the foremost projection of the adjacent treads at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than ¾ inch.

R311.7.5.2.1 Winder treads. Winder treads shall have a tread depth of not less than 10 inches measured between the vertical planes of the foremost projection of the adjacent treads at the intersections with the walkline. Winder treads shall have a tread depth of not less than 6 inches at any point within the clear width of the stair. Within any flight of stairs, the largest winder tread depth at the walkline shall not exceed the smallest winder tread by more than ¾ inch. Consistently shaped winders at the walkline shall be allowed within the same flight of stairs as rectangular treads and do not have to be within ¾ inch of the rectangular tread depth.

Exception: The tread depth at spiral stairways shall be in accordance with Figure 11.

R311.7.5.3 Nosings. See Figure 7. The radius of curvature at the nosing shall be no greater than ¼ inch. A nosing projection not less than ¾ inch and not more than 1 ¼ inches shall be provided on stairways with solid risers. The greatest nosing projection shall not exceed the smallest nosing projection by more than ¾ inch between two stories, including the nosing at the level of floors and landings. Beveling of nosings shall not exceed ½ inch.

Exception: A nosing projection is not required where the tread depth is not less than 11 inches.

R311.7.6 Landings for Stairways. See Figure 8. There shall be a floor or landing at the top and bottom of each stairway. The minimum width perpendicular to the direction of travel shall be no less than the width of the flight served. Landings of shapes other than square or rectangular shall be permitted provided the depth at the walkline and the total area is not less than that of a quarter circle with a radius equal to the required landing width. Where the stairway has a straight run, the minimum depth in the direction of travel shall be not less than 36 inches.

Exception: A floor or landing is not required at the top of an interior flight of stairs, including stairs in an enclosed garage, provided a door does not swing over the stairs.

R311.7.7 Stairway Walking Surface. See Figure 8. The walking surface of treads and landings of stairways shall be sloped no steeper than one unit vertical in 48 inches horizontal (2% slope).

R311.7.8 Handrails. See Figure 9 and Figure 10. Also, see **Guardrail** requirements in this section. Handrails shall be provided on at least one side of each continuous run of treads or flight with four or more risers.

R311.7.8.1 Height. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp or slope, shall be not less than 34 inches and not more than 38 inches.

Exceptions:

1. The use of a volute, turnout or starting easing shall be allowed over the lowest tread.
2. Where handrail fittings or bendings are used to provide continuous transition between flights, transitions at winder treads, the transition from handrail to guard, or used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed 38 inches.

R311.7.10 Special Stairways. See Figure 11. Spiral stairways and bulkhead enclosure stairways shall comply with all requirements of Section R311.7 except as specified below.

R311.7.10.1 Spiral Stairways. Spiral stairways are permitted, provided that the clear width at and below the handrail is not less than 26 inches and the walkline radius is not greater than 24 ½ inches. Each tread shall have a depth of not less than 6 ¾ inches at the walkline. All treads shall be identical, and the rise shall be not more than 9 ½ inches. Headroom shall be not less than 6 feet 6 inches.

R311.7.10.2 Bulkhead enclosure stairways. Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside grade level to the basement shall be exempt from the requirements of door landing requirements and stairway requirements where the maximum height from the basement finished floor level to grade adjacent to the stairway does not exceed 8 feet, and the grade level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other approved means.

R302.7 Under Stair Protection. See Figure 4. Enclosed accessible space under stairs shall have walls, under stair surface and any soffits protected on the enclosed side with ½ inch gypsum board.

R311.8 RAMPS - See Figure 8A

R312 GUARDRAILS - See Figure 8A.

R312.1.1 Where required. Guards shall be located along open-sided walking surfaces, including stairs, ramps and landings, that are located more than 30 inches measured vertically to the floor or grade below at any point within 36 inches horizontally to the edge of the open side. Insect screening shall not be considered as a guard.

R312.1.2 Height. Required guards at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches high measured vertically above the adjacent walking surface, adjacent fixed seating or the line connecting the leading edges of the treads.

Exceptions:

1. Guards on the open sides of stairs shall have a height not less than 34 inches measured vertically from a line connecting the leading edges of the treads.
2. Where the top of the guards also serves as a handrail on the open sides of stairs, the top of the guard shall not be less than 34 inches and not more than 38 inches measured vertically from a line connecting the leading edges of the treads.

R312.1.3 Opening limitations. Required guards shall not have openings from the walking surface to the required guard height which allows passage of a sphere 4 inches in diameter.

Exceptions:

1. The triangular openings at the open side of a stair, formed by the riser, tread and bottom rail of a guard, shall not allow passage of a sphere 6 inches in diameter.
2. Guards on the open side of stairs shall not have openings which allow passage of a sphere 4 $\frac{3}{8}$ " in diameter.

R314 and R315 SMOKE ALARMS/CARBON MONOXIDE ALARMS - See Figure 12.

DWELLING UNIT SEPARATION:

Two family Dwellings: See Figure 13. Dwelling units in two-family dwellings are required to be separated from each other by fire resistive wall and/or floor assemblies.

Townhouses: See Figure 14. Each townhouse shall be considered a separate building and shall be separated by fire resistive rated wall assemblies.

SITE ADDRESS:

R319.1 Address identification. Buildings shall be provided with an approved address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be not less than 4 inches in height with a stroke width of not less than 0.5 inch. Where required by the fire code official, address identification shall be provided in additional approved locations to facilitate emergency response. Where access is by means of a private road and the building address cannot be viewed from the public way, a monument, pole or other sign or means shall be used to identify the structure. Address identification shall be maintained.

ACCESSIBILITY: Where there are four or more dwelling units or sleeping units in a single structure, the provisions of Chapter 11 of the *International Building Code for Group R-3* shall apply.

ELEVATORS: Where provided, passenger elevators, limited-use/limited-application elevators or private residence elevators shall comply with ASTM A 17.1.

PLATFORM LIFTS: Where provided, platform lifts shall comply with ASME A 18.1.

ACCESSIBILITY: Elevators or platform lifts that are part of an accessible route required by Chapter 11 of the *International Building Code*, shall comply with ICC A 117.1.

Section 4

FOUNDATIONS

R317.1 Protection against decay. Figure 15 depicts situations where treated wood, and separation of wood and ground, is required.

R401.2 Requirements. Foundation construction shall be capable of accommodating all loads imposed and of transmitting the resulting loads to the supporting soil. Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice. Gravel fill used as footings for wood and precast concrete foundations shall comply with Section R403. **(A professional engineer licensed in the State of Washington shall perform the geotechnical evaluation, and documentation shall include soil load bearing values at fill areas).**

R401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection that does not create a hazard. Lots shall be graded to drain surface water away from foundation walls. The grade shall fall a minimum of 6 inches within the first 10 feet.

Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches of fall within 10 feet, drains or swales shall be constructed to ensure drainage away from the structure. Swales shall be sloped a minimum of 2 percent when located within 10 feet of the building foundation. Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2% away from the building.

R403.1.7 Footings on or adjacent to slopes. The placement of buildings and structures on or adjacent to slopes shall comply with Figure 20 when steeper than 1 unit vertical in 3 units horizontal (33.3% slope). Footings not complying with Figure 20 shall require stamped and signed engineering.

R404.1 Concrete and masonry foundation walls. Concrete foundation walls shall be selected and constructed in accordance with the provisions of Section R404.1.3. Masonry foundation walls shall be selected and constructed in accordance with the provisions of Section R404.1.2.

R404.1.1 Design required. Concrete or masonry foundation walls shall be designed in accordance with accepted engineering practice where either of the following conditions exist:

1. Walls are subject to hydrostatic pressure from ground water.
2. Walls supporting more than 48 inches of unbalanced backfill that do not have permanent lateral support at the top or bottom.

R404.1.3.2 Reinforcement for foundation walls. Concrete foundation walls shall be laterally supported at the top, and at the bottom. Horizontal and vertical reinforcement shall be provided. Reference Figures 16, 17 or 18, or provide an engineered alternate.

R404.1.9 Isolated masonry piers. Contact the Building Department for specific requirements.

R404.4 Retaining walls. Retaining walls that are not laterally supported at the top and that retain in excess of 48 inches of unbalanced fill, or retaining walls exceeding 24 inches in height that resist lateral loads in addition to soil, shall be designed in accordance with accepted engineering practice to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. Retaining walls shall be designed for a safety factor of 1.5 against lateral sliding and overturning. This section shall not apply to foundation walls supporting buildings. See Figure 19. **Retaining walls that exceed 4' in height require permitting.**

R405.1 Concrete or masonry foundations. See Figure 18. Drains shall be provided around concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend not less than 1 foot beyond the outside edge of the footing and 6 inches above the top of the footing and be covered with an approved filter membrane material.

The top of open joints of drain tiles shall be protected with strips of building paper. Except where otherwise recommended by the drain manufacturer, perforated drains shall be surrounded with an approved filter membrane or the filter membrane shall cover the washed gravel or crushed rock covering the drain. Drainage tiles or perforated pipe shall be placed on a minimum of 2 inches of washed gravel or crushed rock not less than one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches of the same material.

Exception: A drainage system is not required where the foundation is installed on well-drained ground or sand-gravel mixture soils according to the Unified Soil Classification System, Group I Soils, as detailed in Table R405.1.

The International Residential Code assumes known soil load bearing values in sizing footings and foundations and prescribing reinforcing requirements. Klickitat County does not assume soil load bearing values. Therefore, a soil evaluation shall be required if using the prescriptive requirements of the International Residential Code. Calculations using 1500 psf are allowed if Klickitat County Building Department minimum requirements are used.

Exception: Requirements depicted in Figure 16, Figure 17 or Figure 18 may be used on undisturbed natural soils.

R406.1 Concrete and masonry foundation dampproofing. Except where required by Section R406.2 to be waterproofed, foundation walls that retain earth and enclose interior spaces and floors below grade shall be dampproofed from the higher of (a) the top of the footing or (b) 6 inches below the top of the basement floor, to the finished grade. Masonry walls shall have not less than $\frac{3}{8}$ inch portland cement parging applied to the exterior of the wall. The parging shall be dampproofed in accordance with one of the following:

1. Bituminous coating.
2. Three pounds per square yard of acrylic modified cement.
3. One-eighth inch coat of surface-bonding cement complying with ASTM C 887.
4. Any material permitted for waterproofing in Section R406.2.
5. Other approved methods or materials.

Exception: Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

Concrete walls shall be dampproofed by applying any one of the listed dampproofing materials or any one of the waterproofing materials listed in Section R406.2 to the exterior of the wall.

R406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose interior spaces and floors below grade shall be waterproofed from the higher of (a) the top of the footing or (b) 6 inches below the top of the basement floor, to the finished grade. Walls shall be waterproofed in accordance with one of the following:

1. Two-ply hot-mopped felts.
2. Fifty-five pound roll roofing.
3. Six-mil polyvinyl chloride.
4. Six-mil polyethylene.
5. Forty-mil polymer-modified asphalt.
6. Sixty-mil flexible polymer cement.
7. One-eighth-inch cement-based, fiber-reinforced, waterproof coating.
8. Sixty-mil solvent-free liquid-applied synthetic rubber.

Exception: Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to Type C of ASTM D 449. Hot asphalt shall be applied at a temperature of less than 200 degrees F.

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

Insulating Concrete Form (ICF) foundation walls shall be designed and constructed in accordance with the provisions of the International Residential Code or with the provisions of American Concrete Institute Standard 318 (ACI318). Detailed documentation of compliance will be required and in some cases, engineering will be required.

R408 Under-Floor Space

R408.1 Ventilation. See Figure 21. The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a basement) shall have ventilation openings through foundation walls or exterior walls. A ground cover of six mil thick black polyethylene or approved equal shall be laid over the ground within crawl spaces. The ground cover shall extend to the foundation wall.

Exception: The ground cover may be omitted in crawl spaces if the crawl space has a concrete slab floor with a minimum thickness of two inches.

R408.2 Openings for under-floor ventilation. The minimum net area of ventilation openings shall not be less than 1 square foot for each 300 square feet of under-floor area. Required openings shall be evenly placed to provide cross ventilation of the space except one side of the building shall be permitted to have no ventilation openings. Ventilation openings shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed $\frac{1}{4}$ inch.

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast-iron grill or grating.
4. Extruded load-bearing brick vents.
5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension being $\frac{1}{8}$ inch.

Exception: The total area of ventilation openings shall be permitted to be reduced to $\frac{1}{1500}$ of the under-floor area where the ground surface is covered with an approved Class I vapor retarder material and the required openings are placed to provide cross ventilation of the space. The installation of operable louvers shall not be prohibited. If the installed ventilation is less than $\frac{1}{300}$, or if operable louvers are installed, a radon vent shall be installed to originate from a point between the ground cover and soil. The radon vent shall be installed in accordance with the requirements of Appendix F (Radon) of this code.

R408.3 Unvented crawl space. Ventilation openings in under-floor spaces specified in Sections R408.1 and R408.2 shall not be required where:

1. Exposed earth is covered with a continuous Class I vapor retarder. Joints of the vapor retarder shall overlap by 6 inches and shall be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches up the stem wall and shall be attached and sealed to the stem wall; and a radon system shall be installed that meets the requirements of Appendix F (Radon) of this code.
2. Continuously operated mechanical exhaust ventilation is provided at a rate equal to 1 cubic foot per minute for each 50 square feet of crawlspace floor area. Exhaust ventilation shall terminate to the exterior.

Exception: Plenum in existing structures complying with Section M1601.5, if under-floor space is used as a plenum.

Section 5

FLOORS

See Figure 23 for general requirements.

R302.13 Fire protection of floors. See Figure 21. Floor assemblies that are not required elsewhere in this code to be fire-resistance rated, shall be provided with $\frac{1}{2}$ inch gypsum wallboard membrane, $\frac{5}{8}$ inch wood structural panel membrane, or equivalent on the underside of the floor framing member. Penetrations or openings for ducts, vents, electrical outlets, lighting, devices, luminaires, wires, speakers, drainage, piping and similar openings or penetrations shall be permitted.

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section P2904, NFPA 13D, or other approved equivalent sprinkler system.
2. Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.
3. Portions of floor assemblies shall be permitted to be unprotected where complying with the following:
 - 3.1 The aggregate area of the unprotected portions shall not exceed 80 square feet per story.
 - 3.2 Fire blocking in accordance with Figure 29 shall be installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.
4. Wood floor assemblies using dimensional lumber or structural composite lumber equal to or greater than 2 inch by 10 inch nominal dimension, or other approved floor assemblies demonstrating equivalent fire performance.

R502.1 General. Wood and wood-based products used for load-supporting purposes shall conform to the applicable provisions of this section.

R502.1.1 Sawn lumber. Sawn lumber shall be identified by a grade mark of an accredited lumber grading or inspection agency and have design values certified by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted.

R502.4 Joists under bearing partitions. Joists under parallel bearing partitions shall be of adequate size to support the load. Double joists, sized to adequately support the load, that are separated to permit the installation of piping or vents shall be full depth solid blocked with lumber not less than 2 inches in nominal thickness spaced not more than 4 feet on center. Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth unless such joists are of sufficient size to carry the additional load.

R502.6 Bearing. The ends of each joist, beam or girder shall have not less than $1\frac{1}{2}$ inches of bearing on wood or metal and not less than 3 inches on masonry or concrete except where supported on a 1 inch by 4 inch ribbon strip and nailed to the adjacent stud or by the use of approved joist hangers. The bearing on masonry or concrete shall be direct, or a sill plate of 2 inch minimum nominal thickness shall be provided under the joist, beam or girder. The sill plate shall provide a minimum nominal bearing area of 48 square inches.

R502.6.1 Floor systems. Joists framing from opposite sides over a bearing support shall lap a minimum of 3 inches and shall be nailed together with a minimum three 10d face nails. A wood or metal splice with strength equal to or greater than that provided by the nailed lap is permitted.

R502.6.2 Joist framing. Joists framing into the side of a wood girder shall be supported by approved framing anchors or on ledger strips not less than nominal 2 inches by 2 inches.

R502.7 Lateral restraint at supports. Joists shall be supported laterally at the ends by full-depth solid blocking not less than 2 inches nominal in thickness; or by attachment to a full-depth header, band, or rim joist, or to an adjoining stud; or shall be otherwise provided with lateral support to prevent rotation.

Exception: Trusses, structural composite lumber, structural glued-laminated members and I-joists shall be supported laterally as required by the manufacturer's recommendations.

R502.8 Cutting, Drilling and Notching. For sawn lumber, shall be as per Figure 22.

R502.8.2 Engineered wood products. Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members, cross-laminated timber members or I-joists are prohibited except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

R502.9 Fastening. Floor framing shall be nailed in accordance with Figure 24. For alternate fasteners such as staples, see Figure 25. Where post and beam or girder construction is used to support floor framing, positive connections shall be provided to ensure against uplift and lateral displacement.

R502.10 Framing of openings. Openings in floor framing shall be framed with a header and trimmer joists. When the header joist span does not exceed 4 feet, the header joist may be a single member the same size as the floor joist. Single trimmer joists shall be used to carry a single header joist that is located within 3 feet of the trimmer joist bearing. Where the header joist span exceeds 4 feet, the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the floor joists framing into the header.

R502.11 Wood trusses. Wood trusses shall be designed by a professional engineer licensed in the State of Washington and drawings shall bear his/her stamp.

R502.11.3 Alterations to trusses. Truss members and components shall not be cut, notched, spliced or otherwise altered in any way without the approval of a registered design professional. Alterations resulting in the addition of load (e.g., HVAC equipment, water heater, etc.), that exceed the design load for the truss, shall not be permitted without verification that the truss is capable of supporting the additional loading.

R302.12 Draftstopping required. In combustible construction where there is usable space both above and below the concealed space of a floor/ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1,000 square feet. Draftstopping shall divide the concealed space into approximately equal areas. Where the assembly is enclosed by a floor membrane above and a ceiling membrane below, draftstopping shall be provided in floor/ceiling assemblies under the following circumstances:

1. Ceiling is suspended under the floor framing.
2. Floor framing is constructed of truss-type open-web or perforated members.

R302.12.1 Materials. Draftstopping materials shall not be less than ½ inch gypsum board, ¾ inch wood structural panels or other approved materials adequately supported. Draftstopping shall be installed parallel to the floor framing members unless otherwise approved by the building official. The integrity of all draftstops shall be maintained.

R302.11 Fireblocking required. Fireblocking shall be provided in wood-frame floor construction and floor-ceiling assemblies in accordance with Section 6 and Figure 29.

R503 Floor sheathing. Shall be as per Figure 26.

R507.1 Decks. See Figure 40.

CONCRETE FLOORS (ON GROUND)

R506.1 General. Concrete slab-on-ground floors shall be designed and constructed in accordance with the provisions of this section or ACI 332. Floors shall be a minimum 3.5 inches thick. The specified compressive strength of concrete shall be 2500 psi.

R508.2 Site preparation. The area within the foundation walls shall have all vegetation, top soil and foreign material removed.

R506.2.1 Fill. Fill material shall be free of vegetation and foreign material. The fill shall be compacted to assure uniform support of the slab, and except where approved, the fill depths shall not exceed 24 inches for clean sand or gravel and 8 inches for earth.

R506.2.2 Base. A 4 inch thick base course consisting of clean graded sand, gravel, crushed stone, crushed concrete or crushed blast-furnace slag passing a 2 inch sieve shall be placed on the prepared subgrade where the slab is below grade.

Exception: A base course is not required where the concrete slab is installed on well-drained or sand-gravel mixture soils.

R506.2.3 Vapor retarder. A 6-mil polyethylene or approved vapor retarder with joints lapped not less than 6 inches shall be placed between the concrete floor slab and the base course or the prepared subgrade where no base course exists.

Exception: The vapor retarder may be omitted:

1. From garages, utility buildings and other unheated accessory structures.
2. For unheated storage rooms having an area of less than 70 square feet and carports.
3. From driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
4. Where approved by the building official, based on local site conditions.

R506.2.4 Reinforcement support. Where provided in slabs on ground, reinforcement shall be supported to remain in place from the center to upper one third of the slab for the duration of the concrete placement.

R301.5 Live Load. The minimum uniformly distributed live loads shall be as provided in Table R301.5.

**TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
(in pounds per square foot)**

USE	LIVE LOAD
Uninhabitable attics without storage ^b	10
Uninhabitable attics with limited storage ^{b,g}	20
Habitable attics and attics served with fixed stairs	30
Balconies (exterior) and decks ^e	60
Fire escapes	40
Guards and handrails ^d	200 ^h
Guard in-fill components ^f	50 ^h
Passenger vehicle garages ^a	50 ^a
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40 ^c

- a. Elevated garage floors shall be capable of supporting a 2,000 pound load applied over a 20 square inch area.
- b. Uninhabitable attics without storage are those where the clear height between joists and rafters is not more than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within any plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
- c. Individual stair treads shall be designed for the uniformly distributed live load or a 300 pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.
- d. A single concentrated load applied in any direction at any point along the top.
- e. See Section R507.1 for decks attached to exterior walls.
- f. Guard in-fill components (all those except handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirements.
- g. Uninhabitable attics with limited storage are those where the clear height between joists and rafters is not greater than 42 inches, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:
 1. The attic area is accessible from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is not less than 30 inches.
 2. The slopes of the joists or truss bottom chords are not greater than 2 inches vertical to 12 units horizontal.
 3. Required insulation depth is less than the joist or truss bottom chord member depth.
 The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot.
- h. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and the load on the infill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.

Section 6

WALL CONSTRUCTION

For General framing provisions see Figure 27 and Figure 28. Fastening see Figure 24 and Figure 25.

R302.11 Fireblocking. In combustible construction, fireblocking shall be provided to cut off all concealed draft openings (both vertical and horizontal) and to form an effective fire barrier between stories, and between a top story and the roof space. See Figure 29.

Fireblocking shall be provided in wood-frame construction in the following locations:

1. In concealed spaces of stud walls and partitions, including furred spaces and parallel rows of studs or staggered studs as follows:
 - 1.1 Vertically at the ceiling and floor levels.
 - 1.2 Horizontally at intervals not exceeding 10 feet.
2. At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings.
3. In concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with Section R302.7. See Figure 4.
4. At openings around vents, pipes, ducts, cables and wires at ceiling and floor level, with an approved material to resist the free passage of flame and products of combustion. The material filling this annular space shall not be required to meet ASTM E 136 requirements.
5. For the fireblocking of chimneys and fireplaces, see Section R1003.19.
6. Fireblocking of cornices of a two-family dwelling is required at the line of dwelling unit separation.

R602.11.2 Stepped foundations. Where stepped foundations occur, see Figure 30.

Braced Wall Lines. All exterior walls and some interior walls shall be braced in accordance with Figure 31 or Figure 32. Where a building or portion thereof does not comply with the bracing requirements of these figures, those portions shall be designed by a professional engineer.

Adequate bracing of buildings against wind or earthquake loadings is required to minimize structural and nonstructural damage. Conventional buildings are usually shaped like a box, and if one were to experiment with cutting out panels in the sides of a cardboard box, one would find that in most cases the box would be unusable against a push or force coming from a direction parallel to the diagonal of the building unless wall panels of sufficient size existed at the corners and in the plane of the walls. The walls would rack (using engineering terminology) or twist and collapse. Therefore, all buildings are required to have some form of bracing. For conventional light-frame construction, this is typically the exterior or interior wall coverings. The code has specific requirements as to the spacing of these braced wall lines. Usually, all exterior walls are considered braced wall lines. Sometimes, if a building is very long, interior braced walls are used. Additionally, "L" shaped buildings will require some type of wall bracing at or near the two legs of the building that intersect at the "L". Even if they occur in the interior, walls should be braced as if they are exterior braced panels.

R602.3 Design and construction. Studs shall be continuous from support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice.

Exception: Jack studs, trimmer studs and cripple studs at openings in walls.

Insulating Concrete Form (ICF) walls shall be designed and constructed in accordance with the provisions of the International Residential Code or with the provisions of American Concrete Institute Standard 318 (ACI318). Detailed documentation of compliance will be required and in some cases, engineering will be required.

R312.2.1 Window sills. See Figure 3.

Section 7

WALL COVERING

Interior

R702.3.1 Gypsum board (sheetrock). See Figure 34. All gypsum board materials and accessories shall conform to listed standards, and shall be installed in accordance with the provisions of this section and Figure 34.

R702.5 Other finishes. Wood veneer paneling and hardboard paneling shall be placed on wood or cold-formed steel framing spaced not more than 16 inches on center. Wood veneer and hardboard paneling less than $\frac{1}{4}$ inch nominal thickness shall not have less than a $\frac{3}{8}$ inch gypsum board backer or gypsum panel product backer. Wood veneer paneling not less than $\frac{1}{4}$ inch nominal thickness shall conform to ANSI/HPVA HP-1. Hardboard paneling shall conform to CPA/ANSI A 135.5.

Exterior

R703.1.2 Wind resistance. Wall coverings, backing materials and their attachments shall be capable of resisting wind loads of 110 mph, Exposure B. Wind-pressure resistance of the siding and backing materials shall be determined by ASTM E 330 or other applicable standard test methods.

R703.2 Water-resistive barrier. One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D 226 for Type I felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches. Where joints occur, felt shall be lapped not less than 6 inches. The felt or other approved material shall be continuous to the top of the walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1. The water-resistive barrier is not required for detached accessory structures.

R703.3 Nominal thickness and attachments. The nominal thickness and attachment of exterior wall coverings shall be in accordance with Table R703.3(1), the wall covering material requirements of this section, and the wall covering manufacturer's installation instructions. Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Sections R703.15 through R703.17. Nominal material thicknesses in Table R703.3(1) are based on a maximum stud spacing of 16 inches on center. Where specified by the siding manufacturer's instructions and supported by a test report or other documentation, attachment to studs with greater spacing is permitted. Fasteners for exterior wall coverings attached to wood framing shall be in accordance with Section R703.3.2 and Table R703.3(1).

R703.5 Wood shakes and shingles. Contact the Building Department.

R703.6 Exterior Plaster. Contact the Building Department.

R703.7 Stone and Masonry Veneer. Contact the Building Department.

R703.9 Exterior Insulation Finish Systems (EIFS). Contact the Building Department.

R703.4 Flashing. See Figure 33. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier complying with Section 703.2 for subsequent drainage. Mechanically attached flexible flashings shall comply with AAMA 712.

2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

R703.10 Fiber cement siding.

R703.10.1 Panel Siding. Fiber-cement panels shall comply with the requirements of ASTM C 1186, Type A, minimum Grade II or ISO 8336, Category A, minimum Class 2. Panels shall be installed with the long dimension either parallel or perpendicular to framing. Vertical and horizontal joints shall occur over framing members and shall be protected with caulking, or covered with battens or flashing, or be vertical or horizontal shiplap, or otherwise designed to comply with Section R703.1. Panel siding shall be installed with fasteners in accordance with Table R703.3(1) or the approved manufacturer's installation instructions.

R703.10.2 Lap siding. Fiber-cement lap siding having a maximum width of 12 inches shall comply with the requirements of ASTM C 1186, Type A, minimum Grade II or ISO 8336, Category A, minimum Class 2. Lap siding shall be lapped a minimum of 1 ¼ inches and lap siding shall be installed in accordance with the manufacturer's installation instructions or shall be designed to comply with Section R703.1. Lap siding courses shall be installed with the fastener heads exposed or concealed, in accordance with Table R703.3(1) or approved manufacturer's instructions.

R703.11 Vinyl siding. Vinyl siding shall be certified and labeled as conforming to the requirements of ASTM D 3679 by an approved quality control agency.

R703.11.1 Installation. Vinyl siding, soffit and accessories shall be installed in accordance with the manufacturer's installation instructions.

R703.11.2 Foam plastic sheathing. Contact the Building Department.

R703.12 Adhered masonry veneer installation. Adhered masonry veneer shall be installed in accordance with the manufacturer's instructions.

R703.12.1 Clearances. On exterior stud walls, adhered masonry veneer shall be installed:

1. Minimum of 4 inches above earth;
2. Minimum of 2 inches above paved areas; or
3. Minimum of ½ inch above exterior walking surfaces which are supported by the same foundation that supports the exterior wall.

R703.12.2 Flashing at foundation. See Figure 34. A corrosion-resistant screed or flashing of minimum 0.019 inch or 26 gage galvanized or plastic with a minimum vertical attachment flange of 3 ½ inches shall be installed to extend a minimum of 1 inch below the foundation plate line on exterior stud walls in accordance with Section R703.4.

R703.12.3 Water-resistive barrier. A water-resistive barrier shall be installed as required by Section R703.2 and shall comply with the requirements of Section R703.6.3. The water-resistive barrier shall lap over the exterior of the attachment flange of the screed or flashing provided in accordance with Section R703.12.2.

Fastening. See Figure 24 and Figure 25.

All structural panel components within the conditioned space such as plywood, particle board, wafer board and oriented strand board shall be identified as "EXPOSURE 1", "EXTERIOR" or "HUD-APPROVED".

Section 8

ROOF-CEILING CONSTRUCTION

See Figure 35 for general framing details.

R202 Attic, habitable. See Figure 35.

ALWAYS CHECK WITH THE BUILDING DEPARTMENT TO CONFIRM THE REQUIRED DESIGN CRITERIA PRIOR TO ORDERING ROOF TRUSSES.

R803 Roof sheathing. See Figure 36 and Section 9.

Ceilings shall be installed in accordance with the requirements for interior finishes found in Section 7.

R806.1 Ventilation required. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilation openings shall have a least dimension of $\frac{1}{6}$ inch minimum and $\frac{1}{4}$ inch maximum. Ventilation openings having a least dimension larger than $\frac{1}{4}$ inch shall be provided with corrosion-resistant wire cloth screening, hardware cloth or similar material with openings having a least dimension of $\frac{1}{6}$ inch minimum and $\frac{1}{4}$ inch maximum. Openings in roof framing members shall conform to the requirements of Section R802.7. Required ventilation openings shall open directly to the outside air.

R806.2 Minimum vent area. The minimum net free ventilation area shall be 1:150 of the area of the vented space.

Exception: The minimum net free ventilation area shall be 1:300 of the vented space provided one or more of the following conditions are met:

1. In climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.
2. Not less than 40 percent and not more than 50 percent of the required ventilation area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located no more than 3 feet below the ridge or highest point of the space, measured vertically, with the balance of the required ventilation provided by eave or cornice vents. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet below the ridge or highest point of the space shall be permitted.

R806.3 Vent and insulation clearance. Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a 1 inch space shall be provided between the insulation and the roof sheathing at the location of the vent.

R806.4 Installation and weather protection. Ventilators shall be installed in accordance with manufacturer's installation instructions. Installation of ventilators in roof systems shall be in accordance with the requirements of Section 9. Installation of ventilators in wall systems shall be in accordance with Section 7.

R806.5 Unvented attic and unvented enclosed rafter assemblies. See Figure 35. Unvented attics and unvented enclosed roof framing assemblies created by ceilings that are applied directly to the underside of the roof framing members and structural roof sheathing applied directly to the top of the roof framing members/rafters, shall be permitted where **all** of the following conditions are met:

1. The unvented attic space is **completely** within the building thermal envelope.
2. No interior Class I vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly or on the ceiling side of the unvented enclosed roof framing assembly.
3. Where wood shingles or shakes are used, a minimum $\frac{1}{4}$ inch vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In Climate Zones 5, 6, 7 and 8, any air-impermeable insulation shall be a Class II vapor retarder, or shall have a Class II vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Insulation shall be located in accordance with the following:
 - 5.1 Item 5.1.1, 5.1.2, 5.1.3 or 5.1.4 shall be met, depending on the air permability of the insulation directly under the structural roof sheathing.

5.1.1 Where only air-impermeable insulation is provided, it shall be applied in direct contact with the underside of the structural roof sheathing.

5.1.2 Where air-permeable insulation is provided inside the building thermal envelope, it shall be installed in accordance with Section 5.1. In addition to the air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing in accordance with the R-values in Table R806.5 for condensation control.

5.1.3 Where both air-impermeable and air-permeable insulation are provided, the air-impermeable insulation shall be applied in direct contact with the underside of the structural roof sheathing in accordance with Item 5.1.1 and shall be in accordance with the R-values in Table R806.5 for condensation control. The air-permeable insulation shall be installed directly under the air-impermeable insulation.

5.1.4 Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45 degrees F. For calculation purposes, an interior air temperature of 68 degrees F is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

5.2 Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

**** Some asphalt shingle manufacturers have limited warranties for unvented, conditioned attic assemblies. We strongly recommend verification with the manufacturers of your shingles prior to proceeding when choosing this type of roof assembly. ****

In order to be approved by the inspector, all of the conditions as listed above, will need to be verified, in writing. (ie: manufacturer's installation instructions for the insulation, and the product listing showing compliance with this code).

R807.1 Attic access. See Figure 35. Buildings with combustible ceiling or roof construction shall have an attic access opening to attic areas that have a vertical height of 30 inches or greater over an area of not less than 30 square feet. The vertical height shall be measured from the top of the ceiling framing members to the underside of the roof framing members. The rough-framed opening shall be not less than 22 inches by 30 inches and shall be located in a hallway or other readily accessible location. Where located in a wall, the opening shall be not less than 22 inches wide by 30 inches high. Where the access is located in a ceiling, minimum unobstructed headroom in the attic space shall be 30 inches at some point above the access measured vertically from the bottom of the ceiling framing members. See Section M1305.1.3 for access requirements where mechanical equipment is located in attics.

R302.14 Combustible insulation clearance. Combustible insulation shall be separated not less than 3 inches from recessed luminaires, fan motors and other heat-producing devices.

Exception: Where heat-producing devices are listed for lesser clearances, combustible insulation complying with the listing requirements shall be separated in accordance with the conditions stipulated in the listing.

Recessed luminaires installed in the building thermal envelope shall meet the requirements of Section N1102.4.5 of this code.

Fastening. See Figure 24 and 25.

Section 9

ROOF ASSEMBLIES

R903.1 General. Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with this section. Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's installation instructions such that the roof assembly shall serve to protect the building or structure.

R903.2 Flashings. See Figure 33. Flashings shall be installed in a manner that prevents moisture from entering the wall and roof through joints in copings, through moisture permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

R905.2.1 Sheathing Requirements. Asphalt shingles shall be fastened to solidly sheathed decks.

R905.2.2 Slope. Asphalt shingles shall only be used on roof slopes of two units vertical in 12 units horizontal (2:12) or greater. For roof slopes from two units vertical in 12 units horizontal (2:12) up to four units vertical in 12 units horizontal (4:12), double underlayment application is required in accordance with underlayment application section below.

R905.2.4 Asphalt shingles. Asphalt shingles shall comply with ASTM D 3462.

R905.2.4.1 Wind resistance of asphalt shingles. Asphalt shingles shall be tested in accordance with ASTM D 7158. Asphalt shingles shall meet the classification requirements of D, G or H as designated by wind speed of 110mph. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D 7158 and the required classification.

Exception: Asphalt shingles not included in the scope of ASTM D 7158 shall be tested and labeled to indicate compliance with ASTM D 3161 and the required classification.

R905.2.5 Fasteners. Fasteners for asphalt shingles shall be galvanized steel, stainless steel, aluminum or copper roofing nails, minimum 12 gage (0.105 inch) shank with a minimum $\frac{3}{8}$ inch diameter head, complying with ASTM F 1667, of a length to penetrate through the roofing materials and not less than $\frac{3}{4}$ inch into the roof sheathing. Where the roof sheathing is less than $\frac{3}{4}$ inch thick, the fasteners shall penetrate through the sheathing.

R905.2.6 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer, but not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12), shingles shall be installed as required by the manufacturer.

R905.1.1/Table R905.1.1(2) Underlayment Application. For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a 19 inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36 inch wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingle to seal. For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.

R905.2.8.1 Base and cap flashing. Base and cap flashing shall be installed in accordance with manufacturer's installation instructions. Base flashing shall be of either corrosion-resistant metal of minimum nominal 0.019 inch thickness or mineral surface roll roofing weighing a minimum of 77 pounds per 100 square feet. Cap flashing shall be corrosion-resistant metal of minimum nominal 0-019 inch thickness.

R905.2.8.2 Valleys. Valley linings shall be installed in accordance with manufacturer's installation instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valley (valley lining exposed) lined with metal, the valley lining shall be at least 24 inches wide and of any approved corrosion-resistant metals.
2. For open valleys, valley lining of two plies of mineral surfaced roll roofing, complying with ASTM D 3909 or ASTM D 6380 Class M, shall be permitted. The bottom layer shall be 18 inches and the top layer a minimum of 36 inches wide.
3. For closed valleys (valley covered with shingles), valley lining of one ply of smooth roll roofing complying with ASTM D 6380 and at least 36 inches wide or valley lining as described in Items 1 and 2 above shall be permitted. Self-adhering polymer modified bitumen underlayment complying with ASTM D 1970 shall be permitted in lieu of the lining material.

R905.2.8.3 Sidewall flashing. See Figure 33. Base flashing against a vertical sidewall shall be continuous or step flashing and shall be a minimum of 4 inches in height and 4 inches in width and shall direct water away from the vertical sidewall onto the roof and/or into the gutter. Where siding is provided on the vertical sidewall, the vertical leg of the flashing shall be continuous under the siding. Where anchored masonry veneer is provided on the vertical sidewall, the base flashing shall be provided in accordance with this section and counterflashing shall be provided in accordance with Section R703.7.2.2. Where exterior plaster or adhered masonry veneer is provided on the vertical sidewall, the base flashing shall be provided in accordance with this section and Section R703.6.3.

R905.2.8.4 Other flashing. Flashing against a vertical front wall, as well as soil stack, vent pipe and chimney flashing, shall be applied according to asphalt shingle manufacturer's printed instructions.

R905.2.8.5 Drip edge. A drip edge shall be provided at eaves and rake edges of shingle roofs. Adjacent segments of drip edge shall be overlapped not less than 2 inches. Drip edges shall extend not less than $\frac{1}{4}$ inch below the roof sheathing and extend up back onto the roof deck not less than 2 inches. Drip edges shall be mechanically fastened to the roof deck at not more than 12 inches o.c. with fasteners as specified in Section R905.2.5. Underlayment shall be installed over the drip edge along eaves and under the underlayment along rake edges.

R905.7 Wood Shingles

R905.7.4 Material Requirements. Wood shingles shall be of naturally durable wood with a minimum grade of 1, 2 or 3 as established by the Cedar Shake and Shingle Bureau.

R905.7.1 Deck Requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1 inch by 4 inch nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

R905.7.2 Deck Slope. Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (25 percent slope) or greater.

R905.7.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869, Type I or II, III or IV.

R905.7.5 Application. Wood shingles shall be installed in accordance with this chapter and the manufacturer's instructions. Wood shingles shall be laid with a side lap not less than $1\frac{1}{2}$ inches between joints in courses, and two joints shall not be in direct alignment in any three adjacent courses. Spacing between shingles shall be not less than $\frac{1}{4}$ inch to $\frac{3}{8}$ inch. Weather exposure for wood shingles shall not exceed those set forth in Table R905.7.5(1). Fasteners for untreated (naturally durable) wood shingles shall be box nails in accordance with Table R905.7.5(2). Nails shall be stainless steel Type 304 or 316 or hot-dipped galvanized with a coating weight of ASTM A 153 Class D. Alternatively, two 16-gage stainless steel Type 304 or 316 staples with crown widths $\frac{7}{16}$ inch minimum, $\frac{3}{4}$ inch maximum, shall be used. Fasteners for fire-retardant-treated shingles in accordance with Section R902 or pressure-impregnated-preservative-treated shingles of naturally durable wood in accordance with AWWPA U1 shall be stainless steel Type 316. All fasteners shall have a minimum penetration into the sheathing of $\frac{3}{4}$ inch. For sheathing less than $\frac{3}{4}$ inch in thickness, each fastener shall penetrate through the sheathing. Wood shingles shall be attached to the roof with two fasteners per shingle, positioned in accordance with the manufacturer's installation instructions. Fastener packaging shall bear a label indicating the appropriate grade material or coating weight.

TABLE R905.7.5(1)
WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)	
			3:12 pitch to < 4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3 ¾	5
		No. 2	3 ½	4
		No. 3	3	3 ½
	18	No. 1	4 ¼	5 ½
		No. 2	4	4 ½
		No. 3	3 ½	4
	24	No. 1	5 ¾	7 ½
		No. 2	5 ½	6 ½
		No. 3	5	5 ½

TABLE R905.7.5(2)
NAIL REQUIREMENTS FOR WOOD SHAKES AND WOOD SHINGLES

SHAKES	NAIL TYPE AND MINIMUM LENGTH	MINIMUM HEAD SIZE	MINIMUM SHANK DIAMETER
18" straight-split	5d box 1 ¾"	0.19"	.080"
18" and 24" handsplit and resawn	6d box 2"	0.19"	.0915"
24" taper-split	5d box 1 ¾"	0.19"	.080"
18" and 24" tapersawn	6d box 2"	0.19"	.0915"
Shingles	Nail Type and Minimum Length		
16" and 18"	3d box 1 ¼"	0.19"	.080"
24"	4d box 1 ½"	0.19"	.080"

R905.7.6 Valley Flashing. Roof flashing shall be not less than No. 26 gage (0.019 inches) corrosion-resistant sheet metal and shall extend 10 inches from the centerline each way for roofs having slopes less than 12 units vertical in 12 units horizontal (100 percent slope), and 7 inches from the centerline each way for slopes of 12 units vertical in 12 units horizontal and greater. Sections of flashing shall have an end lap of not less than 4 inches.

R905.8 Wood Shakes

R905.8.5 Material Standards. Wood shakes shall comply with the requirements of Table R905.8.5.

TABLE R905.8.5
WOOD SHAKE MATERIAL REQUIREMENTS

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING STANDARDS
Wood shakes of naturally durable wood	1	Cedar Shake and Shingle Bureau
Tapersawn shakes of naturally durable wood	1 or 2	Cedar Shake and Shingle Bureau
Preservative-treated shakes and shingles of naturally durable wood	1	Cedar Shake and Shingle Bureau
Fire-retardent-treated shakes and shingles of naturally durable wood	1	Cedar Shake and Shingle Bureau
Preservative-treated tapersawn shakes of Southern pine treated in accordance with AWPA Standard U1 (Commodity Specification A, Use category 3B and Section 5.6)	1 or 2	Forest Products Laboratory of the Texas Forest Services

R905. 8.1 Deck Requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1 inch by 4 inch nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1 inch by 4 inch spaced sheathing is installed at 10 inches on center, additional 1 inch by 4 inch boards shall be installed between the sheathing boards.

R905.8.2 Deck Slope. Wood shakes shall only be used on slopes of 3 units vertical in 12 units horizontal (25 percent slope) or greater.

R905.8.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or II, or ASTM D 4869 Type I, II, III or IV.

R905.8.6 Application. Wood shakes shall be installed according to this section and the manufacturer's installation instructions. Wood shakes shall be laid with a side lap not less than 1 ½ inches between joints in adjacent courses. Spacing between shakes in the same course shall be ⅜ inch to ⅝ inch including tapersawn shakes. Weather exposures for wood shakes shall not exceed those set in Table R905.8.6. Fasteners for untreated (naturally durable) wood shakes shall be box nails in accordance with Table R905.7.5(2). Nails shall be stainless steel Type 304, or Type 316 or hot-dipped with a coating weight of ASTM A 153 Class D. Alternatively, two 16-gage Type 304 or Type 316 stainless steel staples, with crown widths 7/16 inch minimum, ¾ inch maximum, shall be used. Wood shakes shall be attached to the roof with two fasteners per shake positioned in accordance with the manufacturer's installation instructions. Fasteners for fire-retardent-treated (as defined in Section R902) shakes or pressure-impregnated-preservative-treated shakes of naturally durable wood in accordance with AWPA U1 shall be stainless steel Type 316. All fasteners shall have a minimum penetration into sheathing of ¾ inch. Where the sheathing is less than ¾ inch thick, each fastener shall penetrate through the sheathing. Fastener packaging shall bear a label indicating the appropriate grade material or coating weight.

**TABLE R905.8.6
WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE**

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)
			4:12 pitch or steeper
Shakes of naturally durable wood	18	No.1	7 ½
	24	No. 1	10 ^a
Preservative-treated tapersawn shakes of Southern Yellow Pine	18	No. 1	7 ½
	24	No. 1	10
	18	No. 2	5 ½
	24	No. 2	7 ½
Taper-sawn shakes of naturally durable wood	18	No. 1	7 ½
	24	No. 1	10
	18	No. 2	5 ½
	24	No. 2	7 ½

a. For 24 inch by ¾ inch handsplit shakes, the maximum exposure is 7 ½ inches.

R905. 8.7 Shake Placement. The starter course at the eaves shall be doubled and the bottom layer shall be either 15 inch, 18 inch or 24 inch wood shakes or wood shingles. Fifteen inch or 18 inch wood shakes may be used for the final course at the ridge. Shakes shall be interlaid with 18 inch wide strips of not less than No. 30 felt shingled between each course in such manner that no felt is exposed to the weather by positioning the lower edge of each felt strip above the butt end of the shake it covers a distance equal to twice the weather exposure.

R905.8.8 Valley Flashing. Roof valley flashing shall not be less than No. 26 gage (0.019 inches) corrosion-resistant sheet metal and shall extend at least 11 inches from the centerline each way. Sections of flashing shall have an end lap of not less than 4 inches.

R905.10.3 Material Standards. Metal-sheet roof covering systems that incorporate supporting structural members shall be designed in accordance with the *International Building Code*. Metal-sheet roof coverings installed over structural decking shall comply with Table R905.10.3(1).

**TABLE R905.10.3(1)
METAL ROOF COVERING STANDARDS**

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
Galvanized steel	ASTM A 653 G90 Zinc coated
Stainless steel	ASTM A 240, 300 Series alloys
Steel	ASTM A 924
Lead-coated copper	ASTM B 101
Cold-rolled copper	ASTM B 370 minimum 16 oz/sq ft and 12 oz/sq ft high-yield copper for metal-sheet roof-covering systems; 12 oz/sq ft for preformed metal shingle systems
Hard lead	2 lb/sq ft
Soft lead	3 lb/sq ft
Aluminum	ASTM B 209, 0.024 minimum thickness for roll-formed panels and 0.019 inch minimum thickness for pressformed shingles
Terne (tin) and terne-coated stainless	Terne coating of 40 lb per double base box, field painted where applicable in accordance with manufacturer's installation instructions
Zinc	0.027 inch minimum thickness: 99.995% electrolytic high-grade zinc with alloy additives of copper (0.08% - 0.20%), titanium (0.07% - 0.12%) and aluminum (0.015%)

The material used for metal-sheet roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses shown in Table R905.10.3(2).

**TABLE R905.10.3(2)
MINIMUM CORROSION RESISTANCE**

55% aluminum-zinc alloy coated steel	ASTM A 792 AZ 50
5% aluminum-alloy coated steel	ASTM A 875 GF60
Aluminum coated steel	ASTM A 463 T2 65
Galvanized steel	ASTM A 653 G-90
Prepainted steel	ASTM A 755 ^a

a. Paint systems in accordance with ASTM A 755 shall be applied over steel products with corrosion-resistant coatings complying with ASTM A 792, ASTM A 875, ASTM A 463, or ASTM A 653.

R905.10.1 Deck Requirements. Metal roof panel coverings shall be applied to a solid or spaced sheathing, except where the roof covering is specifically designed to be applied to spaced supports.

R905.10.2 Slope. Minimum slopes for metal roof panels shall comply with the following:

1. The minimum slope for lapped, nonsoldered-seam metal roofs without applied lap sealant shall be three units vertical in 12 units horizontal (25 percent slope).
2. The minimum slope for lapped, nonsoldered-seam metal roofs with applied lap sealant shall be one-half vertical unit in 12 units horizontal (4 percent slope). Lap sealants shall be applied in accordance with the approved manufacturer's installation instructions.
3. The minimum slope for standing-seam roof systems shall be one-quarter unit vertical in 12 units horizontal (92 percent slope).

R905.10.4 Attachment. Metal roof panels shall be secured to the supports in accordance with this section and the manufacturer's installation instructions. In the absence of manufacturer's installation instructions, the following fasteners shall be used:

1. Galvanized fasteners shall be used for steel roofs.
2. Copper, brass, bronze, copper alloy and 300 series stainless fasteners shall be used for copper roofs.
3. Stainless steel fasteners are acceptable for metal roofs.

R905.10.5 Underlayment. Underlayment shall be installed in accordance with the manufacturer's installation instructions.

For clay or concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, built-up roofs, modified bitumen roofing, thermoset single-ply roofing, thermoplastic single-ply roofing, sprayed polyurethane foam roofing, liquid applied coatings, or photovoltaic shingles contact the Building Department.

R908 Reroofing

R908.2 Structural and construction loads. The structural roof components shall be capable of supporting the roof covering system and the material and equipment loads that will be encountered during installation of the roof covering system.

R908.3 Roof replacement. Roof replacement shall include the removal of existing layers of roof coverings down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section R905.

R908.3.1 Roof re-cover. The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. Where the new roof covering is installed in accordance with the roof covering manufacturer's approved instructions.
2. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
3. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs where applied in accordance with Section R908.4.
4. The application of new protective coating over an existing spray polyurethane foam roofing system shall be permitted without tear-off of existing roof coverings.

R908.3.1.1 A roof re-cover shall not be permitted where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

R908.4 Roof re-covering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

R908.5 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Any existing flashings, edgings, outlets, vents or similar devices that are part of the assembly shall be replaced where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.

R908.6 Flashings. Flashings shall be reconstructed in accordance with approved manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

Section 10

CHIMNEYS AND FIREPLACES

Chapter 10 of the *International Residential Code* regulates two basic types of chimneys and fireplaces: factory built and those constructed of masonry and other approved materials.

Chimneys and fireplaces constructed of masonry rely on prescriptive requirements for the details of their construction, while the factory built type rely on the listing and labeling method for approval and installation requirements.

For specific requirements on chimneys and fireplaces, please contact the Building Department to request the "**Residential Chimneys and Fireplaces**" handout.

Section 11

ENERGY AND VENTILATION CODES

- * New residences and additions to existing residences are required to be constructed in a manner that complies with the International Energy Conservation Code of the State of Washington.
- * Although designated department staff members will help you with general questions about completing the required form, it is ultimately your responsibility to provide detailed information about heating systems, glazing, insulation and other requested building specifications. Since these forms will be evaluated for completeness and accuracy, you can avoid unnecessary permit delays by carefully providing all required information.
- * The International Energy Conservation Code of the State of Washington prescriptive compliance form (yellow packet) must be completed in its entirety and submitted with the building permit application.
- * Your construction drawings (plans) should reflect the insulation values and window U-values that have been selected on the required form, as well as the method of venting, fresh air distribution and energy credit options that have been chosen.
- * Keep in mind that R-21 Fiberglass batt insulation will need stud widths of at least 5 ½ inches.
- * Ventilation of the roof framing members is very important and required by the International Residential Code except where rigid insulation is placed on the roof deck and there is no airspace. Failure to provide proper ventilation can cause framing members to become damp from heat and cause rotting or insect infestation or both. You will need to plan your construction so as to provide at least 1 inch of airspace above the insulation in vaulted ceiling locations. Vaulted ceilings are those that have no attic space above, and the insulation lies in the rafter cavity between the ceiling covering and roof sheathing. **When choosing an approved unvented attic assembly, please be aware that some roofing manufacturers have limited warranties for unvented, conditioned attic assemblies. We strongly recommend verification with the manufacturer of your roofing prior to proceeding when choosing this type of roof assembly.**

So as not to compress the insulation and allow for the proper air space in a vaulted ceiling, you will need to use these minimum rafter sizes with the following insulation values:

Insulation Type (Fiberglass Batt)	R-38 Normal Density	R-38 High Density
Nominal Rafter Depth Minimum	12"	10.25"

Check your construction drawings (plans) to make sure your roof framing has been designed to accommodate the required insulation values.

- * Please note that a scissor truss roof system is not defined as a vaulted ceiling and requires insulation to be consistent with that of an attic roof system.
- * All insulation (including floor) must be placed and if necessary, held in place, so that the insulation will remain in substantial contact with the surface closest to the heated space.

IF YOU ARE UNABLE TO COMPLY WITH THE PRESCRIPTIVE METHOD, YOU WILL NEED TO PERFORM A SIMULATED PERFORMANCE ALTERNATIVE, OR YOU MAY HIRE A PROFESSIONAL.

The information here is provided to assist you in the construction process. Items listed here will, when applicable, be checked during the inspection process and are subject to field corrections.

This code applies to residential buildings and the buildings sites and associated systems and equipment. This code shall be the maximum and minimum energy code for residential construction in each town, city and county.

Insulation

General. All insulating materials shall be installed in accordance to the manufacturer's instructions to achieve proper densities and maintain uniform R-values and shall be installed in a manner which will permit inspection of the manufacturer's R-value identification mark. The thickness of roof/ceiling insulation that is either blown in or spray-applied shall be identified by inches of thickness, density and R-value markers installed at least one for every 300 square feet through the attic and/or ceiling space. In attics, the markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum 1 inch in height. Each marker shall face the attic access. The thickness of installed attic insulation shall meet or exceed the minimum initial installed thickness shown by the marker.

Clearances. Where required, insulation shall be installed with clearances according to manufacturer's specifications. Insulation shall be installed so that required ventilation is unobstructed. For blown or poured loose fill insulation, clearances shall be maintained through installation of a permanent manner.

R401.3 Certificate (Mandatory). A permanent certificate shall be completed by the builder or registered design professional and posted on a wall in the space where the furnace is located, a utility room, or an approved location inside the building. When located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. The certificate shall list the predominant R-values of insulation installed in or on ceiling/roof, walls, foundation (slab, below-grade wall, and/or floor) and ducts outside conditioned spaces; U-factors for fenestration and the solar heat gain coefficient (SHGG) of fenestration, and the results from any required duct system and building envelope air leakage testing done on the building. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace, or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater", "electric furnace", or "baseboard electric heater", as appropriate. An efficiency shall not be listed for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters.

R402.1 General (Prescriptive). The building thermal envelope shall meet the requirements of this Section.

Exception: The following buildings, or portions thereof, separated from the remainder of the building by building thermal envelope assemblies complying with this code shall be exempt from the building thermal envelope provisions of this code:

1. Those with a peak design rate of energy usage less than 3.4 Btu/h ft² or 1.0 watt/ft² of floor area for space conditioning purposes.
2. Those that do not contain conditioned space.
3. Greenhouses isolated from any conditioned space and not intended for occupancy.

R402.1.1 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Table R402.1.

R402.1.2 R-value computation. Insulation material used in layers, such as framing cavity insulation or continuous insulation, shall be summed to compute the corresponding component R-value. The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films. Where insulated siding is used for the purpose of complying with the continuous insulation requirements of Table R402.1.1, the manufacturer must supply an ICC Report that the R-factor has been certified, or use R-5 per inch for extruded polystyrene, and R-6 per inch for polyisocyanurate rigid insulation.

R402.1.3 U-factor alternative. An assembly with a U-factor equal to or less than that specified in Table R402.1.3 shall be permitted as an alternative to the R-value in table R402.1.1.

R402.1.5 Vapor retarder. Wall assemblies in the building thermal envelope shall comply with the vapor retarder requirements of Section R702.7 of the International Residential Code.

**TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT ^a**

CLIMATE ZONE	5 AND MARINE 4
FENESTRATION U-FACTOR ^b	0.30
SKYLIGHT ^b U-FACTOR	0.50
GLAZED FENESTRATION SHGC ^{b,e}	NR
CEILING R-VALUE ^k	49
WOOD FRAME WALL ^{g,m,n} R-VALUE	21 int
MASS WALL R-VALUE ⁱ	21 / 21
FLOOR R-VALUE	30
BELOW-GRADE ^{c,m} WALL R-VALUE	10 / 15 / 21 int + TB
SLAB ^d R-VALUE & DEPTH	10, 2 ft

- a. R-values are minimum. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the compressed R-value of the insulation from Appendix Table A101.4 shall not be less than the R-value specified in the table.
- b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
- c. "10/15/21 + TB" means R-10 continuous insulation on the exterior of the wall, or R-15 continuous insulation on the interior of the wall, or R-21 cavity insulation plus a thermal break between the slab and the basement wall at the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the wall. "TB" means a thermal break between floor slab and basement wall.
- d. R-10 continuous insulation is required under heated slab on grade floors. See R402.2.9.1.
- e. There are no SHGC requirements in the Marine Zone.
- f. Reserved
- g. Reserved
- h. Reserved
- i. The second R-value applies when more than half the insulation is on the interior of the mass wall.
- j. Reserved
- k. For single rafter or joist vaulted ceilings, the insulation may be reduced to R-38.
- l. Reserved
- m. Int. (intermediate framing) denotes standard framing 16 inches on center with headers insulated with a minimum of R-10 insulation.
- n. Log and solid timber walls with a minimum average thickness of 3.5 inches are exempt from this insulation requirement.

R402.2.1 Ceilings with attic spaces. Where Section R402.1.1 would require R-49 in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall be deemed to satisfy the requirements for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the U-factor alternative approach in Section R402.1.3 and the total UA alternative in Section R402.1.4.

R402.2.1.1. Loose insulation in attic spaces. Open-blown or poured loose fill insulation may be used in attic spaces where the slope of the ceiling is not more than 3 feet in 12 and there is at least 30 inches of clear distance from the top of the bottom chord of the truss or ceiling joist to the underside of the sheathing at the roof ridge.

R402.2.3 Eave baffle. For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal to or greater than the size of the vent. The baffle shall extend over the top of the attic insulation. The baffle shall be permitted to be any solid material.

R402.2.4 Access hatches and Doors. Access doors from conditioned spaces to unconditioned spaces (attics and crawl spaces) shall be weather-stripped and insulated to a level equivalent to the insulation on the surrounding surfaces. A wood framed or equivalent baffle or retainer must be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

Exception: Vertical doors that provide access from conditioned to unconditioned spaces shall be permitted to meet the fenestration requirements of Table R402.1.1.

R402.2.7 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking. Insulation supports shall be installed so spacing is no more than 24 inches on center. Foundation vents shall be placed so that the top of the vent is below the lower surface of the floor insulation.

Exceptions:

1. The floor framing cavity insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the bottom side of floor framing where combined with insulation that meets or exceeds the minimum Wood Frame R-value in Table R402.1.1. and extends from the bottom to the top of all perimeter floor framing members.
2. When foundation vents are not placed so that the top of the vent is below the lower surface of the floor insulation, a permanently attached baffle shall be installed at an angle of 30 degrees from horizontal, to divert air flow below the lower surface of the floor insulation.
3. Substantial contact with the surface being insulated is not required in enclosed floor/ceiling assemblies containing ducts where full R-value insulation is installed between the duct and the exterior surface.

R402.2.8 Below-grade walls. Below-grade exterior wall insulation used on the exterior (cold) side of the wall shall extend from the top of the below-grade wall to the top of the footing and shall be approved for below-grade use. Above-grade insulation shall be protected. Insulation used on the interior (warm) side of the wall shall extend from the top of the below-grade wall to the below-grade floor level and shall include R-5 rigid board providing a thermal break between the concrete wall and the slab.

R402.2.9 Slab-on-grade floors. The minimum thermal resistance (R-value) of the insulation around the perimeter of unheated or heated slab-on-grade floors shall be as specified in Table R402.1.1. The insulation shall be placed on the outside of the foundation wall or on the inside of the foundation wall. The insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to at least the bottom of the slab and then horizontally to the interior or exterior for the total distances shown in the table. A two-inch by two-inch (maximum) pressure treated nailer may be placed at the finished floor elevation for attachment of interior finish materials. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches of soil.

R402.2.9.1 Heated slab-on-grade floors (Mandatory). The entire area of a heated slab-on-grade floor shall be thermally isolated from the soil with a minimum R-10 insulation. The insulation shall be an approved product for its intended use. If a soil gas control system is present below the heated slab-on-grade floor, which results in increased convective flow below the heated slab-on-grade floor, the heated slab-on-grade floor shall be thermally isolated from the sub-slab gravel layer. R-10 heated slab-on-grade floor insulation is required for all compliance paths.

R402.3 Fenestration (Prescriptive). In addition to the requirements of Section R402, fenestration shall comply with Sections R402.3.1 through R402.3.5.

R402.3.1 U-factor. An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements.

R402.3.2 Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50 percent glazed shall be permitted to satisfy the SHGC requirements.

R402.3.3 Glazed fenestration exemption. Up to 15 square feet of glazed fenestration per dwelling unit shall be permitted to be exempt from U-factor and SHGC requirements in Section R402.1.1. This exemption shall not apply to the U-factor alternative approach in Section R402.1.3 and the total UA alternative in Section R402.1.4.

R402.3.4 Opaque door exemption. One side-hinged opaque door assembly up to 24 square feet in area is exempted from the U-factor requirements in Section R402.1.1. This exemption shall not apply to the U-factor alternative approach in Section R402.1.3 and the total UA alternative in Section R402.1.4.

R402.4 Air leakage (Mandatory). The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.4.

R402.4.1 Building thermal envelope. The building thermal envelope shall comply with Sections R402.4.1.1 and R402.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

R402.4.1.1 Installation. The components of the building thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction. Where required by the code official, an approved third party shall inspect all components and verify compliance.

R402.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 5 air changes per hour. Testing shall be conducted with a blower at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of the penetrations of the building thermal envelope. Once visual inspection has confirmed sealing (see Table R402.4.1.1), operable windows and doors manufactured by small business shall be permitted to be sealed off at the frame prior to the test. During test:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures;
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures;
3. Interior doors, if installed at the time of the test, shall be open, access hatches to conditioned crawl spaces and conditioned attics shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

Exceptions:

1. Additions less than 500 square feet of conditioned floor area.
2. Additions tested with the existing home having a combined maximum air leakage rate of 7 air changes per hour. To qualify for this exception, the date of construction of the existing house must be prior to the 2009 Washington State Energy Code.

R402.4.2 Fireplaces. New wood-burning fireplaces shall have tight-fitting flue dampers or doors and outdoor combustion air. When using tight-fitting doors on factory-built fireplaces listed and labeled in accordance with UL 127, the doors shall be tested and listed for the fireplace. Where using tight-fitting doors on masonry fireplaces, the doors shall be listed and labeled in accordance with UL 907.

R402.4.3 Air leakage of fenestration. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot, and swinging doors no more than 0.5 cfm per square foot, when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled by the manufacturer.

Exceptions:

1. Field-fabricated fenestration products (window, skylights and doors).
2. Custom exterior fenestration products manufactured by a small business provided they meet the applicable provisions of Chapter 24 of the International Building Code. Once visual inspection has confirmed the presence of a gasket, operable windows and doors manufactured by small business shall be permitted to be sealed off at the frame prior to the test.

R402.4.4 Combustion air openings. Where open combustion air ducts provide combustion air to open combustion, space conditioning fuel burning appliances, the appliances and combustion air openings shall be located outside of the building thermal envelope, or enclosed in a room isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table R402.1.1, where the walls, floors and ceilings shall meet the minimum of the below-grade wall R-value requirement. The door into the room shall be fully gasketed and water lines and ducts in the room insulated in accordance with Section R403. The combustion air ducts shall be insulated where it passes through conditioned space to a minimum of R-8.

Exceptions:

1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2. Fireplaces and stoves complying with Section R402.4.2 and Section R1006 of the International Residential Code.

R402.4.5 Recessed lighting. Recessed luminaires installed in the building thermal envelope shall be Type IC-rated and certified under ASTM E283 as having an air leakage rate not more than 2.0 cfm when tested at 1.57 psf (75 Pa) pressure differential and shall have a label attached showing compliance with this test method. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling cover.

R402.5 Maximum fenestration U-factor (Mandatory). The area-weighted average maximum fenestration U-factor permitted using tradeoffs from Section R402.1.4 or R405 shall be 0.48 for vertical fenestration, and 0.75 for skylights.

**TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION**

COMPONENT	AIR BARRIER CRITERIA ^a	INSULATION CRITERIA ^a
General Requirements	A continuous barrier shall be installed in the building envelope. Exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Cavity insulation installation		All cavities in the thermal envelope shall be filled with insulation. The density of the insulation shall be at the manufacturer's product recommendation and said density shall be maintained for all volume of each cavity. Batt type insulation will show no voids or gaps and maintain an even density for the entire cavity. Batt insulation shall be installed in the recommended cavity depth. Where an obstruction in the cavity due to services, blocking, bracing or other obstruction exists, the batt product will be cut to fit the remaining depth of the cavity. Where the batt is cut around obstructions, loose fill insulation shall be placed to fill any surface or concealed voids, and at the manufacturer's specified density. Where faced batt is used, the installation tabs must be stapled to the face of the stud. There shall be no compression to the batt at the edges of the cavity due to inset stapling installation tabs. Insulation that upon installation readily conforms to available space shall be installed filling the entire cavity and within the manufacturer's density recommendation.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed. Batt insulation installed in attic roof assemblies may be compressed at exterior wall lines to allow for required attic ventilation.	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed. Batt insulation installed in attic roof assemblies may be compressed at exterior wall lines to allow for required attic ventilation.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.	
Rim joists	Rim joists shall be insulated and include the air barrier.	Rim joists shall be insulated and include the air barrier.
Floors (including above-garage and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking or floor framing cavity insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the underside of floor framing and extend from the bottom to the top of all perimeter floor framing members.

**TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION (CONT.)**

COMPONENT	AIR BARRIER CRITERIA^a	INSULATION CRITERIA^a
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I, black vapor retarder with overlapping joints taped.	Where provided instead of floor insulation, insulation shall be permanently attached to the crawlspace walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	
Narrow cavities		Batts in narrow cavities shall be cut to fit and installed to the correct density without any voids or gaps or compression, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned space.	
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the drywall.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring		Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls. There shall be no voids or gaps or compression where cut to fit. Insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed.	
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	
Concealed sprinklers	When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

R403.1 Controls (Mandatory). At least one thermostat shall be provided for each separate heating and cooling system.

R403.1.1 Programmable thermostat. Where the primary heating system is a forced-air furnace, at least one thermostat per dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. The thermostat shall allow for, at a minimum, a 5-2 programmable schedule (weekdays/weekends) and be capable of providing at least two programmable setback periods per day. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55 degrees F or up to 85 degrees F. The thermostat shall initially be programmed by the manufacturer with a heating temperature set point no higher than 70 degree F and a cooling temperature set point no lower than 78 degrees F. The thermostat and/or control system shall have an adjustable deadband of not less than 10 degrees F.

Exceptions:

1. Systems controlled by an occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.
2. Systems controlled solely by a manually operated timer capable of operating the system for no more than two hours.

R403.1.2 Heat pump supplementary heat (Mandatory). Unitary air cooled heat pumps shall include controls that minimize supplemental heat usage during start-up, set-up, and defrost conditions. These controls shall anticipate need for heat and use compression heating as the first stage of heat. Controls shall indicate when supplemental heating is being used through visual means (e.g., LED indicators). Heat pumps equipped with supplementary heaters shall be installed with controls that prevent supplemental heater operation above 40 degrees F. At final inspection the auxiliary heat lock out control shall be set to 35 degrees F or less.

R403.2 Hot water boiler outdoor temperature setback. Hot water boilers that supply heat to the building through one or two pipe heating systems shall have an outdoor temperature setback control that lowers the boiler water temperature based on the outdoor temperature.

R403.3 Ducts. Ducts and air handlers shall be in accordance with Sections R403.3.1 through R403.3.5.

R403.3.1 Insulation (Prescriptive). Ducts outside the building thermal envelope shall be insulated to a minimum of R-8. Ducts within a concrete slab or in the ground shall be insulated to R-10 with insulation designed to be used below grade.

Exception: Ducts or portions thereof located completely inside the building thermal envelope. Ducts located in crawl spaces do not qualify for this exception.

R403.3.2 Sealing (Mandatory). Ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code or International Residential Code, as applicable.

Exceptions:

1. Air-impermeable spray foam products shall be permitted to be applied without additional joint seals.
2. For ducts having a static pressure classification of less than 2 inches of water column (500Pa), additional closure systems shall not be required for continuously welded joints and seams, and locking-type joints and seams of other than the snap-lock and button-lock types.

R403.3.2.1 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested in accordance with ASHRAE 193.

R403.3.3 Duct testing (Mandatory). Ducts shall be leak tested in accordance with WSU RS-33, using the maximum duct leakage rates specified.

Exception: The total leakage test or leakage to the outdoors is not required for ducts and air handlers located entirely within the building thermal envelope. For forced air ducts, a maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts may be located outside the conditioned space. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool. Ducts located in crawl spaces do not qualify for this exception.

A written report of the results shall be signed by the party conducting the test and provided to the code official.

R403.3 Duct leakage (Mandatory). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: Total leakage shall be less than or equal to 4 cfm per 100 square feet of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All registers shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm per 100 square feet of conditioned floor area.
2. Postconstruction test: Leakage to outdoors shall be less than or equal to 4 cfm per 100 square feet of conditioned floor area or total leakage shall be less than or equal to 4 cfm per 100 square feet of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

R403.3.3 Building cavities (Mandatory). Building framing cavities shall not be used as ducts or plenums. Installation of ducts in exterior walls, floors or ceilings shall not displace required envelope insulation.

R403.4 Mechanical system piping insulation (Mandatory). Mechanical system piping capable of carrying fluids above 105 degrees F or below 55 degrees F shall be insulated to a minimum of R-6.

Exception: Up to 200 feet of hydronic system piping installed within the conditioned space may be insulated with a minimum of ½ inch insulation with a *k* value of 0.28.

R403.4.1 Protection of piping insulation. Piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance, and wind, and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

R403.5 Service hot water systems. Energy conservation measures for service hot water systems shall be in accordance with Sections R403.5.1 through R403.5.5.

R403.5.1 Heated water circulation and temperature maintenance system (Mandatory). Heated water circulation systems shall be in accordance with Section R403.5.1.1. Heat trace temperature maintenance systems shall be in accordance with Section R403.5.1.2. Automatic controls, temperature sensors and pumps shall be accessible. manual controls shall be readily accessible.

R403.5.1.1 Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

R403.5.1.2 Heat trace systems. Electric heat trace systems shall comply with IEEE 515.1 or automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping in accordance with the times when heated water is used in the occupancy.

R403.5.2 Demand recirculation systems. A water distribution system having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe shall be a demand recirculation water system. Pumps shall have controls that comply with both of the following:

1. The control shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.
2. The control shall limit the temperature of the water entering the cold water piping to 104 degrees F.

R403.5.3 Hot water pipe insulation (Prescriptive). Insulation for hot water pipe, both within and outside the conditioned space, shall have a minimum thermal resistance (R-value) of R-3.

Exception: Pipe insulation is permitted to be discontinuous where it passes through studs, joists or other structural members and where the insulated pipes pass other piping, conduit or vents, provided the insulation is installed tight to each obstruction.

R403.5.4 Drain water heat recovery units. Drain water heat recovery units shall comply with CSA 55.2. Drain water heat recovery units shall be in accordance with CSA 55.1. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi for individual units connected to one or two showers. Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi for individual units connected to three or more showers.

R403.5.5 Electric water heater insulation. All electric water heaters in unheated spaces or on concrete floors shall be placed on an incompressible, insulated surface with a minimum thermal resistance of R-10.

R403.6 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other approved means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

R403.6.1 Whole-House mechanical ventilation system fan efficacy. Mechanical ventilation system fans shall meet the efficacy requirements of Table R403.6.1.

Exception: Where mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an automatically commutated motor.

**TABLE R403.6.1
MECHANICAL VENTILATION SYSTEM FAN EFFICACY**

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	90
Bathroom, utility room	90	2.8 cfm/watt	Any

R403.7 Equipment sizing and efficiency rating (Mandatory). Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies. The output capacity of heating and cooling equipment shall not be greater than that of the smallest available equipment size that exceeds the loads calculated, including allowable oversizing limits. New or replaced heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.

R403.7.1 Electric resistance zone heated units. All detached one and two family dwellings and multiple single-family dwellings (townhouses) up to three stories in height above grade plane using electric zonal heating as the primary heat source shall install an inverter-driven ductless mini-split heat pump in the largest zone of the dwelling. Building permit drawings shall specify the heating equipment type and location of the heating system.

Exception: Total installed heating capacity of 2Kw per dwelling or less.

R403.8 Systems serving multiple dwelling units (Mandatory). Systems serving multiple dwelling units shall comply with Sections C403 and C404 of the WSEC-Commercial Provisions in lieu of Section R403.

R403.9 Snow melt system controls (Mandatory). Snow and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50 degrees F, and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40 degrees F.

R403.10 Pool and permanent spa energy consumption (Mandatory). Pools and permanent spas shall comply with Sections R403.10.1 through R403.10.4.2.

R403.10.1 Heaters. The electric power to heaters shall be controlled by a readily accessible on-off switch that is an integral part of the heater mounted on the exterior of the heater, or external to and within 3 feet of the heater. Operation of such switch shall not change the settings of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with constant burning pilot lights.

R403.10.2 Time switches. Time switches or other control method than can automatically turn off and on according to a preset schedule shall be installed for heaters and pump motors. Heaters and pump motors that have built in time switches shall be deemed in compliance with this requirement.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Pumps that operate solar and waste heat recovery pool heating systems.

R403.10.3 Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover, or other approved vapor retardant means.

Exception: Where more than 70 percent of the energy for heating, computed over an operating seasons, is from site-recovered energy, such as from a heat pump or solar source, covers or other vapor-retardant means shall not be required.

R403.10.4 Residential pool pumps. Pool pump motors may not be split-phase or capacitor start-induction run type.

R403.10.4.1 Two-speed capability.

1. Pump motors: Pool pump motors with a capability of operating at two or more speeds with low speed having a rotation rate that is no more than one-half of the motor's maximum rotation rate.
2. Pump controls: Pool pump motor controls shall have the capability of operating the pool pump with at least two speeds. The default circulation speed shall be the lowest speed, with a high speed override capability being for a temporary period not to exceed one normal cycle.

R403.10.4.2 Pump operation. Circulating water systems shall be controlled so that the circulation pump(s) can be conveniently turned off, automatically or manually, when the water system is not in operation.

R403.11 Portable spas (Mandatory). The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP-14.

R403.12 Residential pools and permanent residential spas. Residential swimming pools and permanent residential spas that are accessory to detached one and two family dwellings and townhouses three stories or less in height above grade plane and that are available only to the household and its guests shall be in accordance with APSP-15.

LIGHTING

R404.1 Lighting equipment (Mandatory). A minimum of 75 percent of lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

R404.1.1 Lighting equipment (Mandatory). Fuel gas lighting systems shall not have continuously burning pilot lights.

ADDITIONAL ENERGY EFFICIENCY REQUIREMENTS

R406.1 Scope. This section establishes options for additional criteria to be met for one and two family dwellings and townhouses, as defined in Section 101.2 of the International Residential Code to demonstrate compliance with this code.

R406.2 Additional energy efficiency requirements (Mandatory). Each dwelling unit in a residential building shall comply with sufficient options from Table R406.2 so as to achieve the minimum number of required credits. See yellow Energy Code Handout for options and number of credits required.

EXISTING BUILDINGS

R501.1 Scope. The provisions of this chapter shall control the alteration, repair, addition and change of occupancy of existing buildings and structures.

R501.1.1 Additions, alterations, or repairs. Additions, alterations, or repairs to an existing building, building system or portion thereof shall comply with Sections R502, R503 or R504. Unaltered portions of the existing building or building supply system shall not be required to comply with this code.

R501.2 Existing buildings. Except as specified in this chapter, this code shall not be used to require the removal, alteration or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.

R501.3 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices and systems that are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's authorized agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.

R501.4 Compliance. Alterations, repairs, additions and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for alterations, repairs, additions and changes of occupancy or relocation, respectively, in the International Residential Code, International Building Code, International Fire Code, International Fuel Gas Code, International Mechanical Code, Uniform Plumbing Code, International Property Maintenance Code, and NFPA 70.

R501.5 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs, provided hazards to life, health or property are not created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose or location.

R501.6 Historic buildings. The building official may modify the specific requirements of this code for historic buildings and require alternate provisions which will result in a reasonable degree of energy efficiency. This modification may be allowed for those buildings or structures that are listed in the state or national register of historic places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a national register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the national or state registers of historic places either individually or as a contributing building to a historic district by the state historic preservation officer or the keeper of the national register of historic places.

ADDITIONS

R502.1 General. Additions to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code where the addition alone complies, where the existing building and addition comply with this code as a single building, or where the building with the addition uses no more energy than the existing building. Additions shall be in accordance with Section R502.1.1 and R502.1.2.

R502.1.1 Prescriptive compliance. Additions shall comply with Sections R502.1.1.1 through R502.1.1.4.

R502.1.1.1 Building envelope. New building envelope assemblies that are part of the addition shall comply with Sections R402.1, R402.2, R402.3.1 through R402.3.5, and R402.4.

Exception: Where nonconditioned space is changed to conditioned space, the building envelope of the addition shall comply where the UA, as determined in Section R402.1.4, of the existing building and the addition, and any alterations that are part of the project, is less than or equal to the UA generated for the existing building.

R502.1.1.2 Heating and cooling systems. New heating, cooling and duct systems that are part of the addition shall comply with Sections R403.1, R403.2, R403.5 and R403.6.

Exception: The following need not comply with the testing requirements of Section R403.3.3:

1. Additions of less than 750 square feet.
2. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in WSU RS-33.
3. Ducts with less than 40 linear feet in unconditioned spaces.
4. Existing duct systems constructed, insulated or sealed with asbestos.

R502.1.1.3 Service hot water systems. New service hot water systems that are part of the addition shall comply with Section R403.4.

R502.1.1.4 Lighting. New lighting systems that are part of the addition shall comply with Section 404.1

ALTERATIONS

R503.1 General. Alterations to any building or structure shall comply with the requirements of the code for new construction. Alterations shall be such that the existing building or structure is no less conforming to the provisions of this code than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems. Alterations shall be such that the existing building or structure uses no more energy than the existing building or structure prior to alteration. Alterations to existing buildings shall comply with Section R503.1 through R503.2. The code official may approve designs of alterations which do not fully conform to all of the requirements of this code where in the opinion of the building official full compliance is physically impossible and/or economically impractical and:

1. The alteration improves the energy efficiency of the building; or
2. The alteration is energy efficient and is necessary for the health, safety, and welfare of the general public.

R503.1.1 Building envelope. Building envelope assemblies that are part of the alterations shall comply with Section R402.1 or R402.1.4, Sections R402.2.1 through R402.2.11, R402.3.1, R402.3.2, R402.4.3 and R402.4.4.

Exception: The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation. 2x4 framed walls shall be insulated to a minimum of R-15 and 2x6 framed walls shall be insulated to a minimum of R-21.
3. Construction where the existing roof, wall or floor cavity is not exposed.
4. Roof recover.
5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided the code does not require the glazing fenestration to be replaced.

R503.1.1.1 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for U-factor and SHGC in Table R402.1.1.

R503.1.2 Heating and cooling systems. New heating, cooling and duct systems that are part of the alteration shall comply with Sections R403.1, R403.2, R403.3 and R403.6.

Exceptions:

1. Where ducts from an existing heating and cooling system are extended, duct systems with less than 40 linear feet in unconditioned spaces shall not be required to be tested in accordance with Section R403.2.2.
2. Existing duct systems constructed, insulated or sealed with asbestos.

R503.1.3 Service hot water systems. New service hot water systems that are part of the alteration shall comply with Section R403.4.

R503.1.4 Lighting. New lighting systems that are part of the alteration shall comply with Section R404.1.

Exception: Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

R503.2 Change in space conditioning. Any nonconditioned or low-energy space that is altered to become conditioned space shall be required to be brought into full compliance with this code.

Exception: Where the simulated performance option in Section R405 is used to comply with this section, the annual energy use of the proposed design is permitted to be 110 percent of the annual energy use otherwise allowed by Section R405.3.

REPAIRS

R504.1 General. Buildings, structures and parts thereof shall be repaired in compliance with Section R501.3 and this section. Work on nondamaged components that is necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to the requirements for alterations in this chapter. Routine maintenance required by Section R501.3, ordinary repairs exempt from permit, and abatement of wear due to normal service conditions shall not be subject to the requirements for repairs in this section. The code official may approve designs of repairs which do not fully conform with all of the requirements of this code where in the opinion of the building official full compliance is physically impossible and/or economically impractical and:

1. The repair improves the energy efficiency of the building; or
2. The repair is energy efficient and is necessary for the health, safety, and welfare of the general public.

R504.2 Application. For the purposes of this code, the following shall be considered repairs.

1. Glass only replacements in an existing sash and frame.
2. Roof repairs.
3. Repairs where only the bulb and/or ballast within the existing luminaires in a space are replaced provided that the replacement does not increase the installed interior lighting power.

R505.1 Change in occupancy or use. Any space not within the scope of Section R101.2 which is converted to space that is within the scope of Section R101.2 shall be brought into full compliance with this code.

Section 12

MISCELLANEOUS SUBJECTS

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FIGURES IN DWELLING PROVISIONS

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FIGURE 1 PROPERTY LINE PROTECTION

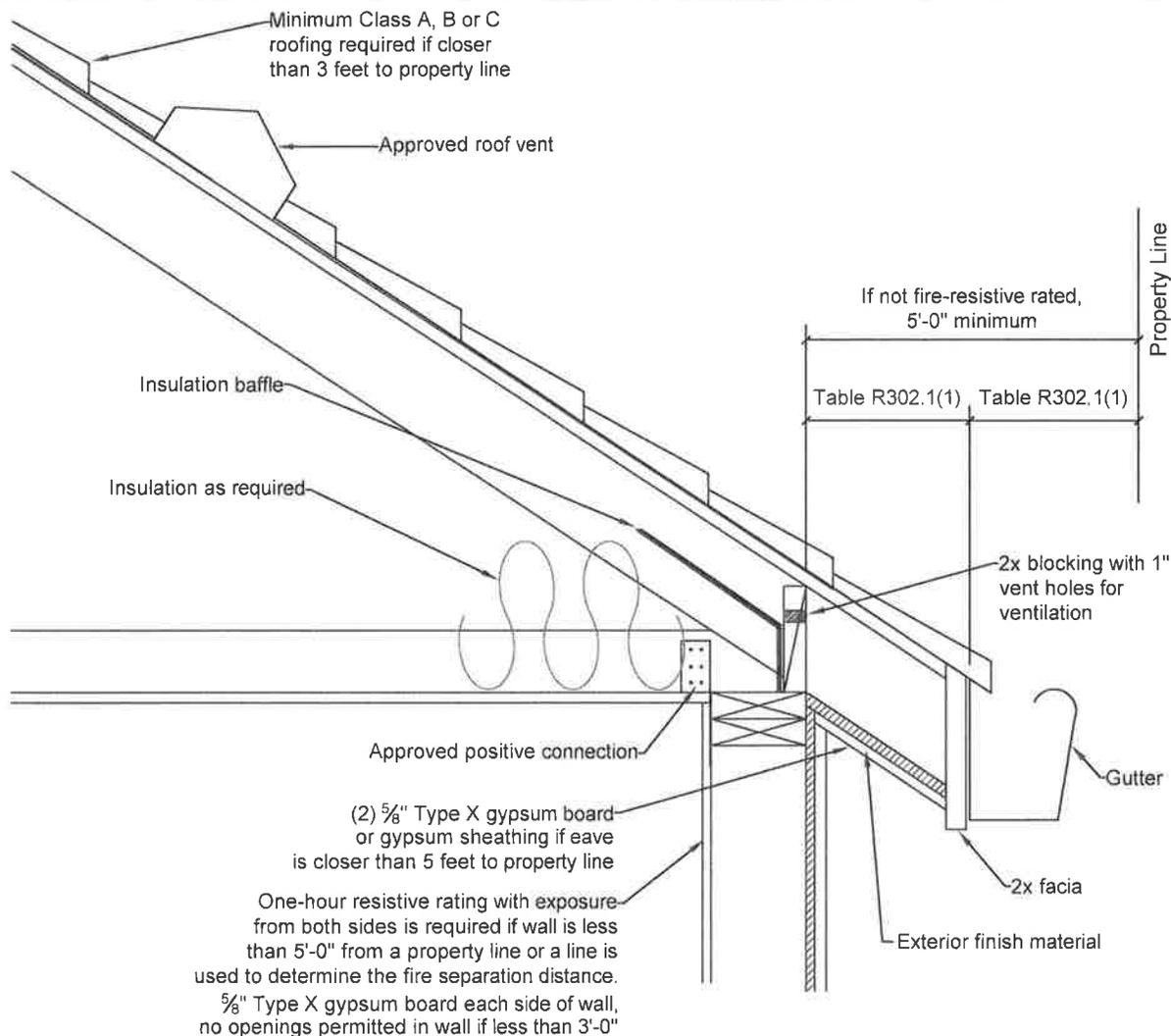


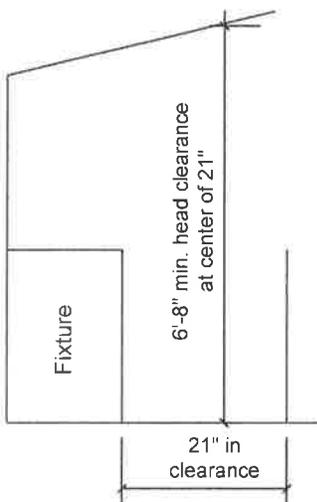
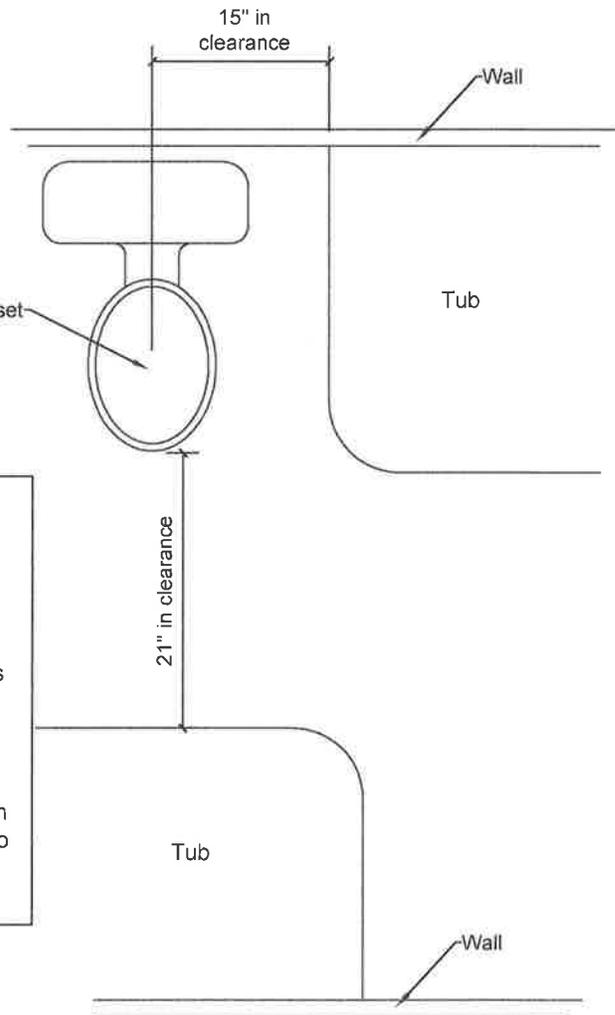
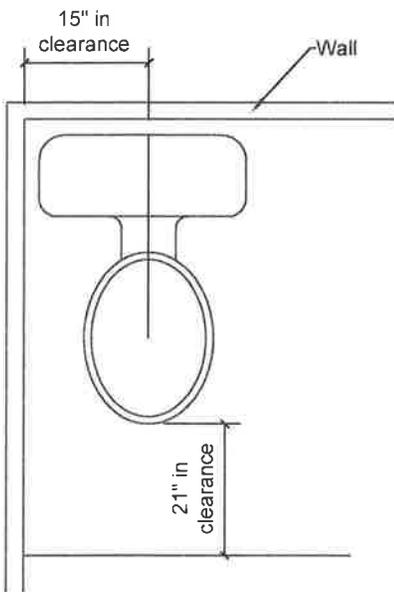
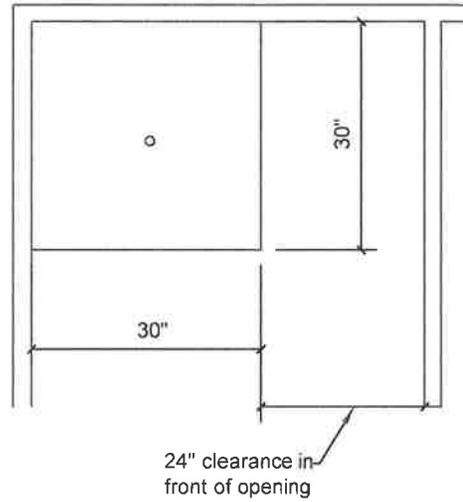
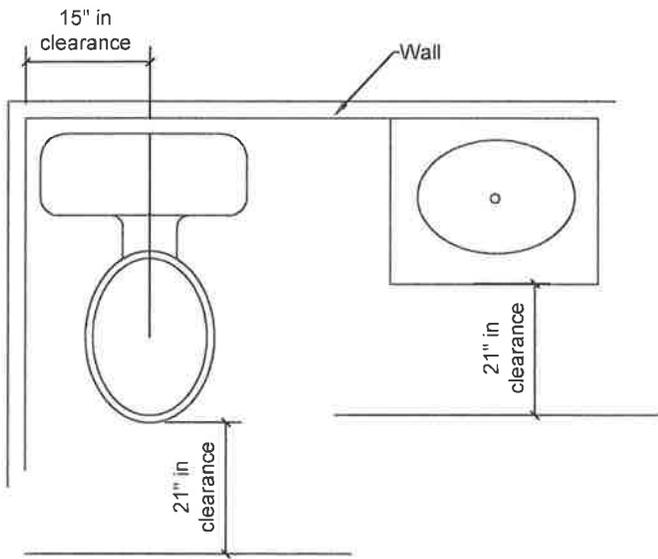
TABLE R302.1(1) EXTERIOR WALLS

EXTERIOR WALL ELEMENT	EXTERIOR WALL ELEMENT	MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistive rated	1-hour tested in accordance with ASTM E 119 or UL 263 with exposure from both side	< 5 feet
Walls	Not fire-resistive rated	0 hours	≥ 5 feet
Projections	Not allowed	N/A	< 2 feet
Projections	Fire-resistance rated	1 hour on the underside ^{a,b}	≥ 2 feet to < 5 feet
Projections	Not fire-resistance rated	0 hours	≥ 5 feet
Openings in walls	Not allowed	N/A	< 3 feet
Openings in walls	25% maximum of wall area	0 hours	3 feet
Openings in walls	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 3 feet
Penetrations	All	None required	3 feet

a. Roof eave fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave if fire blocking is provided from the wall top plate to the underside of the roof sheathing.

b. Roof eave fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave that gable vent openings are not installed.

FIGURE 2 TOILET, BATH & SHOWER SPACES



R307.1 Space required. Fixtures shall be spaced as shown.

R307.2 Bathtub and shower spaces. Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a nonabsorbent surface. Such wall surfaces shall extend to a height of not less than 6 feet above the floor.

FIGURE 3 GLAZING IN HAZARDOUS LOCATIONS

R308.4 Hazardous locations. The locations specified in Sections R308.4.1 through R308.4.7 shall be considered specific hazardous locations for the purposes of glazing.

R308.4.1 Glazing in doors. Glazing in all fixed and operable panels in swinging, sliding, and bifold doors shall be considered hazardous locations.

Exceptions:

1. Glazed openings of a size through which a 3-inch-diameter sphere is unable to pass.
2. Decorative glazing.

R308.4.2 Glazing adjacent doors. Glazing in an individual fixed or operable panel adjacent to a door shall be considered to be a hazardous location where the bottom exposed edge of the glazing is less than 60 inches above the floor or walking surface and it meets either of the following conditions:

1. Where the glazing is within 24 inches of either side of the door in the plane of the door in a closed position.
2. Where the glazing is on a wall perpendicular to the plane of the door in a closed position and within 24 inches of the hinge side of an-swinging door.

Exceptions:

1. Decorative glazing.
2. When there is an intervening wall or other permanent barrier between the door and the glazing.
3. Where access through the door is to a closet or storage area 3 feet or less in depth. Glazing in this application shall comply with Section R308.4.3.
4. Glazing that is adjacent to the fixed panel of patio doors.

R308.4.3 Glazing in windows. Glazing in an individual or operable panel that meets all of the following conditions shall be considered a hazardous location:

1. The exposed area of an individual pane is larger than 9 square feet;
2. The bottom edge of the glazing is less than 18 inches above the floor;
3. The top edge of the glazing is more than 36 inches above the floor; and
4. One or more walking surfaces are within 36 inches, measured horizontally and in a straight line, of the glazing.

Exceptions:

1. Decorative glazing.
2. When a horizontal rail is installed on the accessible side(s) of the glazing 34 to 38 inches above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass and be a minimum of 1 ½ inches in cross sectional height.
3. Outboard panes in insulating glass units and other multiple glazed panels when the bottom edge of the glass is 25 feet or more above grade plane, a roof, walking surfaces or other horizontal [within 45 degrees of horizontal] surface adjacent to the glass exterior.

R308.4.4 Glazing in guards and railings. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface shall be considered a hazardous location.

R308.4.5 Glazing and wet surfaces. Glazing in walls, enclosures, or fences containing or facing hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers and indoor or outdoor swimming pools where the bottom exposed edge of the glazing is less than 60 inches measured vertically above standing or walking surfaces shall be considered a hazardous location. This shall apply to single glazing and all panes in multiple glazing.

Exception:

Glazing is more than 60 inches, measured horizontally, and in a straight line, from the water's edge of a bathtub, hot tub, spa, whirlpool, or swimming pool or from the edge of a shower, sauna or steam room.

FIGURE 3 - CONTINUED GLAZING IN HAZARDOUS LOCATIONS

R308.4.6 Glazing adjacent stairs and ramps. Glazing where the bottom exposed edge of the glazing is less than 36 inches above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramps shall be considered a hazardous location.

Exceptions:

1. Where a rail is installed on the accessible side(s) of the glazing 34 to 38 inches above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass and be a minimum of 1 ½ inches in cross sectional height.
2. Glazing 36 inches or more measured horizontally from the walking surface.

R308.4.7 Glazing adjacent to the bottom stair landing. Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 36 inches above the landing and within a 60 inch horizontal arc less than 180 degrees from the bottom tread nosing shall be considered to be a hazardous location.

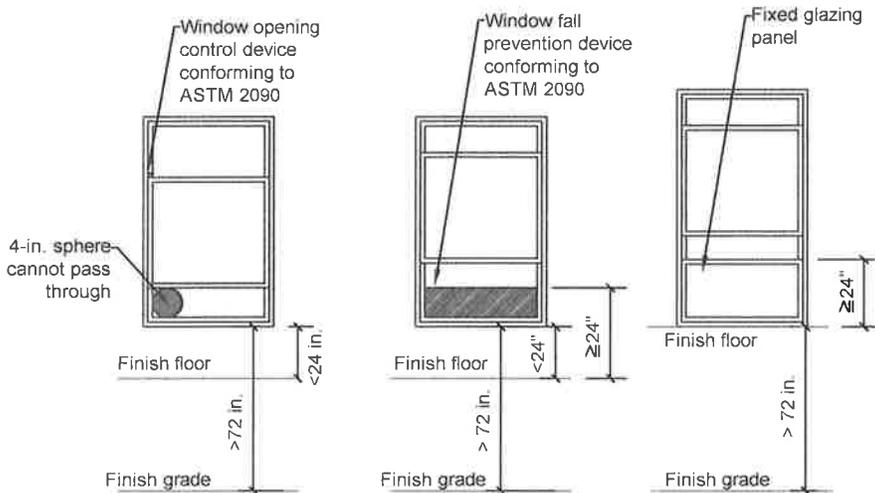
Exception: The glazing is protected by a guard complying with Section R312 and the plane of the glass is more than 18 inches from the guard.

R312.2 Window fall protection. Window fall protection shall be provided in accordance with Sections R312.2.1 and R312.2.2.

R312.2.1 Window sills. In dwelling units, where the top of the sill of an operable window opening is located less than 24 inches above the finished floor and greater than 72 inches above the finished grade or other surface below on the exterior of the building, the operable window shall comply with one of the following:

1. Operable windows with openings that will not allow a 4-inch diameter sphere to pass through the opening where the opening is in its largest opened position.
2. Operable windows that are provided with window fall prevention devices that comply with ASTM F 2090.
3. Operable windows that are provided with window opening control devices that comply with Section R312.2.2..

R312.2.2 Window opening control devices. Window opening control devices shall comply with ASTM F 2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section R310.2.1 (Figure 5)



Examples:



FIGURE 3 - CONTINUED GLAZING IN HAZARDOUS LOCATIONS

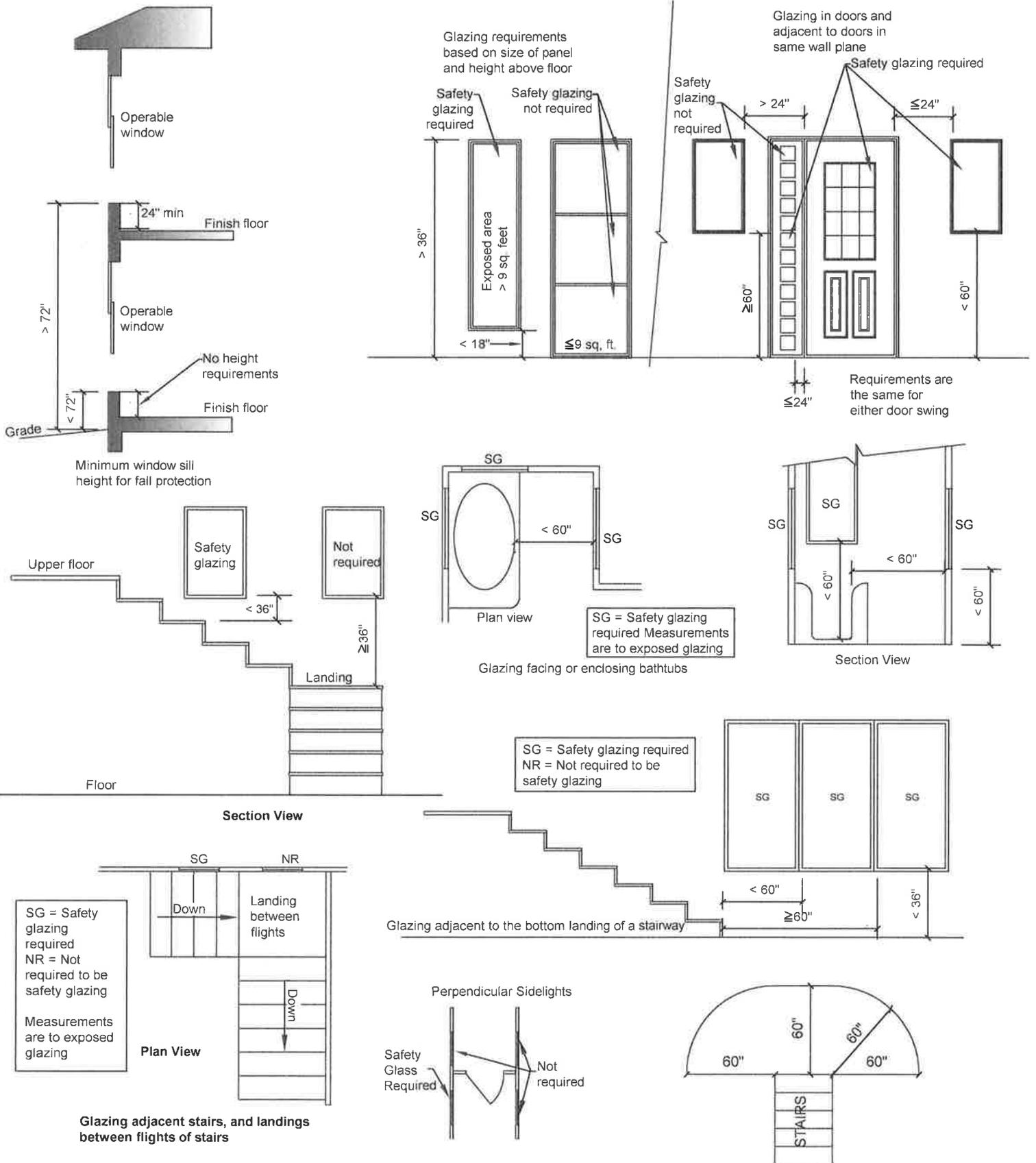


FIGURE 4 GARAGE/DWELLING SEPARATION

R302.6 Dwelling-garage fire separation. The garage shall be separated as required by Table R302.6. Openings in garage walls shall comply with Section R302.5. Attachment of gypsum board shall comply with Table R702.3.5. The wall separation provisions of Table R302.6 shall not apply to garage walls that are perpendicular to the adjacent dwelling unit wall.

R302.5.1 Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1 $\frac{3}{8}$ " in thickness, solid or honeycomb core steel doors not less than 1 $\frac{3}{8}$ " thick, or 20-minute fire-rated doors, equipped with a self-closing device.

R302.5.2 Duct penetration. Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage sheet steel or other approved material and shall have no openings into the garage.

R302.5.3 Other penetrations. Penetrations through the separation required in Section R302.6 shall be protected with fireblocking with an *approved* material to resist the free passage of flame and products of combustion. The material filling the annular space shall not be required to meet ASTM E 136 requirements.

R302.7 Under-stair protection. Enclosed accessible space under stairs shall have walls, under-stair surface and any soffits protected on the enclosed side with $\frac{1}{2}$ " gypsum board.

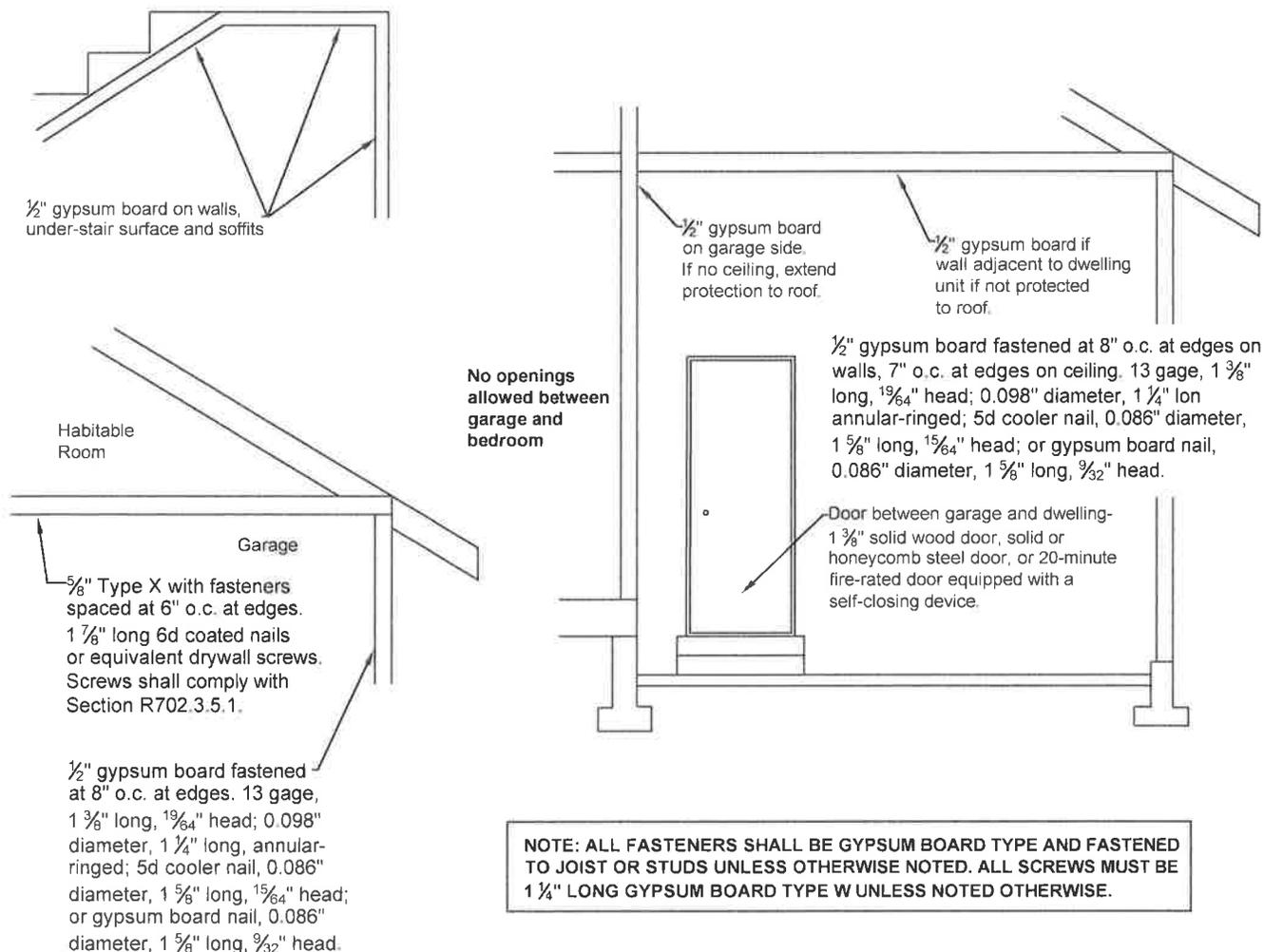


FIGURE 5 EMERGENCY ESCAPE & RESCUE OPENINGS

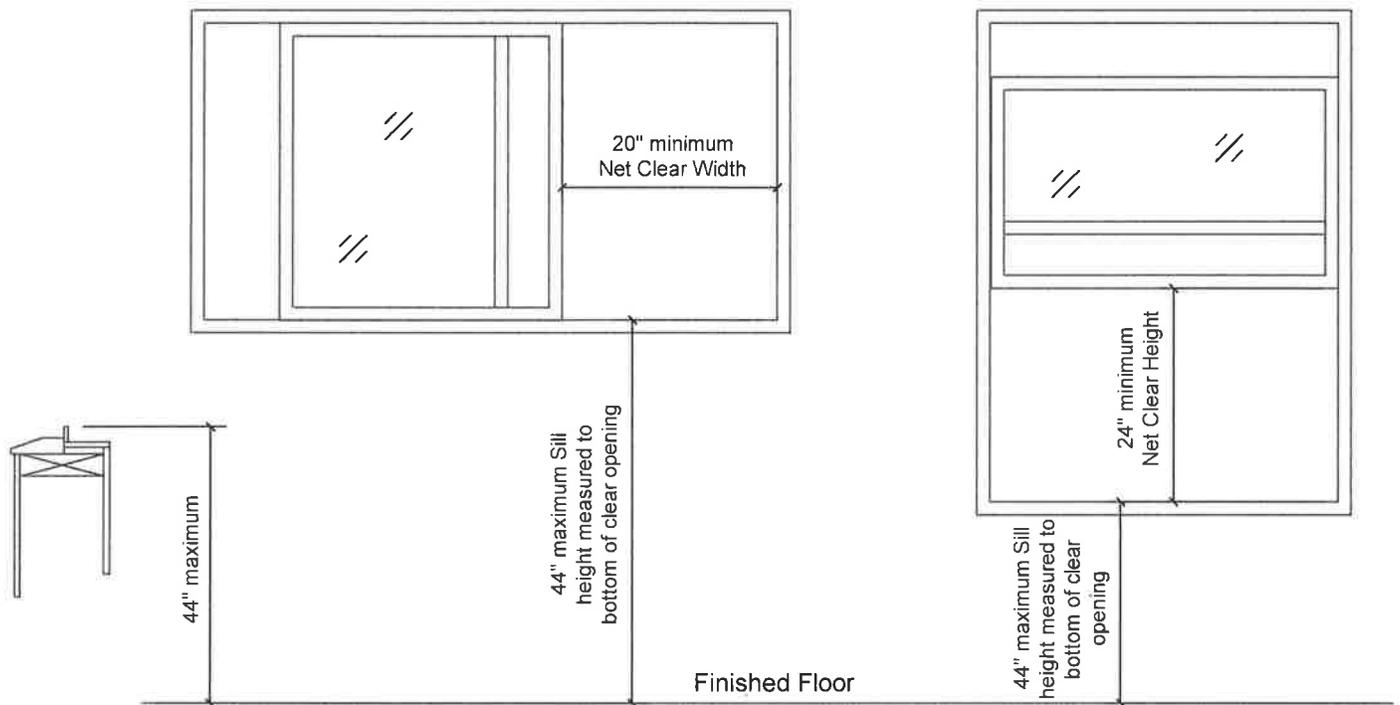
R310.2.1 Minimum opening area. Emergency and escape rescue openings shall have a net clear opening of not less than 5.7 square feet. The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. The net clear height opening shall be not less than 24 inches and the net clear width shall be not less than 20 inches.

Exception: Grade floor or below grade openings shall have a net clear opening of not less than 5 square feet.

R310.2.2 Window sill height. Where a window is provided as the emergency escape and rescue opening, it shall have a sill height of not more than 44 inches above the floor; where the sill height is below grade, it shall be provided with a window well in accordance with Figure 6.

R310.1.1 Operational constraints and opening control devices. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys, tool or special knowledge. Window opening control devices complying with ASTM F 2090 shall be permitted for use on windows serving as a required emergency escape and rescue opening.

R310.3 Emergency escape and rescue doors. Where a door is provided as the required emergency escape and rescue opening, it shall be permitted to be a side-hinged door or a slider. Where the opening is below the adjacent ground elevation, it shall be provided with a bulkhead enclosure.



Minimum Width/Height Requirements for Emergency Escape and Rescue Windows (inches)

Width	20	20.5	21	21.5	22	22.5	23	23.5	24	24.5	25	25.5	26	26.5	27
Height	41	40	39.1	38.2	37.3	36.5	35.7	35	34.2	33.5	32.8	32.2	31.6	31	30.4
Width	27.5	28	28.5	29	29.5	30	30.5	31	31.5	32	32.5	33	33.5	34	34.2
Height	29.8	29.3	28.8	28.3	27.8	27.4	26.9	26.5	26.1	25.7	25.3	24.9	24.5	24.1	24

FIGURE 6 WINDOW WELLS

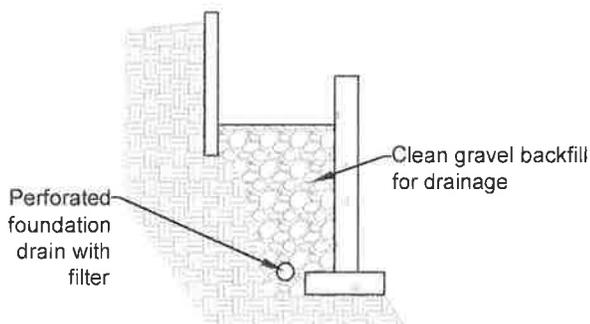
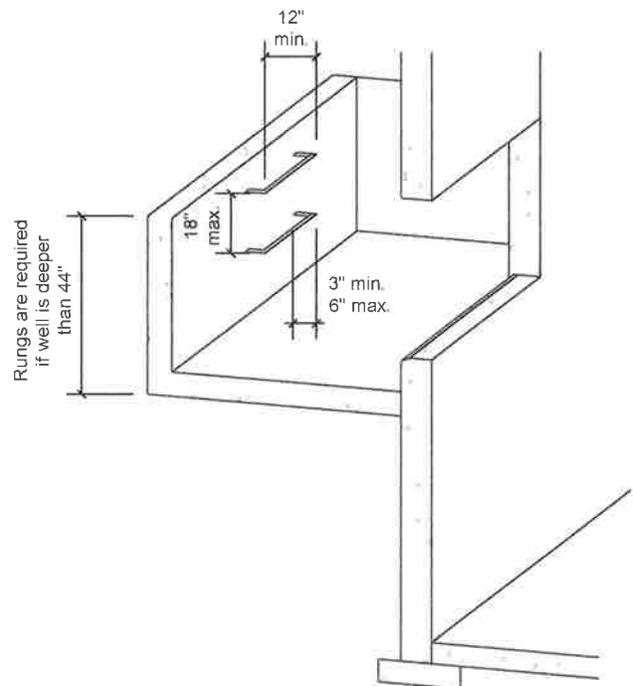
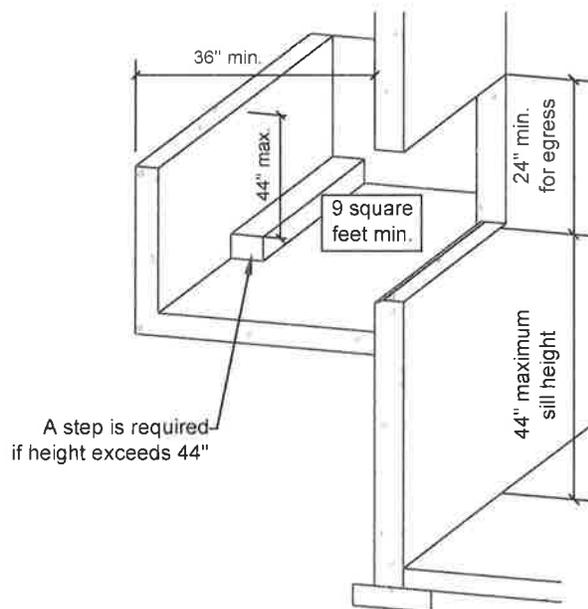
R310.2.3 Window wells. The horizontal area of the window well shall be not less than 9 square feet, with a horizontal projection and width of not less than 36 inches. The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

Exception: The ladder or steps required by Section R310.2.3.1 shall be permitted to encroach not more than 6 inches into the required dimensions of the window well.

R310.2.3.1 Ladder and steps. Window well with a vertical depth greater than 44 inches shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or steps required by this section shall not be required to comply with Sections R311.7 and R311.8. Ladders or rungs shall have an inside width of not less than 12 inches, shall project not less than 3 inches from the wall and shall be spaced not more than 18 inches on center vertically for the full height of the window well.

R310.2.3.2 Drainage. Window wells shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section R405.1 or by an approved alternative method.

Exception: A drainage system for window wells is not required where the foundation is on well-drained soil or sand-gravel mixture soils in accordance with the United Soil Classification System, Group I Soils, as detailed in Table R405.1.



Drainage for a window well serving an emergency escape and rescue opening

FIGURE 7 TYPICAL STAIR SECTION

R311.7.5.1 Risers. The riser height shall be not more than $7\frac{3}{4}$ inches. The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch. Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees from the vertical. Open risers are permitted provided that the openings located more than 30 inches, as measured vertically, to the floor or grade below do not permit the passage of a 4 inch diameter sphere.

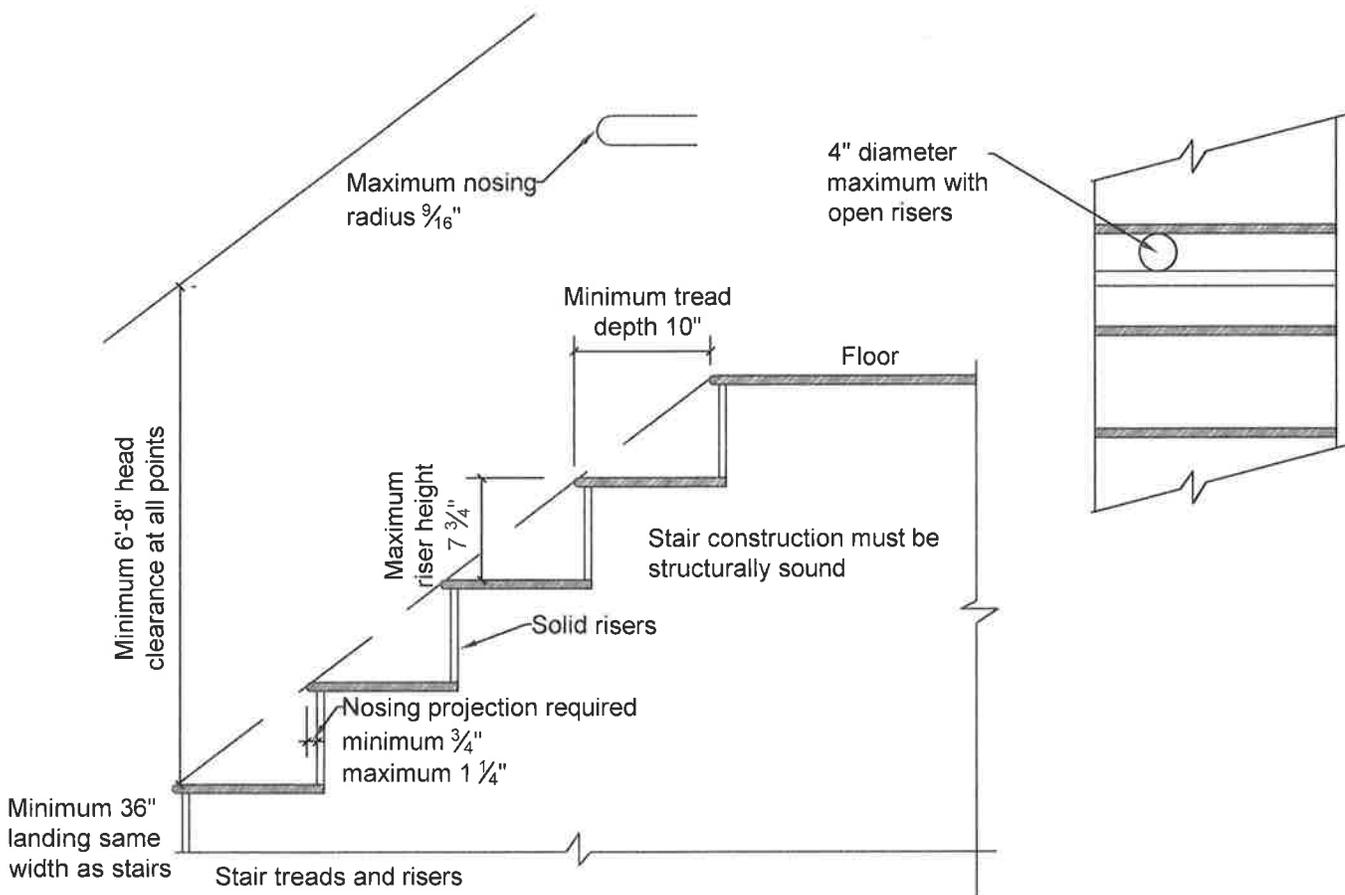
Exceptions:

1. The opening between adjacent treads is not limited on spiral stairways.
2. The riser height of spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.5.2 Treads. The tread depth shall be not less than 10 inches. The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch.

R311.7.5.3 Nosings. The radius of curvature at the nosing shall be not greater than $\frac{9}{16}$ inch. A nosing projection not less than $\frac{3}{4}$ inch and not more than $1\frac{1}{4}$ inches shall be provided on stairways with solid risers. The greatest nosing projection shall not exceed the smallest nosing projection by more than $\frac{3}{8}$ inch between two stories, including the nosing level of floors and landings. Beveling of nosings shall not exceed $\frac{1}{2}$ inch.

Exception: A nosing is not required where the tread depth is not less than 11 inches.



FOR WINDING, CIRCULAR OR SPIRAL STAIRS, SEE FIGURE 11

FIGURE 7 - CONTINUED STAIRWAY ILLUMINATION

R303.7 Interior stairway illumination. Interior stairways shall be provided with an artificial light source to illuminate the landings and treads. The light source shall be capable of illuminating treads and landings to levels of not less than 1 foot-candle (11 lux) as measured at the center of treads and landings. There shall be a wall switch at each floor level to control the light source where the stairway has six or more risers.

Exception: A switch is not required where remote, central or automatic control of lighting is provided.

R303.7.1 Light activation. Where lighting outlets are installed in interior stairways, there shall be a wall switch at each floor level to control the lighting outlet where the stairway has six or more risers. The illumination of exterior stairways shall be controlled from inside the dwelling unit.

R303.8 Exterior stairway illumination. Exterior stairways shall be provided with an artificial light source located at the top landing of the stairway. Exterior stairways providing access to a basement from the outdoor grade level shall be provided with an artificial light source located at the bottom landing of the stairway.

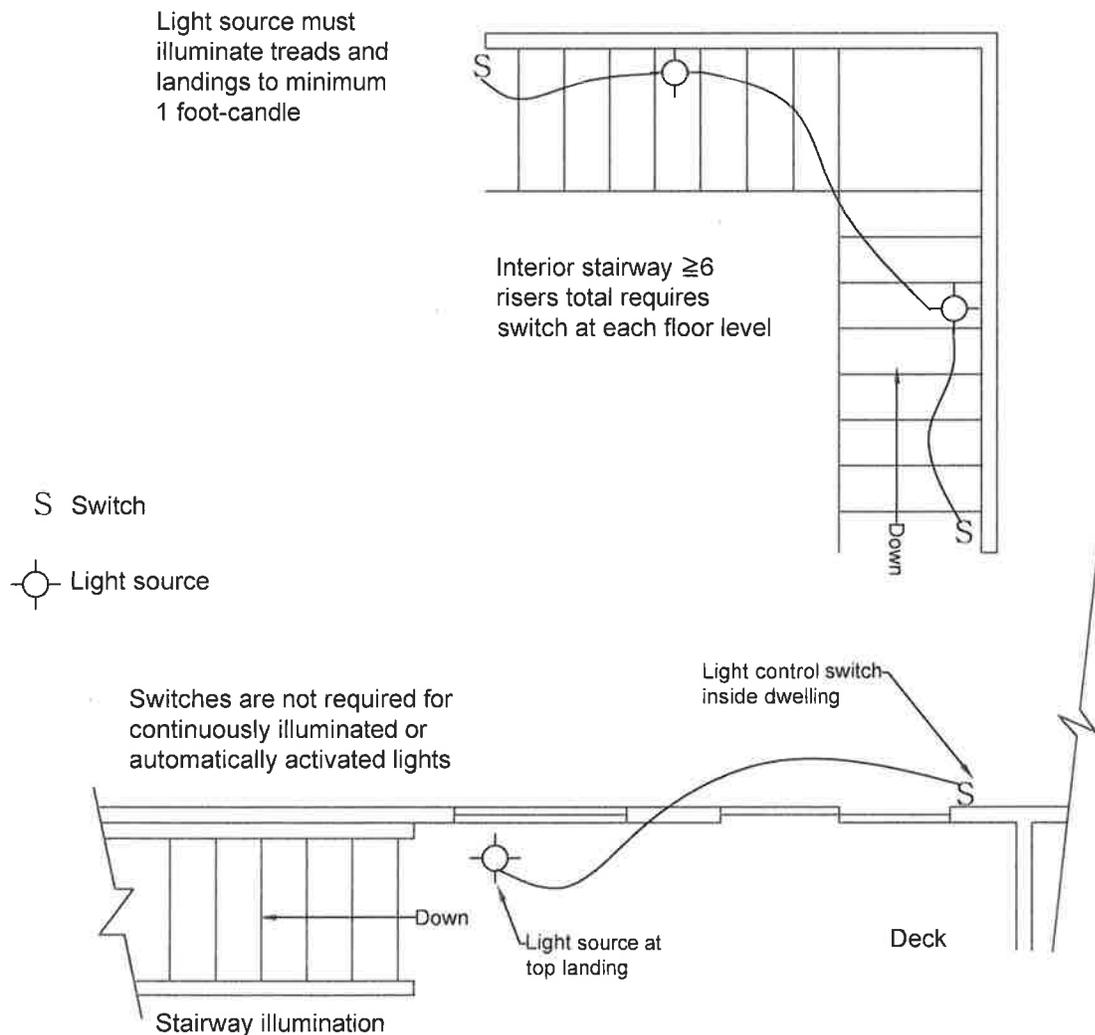


FIGURE 8 DOORS & LANDINGS

R311.1 Means of egress. Dwellings shall be provided with a means of egress in accordance with this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the dwelling to the required egress door without requiring travel through a garage. The required egress door shall open directly into a public way or to a yard or court that opens to a public way.

R311.2 Egress door. Not less than one egress door shall be provided for each dwelling unit. The egress door shall be side-hinged, and shall provide a minimum clear width of not less than 32 inches where measured between the face of the door and the stop, with the door open 90 degrees. The clear height of the door opening shall be not less than 78 inches in height measured from the top of the threshold to the bottom of the stop. Other doors shall not be required to comply with these minimum dimensions. Egress doors shall be readily openable from inside the dwelling without the use of a key or special knowledge or effort.

R311.3 Floors and landings at exterior doors. There shall be a landing or floor on each side of each exterior door. The width of each landing shall not be less than the door served. Every landing shall have a minimum dimension of 36 inches measured in the direction of travel. Exterior landings shall be permitted to have a slope not to exceed $\frac{1}{4}$ unit vertical in 12 units horizontal (2 percent).

Exception: Exterior balconies less than 60 square feet and only accessible from a door are permitted to have a landing less than 36 inches measured in the direction of travel.

R311.3.1 Floor elevations at the required egress doors. Landings or finished floors at the required egress door shall not be more than $1\frac{1}{2}$ inches lower than the top of the threshold.

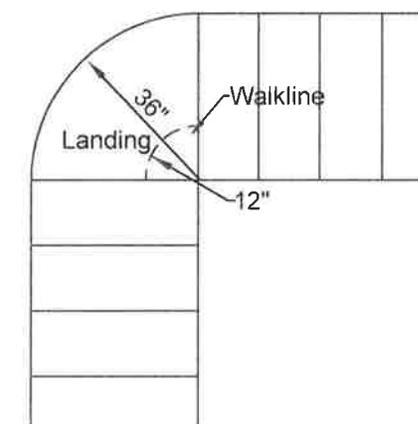
Exception: The landings or floor on the exterior side shall not be more than $7\frac{3}{4}$ inches below the top of the threshold provided the door does not swing over the landing or floor.

Where exterior landings or floors serving the required egress door are not at grade, they shall be provided with access to grade by means of an approved ramp or stairway.

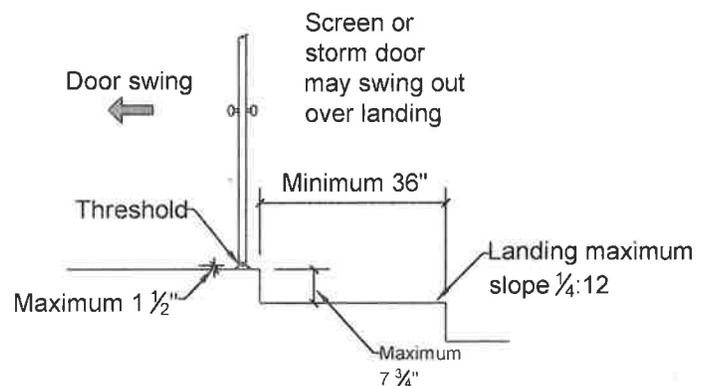
R311.3.2 Floor elevations for other exterior doors. Doors other than the required egress door shall be provided with landings or floors not more than $7\frac{3}{4}$ inches below the top of the threshold.

Exception: A landing is not required where a stairway of not more than two risers is located on the exterior side of the door, provided that the door does not swing over the stairway.

R311.3.3 Storm and screen doors. Storm and screen doors shall be permitted to swing over all exterior stairs and landings.



Curved landing at turn in stair.



Landing on exterior side of required egress door.

FIGURE 8A RAMPS & GUARDS

R311.8 Ramps

R311.8.1 Maximum slope. Ramps serving the egress door required by section R311.2 shall have a slope of not more than 1 unit vertical in 12 units horizontal (8.3 percent slope). All other ramps shall have a maximum slope of 1 unit vertical in 8 units horizontal (12.5 percent).

Exception: Where it is technically infeasible to comply because of site constraints, ramps shall have a slope of not more than 1 unit vertical in 8 units horizontal (12.5 percent).

R311.8.2 Landings required. There shall be a floor or landing at the top and bottom of each ramp, where doors open onto ramps, and where ramps change directions. The width of the landing perpendicular to the ramp slope shall be not less than 36 inches.

R311.8.3 Handrails required. Handrails shall be provided on not less than one side of all ramps exceeding a slope of one unit vertical in 12 units horizontal (8.33 percent slope).

R311.8.3.1 Height. Handrail height, measured above the finished surface of the ramp slope, shall be not less than 34 inches and not more than 38 inches.

R311.8.3.2 Grip size. Handrails on ramps shall comply with Figure 10.

R311.8.3.3 Continuity. Handrails where required on ramps shall be continuous for the full length of the ramp. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1 ½ inches between the wall and the handrails.

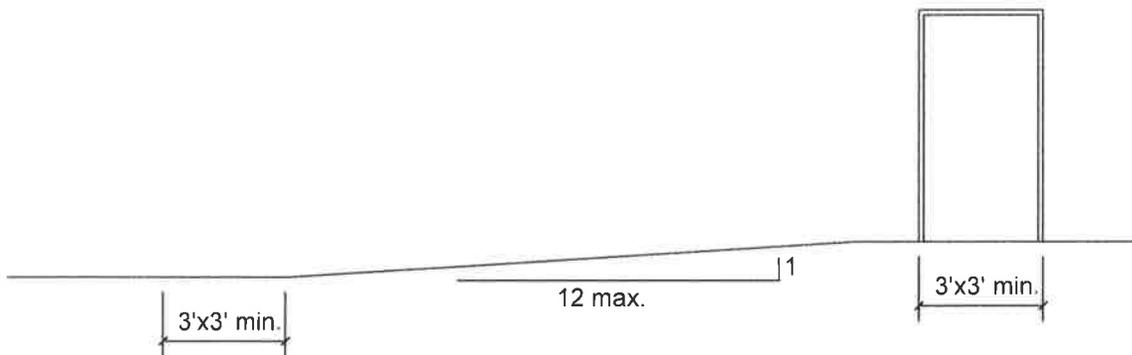


FIGURE 8A - CONTINUED RAMPS & GUARDS

R312.1 Guards

R312.1.1 Where required. Guards shall be located along open-sided walking surfaces, including stairs, ramps and landings that are located more than 30 inches measured vertically to the floor or grade below at any point within 36 inches horizontally to the edge of the open side. Insect screening shall not be considered as a guard.

R312.1.2 Height. Required guards at open sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches in height as measured vertically above the adjacent walking surface or the line connecting the leading edges of the treads.

Exceptions:

1. Guards on the open sides of stairs shall have a height not less than 34 inches measured vertically from a line connecting the leading edges of the treads.
2. Where the top of the guard also serves as a handrail on the open sides of stairs, the top of the guard shall not be less than 34 inches and not more than 38 inches measured vertically from a line connecting the leading edge of the treads.

R312.3 Opening limitations. Required guards shall not have openings from the walking surface to the required guard height which allows passage of a sphere 4 inches in diameter.

Exceptions:

1. The triangular openings at the open side of stair, formed by the riser, tread and bottom rail of a guard, shall not allow passage of a sphere 6 inches in diameter.
2. Guards on the open side of stairs shall not have openings which allow passage of a sphere 4 3/8 inches in diameter.

R312.1.4 Exterior plastic composite guards. Plastic composite exterior guards shall comply with the requirements of Section R317.4.

Guards and handrails shall withstand a single concentrated load applied in any direction at any point along the top of 200 pounds per square foot. Guard in-fill components (except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the infill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load. For additional information on how to comply, contact the Building Department.

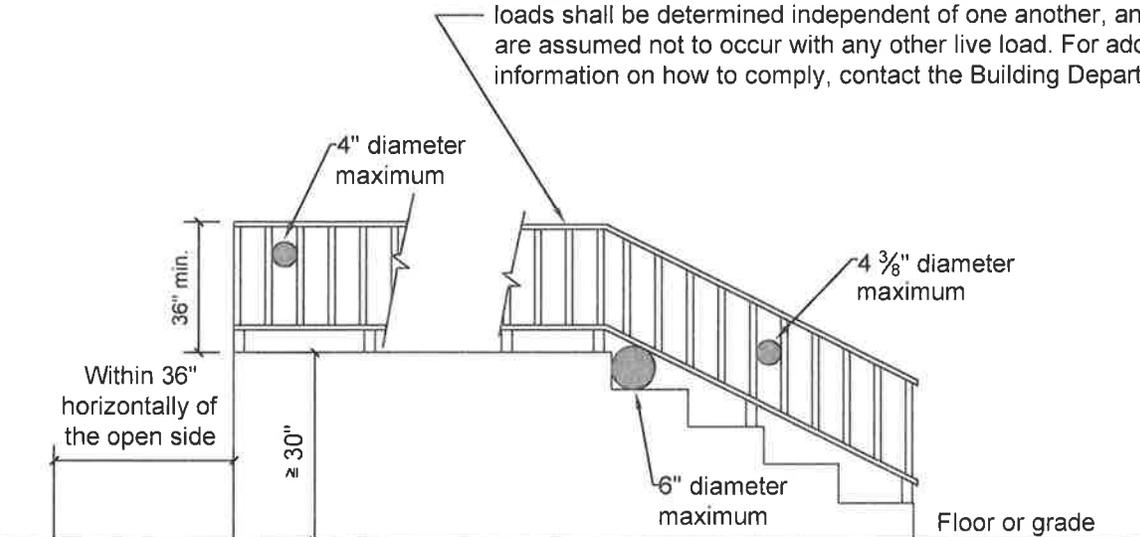


FIGURE 9 HANDRAILS

R311.7.8 Handrails. Handrails shall be provided on at least one side of each continuous run of treads or flight with four or more risers.

R311.7.8.1 Height. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finished surface of ramp slope, shall be not less than 34 inches and not more than 38 inches.

Exceptions:

1. The use of a volute, turnout or starting easing shall be allowed over the lowest tread.
2. Where handrail fittings or bendings are used to provide continuous transition between flights, transitions at winder treads, the transition from handrail to guard, or used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed 38 inches.

R311.7.8.2 Continuity. Handrails for stairways shall be 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. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space not less than 1 1/2 inches between the wall and the handrail.

Exceptions:

1. Handrails shall be permitted to be interrupted by a newel post at the turn.
2. The use of a volute, turnout, starting easing or starting newel shall be allowed over the lowest tread.

R311.7.8.3 Grip size. All required handrails shall comply with Figure 10.

Note: Open sides of stairs with a total rise of more than 30 inches above the floor or grade below shall have guards not less than 34 inches in height measured vertically from the nosing of the treads. See Figure 8A.

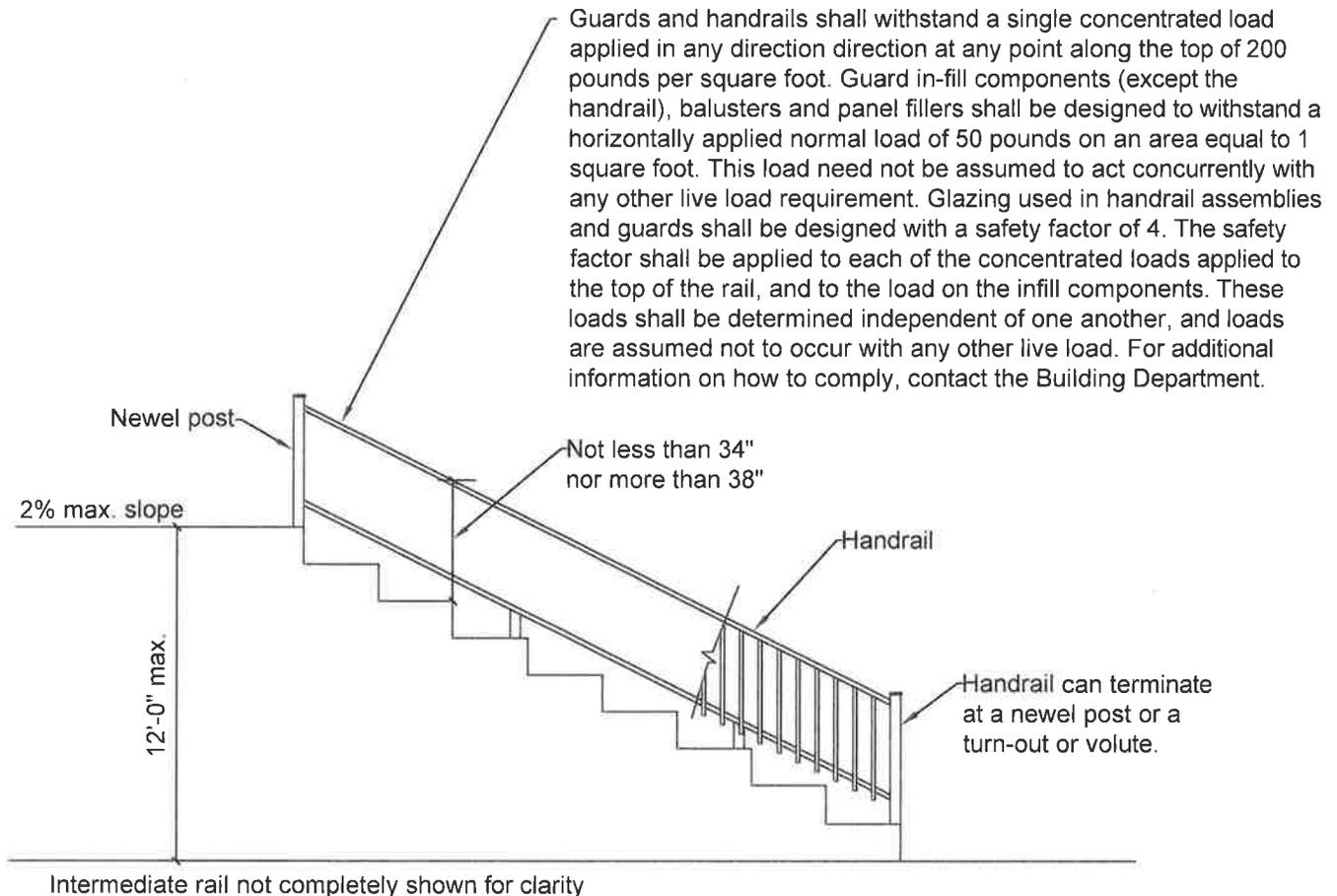
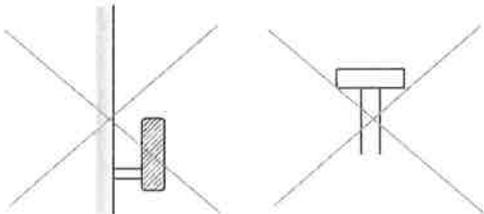
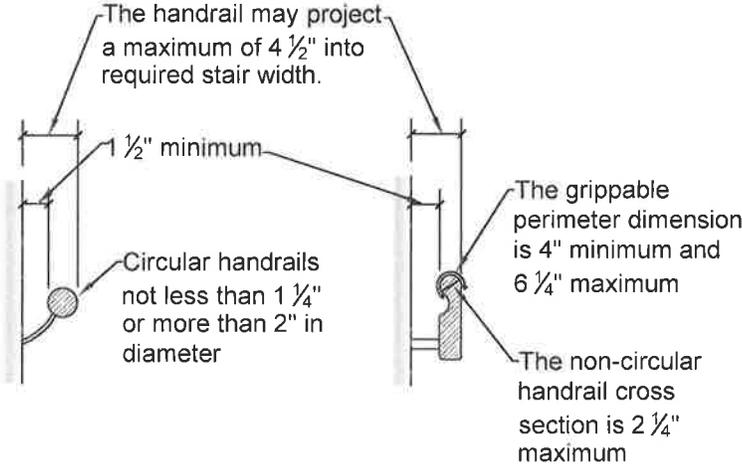


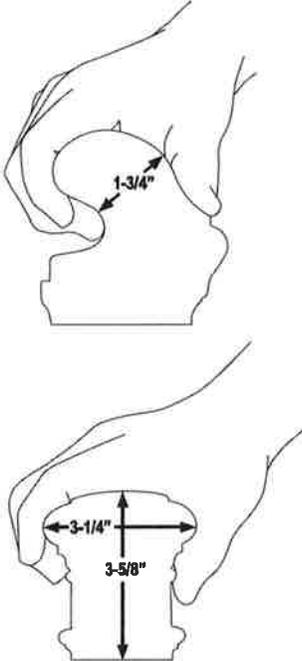
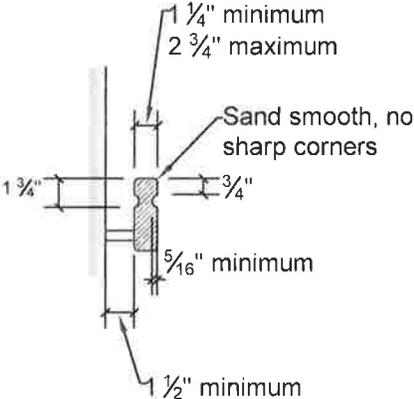
FIGURE 10 RAILING HANDGRIP SIZES

R311.7.8.3 Grip size. All required handrails shall be of one of the following types or provide equivalent graspability.

1. Type I. Handrails with a circular cross section shall have an outside diameter of at least $1\frac{1}{4}$ inches and not greater than 2 inches. If the handrail is not circular, it shall have a perimeter dimension of at least 4 inches and not greater than $6\frac{1}{4}$ inches with a maximum cross section dimension of $2\frac{1}{4}$ inches. Edges shall have a minimum radius of 0.01 inch.
2. Type II. Handrails with a perimeter greater than $6\frac{1}{4}$ inches shall have a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of $\frac{3}{4}$ inch measured vertically from the tallest portion of the profile and achieve a depth of at least $\frac{5}{16}$ inch within $\frac{7}{8}$ inch below the widest portion of the profile. This required depth shall continue for at least $\frac{3}{8}$ inch to a level that is not less than $1\frac{3}{4}$ inches below the tallest portion of the profile. The minimum width of the handrail above the recess shall be $1\frac{1}{4}$ inches to a maximum of $2\frac{3}{4}$ inches. Edges shall have a minimum radius of 0.01 inch.



Unacceptable Handrails



Profiles other than Type I and Type II may be determined to provide equivalent graspability.

FIGURE 11 SPECIAL STAIRS/LANDINGS

R311.7.4 Walkline. The walkline across winder treads shall be concentric to the curved direction of travel through the turn and located 12 inches from the side where the winders are narrower. The 12 inch dimension shall be measured from the widest point of the clear stair width at the walking surface of the winder. If winders are adjacent within the flight, the point of the widest clear stair width of the adjacent winders shall be used.

R311.7.5.2.1 Winder treads. Winder treads shall have a minimum tread depth of 10 inches measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline. Winder treads shall have a minimum tread depth of 6 inches at any point within the clear width of the stair. Within any flight of stairs, the largest winder tread depth at the walkline shall not exceed the smallest winder tread by more than $\frac{3}{8}$ inch. Consistently shaped winders at the walkline shall be allowed within the same flight of stairs as rectangular treads and do not have to be within $\frac{3}{8}$ inch of the rectangular tread depth.

R311.7.6 Landings for stairs. There shall be a floor or landing at the top and bottom of each stairway. The minimum width perpendicular to the direction of travel shall be no less than the width of the flight served. Landings of shapes other than square or rectangular shall be permitted provided the depth at the walkline and the total area is not less than that of a quarter circle with a radius equal to the required landing width. Where the stairway has a straight run, the minimum depth in the direction of travel shall not be less than 36 inches.

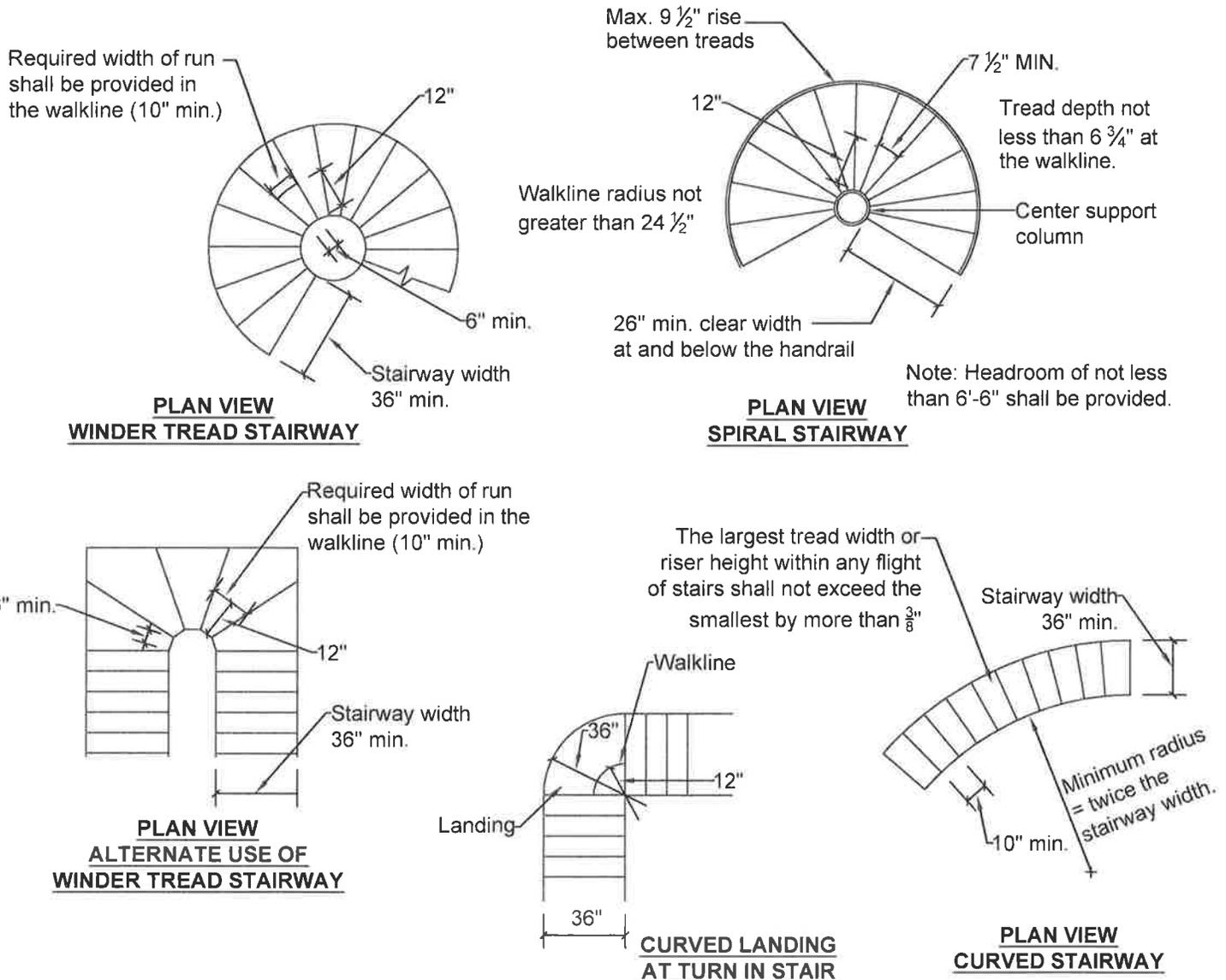


FIGURE 12

SMOKE ALARMS & CARBON MONOXIDE ALARMS

R314.1 General. Smoke alarms shall comply with NFPA 72 and Section R314.

R314.1.1 Listings. Smoke alarms shall be listed in accordance with UL 217. Combination smoke and carbon monoxide alarms shall be listed in accordance with UL 217 and UL 2034.

R314.2 Where required. Smoke alarms shall be provided in accordance with this section.

R314.2.1 New construction. Smoke alarms shall be provided in dwelling units.

R314.2.2 Alterations, repairs and additions. Where alterations, repairs or additions requiring a permit occur, or where one or more sleeping rooms are added or created in existing dwellings, the individual dwelling unit shall be equipped with smoke alarms located as required for new dwellings.

Exceptions:

1. Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of a porch or deck, are exempt from the requirements of this section.
2. Installation, alteration or repairs of plumbing or mechanical systems are exempt from the requirements of this section.

R314.3 Location. Smoke alarms shall be installed in the following locations:

1. In each sleeping room.
2. Outside each separate sleeping area in the immediate vicinity of the bedrooms.
3. On each additional story of the dwelling, including basements and habitable attics and not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.
4. Smoke alarms shall be installed not less than 3 feet horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by Section R314.3.

R314.3.1 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.

1. Ionization smoke alarms shall not be installed less than 20 feet horizontally from a permanently installed cooking appliance.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet horizontally from a permanently installed cooking appliance.
3. Photoelectric smoke alarms shall not be installed less than 6 feet horizontally from a permanently installed cooking appliance.

R314.4 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section R314.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual dwelling unit. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.

Exception: Interconnection of smoke alarms in existing areas shall not be required where alterations or repairs do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available that could provide access for interior connection without the removal of interior finishes.

R314.5 Combination alarms. Combination smoke and carbon monoxide alarms shall be permitted to be used in lieu of smoke alarms.

R314.6 Power source. Smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

FIGURE 12 - CONTINUED

SMOKE ALARMS & CARBON MONOXIDE ALARMS

Exceptions:

1. Smoke alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. Smoke alarms installed in accordance with Section R314.2.2 shall be permitted to be battery powered.

R314.7 Fire alarm systems. Fire alarm systems shall be permitted to be used in lieu of smoke alarms and shall comply with Sections R314.7.1 through R314.7.4.

R314.7.1 General. Fire alarm systems shall comply with the provisions of this code and the household fire warning equipment provisions of NFPA 72. Smoke detectors shall be listed in accordance with UL 268.

R314.7.2 Location. Smoke detectors shall be installed in the locations specified in Section R314.3.

R314.7.3 Permanent fixture. Where a household fire alarm system is installed, it shall become a permanent fixture of the occupancy, owned by the homeowner.

R314.7.4 Combination detectors. Combination smoke and carbon monoxide detectors shall be permitted to be installed in fire alarms systems in lieu of smoke detectors, provided that they are listed in accordance with UL 268 and UL 2075.

CARBON MONOXIDE ALARMS

R315.1 General. Carbon monoxide alarms shall comply with Section R315.

R315.1.1 Listings. Carbon monoxide alarms shall be listed in accordance with UL 2034. Combination carbon monoxide and smoke alarms shall be listed in accordance with UL 2034 and UL 217.

R315.2 Where required. Carbon monoxide alarms shall be provided in accordance with Sections R315.2.1 and R315.2.2.

R315.2.1 New construction. For new construction, an approved carbon monoxide alarms shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms in dwelling units and on each level of the dwelling in accordance with the manufacturer's recommendation.

R315.2.2 Alterations, repairs and additions. Existing dwellings shall be equipped with carbon monoxide alarms in accordance with Section R315.2.1. An inspection will occur in alterations, repairs, or additions requiring a permit occur, or where one or more sleeping rooms are added or created.

Exceptions:

1. Work involving only the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck, is exempt from the inspection requirements of this section.
2. Installation, alteration or repair of nonfuel burning plumbing or mechanical systems or electrical systems are exempt from the inspection requirements of this section.
3. Owner-occupied single-family residences legally occupied before July 26, 2009. RCW 19.27.530 (2)(b).

R315.3 Location. Carbon monoxide alarms in dwelling units shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms on each level of the dwelling and in accordance with the manufacturer's recommendations. Where a fuel burning appliance is located within a bedroom or its attached bathroom, a carbon monoxide alarm shall be installed within the bedroom.

R315.4 Combination alarms. Combination carbon monoxide and smoke alarms shall be permitted to be used in lieu of carbon monoxide alarms.

FIGURE 12 - CONTINUED SMOKE ALARMS & CARBON MONOXIDE ALARMS

R315.5 Power source. Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

Exceptions:

1. Carbon monoxide alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. Carbon monoxide alarms installed in accordance with Section R315.2.2 shall be permitted to be battery powered.

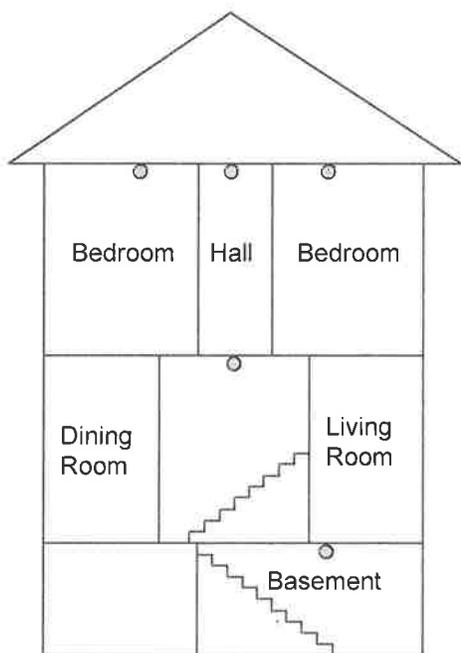
R315.6 Carbon monoxide detection systems. Carbon monoxide detection systems shall be permitted to be used in lieu of carbon monoxide alarms and shall comply with Sections R315.6.1 through R315.6.4.

R315.6.1 General. Household carbon monoxide detection systems shall comply with NFPA 720. Carbon monoxide detectors shall be listed in accordance with UL 2075.

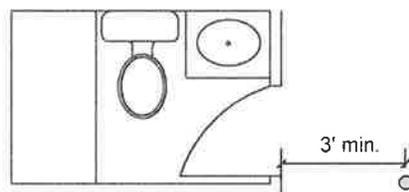
R315.6.2 Location. Carbon monoxide detectors shall be installed in the locations specified in Section R315.5.3. These locations supersede the locations specified in NFPA 720.

R315.6.3 Permanent fixture. Where a household carbon monoxide detection system is installed, it shall become a permanent fixture of the occupancy and owned by the homeowner.

R315.6.4 Combination detectors. Combination carbon monoxide and smoke detectors shall be permitted to be installed in carbon monoxide detection systems in lieu of carbon monoxide detectors, provided that they are listed in accordance with UL 2075 and UL 268.



○ Areas requiring alarms



UNLESS THIS WOULD PREVENT
PLACEMENT OF A SMOKE ALARM
REQUIRED BY SECTION R314.3

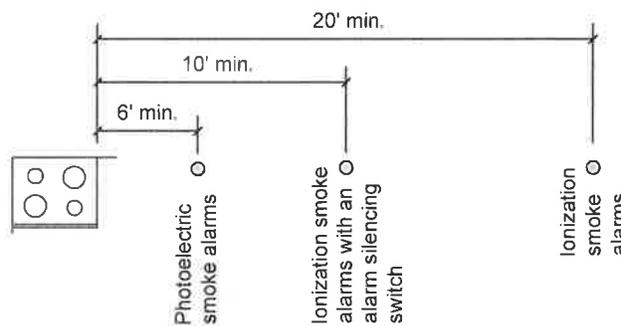


FIGURE 13 DWELLING UNIT SEPARATION

R302.3 Two-family dwellings. Dwelling units in two-family dwellings shall be separated from each other by wall and/or floor assemblies having not less than a 1-hour fire-resistance rating when tested in accordance with ASTM E 119 or UL 263. Fire-resistance-rated floor/ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.

Exceptions:

1. A fire-resistance rating of $\frac{1}{2}$ hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.
2. Wall assemblies need not extend through attic spaces when the ceiling is protected by not less than $\frac{5}{8}$ inch Type X gypsum board and an attic draft stop constructed as specified in section R302.12.1 is provided above and along the wall assembly separating the dwellings. The structural framing supporting the ceiling shall also be protected by not less than $\frac{1}{2}$ inch gypsum board or equivalent.

R302.3.1 Supporting construction. When floor assemblies are required to be fire-resistance rated by Section R302.3, the supporting construction of such assemblies shall have an equal or greater fire-resistance rating.

R302.4 Dwelling unit rated penetrations. Penetrations of wall or floor/ceiling assemblies required to be fire-resistance rated in accordance with Section R302.2 or R302.3 shall be protected in accordance with this section.

R302.4.1 Through penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R302.4.1.1 or R302.4.1.2.

Exception: Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space shall be protected as follows:

1. In concrete or masonry wall or floor assemblies, concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating, provided:
 - 1.1 The nominal diameter of the penetrating item is a maximum of 6 inches; and
 - 1.2 The area of the opening through the wall does not exceed 144 square inches.
2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 or UL 263 time temperature fire conditions under a minimum positive pressure differential of 0.01 inch of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

R302.4.1.1 Fire-resistance-rated assembly. Penetrations shall be installed as tested in the approved fire-resistance-rated assembly.

R302.4.1.2 Penetration firestop system. Penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water and shall have an F rating of not less than the required fire-resistance rating of the wall or floor/ceiling assembly penetrated.

R302.4.2 Membrane penetrations. Membrane penetrations shall comply with Section R302.4.1. Where walls are required to have a fire-resistance rating, recessed fixtures shall be installed so that the required fire-resistance rating will not be reduced.

FIGURE 13 - CONTINUED DWELLING UNIT SEPARATION

Exceptions:

1. Membrane penetrations of maximum 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches in area provided the aggregate area of the openings through the membrane does not exceed 100 square inches in any 100 square feet of wall area. The annular space between the wall membrane and the box shall not exceed $\frac{1}{8}$ inch. Such boxes on opposite sides of the wall shall be separated by one of the following:
 - 1.1 By a horizontal distance of not less than 24 inches where the wall or partition is constructed with individual non-communicating stud cavities;
 - 1.2 By a horizontal distance of not less than the depth of the wall cavity when the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation;
 - 1.3 By solid fire blocking in accordance with Section R302.11;
 - 1.4 By protecting both boxes with listed putty pads; or
 - 1.5 By other listed materials and methods.

2. Membrane penetrations by listed electrical boxes of any materials provided the boxes have been tested for use in fire-resistance rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the wall membrane and the box shall not exceed $\frac{1}{8}$ inch unless listed otherwise. Such boxes on opposite sides of the wall shall be separated by one of the following:
 - 2.1 By horizontal distance specified in the listing of the electrical boxes;
 - 2.2 By solid fireblocking in accordance with Section R302.11;
 - 2.3 By protecting both boxes with listed putty pads; or
 - 2.4 By other listed materials and methods.

3. The annular space created by the penetration of a fire sprinkler provided it is covered by a metal escutcheon plate.

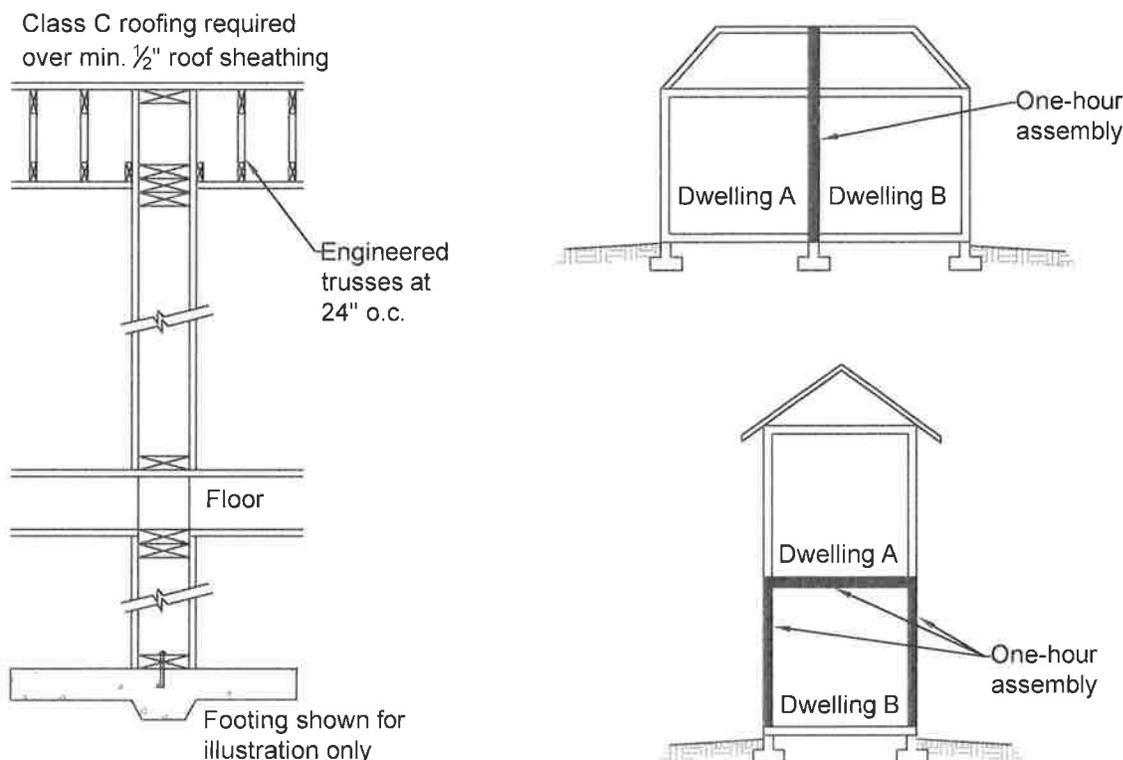


FIGURE 14

TOWNHOUSE DWELLING UNIT SEPARATION

R302.2 Townhouses. Each townhouse shall be considered a separate building and shall be separated by one of the following methods:

1. A common 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 and a fire sprinkler system in accordance with Section P2904 in both townhouses shall be provided. The cavity of the common wall shall not contain plumbing or mechanical equipment, ducts or vents. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.
2. A common 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 shall be provided. The cavity of the common wall shall not contain plumbing or mechanical equipment, ducts or vents. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.
3. Two wall assemblies meeting the requirements of Section R302.1 for exterior walls shall be provided.

R302.2.1 Continuity. The fire-resistance-rated wall or assembly separating townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab. The fire-resistance rating shall extend the full length of the wall assembly, including wall extensions through and separating attached enclosed accessory structures. Where a story extends beyond the exterior wall of a story below:

1. The fire-resistance-rated wall or assembly shall extend to the outside of the upper story (see Figure R302.2(1)); or
2. The underside of the exposed floor-ceiling assembly shall be protected as required for projections in Section R302 (see Figure R302.2(2)).

R302.2.2 Parapets for townhouses. Parapets constructed in accordance with Section R302.2.3 shall be constructed for townhouses as an extension of exterior walls or common walls in accordance with the following:

1. Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches above the roof surfaces.
2. Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches above the lower roof, the parapet shall extend not less than 30 inches above the lower roof surface.

Exception: A parapet is not required in the preceding two cases where the roof covering complies with a minimum Class C rating as tested in accordance with ASTM E 108 or UL 790 and the roof decking or sheathing is of noncombustible materials or approved fire-retardant-treated wood for a distance of 4 feet on each side of the wall or walls, or one layer of $\frac{5}{8}$ inch Type X gypsum board is installed directly beneath the roof decking or sheathing, supported by not less than nominal 2 inch ledgers attached to the sides of the roof framing members, for a distance of not less than 4 feet on each side of the wall or walls and any openings or penetrations in the roof are not within 4 feet of the common walls.

3. A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches above the lower roof. The common wall constructed from the lower roof to the underside of the higher roof deck shall have not less than a 1-hour fire-resistance rating. The wall shall be rated for exposure from both sides.

R302.2.3 Parapet construction. Parapets shall have the same fire-resistance rating as that required for the supporting wall or walls. On any side adjacent to a roof surface, the parapet shall have noncombustible faces for the uppermost 18 inches, to include counterflashing and coping materials. where the roof slopes toward a parapet at slopes greater than 2 units vertical in 12 units horizontal (16.7 percent slope), the parapet shall extend to the same height as any portion of the roof within a distance of 3 feet and the height shall be not less than 30 inches.

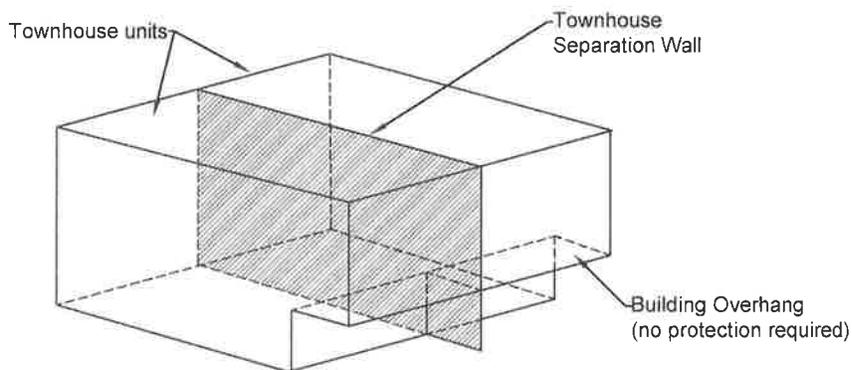
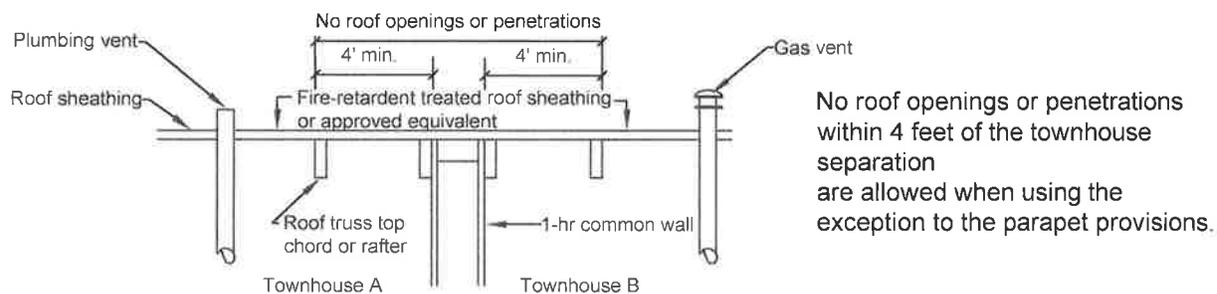
R302.2.4 Structural independence. Each individual townhouse shall be structurally independent.

Exceptions:

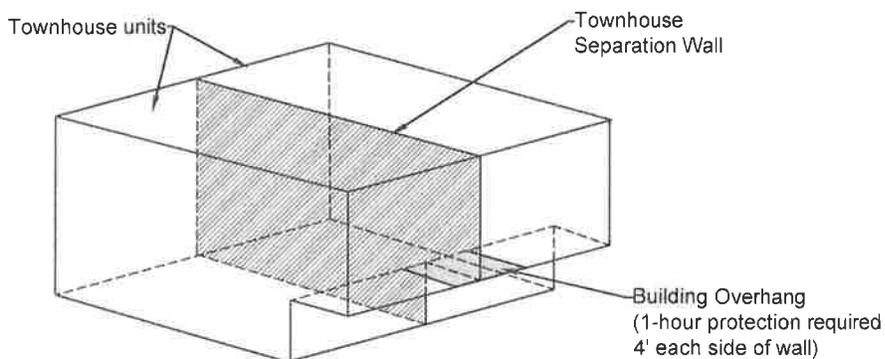
1. Foundation supporting exterior walls or common walls.

FIGURE 14 TOWNHOUSE DWELLING UNIT SEPARATION

2. Structural roof and wall sheathing from each unit may be fastened to the common wall framing.
3. Nonstructural wall and roof coverings.
4. Flashing at termination of roof covering over common wall.
5. Townhouses separated by a common 2-hour fire-resistance-rated wall as provided in Section R302.2.
6. Floor sheathing may fasten to the floor framing of both units.



**FIGURE R302.2(1)
EXTENDED TOWNHOUSE SEPARATION WALL**



**FIGURE R302.2(2)
TOWNHOUSE SEPARATION OVERHANG PROTECTION**

FIGURE 15 PROTECTION AGAINST DECAY

R317.1 Location required. Protection of wood and wood based products from decay shall be provided in the following locations by the use of naturally durable wood or wood that is preservative-treated in accordance with AWP A U1 for the species, product, preservative and end use. Preservatives shall be listed in Section 4 of AWP A U1.

1. Wood joists or the bottom of a wood structural floor when closer than 18 inches or wood girders when closer than 12 inches to the exposed ground in crawl spaces or unexcavated area located within the periphery of the building foundation.
2. All wood framing members that rest on concrete or masonry exterior foundation wall and are less than 8 inches from the exposed ground.
3. Sills and sleepers on a concrete or masonry slab that is in direct contact with the ground unless separated from such slab by an impervious moisture barrier.
4. The ends of wood girders entering exterior masonry or concrete walls having clearances of less than $\frac{1}{2}$ inch on tops, sides and ends.
5. Wood siding, sheathing and wall framing on the exterior of a building having a clearance of less than 6 inches from the ground or less than 2 inches measured vertically from the concrete steps, porch slabs, patio slabs, and similar horizontal surfaces exposed to the weather.
6. Wood structural members supporting moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, unless separated from such floors or roofs by an impervious moisture barrier.
7. Wood furring strips or other wood framing members attached directly to the interior of exterior masonry walls or concrete walls below grade except where an approved vapor retarder is applied between the wall and the furring strips or framing members.

R317.1.1 Field treatment. Field-cut ends, notches and drilled holes of preservative-treated wood shall be treated in the field in accordance with AWP A M4.

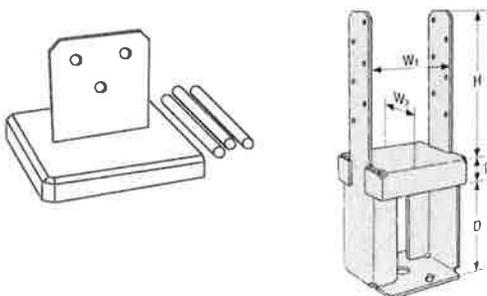
R317.1.2 Ground contact. All wood in contact with the ground, embedded in concrete in direct contact with the ground or embedded in concrete exposed to the weather that supports permanent structures intended for human occupancy shall be approved pressure-preservative-treated wood suitable for ground contact use, except untreated wood may be used where entirely below groundwater level or continuously submerged in fresh water.

R317.1.4 Wood columns. Wood columns shall be approved wood of natural decay resistance or approved pressure-preservative-treated wood.

Exceptions:

1. Columns exposed to the weather or in basements when supported by concrete piers or metal pedestals projecting 1 inch above a concrete floor or 6 inches above exposed earth and the earth is covered by an approved impervious moisture barrier.
2. Columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building when supported by a concrete pier or metal pedestal at a height more than 8 inches from the exposed earth and the earth is covered by an impervious moisture barrier.
3. Deck posts supported by concrete piers or metal pedestals projecting not less than 1 inch above a concrete floor or 6 inches above exposed earth.

R317.1.5 Exposed glued-laminated timbers. The portions of glued-laminated timbers that form the structural supports of a building or other structure and are exposed to weather and not properly protected by a roof, eave or similar covering shall be pressure treated with preservative, or be manufactured from naturally durable or preservative-treated wood.



EXAMPLES

Minimum 1" above concrete,
6" above exposed earth.

FIGURE 15 - CONTINUED PROTECTION AGAINST DECAY

R317.3 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood. Fasteners, including nuts and washers, and connectors in contact with preservative-treated wood and fire-retardant-treated wood shall be in accordance with this section. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153. Stainless steel driven fasteners shall be in accordance with the material requirements of ASTM F 1667.

R317.3.1 Fasteners for preservative-treated wood. Fasteners, including nuts and washers, for preservative-treated wood shall be of hot-dipped, zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Coating types and weights for connectors in contact with preservative-treated wood shall be in accordance with the connector manufacturer's recommendations. In the absence of manufacturer's recommendations, a minimum of ASTM A 653 type G185 zinc-coated galvanized steel, or equivalent, shall be used.

Exceptions:

1. One-half-inch-diameter or greater steel bolts.
2. Fasteners other than nails and timber rivets shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum.
3. Plain carbon steel fasteners in SBX/DOT and zinc borate preservative-treated wood in an interior, dry environment shall be permitted.

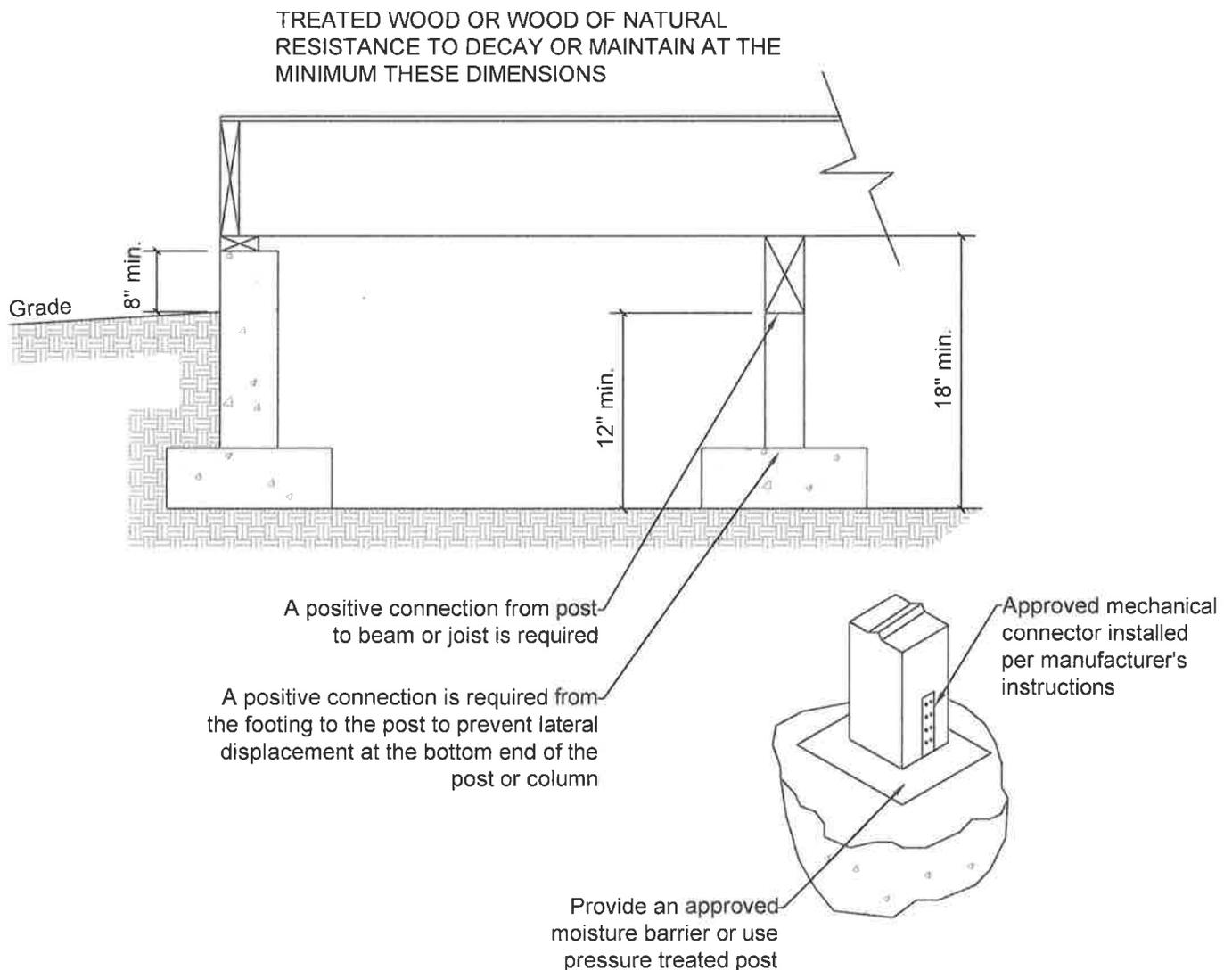


FIGURE 16 EXTERIOR FOUNDATION, FOOTING & STEM WALL

R401.2 Requirements. Foundation construction shall be capable of accommodating all loads according to Section R301 and of transmitting the resulting loads to the supporting soil. Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice. **Documented load bearing values shall be included. A professional engineer licensed in the State of Washington shall perform the geotechnical evaluation.**

R401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection that does not create a hazard. Lots shall be graded to drain surface water away from foundation walls. The grade shall fall a minimum of 6 inches within the first 10 feet.

Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches of fall within 10 feet, drains or swales shall be constructed to ensure drainage away from the structure. Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2 percent away from the building.

R405.1 Concrete or masonry foundation. Drains shall be provided around concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend not less than 1 foot beyond the outside edge of the footing and 6 inches above the top of the footing and be covered with an approved filter membrane material, the top of open joints of drain tiles shall be protected with strips of building paper. Except where otherwise recommended by the drain manufacturer, perforated drains shall be surrounded with an approved filter membrane or the filter membrane shall cover the washed gravel or crushed rock covering the drain. Drainage tiles or perforated pipe shall be placed on a minimum of 2 inches of washed gravel or crushed rock not less than one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches of the same material.

Exception: A drainage system is not required where the foundation is installed on well-drained ground or sand-gravel mixture soils according to the Unified Soils Classification System, Group I Soils, as detailed in Table R405.1.

The International Residential Code assumes known soil load bearing values in sizing footings and foundations and prescribing reinforcing requirements. Klickitat County does not assume soil load bearing values. Therefore, a soil evaluation shall be required if using the prescriptive requirements of the International Residential Code. Calculations using 1500 psf are allowed if the Klickitat County Building Department's minimum requirements are used.

Exception: Requirements depicted in Figures 16, 17, 18 or 38 may be used on undisturbed soils.

Note: Concrete shall be consolidated by suitable means during placement and shall be worked around embedded items and reinforcement and into corners of forms. Where stay-in-place forms are used, concrete shall be consolidated by internal vibration. (IRC 608.5.1.6)

All hold-down bolts/straps shall be set/tied in place prior to inspection

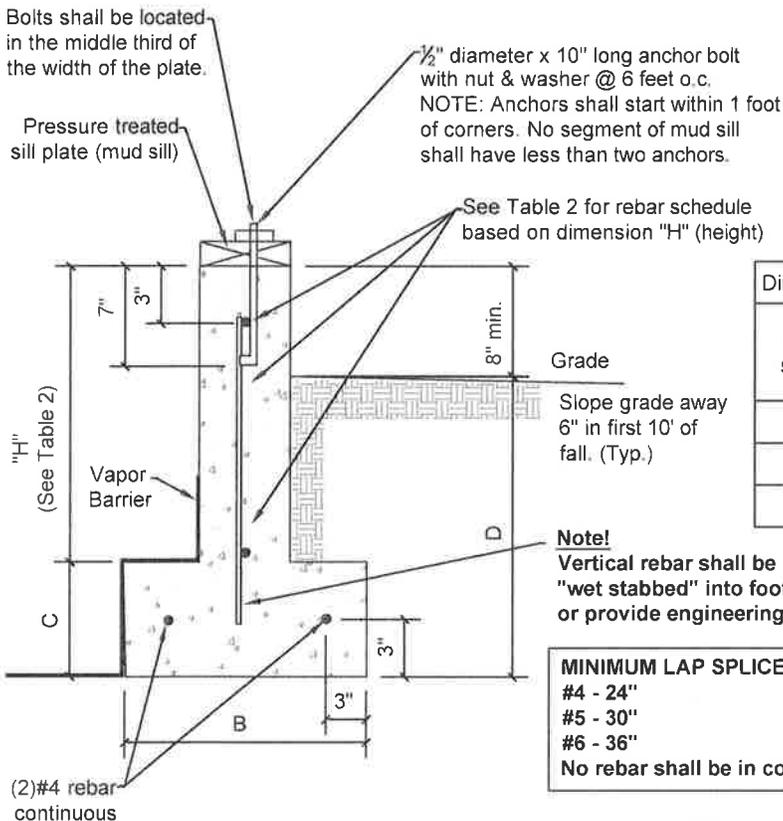


Table 1

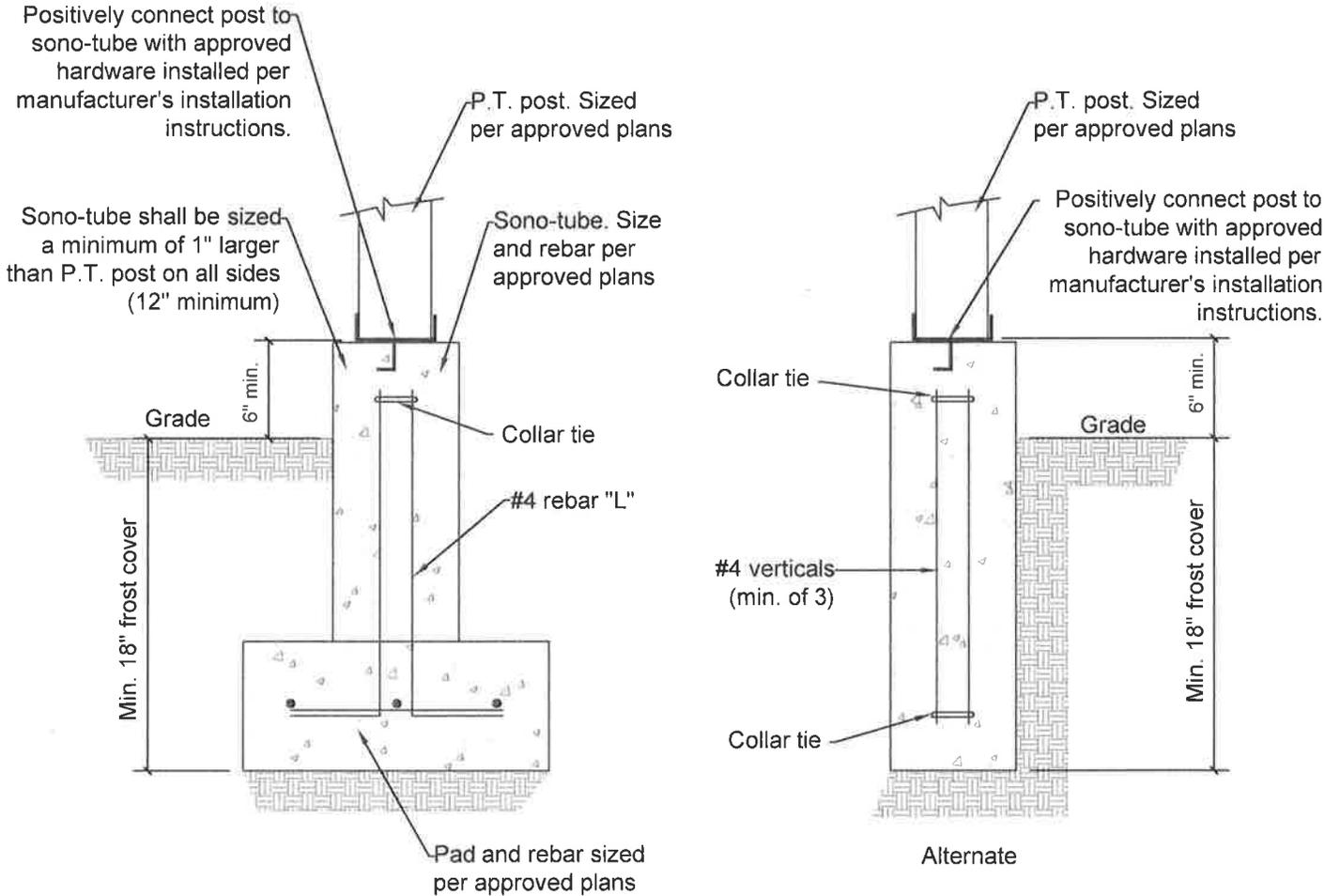
Dimension	A	B	C	D
No. of stories	Thickness of foundation wall	Width of footing	Thickness of footing	Depth of footing below grade
1	6	16	8	18
2	8	16	8	18
3	10	18	8	24

Table 2 Stem Wall reinforcement (See Basement walls if over 6 feet)

"H" = Height of stem wall	Vertical rebar	Horizontal rebar (see note)
0 to 2 feet	#4@6 ft o.c.	(2)#4
2 to 4 feet	#4@4 ft o.c.	#4@2 ft o.c.
4 to 6 feet	#4@2 ft o.c.	#4@2 ft o.c.

FIGURE 16A PAD/SONO-TUBE DETAIL

Note:
Posts that are not pressure treated require a minimum 1" stand-off base.



All hold-down bolts/straps shall be set/tied in place prior to inspection

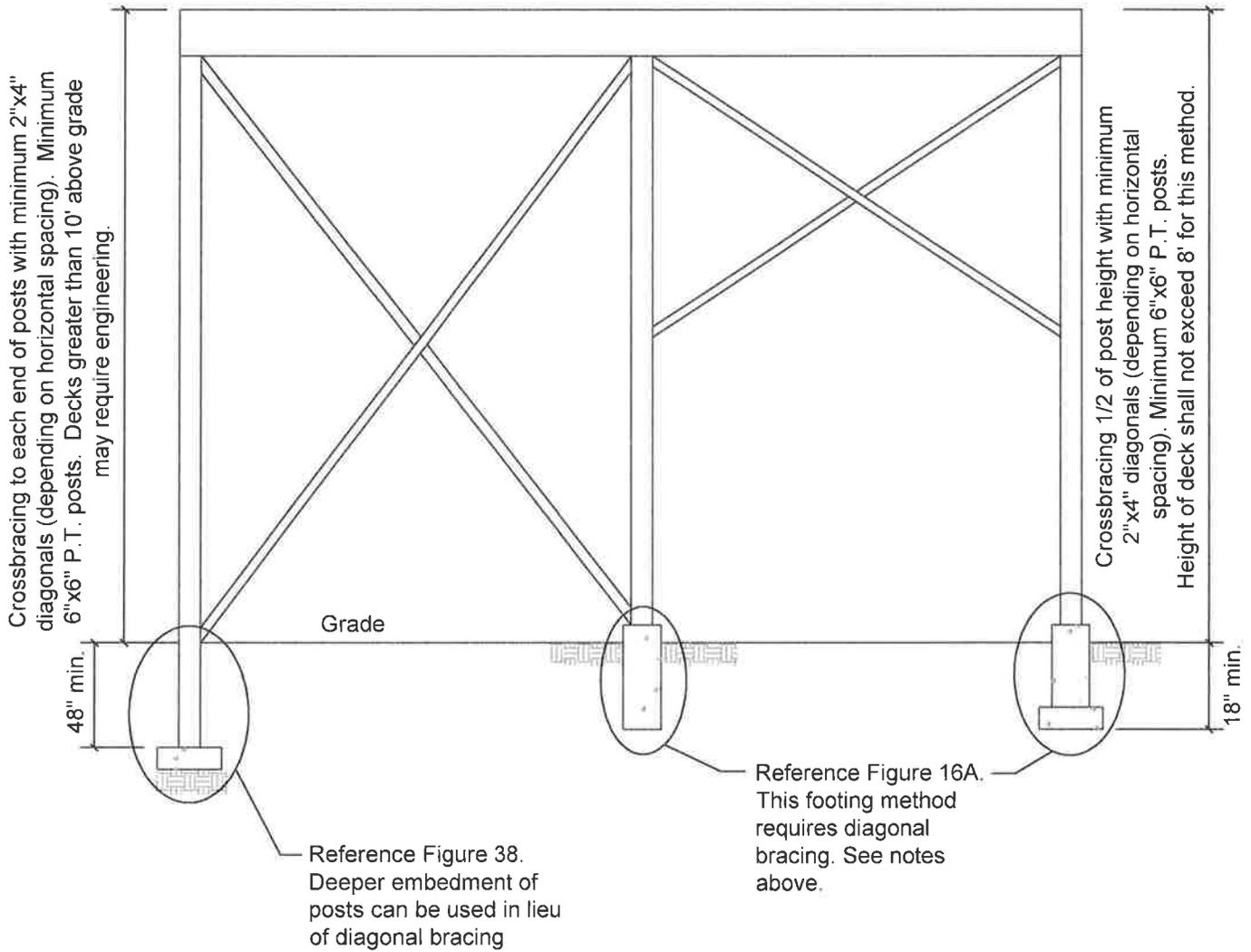


Plan view

ALL FOOTINGS/FOUNDATIONS SHALL BE PLACED ON UNDISTURBED EARTH, OR CONTACT THE BUILDING DEPARTMENT

Note:
Concrete shall be consolidated by suitable means during placement and shall be worked around embedded items and reinforcement and into corners of forms. Where stay-in-place forms are used, concrete shall be consolidated by internal vibration. (IRC 608.5.1.6)

**FIGURE 16B
CROSS-BRACING AT DECKS**



ALL FOOTINGS/FOUNDATIONS SHALL BE PLACED ON UNDISTURBED EARTH, OR CONTACT THE BUILDING DEPARTMENT

NOTE:
Diagonal straps placed on the horizontal plane at each deck bay can be used in lieu of cross-bracing when installed per the manufacturer's instructions.

FIGURE 16C
CONCRETE BLOCK FOUNDATION

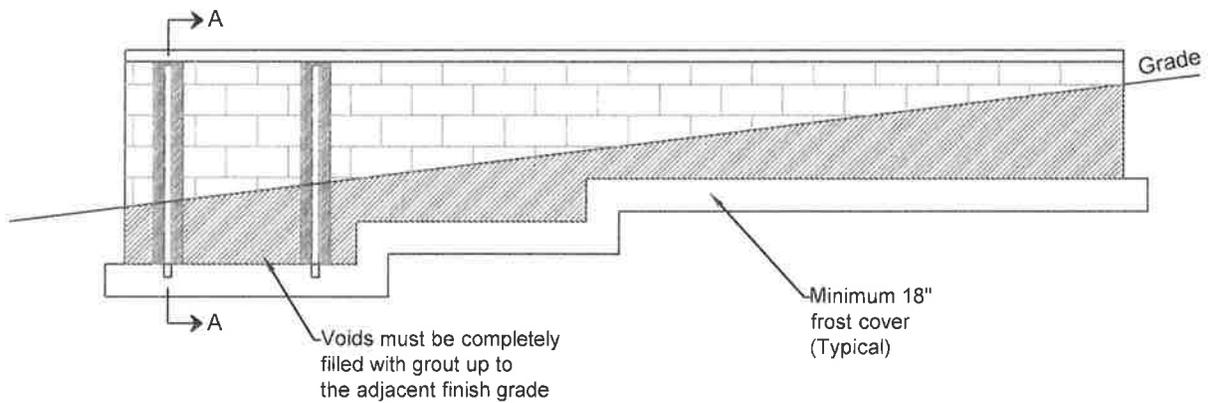
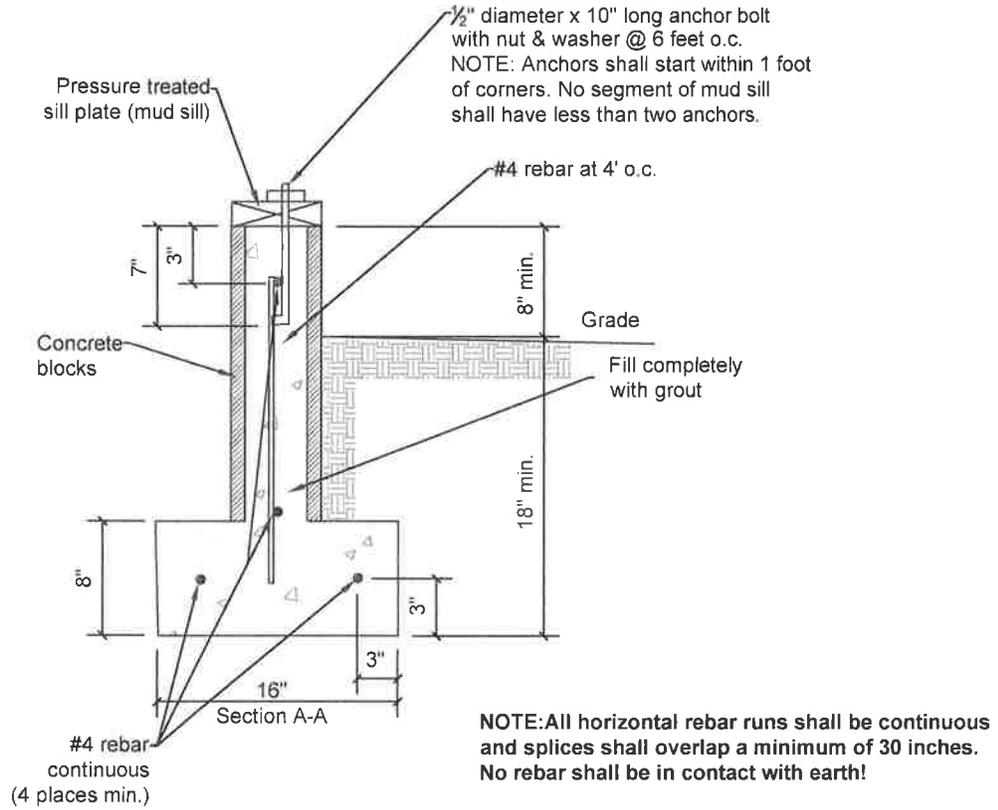


FIGURE 17 MONOLITHIC FOUNDATION, FOOTING & SLAB

R401.2 Requirements. Foundation construction shall be capable of accommodating all loads according to Section R301 and of transmitting the resulting loads to the supporting soil. Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice. **Documented load bearing values shall be included. A professional engineer licensed in the State of Washington shall perform the geotechnical evaluation.**

R401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection that does not create a hazard. Lots shall be graded to drain surface water away from foundation walls. The grade shall fall a minimum of 6 inches within the first 10 feet.

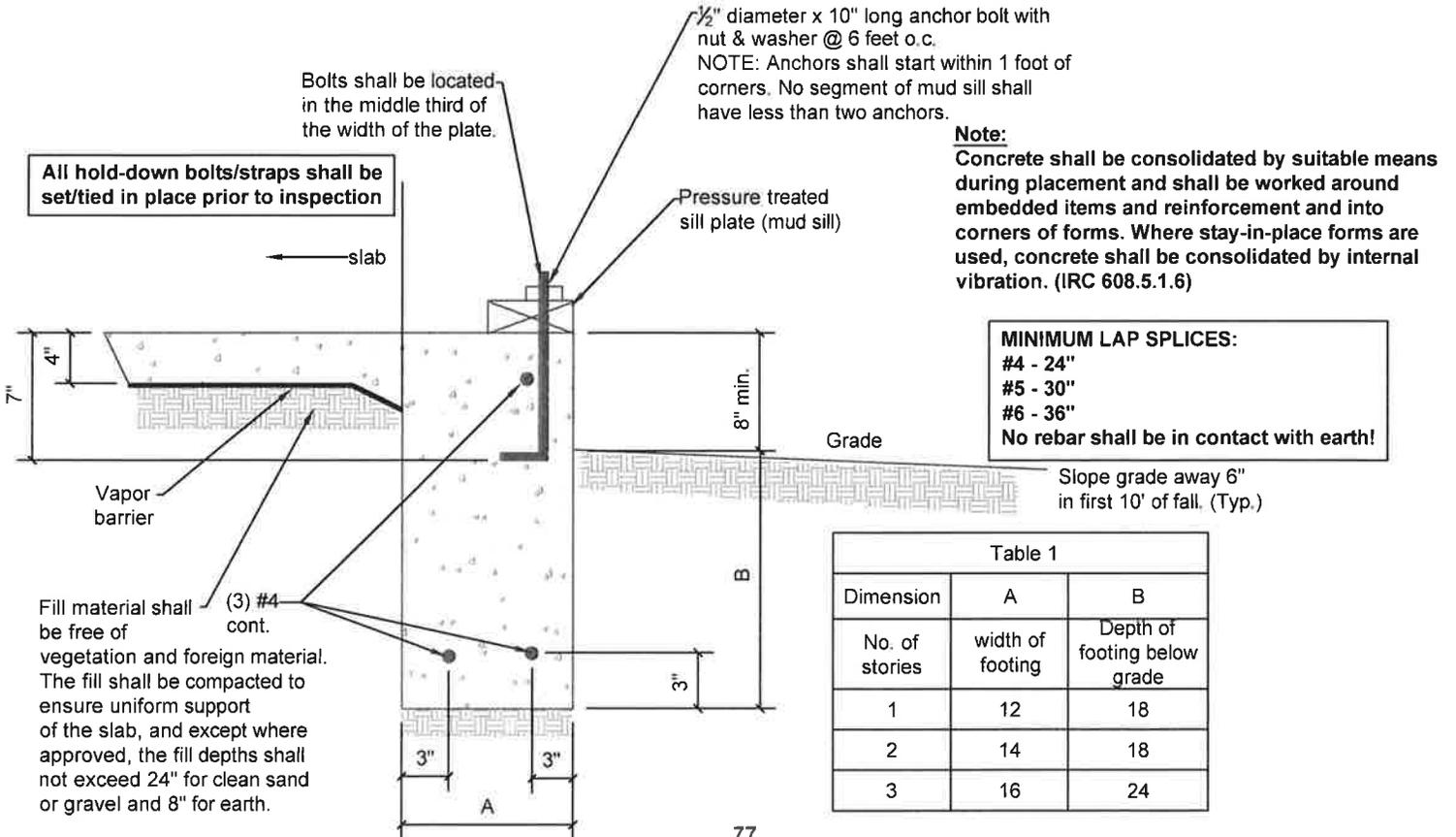
Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches of fall within 10 feet, drains or swales shall be constructed to ensure drainage away from the structure. Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2 percent away from the building.

R405.1 Concrete or masonry foundation. Drains shall be provided around concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend not less than 1 foot beyond the outside edge of the footing and 6 inches above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper. Except where otherwise recommended by the drain manufacturer, perforated drains shall be surrounded with an approved filter membrane or the filter membrane shall cover the washed gravel or crushed rock covering the drain. Drainage tiles or perforated pipe shall be placed on a minimum of 2 inches of washed gravel or crushed rock not less than one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches of the same material.

Exception: A drainage system is not required where the foundation is installed on well-drained ground or sand-gravel mixture soils according to the Unified Soils Classification System, Group I Soils, as detailed in Table R405.1.

The International Residential Code assumes known soil load bearing values in sizing footings and foundations and prescribing reinforcing requirements. Klickitat County does not assume soil load bearing values. Therefore, a soil evaluation shall be required if using the prescriptive requirements of the International Residential Code. Calculations using 1500 psf are allowed if the Klickitat County Building Department's minimum requirements are used.

Exception: Requirements depicted in Figures 16, 17, 18 or 38 may be used on undisturbed soils.



MINIMUM LAP SPLICES:
 #4 - 24"
 #5 - 30"
 #6 - 36"
 No rebar shall be in contact with earth!

Dimension	A	B
No. of stories	width of footing	Depth of footing below grade
1	12	18
2	14	18
3	16	24

FIGURE 18 BASEMENT FOUNDATION WALL - 6' TO 9' **

R401.2 Requirements. Foundation construction shall be capable of accommodating all loads according to Section R301 and of transmitting the resulting loads to the supporting soil. Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice. **Documented load bearing values shall be included. A professional engineer licensed in the State of Washington shall perform the geotechnical evaluation.**

R401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection that does not create a hazard. Lots shall be graded to drain surface water away from foundation walls. The grade shall fall a minimum of 6 inches within the first 10 feet.

Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches of fall within 10 feet, drains or swales shall be constructed to ensure drainage away from the structure. Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2 percent away from the building.

R405.1 Concrete or masonry foundation. Drains shall be provided around concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend not less than 1 foot beyond the outside edge of the footing and 6 inches above the top of the footing and be covered with an approved filter membrane material, the top of open joints of drain tiles shall be protected with strips of building paper. Except where otherwise recommended by the drain manufacturer, perforated drains shall be surrounded with an approved filter membrane or the filter membrane shall cover the washed gravel or crushed rock covering the drain. Drainage tiles or perforated pipe shall be placed on a minimum of 2 inches of washed gravel or crushed rock not less than one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches of the same material.

Exception: A drainage system is not required where the foundation is installed on well-drained ground or sand-gravel mixture soils according the Unified Soils Classification System, Group I Soils, as detailed in Table R405.1.

The International Residential Code assumes known soil load bearing values in sizing footings and foundations and prescribing reinforcing requirements. Klickitat County does not assume soil load bearing values. Therefore, a soil evaluation shall be required if using the prescriptive requirements of the International Residential Code. Calculations using 1500 psf are allowed if the Klickitat County Building Department's minimum requirements are used.

Exception: Requirements depicted in Figures 16, 17, 18 or 38 may be used on undisturbed soils.

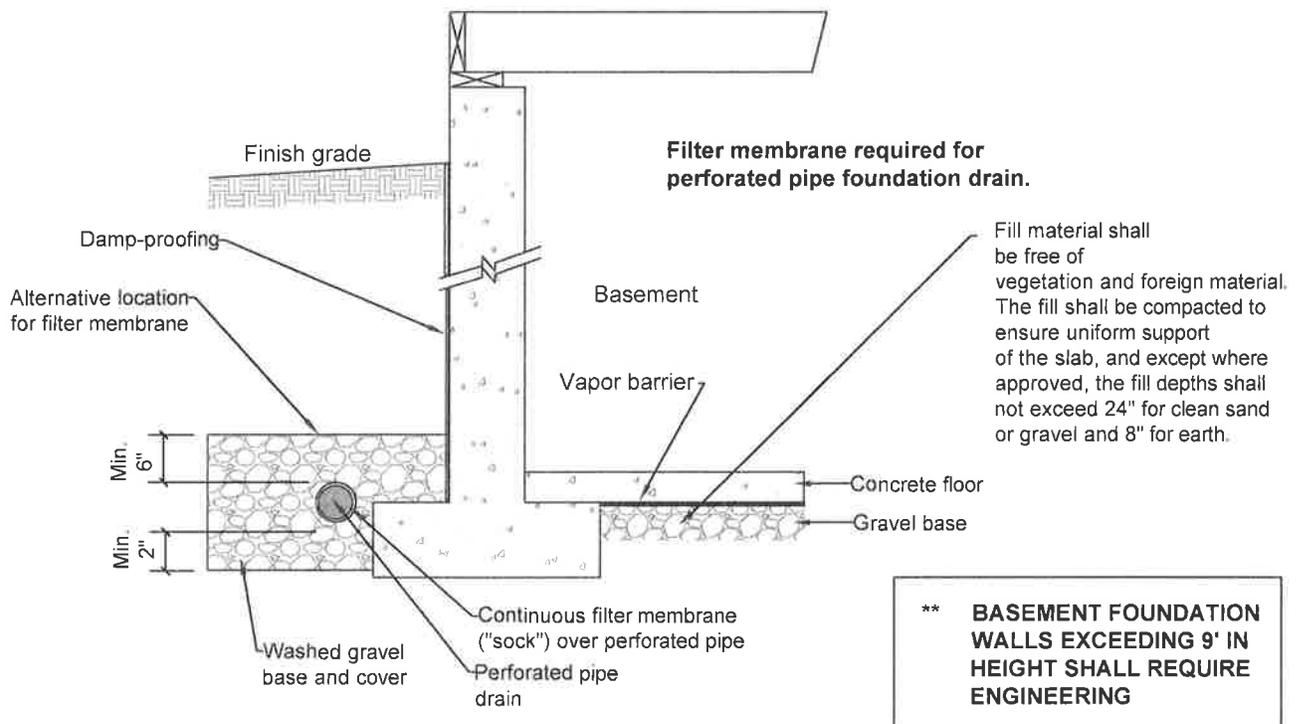


FIGURE 18 - CONTINUED BASEMENT FOUNDATION WALL - 6' TO 9' **

WALLS EXCEEDING 9' IN HEIGHT SHALL REQUIRE ENGINEERING

See Figure 18A

Bolts shall be located in the middle third of the width of the plate.

Pressure treated sill plate (mud sill)

1/2" diameter x 10" long anchor bolt with nut & washer at 3" o.c. NOTE: Anchors shall start within 1' of corners. No segments of mud sill shall have less than two anchors.

All hold-down bolts/straps shall be set/tied in place prior to inspection

Sill sealer

NOTE:

Foundation walls enclosing a basement below grade shall be damp-proofed outside by approved methods.

**** 20" min. @ 9' walls or provide engineering ****

Grade

MINIMUM LAP SPLICES:
#4 - 36"
#5 - 42"
#6 - 48"
No rebar shall be in contact with earth!

NOTE: All horizontal rebar runs shall be continuous and splices shall overlap a minimum of 30 inches. No rebar shall be in contact with earth!

Strongly recommended, when not required by engineering, to backfill basement walls that enclose living spaces, with approved drainrock.

Note:
Concrete shall be consolidated by suitable means during placement and shall be worked around embedded items and reinforcement and into corners of forms. Where stay-in-place forms are used, concrete shall be consolidated by internal vibration. (IRC 608.5.1.6)

Install slab and floor prior to backfilling against basement wall. Or provide temporary shoring until floors have been placed.

Horizontals @ 16" o.c.
12" o.c. @ 9' walls

#4 vertical rebar @ 16" o.c. with 8" hook x 36" vertical. 12" o.c. @ 9' walls. Hooks require a minimum 6" embedment.

(3) #4 rebar

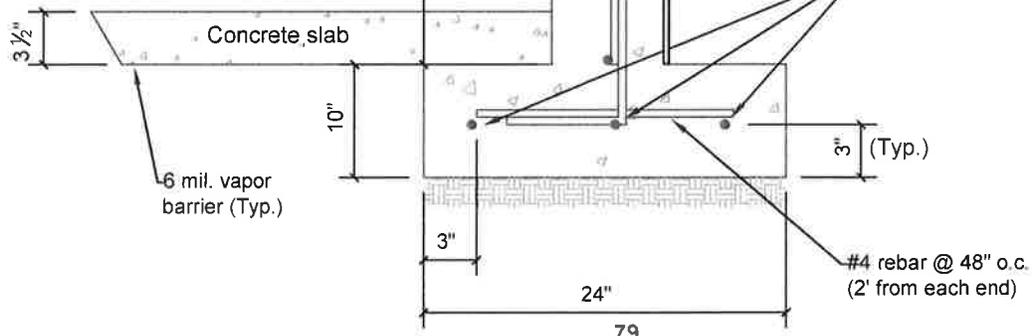
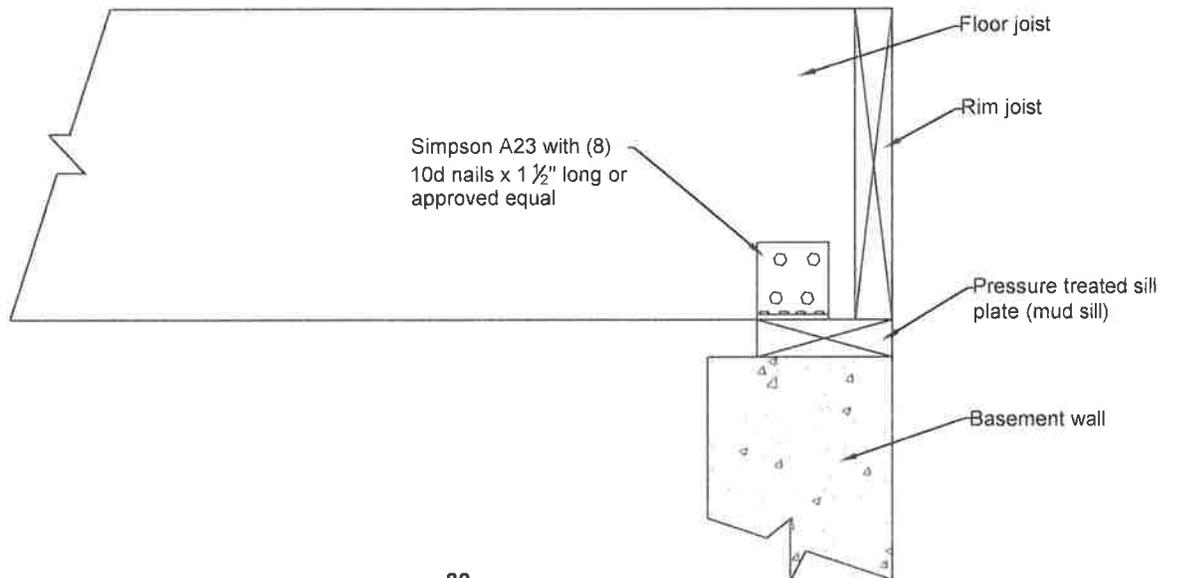
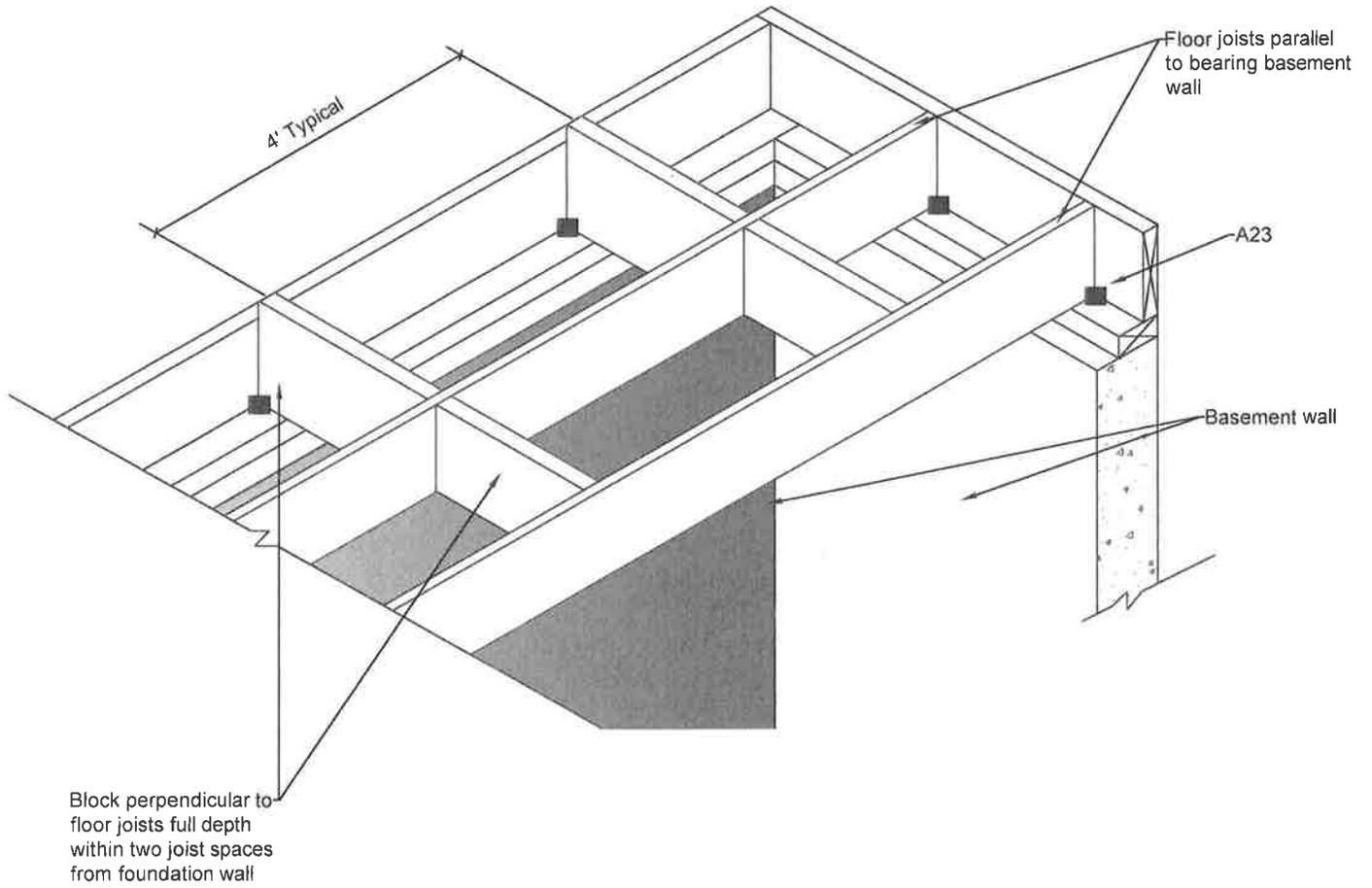


FIGURE 18A BLOCKING FLOORS ABOVE BASEMENTS



**FIGURE 19
RETAINING WALL**

Retaining walls 4 feet and less from bottom of footing to top of wall do not require a permit. Retaining walls taller than 4 feet shall require site specific stamped and signed engineering by an engineer licensed in the State of Washington.

**FIGURE 19 - CONTINUED
RETAINING WALL**

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FIGURE 20 FOUNDATION CLEARANCE FROM SLOPES

R403.1.7 Footings on or adjacent to slopes. The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3 percent slope) shall conform to Sections R403.1.7.1 through R403.1.7.4.

R403.1.7.1 Building clearances from ascending slopes. In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in Section R403.1.7.4 and Figure R403.1.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100 percent slope), the toe of the slope shall be assumed to be at the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

R403.1.7.2 Footing setback from descending slope surfaces. Footings on or adjacent to slope surfaces shall be founded in material with an embedment and setback from the slope surface sufficient to provide vertical and lateral support for the footing without detrimental settlement. Except as provided for in Section R403.1.7.4 and Figure R403.1.7.1, the following setback is deemed adequate to meet the criteria. Where a slope is steeper than one unit vertical in one unit horizontal (100 percent slope), the required setback shall be measured from an imaginary plane 45 degrees to the horizontal, projected upward from the toe of the slope.

R403.1.7.3 Foundation elevation. On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an approved drainage device a minimum of 12 inches plus 2 percent. Alternate elevations are permitted subject to approval of the building official, provided it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

R403.1.7.4 Alternate setbacks and clearances. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official is permitted to require an investigation and recommendation of a qualified engineer to demonstrate that the intent of this section has been satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

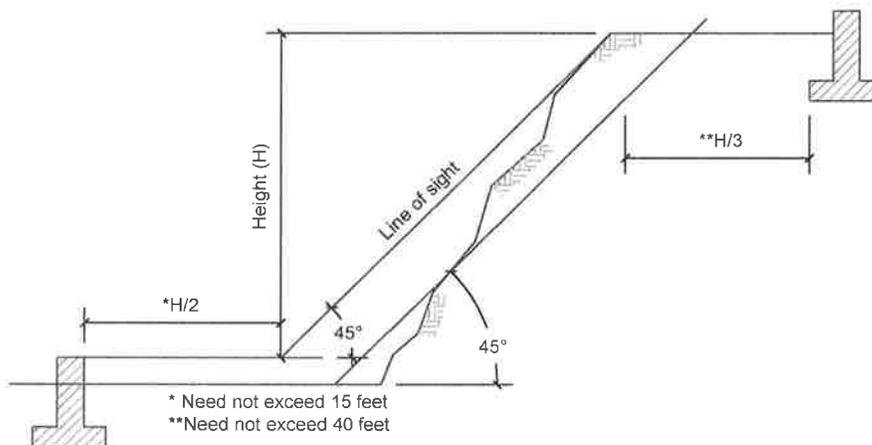
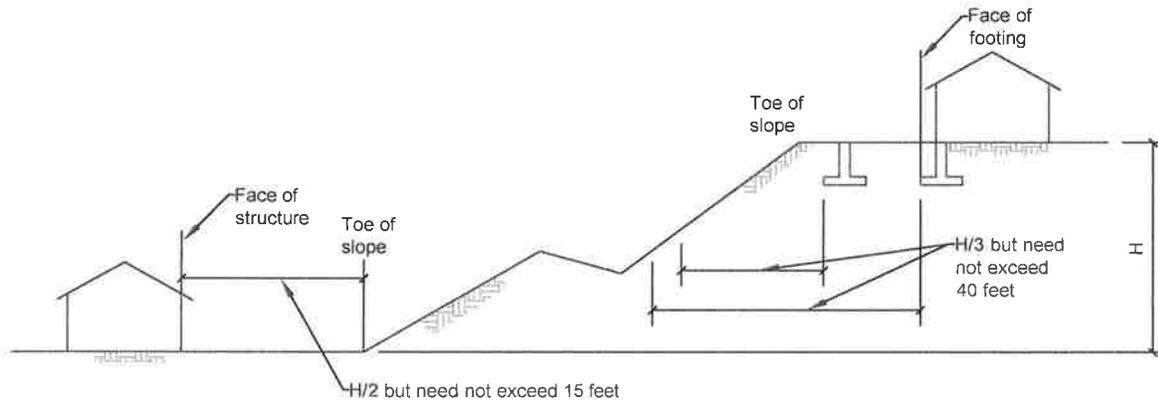


FIGURE 21 UNDER FLOOR SPACE

R408.1 Ventilation. The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a basement) shall have ventilation openings through foundation walls or exterior walls. A ground cover of six mil black polyethylene or approved equal shall be laid over the ground within crawl spaces. The ground cover shall extend to the foundation wall.

Exception: The ground cover may be omitted in crawl spaces if the crawl space has a concrete slab floor with a minimum thickness of two inches.

R408.2 Openings for under-floor ventilation. The minimum net area of ventilation openings shall not be less than 1 square foot for each 300 square feet of under-floor area. Required openings shall be evenly placed to provide cross ventilation of the space except one side of the building shall be permitted to have no ventilation openings. Ventilation openings shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed $\frac{1}{4}$ inch:

1. Perforated sheet metal plates not less than 0.070 inch thick.
2. Expanded sheet metal plates not less than 0.047 inch thick.
3. Cast-iron grill or grating.
4. Extruded load-bearing brick vents.
5. Hardware cloth of 0.035 inch wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension being $\frac{1}{8}$ inch thick.

Exception: The total area of ventilation openings shall be permitted to be reduced to 1:1,500 of the under-floor area where the ground surface is covered with an approved Class I vapor retarder material and the required openings are placed to provide cross ventilation of the space. The installation of operable louvers shall not be prohibited. If the installed ventilation is less than 1:300, or if operable louvers are installed, a radon vent shall be installed to originate from a point between the ground cover and soil. The radon vent shall be installed in accordance with the requirements of Appendix F (Radon) of this code.

R408.3 Unvented crawl space. Ventilation openings in under-floor spaces shall not be required where:

1. Exposed earth is covered with a continuous Class I vapor retarder. Joints of the vapor retarder shall overlap by 6 inches and shall be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches up the stem wall and shall be attached and sealed to the stem wall; and a radon system shall be installed that it meets the requirements of Appendix F (Radon) of this code.
2. Continuously operated mechanical exhaust ventilation is provided at a rate equal to 1 cfm per minute for each 50 square feet of crawlspace floor area. Exhaust ventilation shall terminate to the exterior.

Exception: Plenum in existing structures complying with Section M1601.5, if under-floor space is used as a plenum.

R408.4 Access. Access shall be provided to all under-floor spaces. Access openings through the floor shall be a minimum of 18 inches by 24 inches. Openings through a perimeter wall shall be not less than 16 inches by 24 inches. When any portion of the through-wall access is below grade, an areaway not less than 16 inches by 24 inches shall be provided. The bottom of the areaway shall be below the threshold of the access opening. Through wall access openings shall not be located under a door to the residence. See Section M1305.1.4 for access requirements where mechanical equipment is located under floors.

R408.5 Removal of debris. The under-floor grade shall be cleaned of all vegetation and organic material. All wood forms used for placing concrete shall be removed before a building is occupied or used for any purpose. All construction materials shall be removed before a building is occupied or used for any purpose.

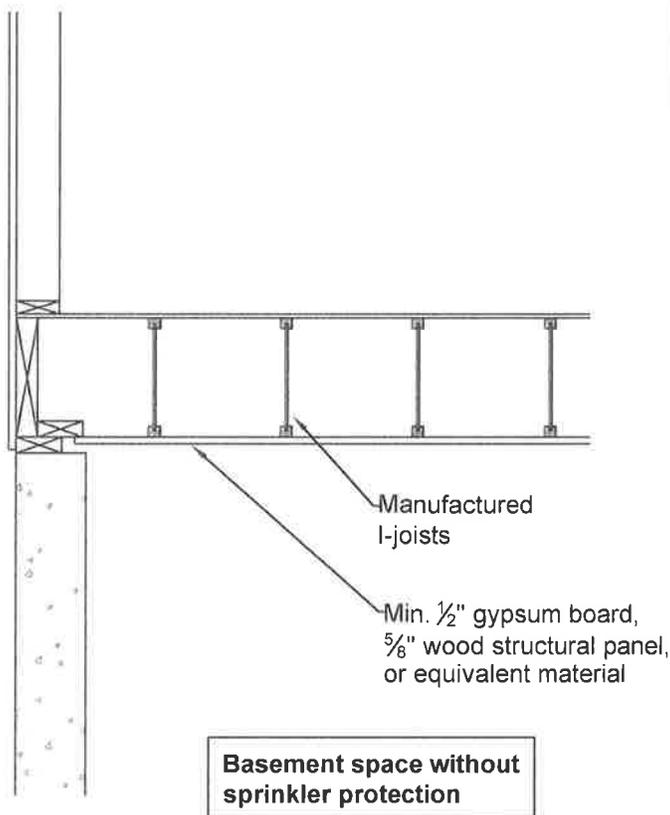
R408.6 Finished grade. The finished grade of under-floor surface may be located at the bottom of the footings; however, where there is evidence that the groundwater table can rise to within 6 inches of the finished floor at the building perimeter or where there is evidence that the surface water does not readily drain from the building site, the grade in the under-floor space shall be as high as the outside finished grade, unless an approved drainage system is provided.

FIGURE 21 - CONTINUED UNDER FLOOR SPACE

R302.13 Fire protection of floors. Floor assemblies, that are not required elsewhere in this code to be fire-resistance rated, shall be provided with a $\frac{1}{2}$ inch gypsum wallboard membrane, $\frac{5}{8}$ inch wood structural panel membrane, or equivalent on the underside of the floor framing member. Penetrations or openings for ducts, vents, electrical outlets, lighting, devices, luminaires, wires, speakers, drainage, piping and similar openings or penetrations shall be permitted.

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Appendix Q, NFPA 13D, or other approved equivalent sprinkler system.
2. Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.
3. Portions of floor assemblies can be unprotected when complying with the following:
 - 3.1 The aggregate area of the unprotected portions shall not exceed 80 square feet per story.
 - 3.2 Fire blocking in accordance with Section R302.11.1 shall be installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.
4. Wood floor assemblies using dimensional lumber or structural composite lumber with a cross sectional area equal to or greater than 2-inch by 10-inch nominal dimension, or other approved floor assemblies demonstrating equivalent fire performance.



For additional methods providing equivalent fire protection of floors, contact the Building Department.

FIGURE 22

SOLID SAWN LUMBER-RAFTER & JOIST NOTCHING & BORING

This figure is only applicable to sawn lumber. For engineered wood products, cuts, notches and holes bored in trusses, structural composite lumber, glued-laminated members or I-joists are prohibited except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

R502.8.1 Sawn lumber. Notches in solid lumber joists, rafters and beams shall not exceed one-sixth of the depth of the member, shall not be longer than one-third of the depth of the member and shall not be located in the middle one-third of the span. Notches at the ends of the member shall not exceed one-fourth the depth of the member. The tension side of members 4 inches or greater in nominal thickness shall not be notched except at the ends of the members. The diameter of holes bored or cut into members shall not exceed one-third the depth of the member. Holes shall not be closer than 2 inches to the top or bottom of the member, or to any other hole located in the member. Where the member is also notched, the hole shall not be closer than 2 inches to the notch.

R802.7.1.1 Cantilevered portions of rafters. Notches on cantilevered portions of rafters are permitted provided the dimension of the remaining portion of the rafters is not less than 3 1/2 inches and the length of the cantilever does not exceed 24 inches.

R802.7.1.2 Ceiling joist taper cut. Taper cuts at the ends of the ceiling joist shall not exceed one-fourth the depth of the member.

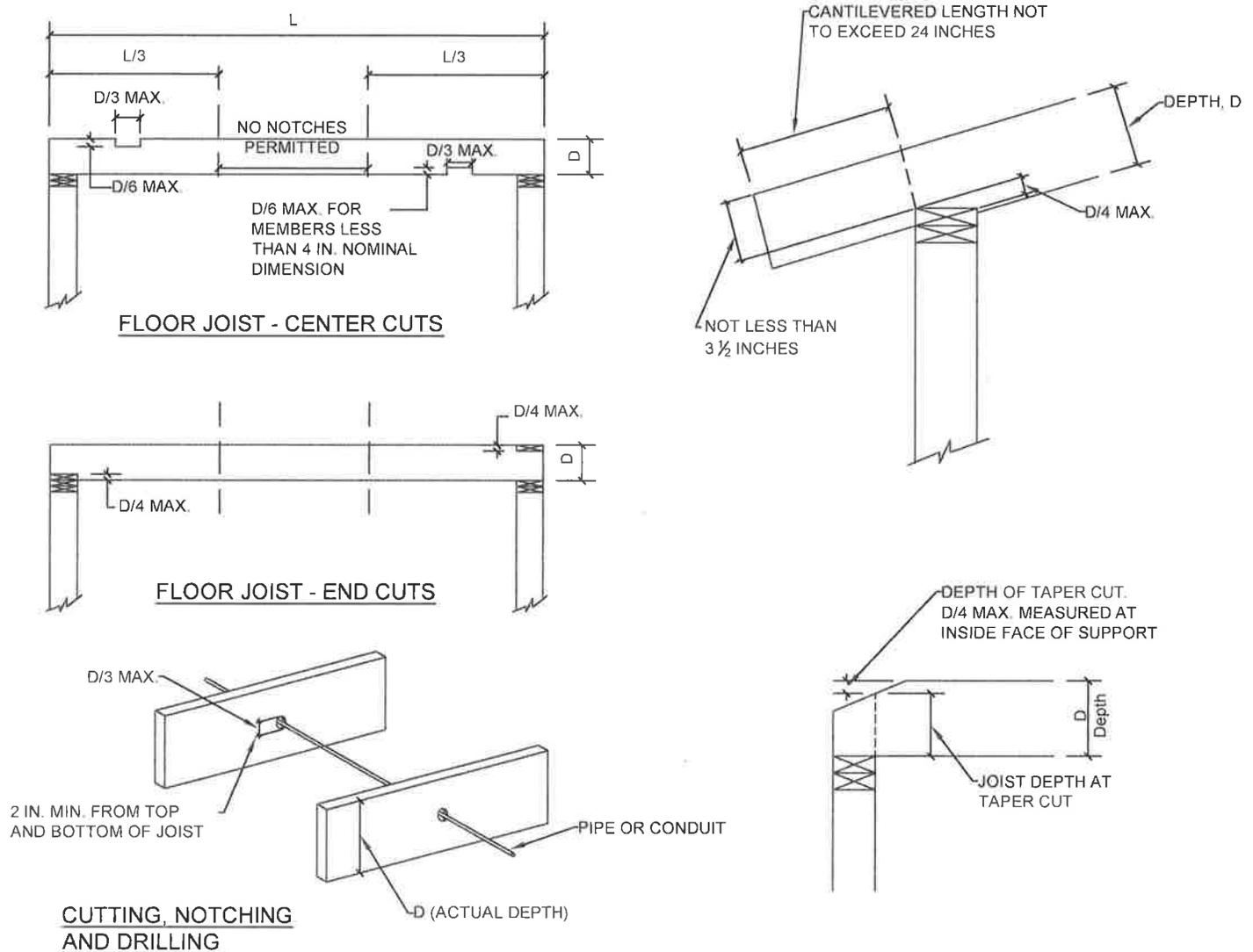


FIGURE 23 FLOOR CONSTRUCTION

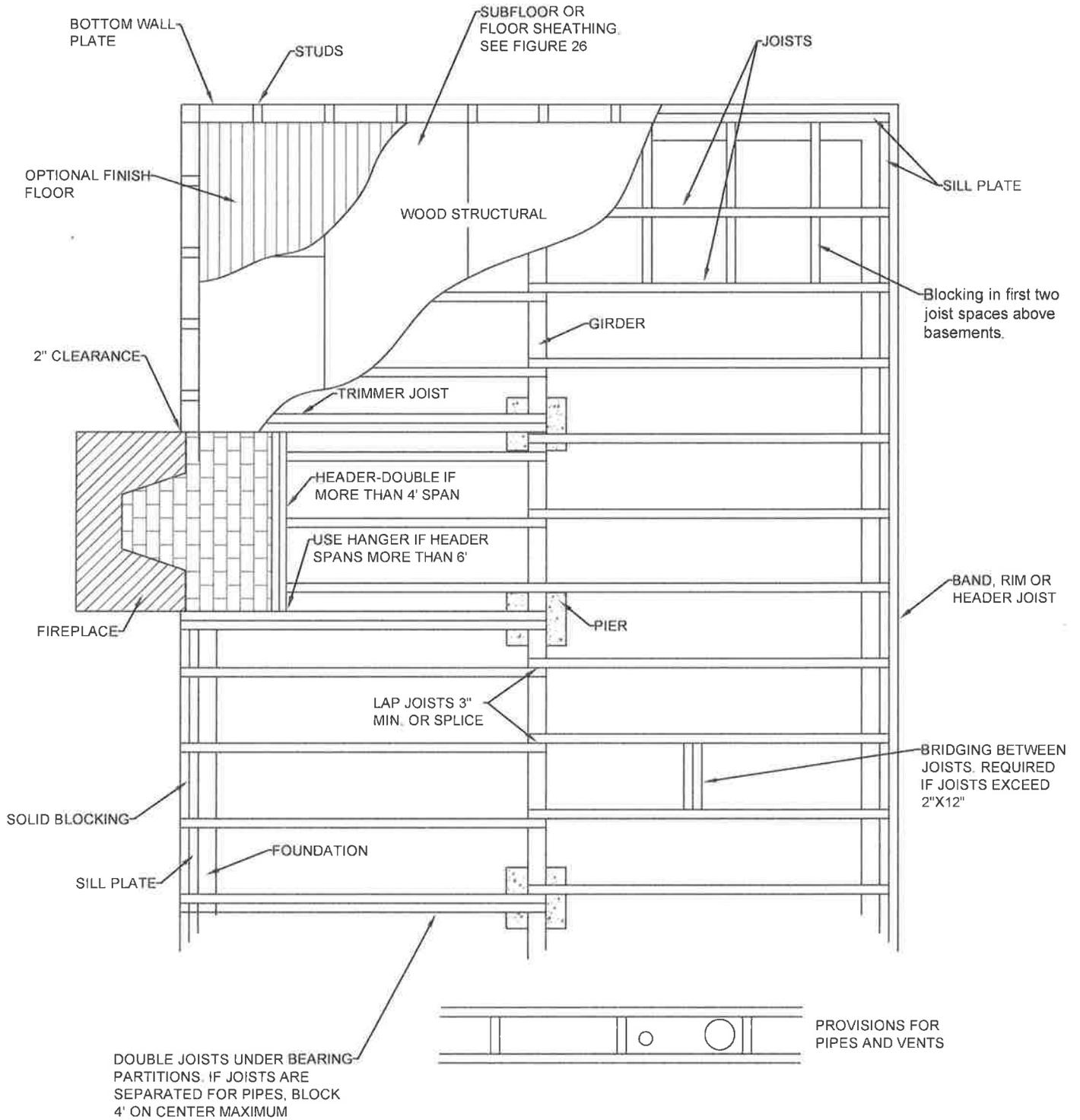


FIGURE 24 FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

Table R602.3(1)

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER & TYPE OF FASTENER ^{a,b,c}	SPACING AND LOCATION
Roof			
1	Blocking between ceiling joists or rafters to top plate	4-8d box (2 1/2"x0.113") or 3-8d common (2 1/2"x0.131"); or 3-10d box (3"x0.128"); or 3-3"x0.131" nails	Toe nail
2	Ceiling joists to top plate	4-8d box (2 1/2"x0.113"); or 3-8d common (2 1/2"x0.131"); or 3-10d box (3"x0.128"); or 3-3"x0.131" nails	Per joist, toe nail
3	Ceiling joists not attached to parallel rafter, laps over partitions [see Sections R802.3.1, R802.3.2 and Table R802.5.1(9)]	4-10d box (3"x0.128"); or 3-16d common (3 1/2"x0.162"); or 4-3"x0.131" nails	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) [see Sections R802.3.1 and R802.3.2 and Table R802.5.1(9)]	Table R802.5.1(9)	Face nail
5	Collar tie to rafter, face nail or 1 1/4"x20 ga. ridge strap to rafter	4-10d box (3"x0.128"); or 3-10d common (3"x0.148"); or 4-3"x0.131" nails	Face nail each rafter
6	Rafter or roof truss to plate	3-16d box nails (3 1/2"x0.135"); or 3-10d common nails (3"x0.148"); or 4-10d box (3"x0.128"); or 4-3"x0.131" nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss ¹
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2" ridge beam	4-16d (3 1/2"x0.135"); or 3-10d common (3 1/2"x0.148"); or 4-10d box (3"x0.128"); or 4-3"x0.131" nails 3-16d box (3 1/2"x0.135"); or 2-16d common (3 1/2"x0.162"); or 3019d box (3"x0.128"); or 3-3"x0.131" nails	Toe nail End nail
Wall			
8	Stud to stud (not at braced wall panels)	16d common (3 1/2"x0.162") ----- 10d box (3"x0.128"); or 3"x0.131" nails	24" O.C. face nail ----- 16" O.C. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3 1/2"x0.135"); or 3"x0.131" nails ----- 16d common (3 1/2"x0.162")	12" O.C. face nail ----- 16" O.C. face nail
10	Built-up header (2" to 2" header with 1/2" spacer)	16d common (3 1/2"x0.162") ----- 16d box (3 1/2"x0.135")	16" O.C. each edge face nail ----- 12" O.C. each edge face nail
11	Continuous header to stud	5-8d box (2 1/2"x0.113"); or 4-8d common (2 1/2"x0.131"); or 4-10d box (3"x0.128")	Toe nail
12	Top plate to top plate	16d common (3"x0.128"); or ----- 10d box (3"x0.128"); or 3"x0.131" nails	16" O.C. face nail ----- 12" O.C. face nail
13	Double top plate splice for SDCs A-D ₂ with seismic braced wall line spacing < 25'	8-16d common (3 1/2"x0.162"); or 12-16d box (3 1/2"x0.135"); or 12-10d box (3"x0.128"); or 12-3"x0.131" nails	Face nail on each side of end joint (minimum 24" lap splice length each side of end joint)

(continued)

FIGURE 24 - CONTINUED FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

Table R602.3(1)-continued

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER & TYPE OF FASTENER ^{a,b,c}	SPACING AND LOCATION
14	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3 1/2"x0.162")	16" O.C. face nail
		16d box (3 1/2"x0.135"); or 3"x0.131" nails	12" O.C. face nail
15	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3 1/2"x0.135"); or 2-16d common (3 1/2"x0.162"); or 4-3"x0.131" nails	3 each 16" O.C. face nail 2 each 16" O.C. face nail 4 each 16" O.C. face nail
16	Top or bottom plate to stud	4-8d box (2 1/2"x0.113"); or 3-16d box (3 1/2"x0.135"); or 4-8d common (2 1/2"x0.131"); or 4-10d box (3"x0.128"); or 4-3"x0.131" nails	Toe nail
		3-16d box (3 1/2"x0.135"); or 2-16d common (3 1/2"x0.162"); or 3-10d box (3"x0.128"); or 3-3"x0.131" nails	End nail
17	Top plates, laps at corners and intersections	3-10d box (3"x0.128"); or 2-16d common (3 1/2"x0.162"); or 3-3"x0.131" nails	Face nail
18	1" brace to each stud and plate	3-8d box (2 1/2"x0.113"); or 2-8d common (2 1/2"x0.131"); or 2-10d box (3"x0.128"); or 2 staples 1 3/4"	Face nail
19	1" x 6" sheathing to each bearing	3-8d box (2 1/2"x0.113"); or 2-8d common (2 1/2"x0.131"); or 2-10d box (3"x0.128"); or 2 staples, 1" crown, 16 ga., 1 3/4" long	Face nail
20	1" x 8" and wider sheathing to each bearing	3-8d box (2 1/2"x0.113"); or 3-8d common (2 1/2"x0.131"); or 3-10d box (3"x0.128"); or 3 staples, 1" crown, 16 ga., 1 3/4" long	Face nail
		Wider than 1" x 8" 4-8d box (2 1/2"x0.113"); or 3-8d common (2 1/2"x0.131"); or 3-10d box (3"x0.128"); or 4 staples, 1" crown, 16 ga., 1 3/4" long	
Floor			
21	Joist to sill, top plate or girder	4-8d box (2 1/2"x0.113"); or 3-8d common (2 1/2"x0.131"); or 3-10d box (3"x0.128"); or 3-3"x0.131" nails	Toe nail
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d common (2 1/2"x0.131"); or 10d box (3"x0.128"); or 3"x0.131" nails	6" O.C. toe nail
23	1" x 6" subfloor or less to each joist	3-8d box (2 1/2"x0.113"); or 2-8d common (2 1/2"x0.131"); or 3-10d box (3"x0.128"); or 2 staples, 1" crown, 16 ga., 1 3/4" long	Face nail

(continued)

FIGURE 24 - CONTINUED FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

Table R602.3(1)-continued

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER & TYPE OF FASTENER ^{a,b,c}	SPACING AND LOCATION	
Floor				
24	2" subfloor to joist or girder	3-16d box (3 1/2"x0.135"); or 2-16d common (3 1/2"x0.162")	Blind and face nail	
25	2" planks (plank & beam-floor & roof)	3-16d box (3 1/2"x0.135"); or 2-16d common (3 1/2"x0.162")	At each bearing, face nail	
26	Band or rim joist to joist	3-16d common (3 1/2"x0.162"); or 4-10 box (3"x0.128"); or 4-3"x0.131" nails; or 4-3"x14 ga. staples, 7/16" crown	End nail	
27	Built-up girders and beams, 2-inch lumber layers	20d common (4"x0.192"); or	Nail each layer as follows: 32" O.C. at top and bottom and staggered.	
		10d box (3"x0.128"); or 3"x0.131" nails	24" O.C. face nail at top and bottom staggered on opposite sides	
		And: 2-20d common (4"x0.192"); or 3-10d box (3"x0.128"); or 3-3"x0.131" nails	Face nail at ends and at each splice	
28	Ledger strip supporting joists or rafters	4-16d box (3 1/2"x0.135"); or 3-16d common (3 1/2"x0.162"); or 4-10d box (3"x0.128"); or 4-3"x0.131" nails	At each joist or rafter, face nail	
29	Bridging to joist	2-10d (3"x0.128")	Each end, toe nail	
ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENERS ^{a,b,c}	SPACING OF FASTENERS	
			Edges (inches) ^h	Intermediate supports ^{c,e} (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel exterior wall and sheathing to wall framing]				
30	3/8" - 1/2"	6d common (2"x0.113") nail (subfloor, wall) 8d common (2 1/2"x0.131") (roof)	6	12 ^f
31	19/32" - 1"	8d common (2 1/2"x0.131")	6	12 ^f
32	1 1/8" - 1 1/4"	10d common (3"x0.148") nail; or 8d (2 1/2"x0.131") deformed nail	6	12
Other wall sheathing^g				
33	1/2" structural cellulosic fiberboard sheathing	1 1/2" galvanized roofing nail, 7/16" head diameter, or 1" crown staple 16 ga., 1 1/4" long	3	6
34	25/32" structural cellulosic fiberboard sheathing	1 3/4" galvanized roofing nail, 7/16" head diameter, or 1" crown staple 16 ga., 1 1/4" long	3	6
35	1/2" gypsum board sheathing ^d	1 1/2" galvanized roofing nail; staple galvanized, 1 1/2" long; 1 1/4" screws, Type W or S	7	7
36	5/8" gypsum board sheathing ^d	1 3/4" galvanized roofing nail; staple galvanized, 1 5/8" long; 1 5/8" screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
37	3/4" and less	6d deformed (2"x0.120") nail; or 8d common (2 1/2"x0.131") nail	6	12
38	7/8" - 1"	8d common (2 1/2"x0.131") nail; or 8d deformed (2 1/2"x0.120") nail	6	12
39	1 1/8" - 1 1/4"	10d common (3"x0.148") nail; or 8d deformed (2 1/2"x0.120") nail	6	12

FIGURE 24 - CONTINUED FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

Table R602.3(1)-continued

- a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less.
- b. Staples are 16 gage wire and have a minimum $\frac{7}{16}$ inch on diameter crown width.
- c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.
- d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.
- e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).
- f. Where the ultimate design wind speed is 130 mph or less, nails for attaching wood structural panel roof sheathing to gable end wall framing shall be spaced 6 inches on center. Where the ultimate design wind speed is greater than 130 mph, nails for attaching panel roof sheathing to intermediate supports shall spaced 6 inches on center for minimum 48-inch distance from ridges, eaves and gable end walls; and 4 inches on center to gable end wall framing.
- g. Gypsum sheathing shall conform to ASTM C 1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C 208.
- h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.
- i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.

FIGURE 25 ALTERNATE ATTACHMENTS

**Table R602.3(2)
ALTERNATE ATTACHMENTS TO TABLE R602.3(1)**

NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a,b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches)	Intermediate supports (inches)
Wood structural panels subfloor, roof ^g and wall sheathing to framing and particleboard wall sheathing to framing ⁱ			
Up to 1/2	Staple 15 ga. 1 3/4	4	8
	0.097 - 0.099 Nail 2 1/4	3	6
	Staple 16 ga. 1 3/4	3	6
19/32 and 5/8	0.113 Nail 2	3	6
	Staple 15 and 16 ga. 2	4	8
	0.097 - 0.099 Nail 2 1/4	4	8
23/32 and 3/4	Staple 14 ga. 2	4	8
	Staple 15 ga. 1 3/4	3	6
	0.097 - 0.099 Nail 2 1/4	4	8
	Staple 16 ga. 2	4	8
1	Staple 14 ga. 2 1/4	4	8
	0.113 Nail 2 1/4	3	6
	Staple 15 ga. 2 1/4	4	8
	0.097 - 0.099 Nail 2 1/2	4	8
NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a,b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches)	Body of panel ^d (inches)
Floor underlayment; plywood-hardboard-particleboard ^f			
Plywood			
1/4 and 5/16	1 1/4 ring or screw shank nail - minimum 12 1/2 ga. (0.099") shank diameter	3	6
	Staple 18 ga., 7/8, 3/16 crown width	2	5
11/32, 3/8, 15/32 and 1/2	1 1/4 ring or screw shank nail - minimum 12 1/2 ga. (0.099") shank diameter	6	8 ^e
19/32, 5/8, 23/32 and 3/4	1 1/2 ring or screw shank nail - minimum 12 1/2 ga. (0.099") shank diameter	6	8
	Staple 16 ga. 1 1/2	6	8
Hardboard ^f			
0.200	1 1/2 long ring-grooved underlayment nail	6	6
	4d cement-coated sinker nail	6	6
	Staple 18 ga., 7/8 long (plastic coated)	3	6
Particleboard			
1/4	4d ring-grooved underlayment nail	3	6
	Staple 18 ga., 7/8 long, 3/16 crown	3	6
3/8	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1 1/8 long, 3/8 crown	3	6
1/2, 5/8	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1 5/8 long, 3/8 crown	3	6

a. Nail is a general description and may be T-head, modified round head or round head.

b. Staples shall have a minimum crown width of 1/16 inch on diameter except as noted.

c. Nails or staples shall be spaced at not more than 6 inches on center at all supports where spans are 48" or greater. Nails or staples shall be spaced at not more than 12 inches on center at intermediate supports for floors.

d. Fasteners shall be placed in a grid pattern throughout the body of the panel.

e. For 5-ply panels, intermediate nails shall be spaced not more than 12 inches on center each way.

f. Hardboard underlayment shall conform to CPA/ANSI A 135.4.

g. Specified alternate attachments for roof sheathing shall be permitted where the ultimate design wind speed is less than 130 mph. Fasteners attaching wood structural panel roof sheathing to gable end wall framing shall be installed using the spacing listed for panel edges.

h. Fiber-cement underlayment shall conform to ASTM C 1288 or ISO 6336, Category C.

FIGURE 26 FLOOR SHEATHING

R503.1 Lumber sheathing. Maximum allowable spans for lumber used as floor sheathing shall conform to Table R503.1, R503.2.1(1) and R503.2.1.1(2).

R503.1.1 End joints. End joints in lumber used as sub-flooring shall occur over supports unless end-matched lumber is used, in which case each piece shall bear on at least two joists. Subflooring may be omitted when joist spacing does not exceed 16 inches and a 1-inch nominal tongue-and-groove wood strip flooring is applied perpendicular to the joists.

R503.2 Wood structural panel sheathing.

R503.2.1 Identification and grade. Wood structural panel sheathing used for structural purposes shall conform to DOC PS 1, DOC PS 2, CSA 0437 or CSA 0325. Panels shall be identified for grade, bond classification and Performance Category by a grade mark or certificate of inspection issued by an approved agency. The Performance Category value shall be used as the "nominal panel thickness" or "panel thickness" wherever referenced in this code.

R503.2.1.1 Subfloor and combined subfloor underlayment. Where used as subflooring or combination subfloor underlayment, wood structural panels shall be one of the grades specified in Table R503.2.1.1(1). When sanded plywood is used as combination subfloor underlayment, the grade, bond classification, and Performance Category shall be as specified in Table R503.2.1.1(2).

R503.2.2 Allowable spans. The maximum allowable span for wood structural panels used as subfloor or combination subfloor underlayment shall be as set forth in Table R503.2.1.1(1) or APA E30. The maximum span for sanded plywood combination subfloor underlayment shall be as set forth in Table R503.2.1.1(2).

R503.2.3 Installation. Wood structural panels used as subfloor or combination subfloor underlayment shall be attached to wood framing in accordance with Table R602.3(1). (Figure 24 or Figure 25)

R503.3 Particleboard

R503.3.1 Identification and grade. Particleboard shall conform to ANSI A208.1 and shall be so identified by a grade mark or certificate of inspection issued by an approved agency.

R503.3.2 Floor underlayment. Particleboard floor underlayment shall conform to Type PBU and shall not be less than ¼ inch in thickness.

R503.3.3 Installation. Particleboard underlayment shall be installed in accordance with the recommendations of the manufacturer and attached to framing in accordance with Table R602.3(1). (Figure 24 or Figure 25)

**TABLE R503.1
MINIMUM THICKNESS OF LUMBER FLOOR SHEATHING**

JOIST OR BEAM SPACING (inches)	MINIMUM NET THICKNESS	
	Perpendicular to joist	Diagonal to joist
24	1 1/16	3/4
16	5/8	5/8
48 ^a	1 1/2 T & G	N/A
54 ^b		
60 ^c		

- a. For this support spacing, lumber sheathing shall have a minimum F_b of 675 and minimum E of 1,100,000 (see AF&PA/NDS).
- b. For this support spacing, lumber sheathing shall have a minimum F_b of 765 and minimum E of 1,400,000 (see AF&PA/NDS).
- c. For this support spacing, lumber sheathing shall have a minimum F_b of 855 and minimum E of 1,700,000 (see AF&PA/NDS).

FIGURE 26 - CONTINUED FLOOR SHEATHING

TABLE R503.2.1.1(1)
ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANELS FOR ROOF AND
SUBFLOOR SHEATHING AND COMBINATION SUBFLOOR UNDERLAYMENT ^{a,b,c}

SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inch)	ALLOWABLE LIVE LOAD (psf) ^{h,i}		MAXIMUM SPAN (inches)		LOAD (pounds per square foot, at maximum span)		MAXIMUM SPAN (inches)	
		SPAN @ 16" O.C.	SPAN @ 24" O.C.	With edge support ^d	Without edge support	Total load	Live load		
Sheathing ^e		Roof ^f						Subfloor ^j	
16/0	3/8	30	—	16	16	40	30	0	
20/0	3/8	50	—	20	20	40	30	0	
24/0	3/8	100	30	24	20 ^g	40	30	0	
24/16	7/16	100	40	24	24	50	40	16	
32/16	1 5/32, 1/2	180	70	32	28	40	30	16 ^h	
40/20	1 9/32, 5/8	305	130	40	32	40	30	20 ^{h,i}	
48/24	2 3/32, 3/4	—	175	48	36	45	35	24	
60/32	7/8	—	305	60	48	45	35	32	
Underlayment, C-C plugged, single floor ^o		Roof ^f						Combination subfloor underlayment ^k	
16 o.c.	1 9/32, 5/8	100	40	24	24	50	40	16 ⁱ	
20 o.c.	1 9/32, 5/8	150	60	32	32	40	30	20 ^{l,j}	
24 o.c.	2 3/32, 3/4	240	100	48	36	35	25	24	
32 o.c.	7/8	—	185	48	40	50	40	32	
48 o.c.	1 3/32, 1 1/8	—	290	60	48	50	40	48	

- a. The allowable total loads were determined using a dead load of 10 psf. If the dead load exceeds 10 psf, then the live load shall be reduced accordingly.
- b. Panels continuous over two or more spans with long dimension (strength axis) perpendicular to supports. Spans shall be limited to values shown because of possible effect of concentrated loads.
- c. Applies to panels 24 inches or wider.
- d. Lumber blocking, panel edge clips (one midway between each support, except two equally spaced between supports when span is 48 inches), tongue-and-groove panel edges, or other approved type of edge support.
- e. Includes Structural 1 panels in these grades.
- f. Uniform load deflection limitation: 1/80 of span under live load plus dead load, 1/240 of span under live load only.
- g. Maximum span 24 inches for 1 5/32 and 5/8 inch panels.
- h. Maximum span 24 inches where 3/4 inch wood finish flooring is installed at right angles to joists.
- i. Maximum span 24 inches where 1.5 inches of lightweight concrete or approved cellular concrete is placed over the subfloor.
- j. Unsupported edges shall have tongue-and-groove joints or shall be supported with blocking unless minimum nominal 1/2 inch thick wood panel-type underlayment, fiber-cement underlayment with end joints offset not less than 2 inches or 1 1/2 inches of lightweight concrete or approved cellular concrete is placed over the subfloor, or 3/4 inch wood finish flooring is installed at right angles to the supports. Fiber-cement underlayment shall comply with ASTM C 1288 or ISO 8336 Category C. Allowable uniform live load at maximum span, based on deflection of 1/360 of span, is 100 psf.
- k. Unsupported edges shall have tongue-and-groove joints or shall be supported by blocking unless nominal 1/4 inch thick wood panel-type underlayment, fiber cement underlayment with end joints offset not less than 2 inches or 3/4 inch wood finish flooring is installed at right angles to the supports. Fiber cement underlayment shall comply with ASTM C 1288 or ISO 8336 Category C. Allowable uniform live load at maximum span, based on deflection of 1/360 of span, is 100 psf, except panels with a span rating of 48 on center are limited to 65 psf total uniform load at maximum span.
- l. Allowable live load values at spans 16 inches on center and 24 inches on center taken from reference standard APA E30, APA Engineered Wood Construction Guide. Refer to reference standard for allowable spans not listed in the table.

TABLE R503.1
MINIMUM THICKNESS OF LUMBER FLOOR SHEATHING

JOIST OR BEAM SPACING (inches)	MINIMUM NET THICKNESS	
	Perpendicular to joist	Diagonal to joist
24	1 1/16	3/4
16	5/8	5/8
48 ^a	1 1/2 T & G	N/A
54 ^b		
60 ^c		

- a. For this support spacing, lumber sheathing shall have a minimum F_b of 675 and minimum E of 1,100,000 (see AF&PA/NDS).
- b. For this support spacing, lumber sheathing shall have a minimum F_b of 765 and minimum E of 1,400,000 (see AF&PA/NDS).
- c. For this support spacing, lumber sheathing shall have a minimum F_b of 855 and minimum E of 1,700,000 (see AF&PA/NDS).

FIGURE 27 TYPICAL WALL, FLOOR & ROOF FRAMING

R602.3.3 Bearing studs. Where joists, trusses or rafters are spaced more than 16 inches on center and the bearing studs below are spaced 24 inches on center, such members shall bear within 5 inches of the studs beneath.

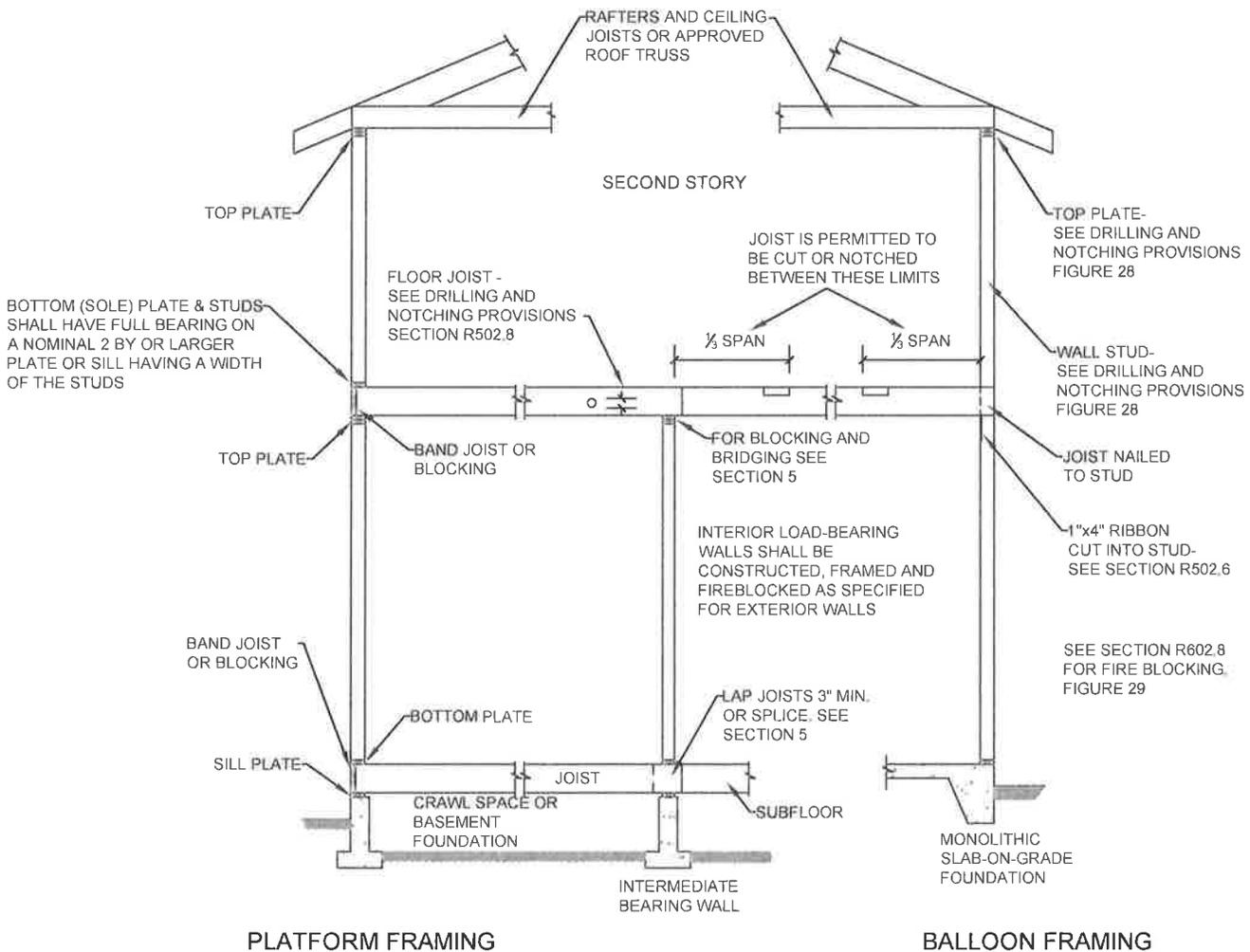
Exceptions:

1. The top plates are two 2-inch by 6-inch or two 3-inch by 4-inch members.
2. A third top plate is installed.
3. Solid blocking equal in size to the studs is installed to reinforce the double top plate.

R602.3.4 Bottom (sole) plate. Studs shall have full bearing on a nominal 2-by or larger plate or sill having a width of not less than than to the width of the studs.

STUDS SHALL BE CONTINUOUS FROM SUPPORT AT THE SOLE PLATE TO A SUPPORT AT THE TOP PLATE TO RESIST LOADS PERPENDICULAR TO THE WALL. THE SUPPORT SHALL BE A FOUNDATION OR FLOOR, CEILING OR ROOF DIAPHRAGM OR SHALL BE DESIGNED IN ACCORDANCE WITH ACCEPTED ENGINEERING PRACTICE.

****SINGLE WALLS EXCEEDING 12' IN HEIGHT SHALL REQUIRE STAMPED AND SIGNED ENGINEERING****



NOTE: FOR FASTENING REQUIREMENTS - SEE FIGURE 24 AND FIGURE 25

FIGURE 27 - CONTINUED TYPICAL WALL, FLOOR & ROOF FRAMING

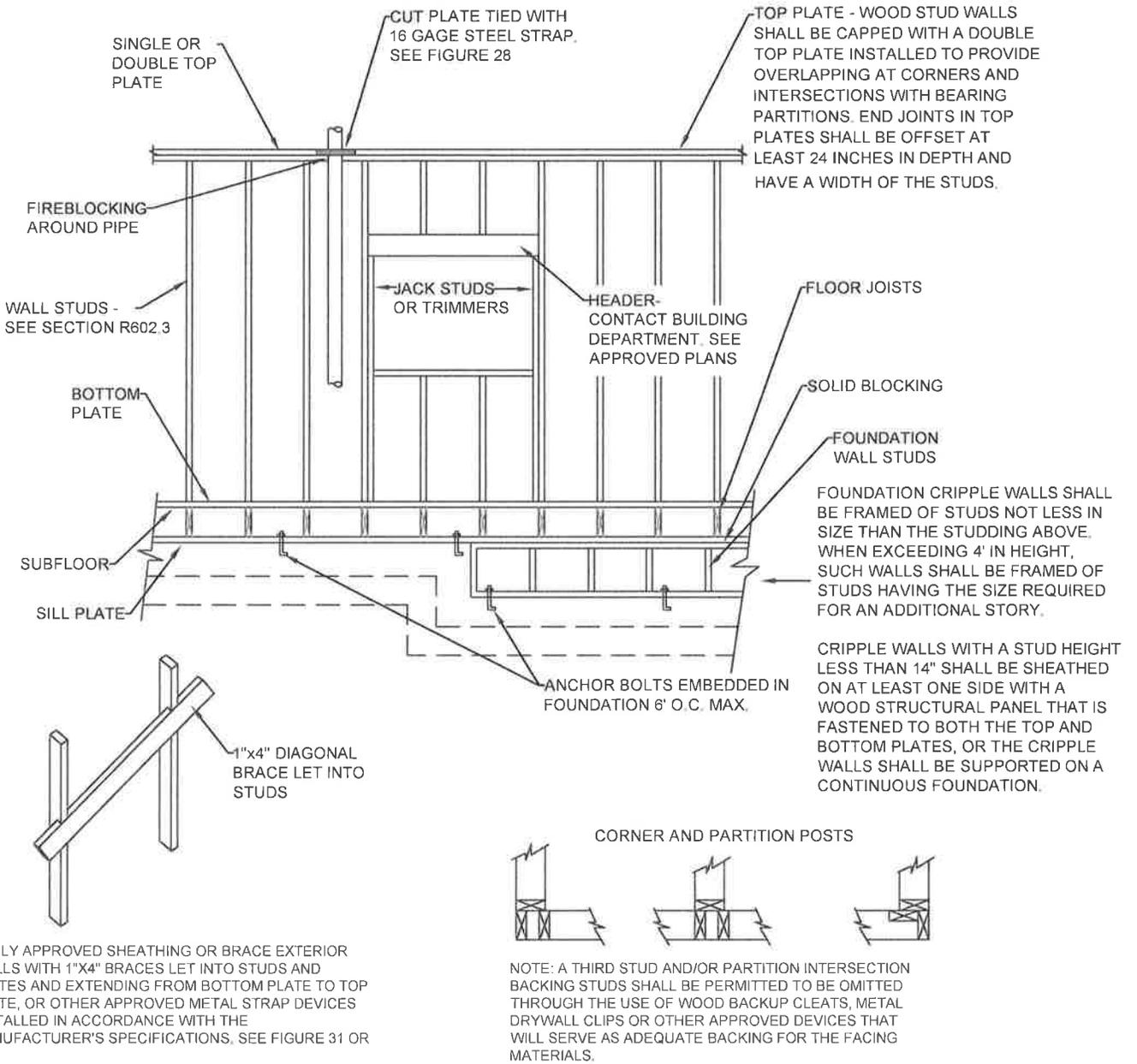


TABLE R602.3(5)
SIZE, HEIGHT AND SPACING OF WOOD STUDS^a

BEARING WALLS						NONBEARING WALLS	
STUD SIZE (inches)	Laterally unsupported stud height ^a (feet)	Maximum spacing when supporting a roof-ceiling assembly or a habitable attic assembly, only (inches)	Maximum spacing when supporting one floor, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing when supporting two floors, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing when supporting one floor height ^a (feet)	Laterally unsupported stud height ^a (feet)	Maximum spacing (inches)
2 x 3 ^b	-						
2 x 4	10	24 ^c	16 ^c	-	24	10	16
3 x 4	10	24	24	16	24	14	24
2 x 5	10	24	24	-	24	16	24
2 x 6	10	24	24	16	24	20	24

- a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Bearing walls shall be sheathed on not less than one side or bridging shall be installed not greater than 4 feet apart measured vertically from either end of the stud. Increases in unsupported height are permitted where in compliance with Exception 2 of Section R602.3.1 or designed in accordance with accepted engineering practice.
- b. Shall not be used in exterior walls.
- c. A habitable attic assembly supported by 2 x 4 studs is limited to a roof span of 32 feet. Where the roof span exceeds 32 feet, the wall studs shall be increased to 2 x 6 or the studs shall be designed in accordance with accepted engineering practice.

FIGURE 28 CUTTING & NOTCHING

R602.6 Drilling and notching of studs.

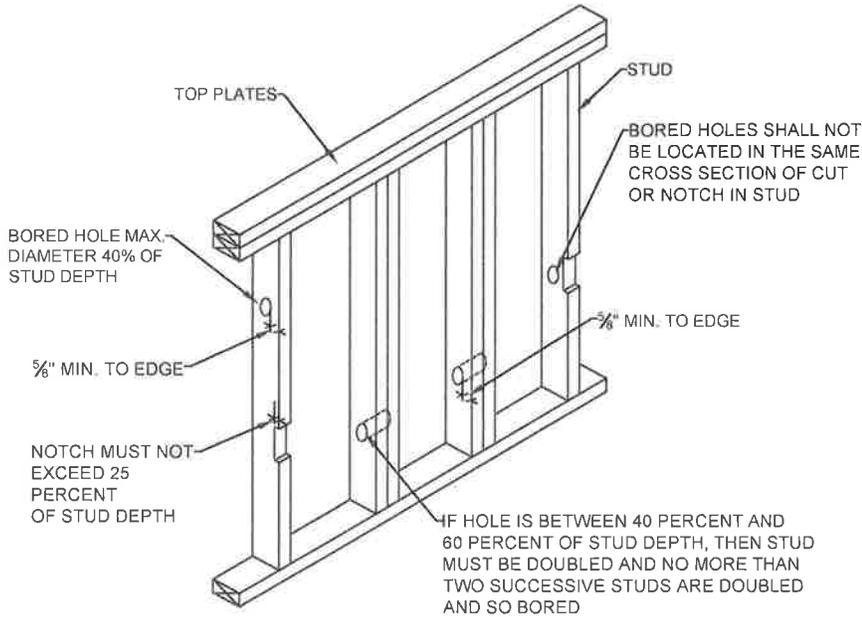


FIGURE R602.6(1)
NOTCHING AND BORED HOLED LIMITATIONS
FOR EXTERIOR WALLS AND BEARING WALLS

R602.6.1 Drilling and notching of top plate.

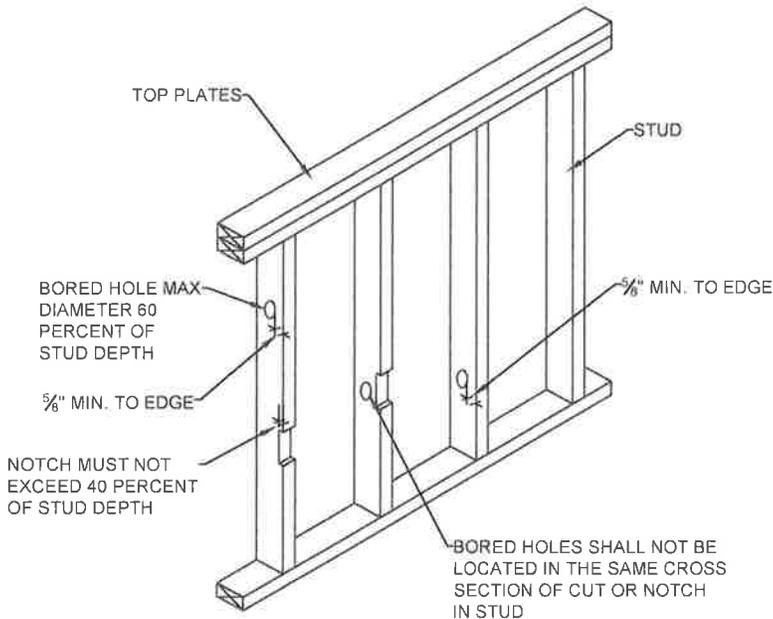


FIGURE R602.6(2)
NOTCHING AND BORED HOLED LIMITATIONS
FOR INTERIOR NONBEARING WALLS

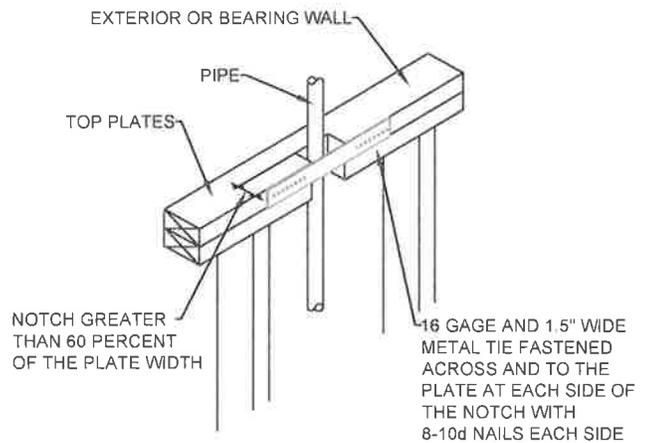


FIGURE R602.6.1
TOP PLATE FRAMING TO ACCOMMODATE PIPING

FIGURE 29 FIRE BLOCKING/DRAFTSTOPPING

R302.11 Fireblocking. In combustible construction, fireblocking shall be provided to cut off all concealed draft openings (both vertical and horizontal) and to form an effective fire barrier between stories, and between a top story and the roof space.

Fireblocking shall be provided in wood-frame construction in the following locations:

1. In concealed spaces of stud walls and partitions, including furred spaces and parallel rows of studs or staggered studs, as follows:
 - 1.1 Vertically at the ceiling and floor levels.
 - 1.2 Horizontally at intervals not exceeding 10 feet.
2. At all interconnections between concealed vertical and horizontal spaces as occurs at soffits, drop ceilings and cove ceilings.
3. In concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with Section R302.7. (See Figure 4).
4. At openings around vents, pipes, ducts, cables and wires at ceiling and floor level, with an approved material to resist the free passage of flame and products of combustion. The material filling the annular space shall not be required to meet the ASTM E 136 requirements.
5. For the fireblocking of chimneys and fireplaces, see Section R1003.19.
6. Fireblocking of cornices of a two-family dwelling is required at the line of dwelling unit separation.

R302.11.1 Fireblocking material. Except as provided in Section R302.11, Item 4, fireblocking shall consist of the following materials.

1. Two-inch nominal lumber.
2. Two thicknesses of 1-inch nominal lumber with broken lap joints.
3. One thickness of $\frac{23}{32}$ inch wood structural panels with joints backed by $\frac{23}{32}$ inch wood structural panels.
4. One thickness of $\frac{3}{4}$ inch particleboard with joints backed by $\frac{3}{4}$ inch particleboard.
5. One-half-inch gypsum board.
6. One-quarter-inch cement-based millboard.
7. Batts or blankets of mineral wool or glass fiber or other approved materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation installed as tested in accordance with ASTM E 119 or UL 263, for the specific application.

R302.11.1.1 Batts or blankets of mineral or glass fiber. Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be permitted for compliance with the 10-foot horizontal fireblocking in walls constructed using parallel rows of studs or staggered studs.

R302.11.1.2 Unfaced fiberglass. Unfaced fiberglass batt insulation used as fireblocking shall fill the entire cross section of the wall cavity to a minimum height of 16 inches measured vertically. When piping, conduit or similar obstructions are encountered, the insulation shall be packed tightly around the obstruction.

R302.11.1.3 Loose-fill insulation material. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

R302.11.2 Fireblocking integrity. The integrity of all fireblocks shall be maintained.

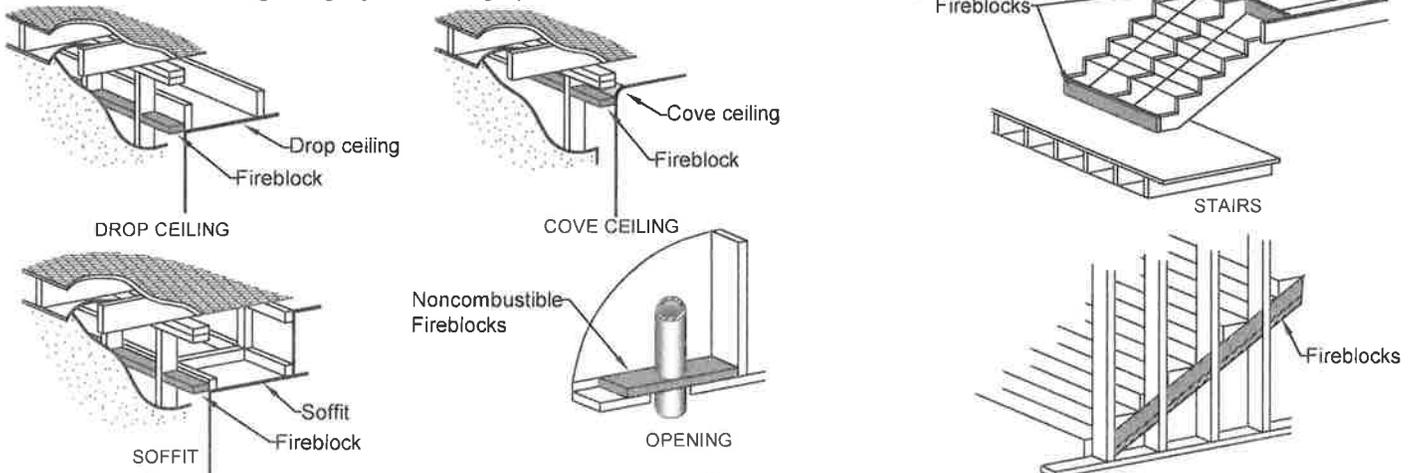


FIGURE 30 STEPPED FOUNDATIONS

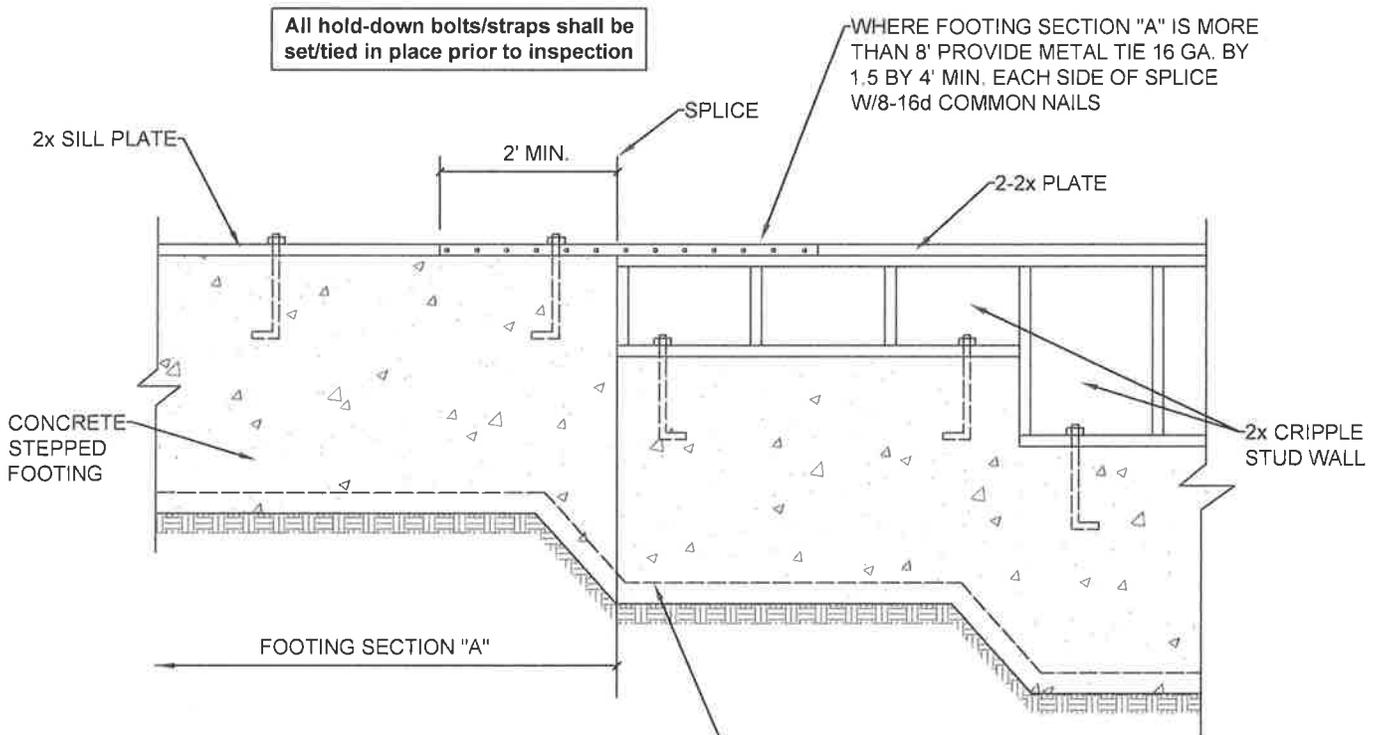
R602.11.2 Stepped foundations. Where the height of a required braced wall line that extends from the foundation to floor above varies more than 4 feet, the braced wall line shall be constructed in accordance with the following:

1. Where the lowest floor framing rests directly on a sill bolted to a foundation not less than 8 feet in length along a line of bracing, the line shall be considered as braced. The double plate of the cripple stud wall beyond the segment of footing that extends to the lowest framed floor shall be spliced by extending the upper top plate a minimum of 4 feet along the foundation. Anchor bolts shall be located a maximum of 1 foot and 3 feet from the step in the foundation. See figure below.
2. Where cripple walls occur between the top of the foundation and the lowest floor framing, the bracing requirements for a story shall apply.
3. Where only the bottom of the foundation is stepped and the lowest floor framing rests directly on a sill bolted to the foundations, the requirements of Sections R403.1.6 and R602.11.1 shall apply.

R602.9 Foundation cripple walls. Foundation cripple walls shall be framed of studs not smaller than than the studding above. When exceeding 4 feet in height, such walls shall be framed of studs having the size required for an additional story. Cripple walls supporting bearing walls or exterior walls or interior braced wall panels with a stud height less than 14 inches shall be continuously sheathed on one side with wood structural panels fastened to both the top and bottom plates in accordance with Figure 24, or the cripple walls shall be constructed of solid blocking. All cripple walls shall be supported on continuous footings or foundations.

Exception:

Footings supporting cripple walls used to support interior braced wall panels shall be continuous for the required length of the cripple wall and constructed beyond the cripple wall for a minimum distance of 4 inches and a maximum distance of the footing thickness. The footing extension is not required at intersections with other footings.



Note:

Concrete shall be consolidated by suitable means during placement and shall be worked around embedded items and reinforcement and into corners of forms. Where stay-in-place forms are used, concrete shall be consolidated by internal vibration. (IRC 608.5.1.6)

NOTE: All horizontal rebar runs shall be continuous and splices shall overlap a minimum of 30 inches. No rebar shall be in contact with earth!

FIGURE 31 WALL BRACING

CONTINUOUS SHEATHING HAS BEEN ASSUMED. IF THIS IS NOT YOUR INTENDED METHOD, YOU WILL NEED TO PROVIDE WALL BRACING METHOD AND DETAILS, OR STAMPED AND SIGNED ENGINEERING. PRESCRIPTIVE WALL BRACING CANNOT EXCEED 12' IN HEIGHT FOR A SINGLE STORY, IF WALLS ARE TALLER THAN 12', STAMPED AND SIGNED ENGINEERING SHALL BE PROVIDED.

R602.10.1 Braced wall lines. For the purpose of determining the amount and location of bracing required in each story level of a building, braced wall lines shall be designated as straight lines in the building plan placed in accordance with this section.

R602.10.1.1 Length of braced wall line. The length of a braced wall line shall be the distance between its ends. The end of a braced wall line shall be the intersection with a perpendicular braced wall line, an angled wall line, or an exterior wall.

R602.10.1.2 Offsets along a braced wall line. All exterior walls parallel to a braced wall line shall be offset not more than 4 feet from the designated braced wall line location. Interior walls used as bracing shall be offset not more than 4 feet from a braced wall line through the interior of the building.

R602.10.1.3 Spacing of braced wall lines. The spacing between parallel braced wall lines shall be in accordance with Table R602.10.1.3 (Maximum of 60'). Intermediate braced wall lines through the interior of the building shall be permitted.

R602.10.1.4 Angled walls. Any portion of a wall along a braced wall line shall be permitted to angle out of plane for a maximum diagonal length of 8 feet. Where the angled wall occurs at a corner, the length of the braced wall line shall be measured from the projected corner. Where the diagonal length is greater than 8 feet, it shall be considered a separate braced wall line and shall be braced in accordance with R602.10.1.

R602.10.2 Braced wall panels. Braced wall panels shall be full-height sections of wall that shall have no vertical or horizontal offsets. Braced wall panels shall be constructed and placed along a braced wall line in accordance with this section and bracing methods specified in Section R602.10.4.

R602.10.2.1 Braced wall panel uplift load path. The bracing lengths apply only when uplift loads are resisted in accordance with Section R602.3.5.

R602.10.2.2 Locations of braced wall panels. A braced wall panel shall begin within 10 feet from each end of a braced wall line as determined in Section R602.10.1.1. The distance between adjacent edges of braced wall panels along a braced wall line shall be no greater than 20 feet.

R602.10.2.3 Minimum number of braced wall panels. Braced wall lines with a length of 16 feet or less shall have a minimum of two braced wall panels of any length or one braced wall panel equal to 48 inches or more. Braced wall lines greater than 16 feet shall have a minimum of two braced wall panels.

R602.10.3 Required length of bracing. The required length of bracing along each braced wall line shall be determined as follows: For detached buildings in Seismic Design Category C, use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).

Only braced wall panels parallel to the braced wall line shall contribute toward the required length of bracing of that braced wall line. Braced wall panels along an angled wall meeting the minimum length requirements of tables R602.10.5 and R602.10.5.2 shall be permitted to contribute its projected length toward the minimum required length of bracing for the braced wall line. Any braced wall panel on an angled wall at the end of a braced wall line shall contribute its projected length for only one of the braced wall lines at the projected corner.

R602.10.4 Construction methods for braced wall panels. Intermittent and continuously sheathed braced wall panels shall be constructed in accordance with this section and the methods listed in Table R602.10.4. *Note: Only the methods for continuous sheathing are listed and shown in the details. For additional information and requirements for less commonly used methods, contact the Building Department.*

R602.10.4.2 Continuous sheathing methods. Continuous sheathing methods require structural panel sheathing to be used on all sheathable surfaces on one side of a braced wall line including areas above and below openings and gable end walls and shall meet the requirements of Section R602.10.7.

FIGURE 31 - CONTINUED WALL BRACING

R602.10.4.3 Braced wall panel interior finish material. Braced wall panels shall have gypsum wall board installed on the side of the wall opposite the bracing material. Gypsum wall board shall be not less than ½ inch in thickness and be fastened with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum wall board.

Exception: An approved interior finish material with an in-plane shear resistance equivalent to gypsum board shall be permitted to be substituted, unless otherwise required by Section R302.6.

R602.10.5 Minimum length of a braced wall panel. The minimum length of a braced wall panel shall comply with Table R602.10.5. For Methods CS-WSP and CS-SFB, the minimum panel length shall be based on the adjacent clear opening height in accordance with Table R602.10.5 and Figure R602.10.5. When a panel has an opening on either side of differing heights, the taller opening height shall be used to determine the panel length.

R602.10.5.1 Contributing length. For purposes of computing the required length of bracing in Tables R602.10.3(1) and R602.10.3(3), the contributing length of each braced wall panel shall be as specified in Table R602.10.5.

CS-WSP Continuously sheathed wood structural panel.

Minimum thickness of sheathing shall be 3/8".

Exterior sheathing: Nail edges at 6" o.c., field nail at 12" o.c.

Stud spacing 16" o.c. with 3/8" thick sheathing, nail with 6d common nails, 1.5 inches of penetration. Minimum wood structural panel span rating 24/0.

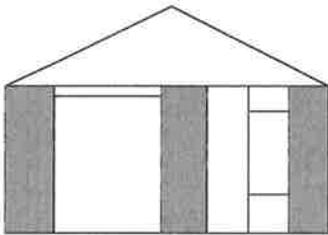
Stud spacing 16" or 24" o.c. with 7/16" thick sheathing, nail with 8d common nails, 1.75 inches of penetration. Minimum wood structural panel span rating 24/16.

Interior sheathing: Fasten edges at 7" o.c., in field 7" o.c.

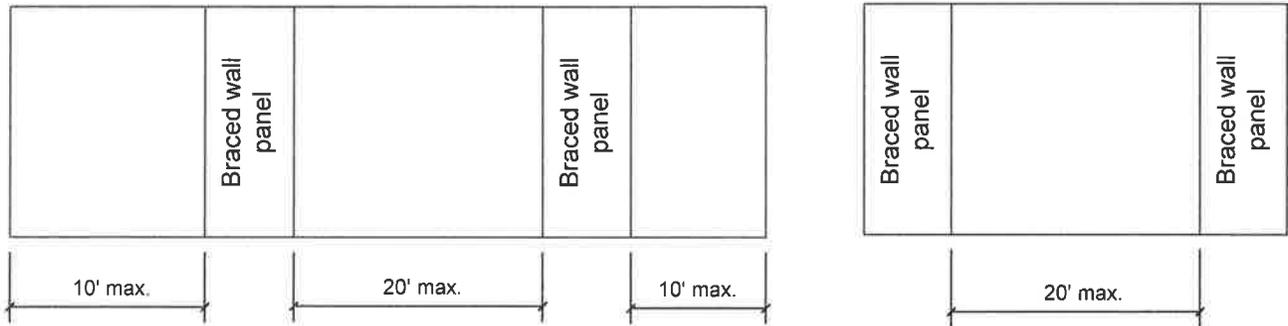
1/2" gypsum sheathing: 1 1/2" galvanized roofing nail; staple galvanized, 1 1/2" long; 1 1/4" screws, Type W or S.

5/8" gypsum sheathing: 1 3/4" galvanized roofing nail; staple galvanized, 1 5/8" long; 1 5/8" screws, Type W or S.

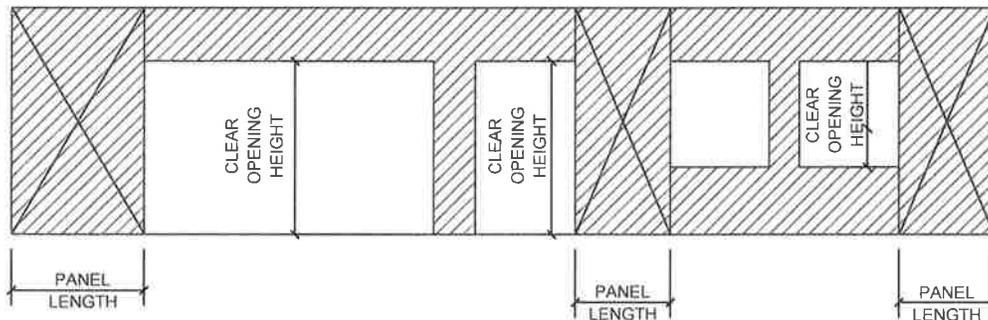
(Four foot by 8 foot or 4 foot by 9 foot panels shall be applied vertically)



For Alternate Attachments see Table R602.3(2).



LOCATION OF BRACED WALL PANELS



**FIGURE R602.10.5
BRACED WALL PANELS WITH CONTINUOUS SHEATHING**

FIGURE 31 - CONTINUED WALL BRACING

EXPOSURE CATEGORY B, 30 FOOT MEAN ROOF HEIGHT, 10 FOOT EAVE-TO-RIDGE HEIGHT, 10 FOOT WALL HEIGHT, 2 BRACED WALL LINES, WIND SPEED \leq 110mph

Table R602.10.3(1)

Braced Wall Line Spacing (feet)	MINIMUM LENGTH IN FEET OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^a Method CS-WSP	Braced Wall Line Spacing (feet)	MINIMUM LENGTH IN FEET OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^a Method CS-WSP	Braced Wall Line Spacing (feet)	MINIMUM LENGTH IN FEET OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^a Method CS-WSP
10	1.5	10	3.0	10	4.5
20	3.0	20	5.5	20	8.5
30	4.5	30	8.0	30	12.0
40	5.5	40	10.5	40	15.5
50	7.0	50	13.0	50	19.0
60	8.0	60	15.5	60	23.0

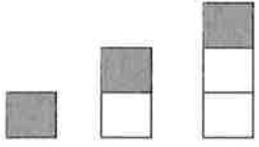
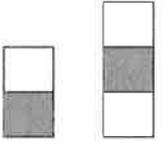
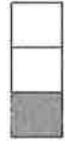




Table R602.10.3(2)
WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ADJUSTMENT BASED ON	STORY/SUPPORTING	CONDITION	ADJUSTMENT FACTOR ^{a,b}	APPLICABLE METHODS
Roof eave-to-ridge height	Roof only	\leq 5 feet	0.70	All methods
		10 feet	1.00	
		15 feet	1.30	
		20 feet	1.60	
	Roof + 1 floor	\leq 5 feet	0.85	
		10 feet	1.00	
Roof + 2 floors	\leq 5 feet	0.85		
	10 feet	1.00		
	15 feet	1.15		
	20 feet	1.30		
Wall height adjustment	Any story	8 feet	0.90	
		9 feet	0.95	
		10 feet	1.00	
		11 feet	1.05	
		12 feet	1.10	
Number of braced wall lines (per plan direction) ^c	Any story	2	1.00	
		3	1.30	
		4	1.45	
		\leq 5	1.60	
Additional 800 pound hold-down device	Top story only	Fastened to the end studs of each braced wall panel and to the foundation or framing below	0.80	DWB, WSP, SFB, PBS, PCP, HPS
Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.40	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB
Gypsum board fastening	Any story	4" o.c. at panel edges, including top and bottom plates, and all horizontal joints blocked	0.70	GB

a. Linear interpolation shall be permitted.

b. The total adjustment factor is the product of all applicable adjustment factors.

c. The adjustment factor is permitted to be 1.0 when determining bracing amounts for intermediate braced wall lines provided the bracing amounts on adjacent braced wall lines are based on a spacing and number that neglects the intermediate braced wall line.

FIGURE 31 - CONTINUED WALL BRACING

R602.10.7 Ends of braced wall lines with continuous sheathing. Each end of a braced wall line with continuous sheathing shall have one of the conditions shown in Figure R602.10.7.

R602.10.8 Braced wall panel connections. Braced wall panels shall be connected to floor framing or foundations as follows:

1. Where joists are perpendicular to a braced wall panel above or below, a rim joist, band joist or blocking shall be provided along the entire length of the braced wall panel in accordance with Figure R602.10.8(1). Fastening of top and bottom wall plates to framing, rim joist, band joist and/or blocking shall be in accordance with Table R602.3(1). (Figure 24)
2. Where joists are parallel to a braced wall panel above or below, a rim joist, end joist or other parallel framing member shall be provided directly above and below the braced wall panel in accordance with Figure R602.10.8(2). Where a parallel framing member cannot be located directly above and below the panel, full-depth blocking at 16 inch spacing shall be provided between the parallel framing members to each side of the braced wall panel in accordance with Figure R602.10.8(2). Fastening of blocking shall be in accordance with Table R602.3(1) (Figure 24) and Figure R602.10.8(2).
3. Connections of braced wall panels to concrete or masonry shall be in accordance with Section R403.1.6.

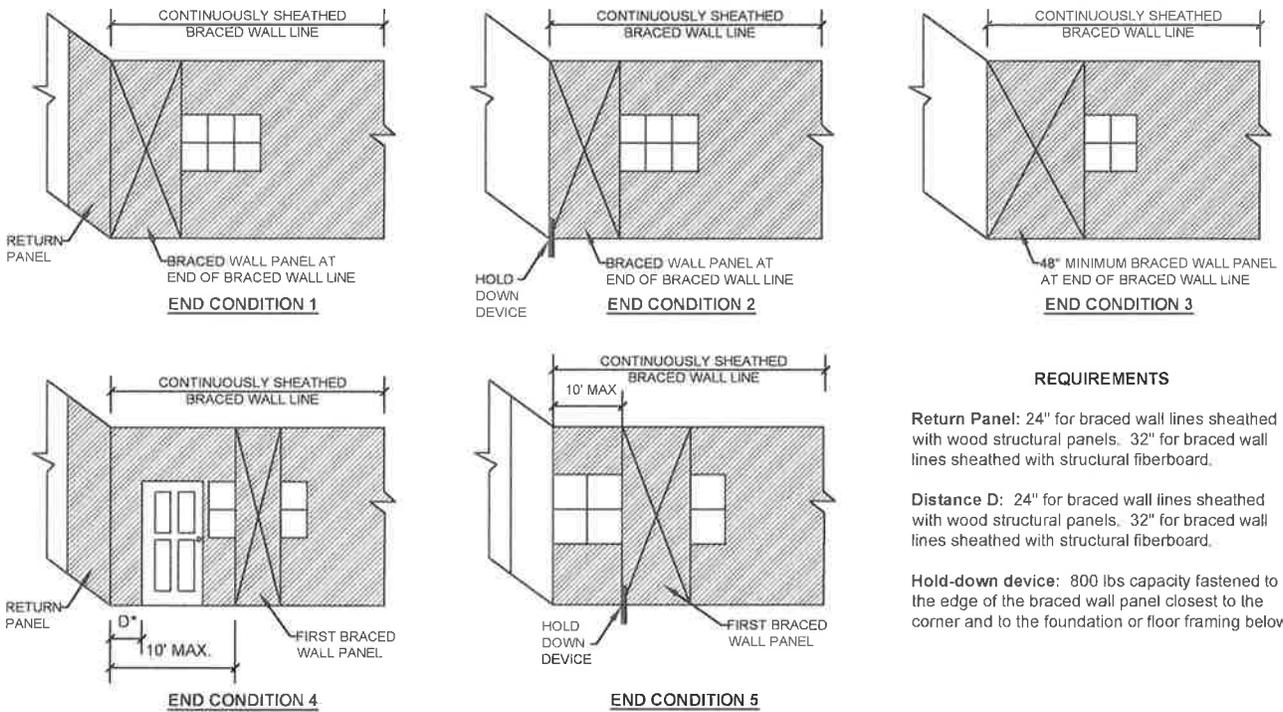


FIGURE R602.10.7

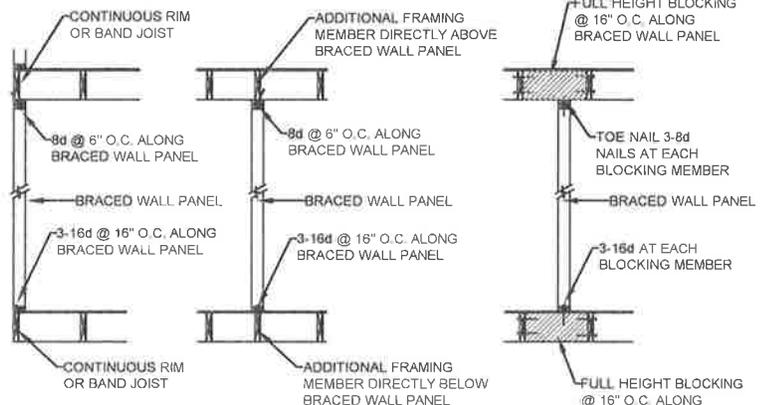
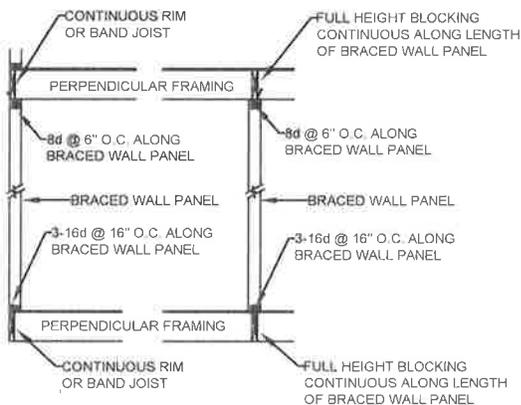


FIGURE 31 - CONTINUED WALL BRACING

**TABLE R602.10.5
MINIMUM LENGTH OF BRACED WALL PANELS**

Method (See Table R602.10.4)		Minimum Length ^a (inches)					Contributing Length (inches)
		Wall Height					
		8 feet	9 feet	10 feet	11 feet	12 feet	
DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP		48	48	48	53	58	Actual ^b
GB		48	48	48	53	58	Double sided=Actual Single sided=.5xActual
ABW	SDC A, B and C, wind speed < 140 mph	28	32	34	38	42	48
	SDC D ₀ , D ₁ and D ₂ , wind speed < 140 mph	32	32	34	NP	NP	
PFH	Supporting roof only	16	16	16	18 ^c	20 ^c	48
	Supporting one story and roof	24	24	24	27 ^c	29 ^c	48
PFG		24	27	30	33 ^d	36 ^d	1.5 x Actual ^b
CS-G		24	27	30	33	36	Actual ^b
CS-PF		16	18	20	22 ^e	24 ^e	1.5 x Actual ^b
CS-WSP, CS-SFB	Adjacent clear opening height (inches)						Actual ^b
	≤ 64	24	27	30	33	36	
	68	26	27	30	33	36	
	72	27	27	30	33	36	
	76	30	29	30	33	36	
	80	32	30	30	33	36	
	84	35	32	32	33	36	
	88	38	35	33	33	36	
	92	43	37	35	35	36	
	96	48	41	38	36	36	
	100	-	44	40	38	38	
	104	-	49	43	40	39	
	108	-	54	46	43	41	
	112	-	-	50	45	43	
	116	-	-	55	48	45	
	120	-	-	60	52	48	
	124	-	-	-	56	51	
	128	-	-	-	61	54	
	132	-	-	-	66	58	
	136	-	-	-	-	62	
140	-	-	-	-	66		
144	-	-	-	-	72		

- a. Linear interpolation shall be permitted.
- b. Use the actual length when it is greater than or equal to the minimum length.
- c. Maximum header height for PFH is 10 feet in accordance with Figure R602.10.6.2, but wall height may be increased to 12 feet with pony wall.
- d. Maximum opening height for PFG is 10 feet in accordance with Figure R602.10.6.3, but wall height may be increased to 12 feet with pony wall.
- e. Maximum opening height for CS-PF is 10 feet in accordance with Figure R602.10.6.4, but wall height may be increased to 12 feet with pony wall.

FIGURE 31 - CONTINUED WALL BRACING

R602.10.8.2 Connections to roof framing. Top plates of exterior braced wall panels shall be attached to rafters or roof trusses above in accordance with Table R602.3(1) and this section. Where required by this section, blocking between rafters or roof trusses shall be attached to top plates of braced wall panels and to rafters and roof trusses in accordance with Table R602.3(1). A continuous band, rim or header joist or roof truss parallel to the braced wall panels shall be permitted to replace the blocking required by this section. Blocking shall not be required over openings in continuously sheathed braced wall lines. In addition to the requirements of this section, lateral support shall be provided for rafters and ceiling joists in accordance with Section R802.10.3. Roof ventilation shall be provided in accordance with Section R806.1. (Figure 35)

1. For Seismic Design Categories A, B and C where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is $9\frac{1}{4}$ inches or less, blocking between rafters or roof trusses shall not be required. Where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is between $9\frac{1}{4}$ inches and $15\frac{1}{4}$ inches, blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure R602.10.8.2(1).

Exception: Where the outside edge of truss vertical web members aligns with the outside face of the wall studs below, wood structural panel sheathing extending above the top plate as shown in Figure R602.10.8.2(3) shall be permitted to be fastened to each truss web with three 8d nails ($2\frac{1}{2}$ inches x 0.131 inch) and blocking between the trusses shall not be required.

3. Where the distance from the top of the braced wall panel to the top of rafters or roof trusses exceeds $15\frac{1}{4}$ inches, the top plates of the braced wall panel shall be connected to perpendicular rafters or roof trusses above in accordance with one or more of the following methods:
 - 3.1 Soffit blocking panels constructed in accordance with Figure R602.10.8.2(20)
 - 3.2 Vertical blocking panels constructed in accordance with Figure R602.10.8.2(3).
 - 3.3 Blocking panels provided by the roof truss manufacturer and designed in accordance with Section R802.
 - 3.4 Blocking, blocking panels or other methods of lateral transfer designed in accordance with AWC WFCM or accepted engineering practice.

R602.10.9 Braced wall panel support. Braced wall panel support shall be provided as follows:

1. Cantilevered floor joists complying with Section R502.3.3 shall be permitted to support braced wall panels.
2. Elevated post or pier foundations supporting braced wall panels shall be designed in accordance with accepted engineering practice.
3. Masonry stem walls with a length of 48 inches or less supporting braced wall panels shall be reinforced in accordance with Figure R602.10.9. Masonry stem walls with a length greater than 48 inches supporting braced wall panels shall be constructed in accordance with Section R403.1. Methods ABW and PFH shall not be permitted to attach to masonry stem walls.
4. Concrete stem walls with a length of 48 inches or less, greater than 12 inches tall and less than 6 inches thick shall have reinforcement sized and located in accordance with Figure R602.10.9.

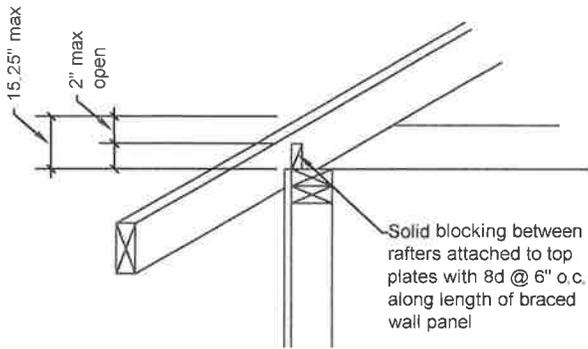
R602.10.10 Panel joints. All vertical joints of panel sheathing shall occur over, and be fastened to, common studs. Horizontal joints in braced wall panels shall occur over, and be fastened to, common blocking of a minimum $1\frac{1}{2}$ inches thickness.

Exceptions:

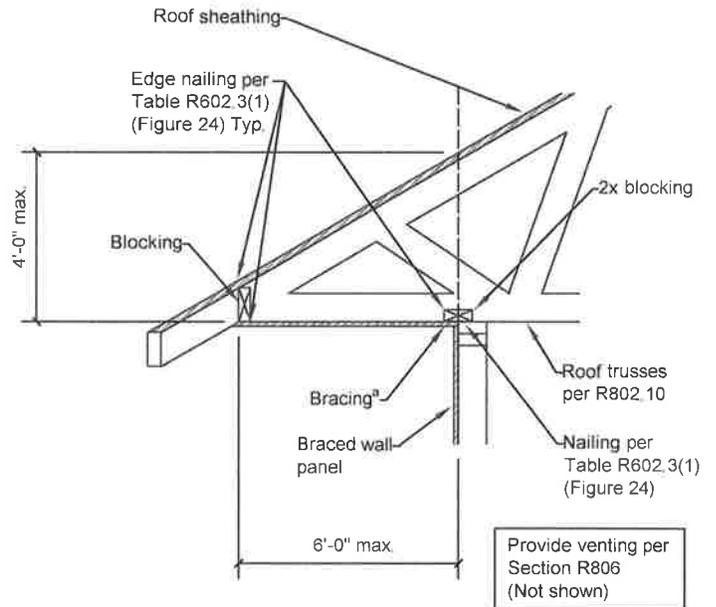
1. Vertical joints of panel sheathing shall be permitted to occur over double studs, where adjoining panel edges are attached to separate studs with the required panel edge fastening schedule, and the adjacent studs are attached together with two rows of 10d box nails at 10 inches o.c.
2. Blocking at horizontal joints shall not be required in wall segments that are not counted as braced wall panels.
3. Where the bracing length provided is at least twice the minimum length required by Table R602.10.3(1) and Table R602.10.3(3) blocking at horizontal joints shall not be required in braced wall panels constructed using methods WSP, SFB, GB, PBS or HPS.
4. When Method GB panels are installed horizontally, blocking of horizontal joints is not required.

R602.10.11 Cripple wall bracing. Cripple walls shall be constructed in accordance with Section R602.9 and braced in accordance with this section. Cripple walls shall be braced with the length and method of bracing used for the wall above in accordance with Tables R602.10.3(1) and R602.10.3(3), and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively, except that the length of cripple wall bracing shall be multiplied by a factor of 1.15. Where gypsum wall board is not used on the inside of the cripple wall bracing, the length adjustments for the elimination of the gypsum wallboard, or equivalent, shall be applied as directed in Tables R602.10.3(2) and R602.10.3(4) to the length of cripple wall bracing required. This adjustment shall be taken in addition to the 1.15 increase.

FIGURE 31 - CONTINUED WALL BRACING

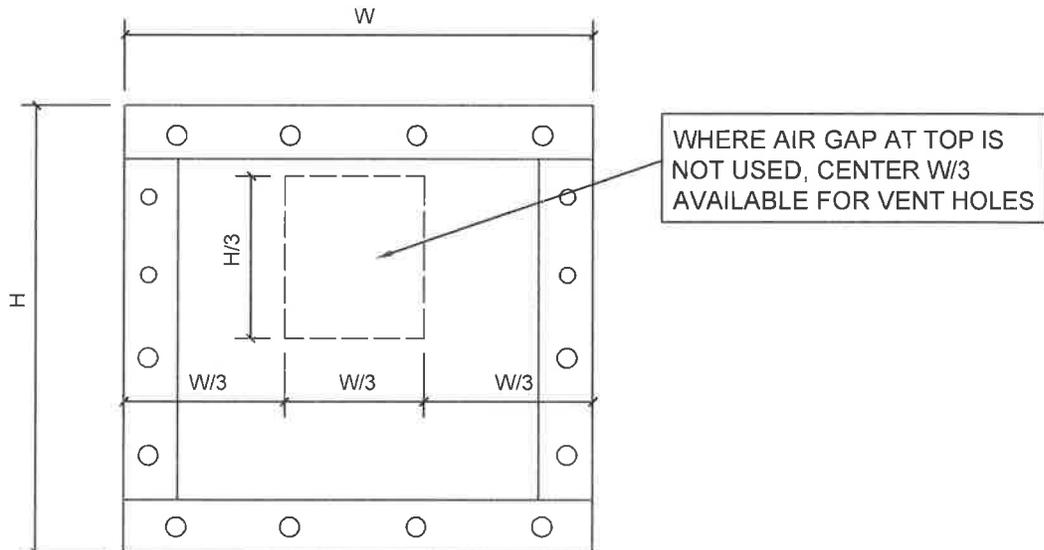


**FIGURE R602.10.8.2(1)
BRACED WALL PANEL CONNECTION
TO PERPENDICULAR RAFTERS**



a. Methods of bracing shall be as described in Section R602.10.4.

**FIGURE R602.10.8.2(2)
BRACED WALL PANEL CONNECTION OPTION
TO PERPENDICULAR RAFTERS OR ROOF TRUSSES**



**FIGURE R602.10.8.2(3)
BRACED WALL PANEL CONNECTION OPTION
TO PERPENDICULAR RAFTERS OR ROOF TRUSSES**

FIGURE 31 - CONTINUED WALL BRACING

NOTE: Not all methods shown. Most commonly used methods for Klickitat County are represented here. For additional methods available contact the Building Department.

**TABLE R602.10.4
INTERMITTENT BRACING METHODS**

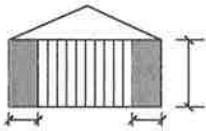
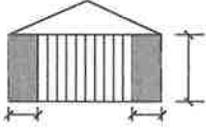
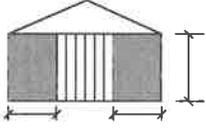
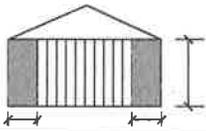
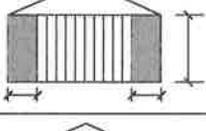
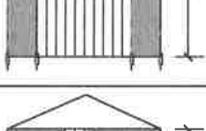
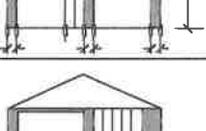
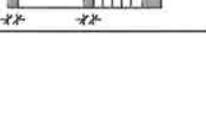
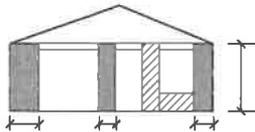
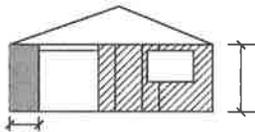
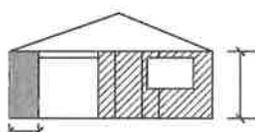
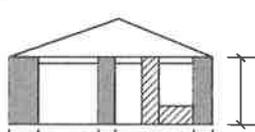
METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA ^a	
			Fasteners	Spacing
WSP Wood structural panel (See Section R604)	$\frac{3}{8}$ "		Exterior sheathing per Table R602.3(3)	6" edges 12" field
			Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
SFB Structural fiberboard sheathing	$\frac{1}{2}$ " or $\frac{25}{32}$ " for maximum 16" stud spacing		1 1/2" long x 0.12" dia. (for 1/2" thick sheathing) 1 3/4" long x 0.12" dia. (for 25/32" thick sheathing) galvanized roofing nails or 8d common (2 1/2" long x 0.131" dia.) nails	3" edges 6" field
GB Gypsum board	$\frac{1}{2}$ "		Nails or screws per Table R602.3(1) for exterior locations	For all braced wall panel locations: 7" edges (including top and bottom plates) 7" field
			Nails or screws per Table R 702.3.5 for interior locations	
PBS Particleboard sheathing (See Section R605)	$\frac{3}{8}$ " or $\frac{1}{2}$ " for maximum 16" stud spacing		For 3/8", 6d common (2" long x 0.113" dia.) nails. For 1/2", 8d common (2 1/2" long x 0.131" dia.) nails	3" edges 6" field
HPS Hardboard panel siding	$\frac{7}{16}$ " for maximum 16" stud spacing		0.092" dia., 0.225" dia. head nails with length to accommodate 1 1/2" penetration into studs	4" edges 8" field
ABW Alternate braced wall	$\frac{3}{8}$ "		Constructed in accordance with Figure R602.10.6.1. The hold-down force shall be in accordance with Table R602.10.6.1	Figure R602.10.6.1 and Table R602.10.6.1
PFH Portal frame with hold-downs	$\frac{3}{8}$ "		Constructed in accordance with Figure R602.10.6.2	Figure R602.10.6.2
PFG Portal frame at garage	$\frac{7}{16}$ "		Where supporting a roof or one story and a roof, constructed in accordance with Figure R602.10.6.3	Figure R602.10.6.3

FIGURE 31 - CONTINUED WALL BRACING

NOTE: Not all methods shown. Most commonly used methods for Klickitat County are represented here. For additional methods available contact the Building Department.

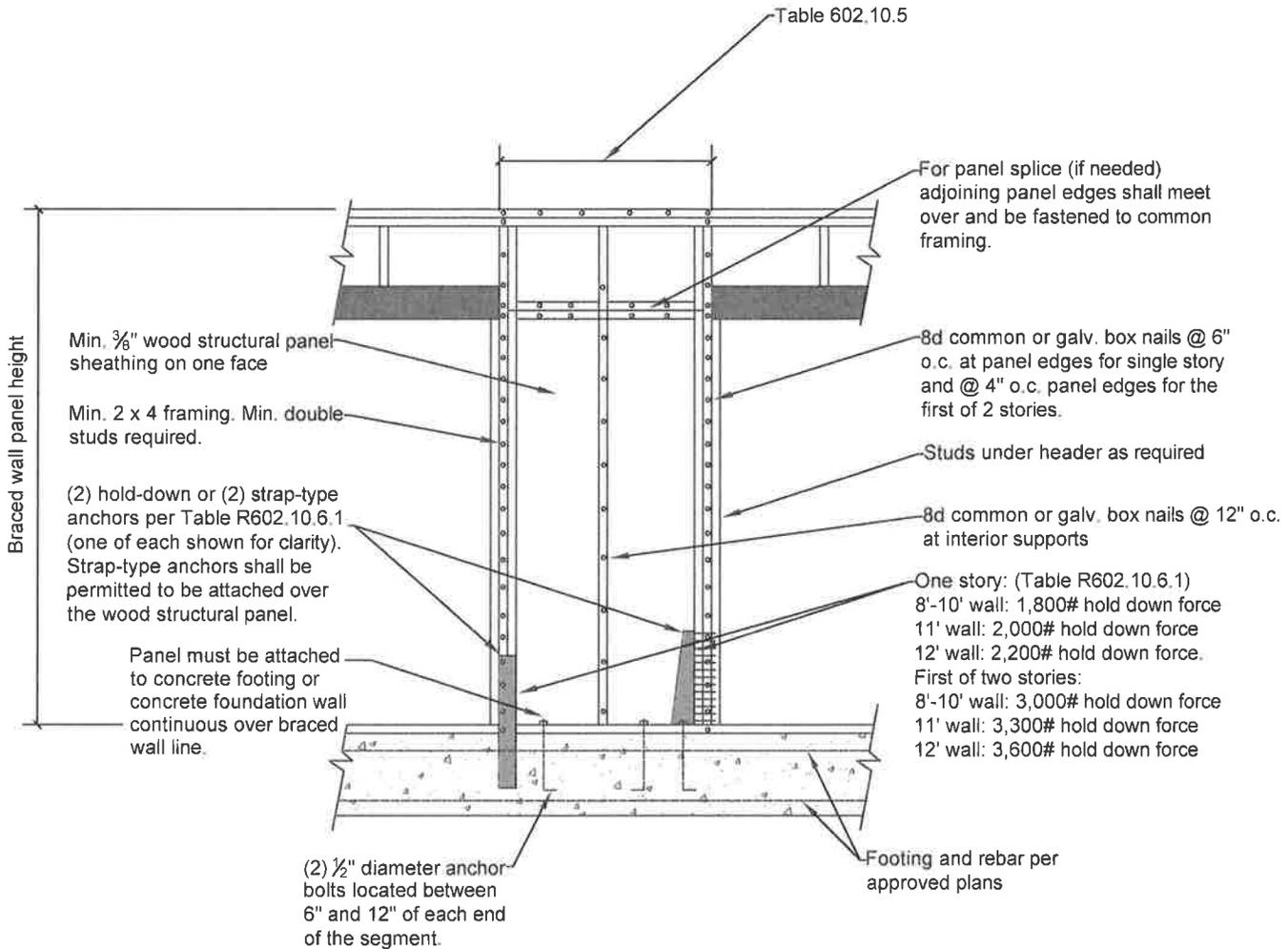
**TABLE R602.10.4
CONTINUOUS SHEATHING METHODS**

METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA ^a	
			Fasteners	Spacing
CS-WSP Continuously sheathed wood structural panel	$\frac{3}{8}$ "		Exterior sheathing per Table R602.3(3)	6" edges 12" field
			Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
CS-G ^{b,c} Continuously sheathed wood structural panel adjacent to garage openings	$\frac{3}{8}$ "		See Method CS-WSP	See Method CS-WSP
CS-PF Continuously sheathed portal frame	$\frac{7}{16}$ "		Constructed in accordance with Figure R602.10.6.4 and Table R602.10.6.4	Figure R602.10.6.4 and Table R602.10.6.4
CS-SFB ^d Continuously sheathed structural fiberboard	$\frac{1}{2}$ " or $\frac{25}{32}$ " for maximum 16" stud spacing		$1 \frac{1}{2}$ " long x 0.12" dia. (for $\frac{1}{2}$ " thick sheathing) $1 \frac{3}{4}$ " long x 0.12" dia. (for $\frac{25}{32}$ " thick sheathing) galvanized roofing nails or 8d common ($2 \frac{1}{2}$ " long x 0.131" dia.) nails	3" edges 6" field

- a. Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design categories C, D₀, D₁ and D₂.
- b. Applies to panels next to garage door opening when supporting gable end wall or roof load only. May only be used on one wall of the garage. In Seismic Design Categories D₀, D₁ and D₂ roof covering dead load may not exceed 3 psf.
- c. Garage openings adjacent to a Method CS-G panel shall be provided with a header per approved plans. A full height clear opening shall not be permitted adjacent to a Method CS-G panel.
- d. Method CS-SFB does not apply in Seismic Design Categories D₀, D₁ and D₂.
- e. Method applies to detached one and two family dwellings in Seismic Design Categories D₀ through D₂ only.

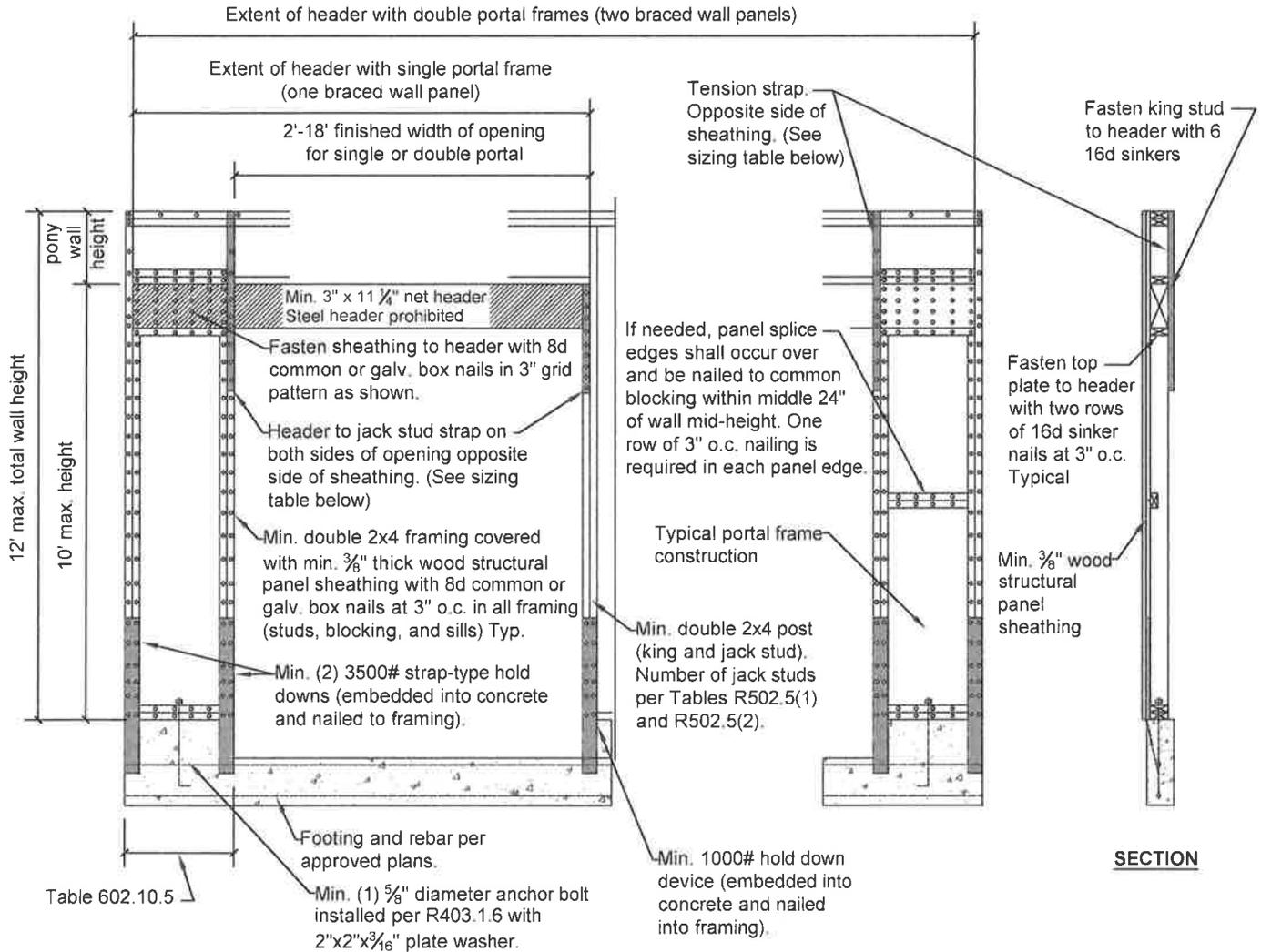
FIGURE 32 ALTERNATE BRACE PANELS

CONTINUOUS SHEATHING HAS BEEN ASSUMED. IF THIS IS NOT YOUR INTENDED METHOD, YOU WILL NEED TO PROVIDE WALL BRACING METHOD AND DETAILS, OR STAMPED AND SIGNED ENGINEERING. PRESCRIPTIVE WALL BRACING CANNOT EXCEED 12' IN HEIGHT FOR A SINGLE STORY, IF WALLS ARE TALLER THAN 12', STAMPED AND SIGNED ENGINEERING SHALL BE PROVIDED.



**FIGURE R602.10.6.1
METHOD ABW - ALTERNATE BRACED WALL PANEL**

FIGURE 32 - CONTINUED ALTERNATE BRACE PANELS



**FIGURE R602.10.6.2
METHOD PFH - PORTAL FRAME WITH HOLD-DOWNS**

Max. pony wall height	Max. total wall height	Maximum opening width	Tension strap capacity required
0	10	18	1,000#
1	10	9	1,000#
		16	1,000#
		18	1,000#
2	10	9	1,000#
		16	1,775#
		18	2,075#
2	12	9	1,150#
		16	2,875#
		18	3,425#
4	12	9	2,275#
		12	3,225#

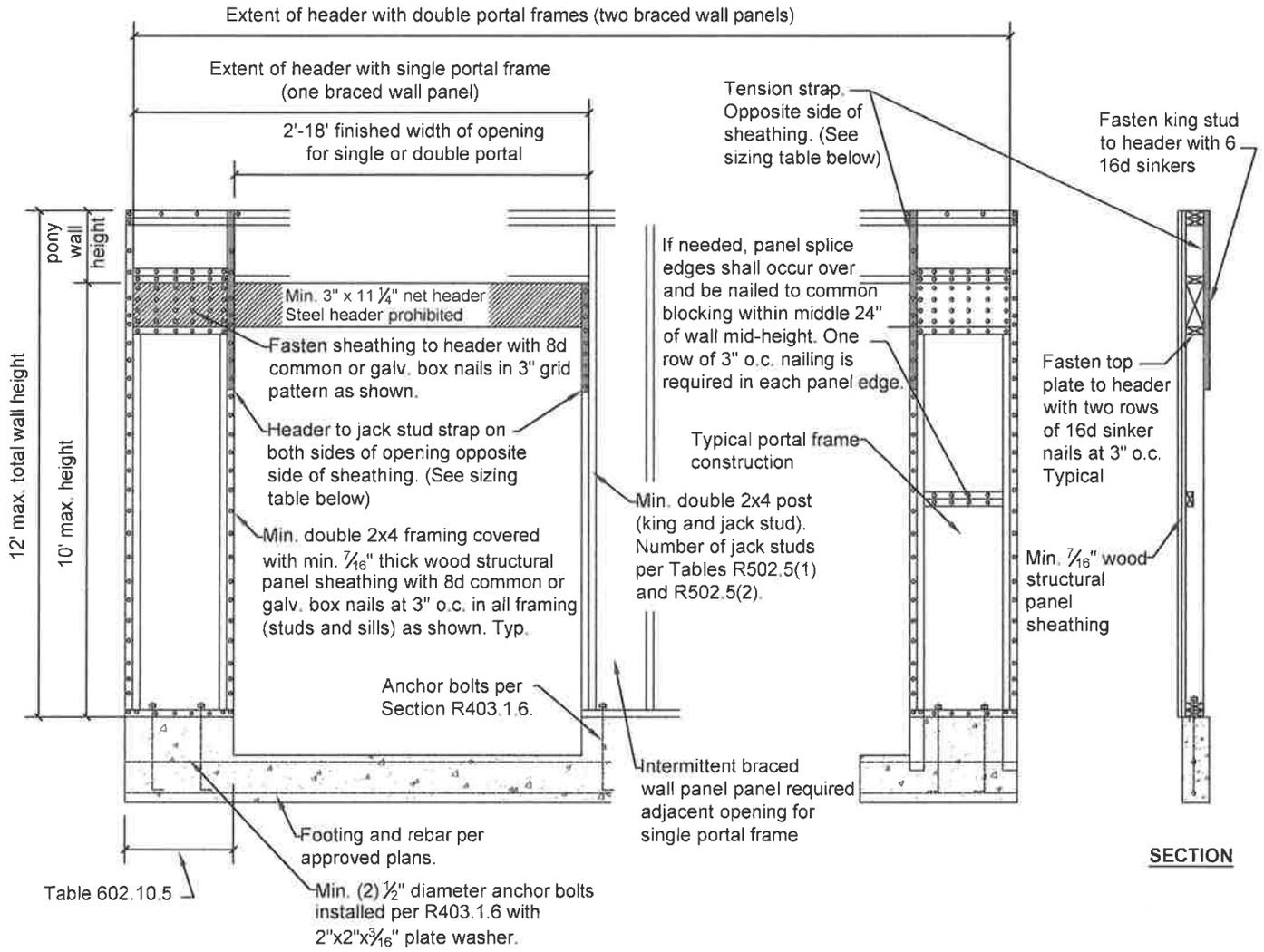
2x4 No. 2 Grade

Max. pony wall height	Max. total wall height	Maximum opening width	Tension strap capacity required
2	12	9	1,000#
		16	1,825#
		18	2,200#
4	12	9	1,450#
		16	2,050#
		18	3,350#

2x6 Stud Grade

**TABLE R602.10.6.4
TENSION STRAP CAPACITY REQUIRED
FOR RESISTING WIND PRESSURES
PERPENDICULAR TO METHOD
PFH, PFG AND CS-PF BRACED WALL PANELS**

FIGURE 32 - CONTINUED ALTERNATE BRACE PANELS



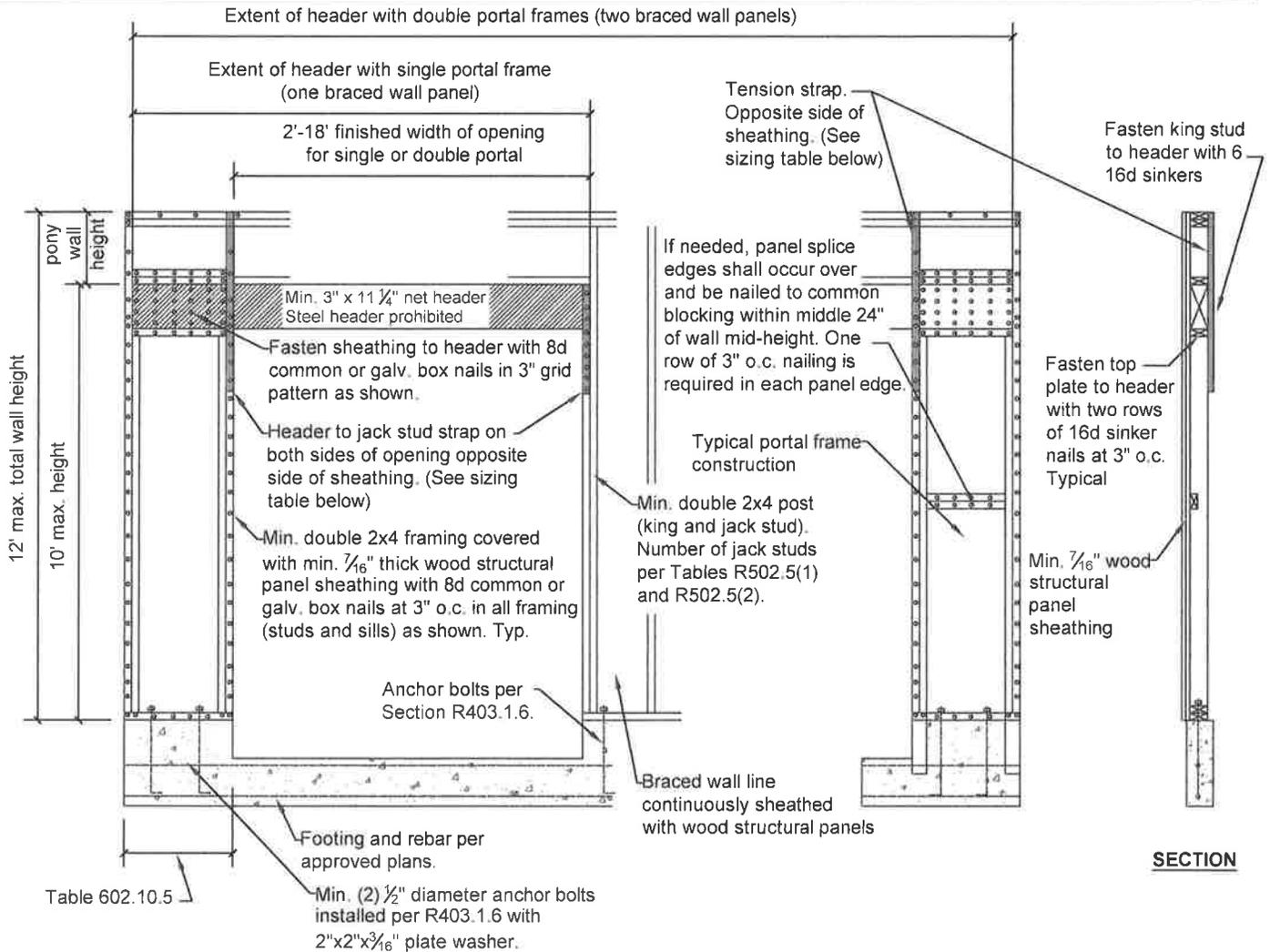
**FIGURE R602.10.6.3
METHOD PFG - PORTAL FRAME AT GARAGE DOOR OPENINGS (NO HOLD DOWNS)**

Max. pony wall height	Max. total wall height	Maximum opening width	Tension strap capacity required
0	10	18	1,000#
1	10	9	1,000#
		16	1,000#
		18	1,000#
2	10	9	1,000#
		16	1,525#
		18	1,875#
2	12	9	1,000#
		16	2,600#
		18	3,175#
4	12	9	1,775#
		16	4,175#

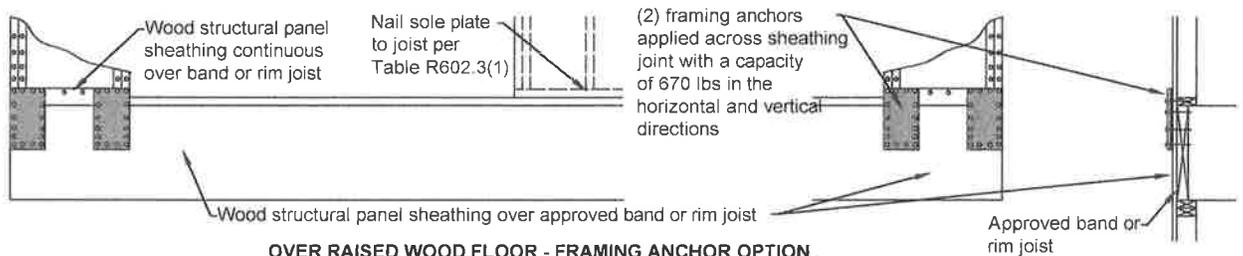
Max. pony wall height	Max. total wall height	Maximum opening width	Tension strap capacity required
0	10	9	1,000#
		16	1,650#
		18	2,025#
1	10	9	1,125#
		16	2,650#
		18	3,125#

**TABLE R602.10.6.4
TENSION STRAP CAPACITY REQUIRED
FOR RESISTING WIND PRESSURES
PERPENDICULAR TO METHOD
PFH, PFG AND CS-PF BRACED WALL PANELS**

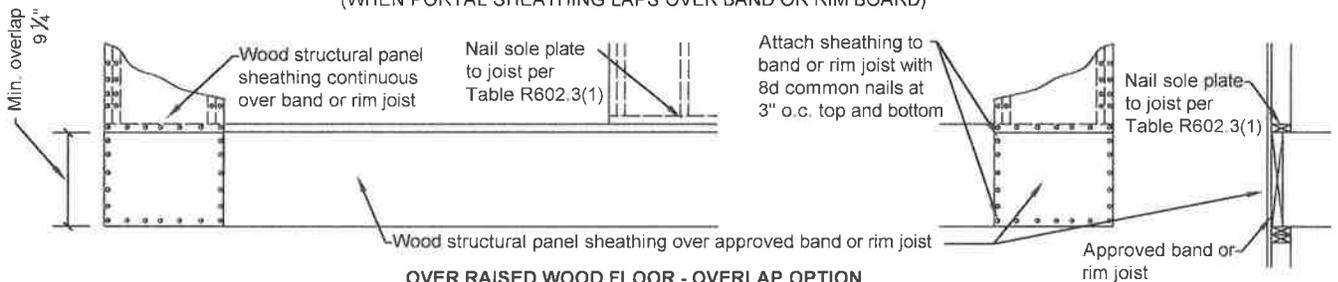
FIGURE 32 - CONTINUED ALTERNATE BRACE PANELS



OVER CONCRETE OR MASONRY BLOCK FOUNDATION



OVER RAISED WOOD FLOOR - FRAMING ANCHOR OPTION (WHEN PORTAL SHEATHING LAPS OVER BAND OR RIM BOARD)



OVER RAISED WOOD FLOOR - OVERLAP OPTION (WHEN PORTAL SHEATHING LAPS OVER BAND OR RIM BOARD)

FIGURE R602.10.6.4
METHOD CS-PFG - CONTINUOUSLY SHEATHED PORTAL FRAME PANEL CONSTRUCTION

FIGURE 33 FLASHING

R703.4 Flashing. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier complying with Section 703.2 for subsequent drainage. Mechanically attached flexible flashings shall comply with AAMA 712. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
 - 1.1 The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall incorporate flashing or protection at the head and sides.
 - 1.2 In accordance with the flashing design or method of a registered design professional.
 - 1.3 In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

R903.2 Flashing. Flashings shall be installed in a manner that prevents moisture from entering the wall and roof through joints in copings, through moisture permeable materials and at intersections with parapet walls and other penetrations through roof plane.

R903.2.1 Locations. Flashings shall be installed at wall and roof intersections, wherever there is a change in roof slope or direction and around roof openings. A flashing shall be installed to divert the water away from where the eave of a sloped roof intersects a vertical sidewall. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (No. 26 galvanized sheet).

R905.2.8 Flashing. Flashing for asphalt shingles shall comply with Section 9.

R905.2.8.5 Drip edge. A drip edge shall be provided at eaves and rake edges of shingle roofs. Adjacent segments of drip edge shall be overlapped not less than 2 inches. Drip edges shall extend not less than $\frac{1}{4}$ inch below the roof sheathing and extend up back onto the roof deck not less than 2 inches. Drip edges shall be mechanically fastened to the roof deck at not more than 12 inches o.c. with fasteners as specified in Section R905.2.5. (See Section 9) Underlayment shall be installed over the drip edge along eaves and under the underlayment along rake edges.

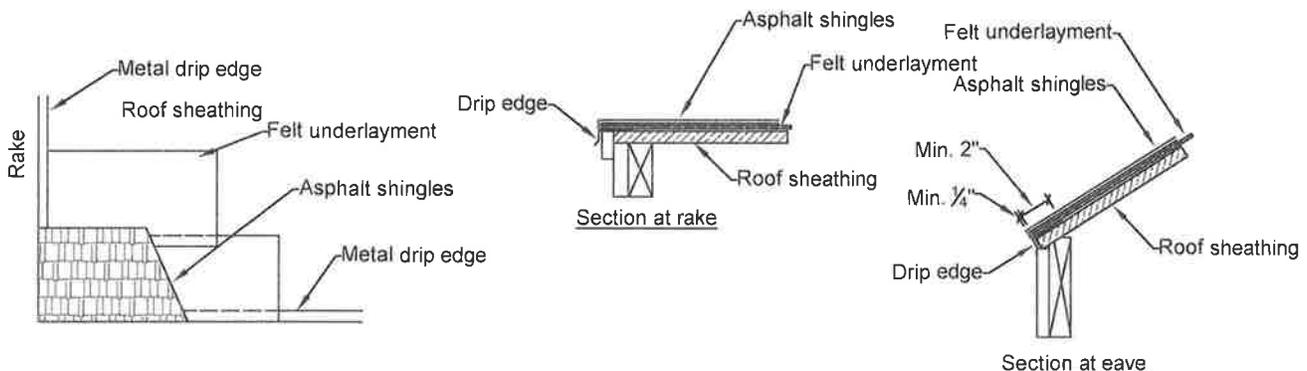
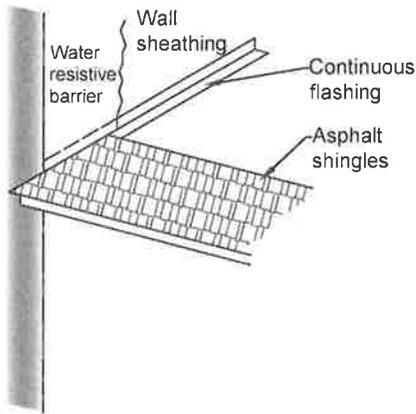
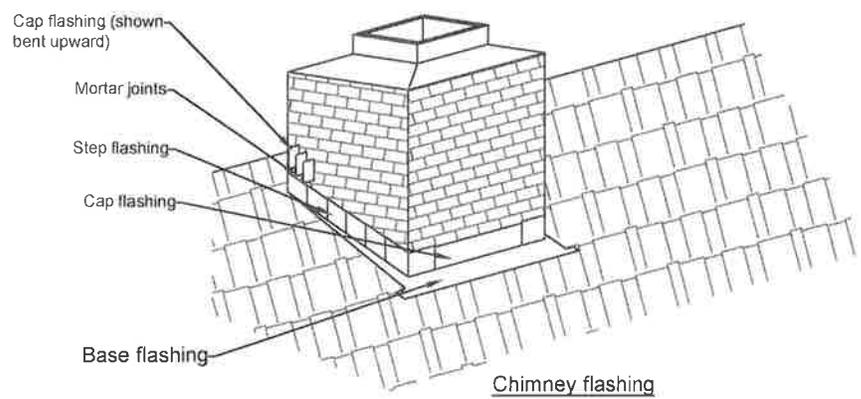
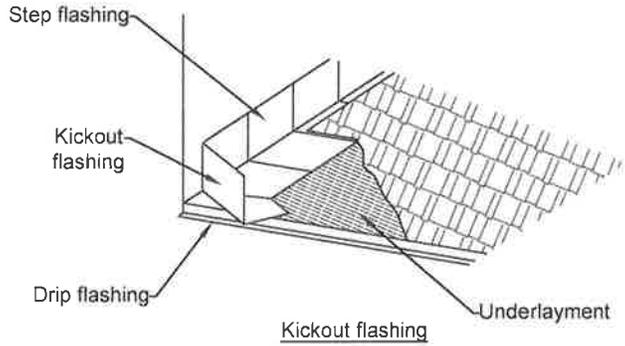


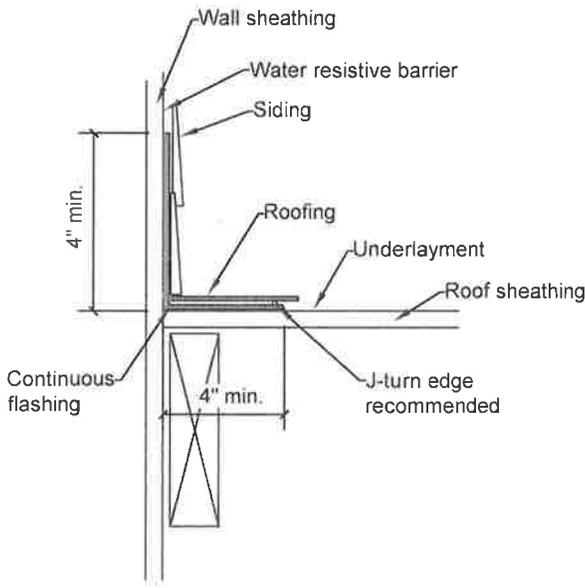
FIGURE 33 - CONTINUED FLASHING



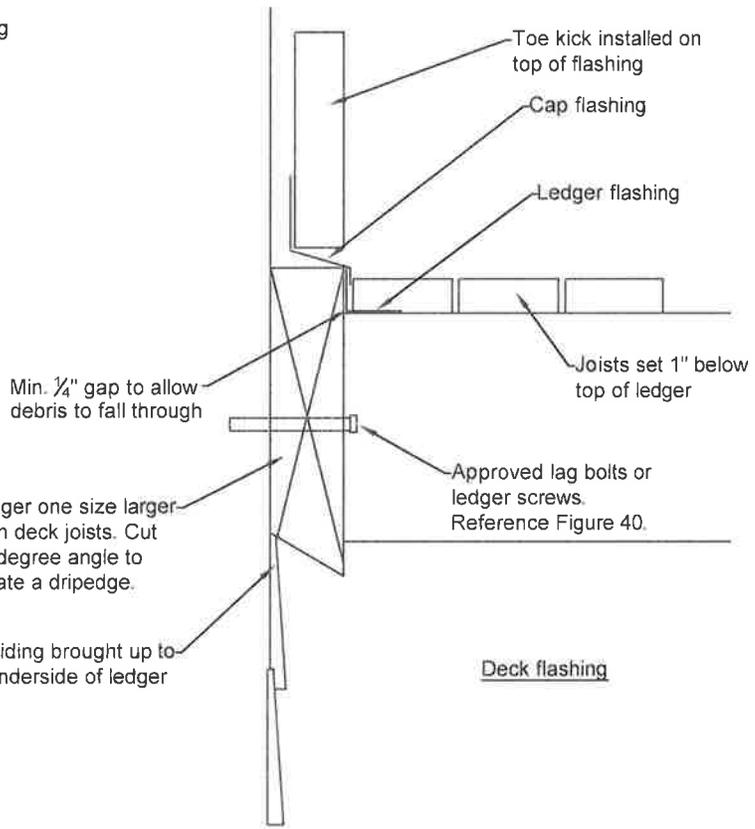
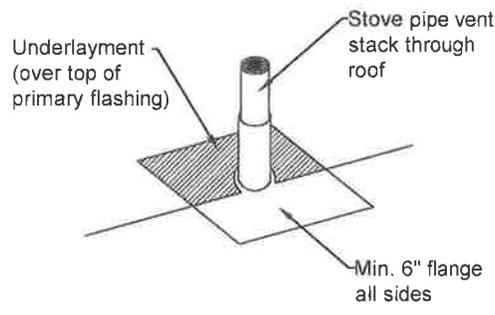
Continuous sidewall flashing



Chimney flashing



Section



Deck flashing

FIGURE 33 - CONTINUED FLASHING

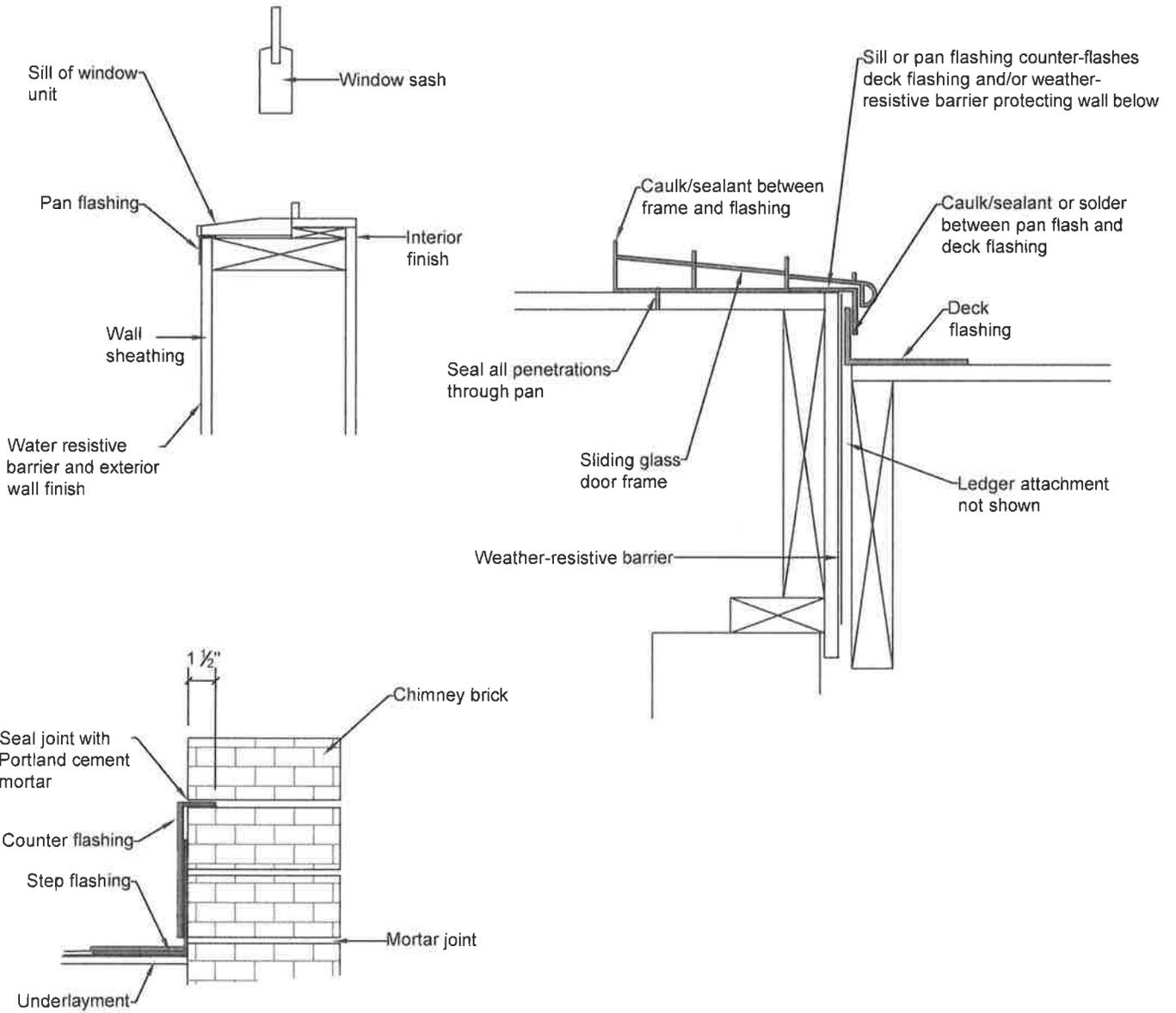


FIGURE 34 WALL COVERING

R702.3 Gypsum Board

R702.3.1 Materials. Gypsum board and gypsum panel product materials and accessories shall conform to ASTM C 22, C 475, C 514, C 1002, C 1047, C 1177, C 1178, C 1278, C 1396 OR C 1658 and shall be installed in accordance with the provisions of this section. Adhesives for the installation of gypsum board and gypsum panel products shall conform to ASTM C 557.

R702.3.2 Wood framing. Wood framing supporting gypsum board and gypsum panel products shall be not less than 2 inches nominal thickness in the least dimension except that wood furring strips not less than 1-inch by 2-inch nominal dimension shall be permitted to be used over solid backing or framing spaced not more than 24 inches on center.

R702.3.3 Cold-formed steel framing. Contact the Building Department

R702.3.4 Insulating concrete form walls. Contact the Building Department

R702.3.5 Application. Supports and fasteners used to attach gypsum board and gypsum panel products shall comply with Table R702.3.5. Gypsum sheathing shall be attached to exterior walls in accordance with Table R602.3(1). Gypsum board and gypsum panel products shall be applied at right angles or parallel to framing members. All edges and ends of gypsum board and gypsum panel products shall occur on the framing members, except those edges and ends that are perpendicular to the framing members. Interior gypsum board shall not be installed where it is directly exposed to the weather or to water.

R702.3.5.1 Screw fastening. Screws for attaching gypsum board and gypsum panel products to wood framing shall be Type W or Type S in accordance with ASTM C 1002 and shall penetrate the wood not less than $\frac{5}{8}$ inch. Gypsum board and gypsum panel products shall be attached to cold-formed steel framing with minimum No. 6 screws. Screws for attaching gypsum board and gypsum panel products to cold-formed steel framing less than 0.033 inch thick shall be Type S in accordance with ASTM C 1002 or bugle head style in accordance with ASTM C 1513 and shall penetrate the steel not less than $\frac{3}{8}$ inch. Screws for attaching gypsum board and gypsum panel products to cold-formed steel framing 0.033 inch to 0.112 inch thick shall be in accordance with ASTM C 954 or bugle head style in accordance with ASTM C 1513. Screws for attaching gypsum board and gypsum panel products to structural insulated panels shall penetrate the wood structural panel facing not less than $\frac{7}{16}$ inch.

R702.3.6 Horizontal gypsum board diaphragm ceilings. Gypsum board and gypsum panel products shall be permitted on wood joists to create a horizontal diaphragm in accordance with Table R702.3.6. Gypsum board and gypsum panel products shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of board and panels shall not occur on the same joist. The maximum allowable diaphragm proportions shall be 1 $\frac{1}{2}$:1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted. Gypsum board or gypsum panel products shall not be used in diaphragm ceilings to resist lateral forces imposed by masonry or concrete construction. Perimeter edges shall be blocked using wood members not less than 2 inch by 6 inch nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than 2 inches in width for the attachment of the gypsum board or gypsum panel product.

R702.3.7 Water-resistant gypsum backing board. Gypsum board used as the base or backer for adhesive application of ceramic tile or other required nonabsorbant finish material shall conform to ASTM C 1396, C 1178 or C 1278. Use of water-resistant gypsum backing board shall be permitted on ceilings. Water-resistant gypsum board shall not be installed over a Class I or II vapor retarder in a shower or tub compartment. Cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.

R702.3.7.1 Limitations. Water-resistant gypsum backing board shall not be used where there will be direct exposure to water, or in areas subject to continuous high humidity.

R702.4.2 Backer boards. Materials used as backers for wall tile in tub and shower areas and wall panels in shower areas shall be of materials listed in Table R702.4.2, and installed in accordance with the manufacturer's recommendations.

R702.5 Other finishes. Wood veneer paneling and hard board paneling shall be placed on wood or cold-formed steel framing spaced not more than 16 inches on center. Wood veneer and hard board paneling less than $\frac{1}{4}$ inch nominal thickness shall not have less than a $\frac{3}{8}$ inch gypsum board or gypsum panel product backer. Wood veneer paneling not less than $\frac{1}{4}$ inch nominal thickness shall conform to ANSI/HPVA HP-1. Hardboard paneling shall conform to CPA/ANSI A135.5.

All structural panel components within conditioned space such as plywood, particle board, wafer board, and oriented strand board shall be identified as "EXPOSURE 1", "EXTERIOR", or "HUD-APPROVED".

FIGURE 34 - CONTINUED WALL COVERING

**TABLE R702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD AND GYPSUM PANEL PRODUCTS**

THICKNESS OF GYPSUM BOARD OR GYPSUM PANEL PRODUCTS (inches)	APPLICATION	ORIENTATION OF GYPSUM BOARD OR GYPSUM PANEL PRODUCTS TO FRAMING	MAXIMUM SPACING OF FRAMING MEMBERS (inches O.C.)	MAXIMUM SPACING OF FASTENERS (inches)		SIZE OF NAILS FOR APPLICATION TO WOOD FRAMING ^c	
				Nails ^a	Screws ^b		
Application without adhesive							
3/8	Ceiling ^d	Perpendicular	16	7	12	13 gage, 1 1/4" long, 1/8" head; 0.098" diameter, 1 1/4" long, annular-ringed; or 4d cooler nail, 0.080" diameter, 1 3/8" long, 7/32" head.	
	Wall	Either direction	16	8	16		
1/2	Ceiling	Either direction	16	7	12	13 gage, 1 3/8" long, 1/8" head; 0.098" diameter, 1 1/4" long, annular-ringed; 5d cooler nail, 0.086" diameter, 1 5/8" long, 1/8" head; or gypsum board nail, 0.086" diameter, 1 5/8" long, 1/2" head.	
	Ceiling ^d	Perpendicular	24	7	12		
	Wall	Either direction	24	8	12		
5/8	Wall	Either direction	16	8	16	13 gage, 1 5/8" long, 1/8" head; 0.098" diameter, 1 3/8" long, annular-ringed; 6d cooler nail, 0.092" diameter, 1 1/2" long, 1/4" head; or gypsum bard nail, 0.0915" diameter, 1 1/2" long, 1/8" head.	
	Ceiling	Either direction	16	7	12		
	Ceiling ^c	Perpendicular	24	7	12		
	Type X at garage ceiling beneath habitable rooms	Perpendicular	24	6	6		1 1/4" long 6d coated nails or equivalent drywall screws. Screws shall comply with Section R702.3.5.1.
	Wall	Either direction	24	8	12		
Wall	Either direction	16	8	16	13 gage, 1 5/8" long, 1/8" head; 0.098" diameter, 1 3/8" long, annular-ringed; 6d cooler nail, 0.092" diameter, 1 1/2" long, 1/4" head; or gypsum bard nail, 0.0915" diameter, 1 1/2" long, 1/8" head.		
Application with adhesive							
3/8	Ceiling ^d	Perpendicular	16	16	16	Same as above for 3/8" gypsum board and gypsum panel products.	
	Wall	Either direction	16	16	24		
1/2 or 5/8	Ceiling	Either direction	16	16	16	Same as above for 1/2" and 5/8" gypsum board and gypsum panel products, respectively.	
	Ceiling ^d	Perpendicular	24	12	16		
Two 3/8 layers	Wall	Either direction	24	24	24	Base ply nailed as above for 1/2" gypsum board and gypsum panel products; face ply installed with adhesive.	
	Ceiling	Perpendicular	16	16	16		

- For application without adhesive, a pair of nails spaced not less than 2 inches apart or more than 2 1/2 inches apart may be used with the pair of nails spaced 12 inches on center.
- Screws shall be in accordance with section R702.3.6. Screws for attaching gypsum board or gypsum panel products to structural insulated panels shall penetrate the wood structural panel facing not less than 1/8 inch.
- Where cold-formed steel framing is used with a clinching design to receive nails by two edges of metal, the nails shall be not less than 5/8 inch longer than the gypsum board or gypsum panel product thickness and shall have ringed shanks. Where the cold-formed steel framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, 13 1/2 gage, 5/8 inches long, 1 5/8 inch head for 1/2 inch gypsum board or gypsum panel product; and 6d, 13 gage, 1 7/8 inches long, 1 5/8 inch head for 5/8 inch gypsum board or gypsum panel product.
- Three-eighths-inch-thick single-ply gypsum board or gypsum panel product shall not be used on a ceiling where a water-based textured finish is to be applied, or where it will be required to support insulation above a ceiling. On ceiling applications to receive a water-based texture material, either hand or spray applied, the gypsum board or gypsum panel product shall be applied perpendicular to framing. Where applying a water-based texture material, the minimum gypsum board thickness shall be increased from 3/8 inch to 1/2 inch for 16 inch on center framing, and from 1/2 inch to 5/8 inch for 24 inch on center framing or 1/2 inch sag resistant gypsum ceiling board shall be used.

**TABLE R702.4.2
BACKER BOARD MATERIALS**

MATERIAL	STANDARD
Glass mat gypsum backing panel	ASTM C 1178
Fiber-reinforced gypsum panels	ASTM C 1278
Nonasbestos fiber-cement backer board	ASTM C 1288 or ISO 8336, Category C
Nonasbestos fiber mat reinforced cementitious backer units	ASTM C 1325

FIGURE 34 - CONTINUED WALL COVERING

R703.1 General. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing as described in Section R703.4. (Figure 33).

R703.2 Water-resistive barrier. One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D 226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches. Where joints occur, felt shall be lapped not less than 6 inches. The felt or other approved material shall 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 as described in Section R703.1. The water-resistive barrier is not required for detached accessory buildings.

TABLE R703.3(1)
SIDING MINIMUM ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL		NOMINAL THICKNESS (inches)	JOINT TREATMENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS ^{b,c,d}					Number or spacing of fasteners	
				Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs		
Anchored veneer: brick, concrete, masonry or stone (see Section R703.8)		2	Section R703.8	Section R703.8						
Anchored veneer: concrete, stone or masonry (see Section R703.12)		-	Section R703.12	Section R703.12						
Fiber cement siding	Panel siding (see Section R703.10.1)	5/16	Section R703.10.1	6d common (2"x0.113")	6d common (2"x0.113")	6d common (2"x0.113")	6d common (2"x0.113")	4d common (1 1/2" x 0.099")	6" panel edges 12" inter. sup.	
	Lap siding (see Section R703.10.2)	5/16	Section R703.10.2	6d common (2"x0.113")	6d common (2"x0.113")	6d common (2"x0.113")	6d common (2"x0.113")	6d common (2" x 0.113") or 11 gage roofing nail	Note f	
Hardboard panel siding (see Section R703.3)		7/16	-	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) w/ 0.225" head	6" panel edges 12" inter. sup. ^d	
Hardboard lap siding (see Section R703.3)		7/16	-	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) w/ 0.240" head	Same as stud spacing 2 per bearing	
Horizontal aluminum ^a	Without insulation	0.019 ^b	Lap	Siding nail 1 1/2" x 0.120"	Siding nail 2" x 0.120"	Siding nail 2" x 0.120"	Siding nail ^h 1 1/2" x 0.120"	Not allowed	Same as stud spacing	
		0.024	Lap	Siding nail 1 1/2" x 0.120"	Siding nail 2" x 0.120"	Siding nail 2" x 0.120"	Siding nail ^h 1 1/2" x 0.120"	Not allowed		
	With insulation	0.019	Lap	Siding nail 1 1/2" x 0.120"	Siding nail 2 1/2" x 0.120"	Siding nail 2 1/2" x 0.120"	Siding nail 1 1/2" x 0.120"	Siding nail 1 1/2" x 0.120"		
Insulated vinyl siding ^l		0.035 (vinyl siding layer only)	Lap	0.120" nail (shank) with a 0.313 head or 16-gage crown ^{h,i}	0.120" nail (shank) with 0.313" head or 16-gage crown ^h	0.120" nail (shank) with 0.313" head or 16-gage crown ^h	0.120" nail (shank) with 0.313" head	Section R703.11.2	Not allowed	16 inches on center or specified by manufacturer instructions, test report or other sections of this code
Particleboard panels		3/8	-	6d box nail (2"x0.099")	6d box nail (2"x0.099")	6d box nail (2"x0.099")	6d box nail (2"x0.099")	6d box nail (2"x0.099")	Not allowed	6" panel edges 12" inter. sup.
		1/2	-	6d box nail (2"x0.099")	6d box nail (2"x0.099")	6d box nail (2"x0.099")	6d box nail (2"x0.099")	6d box nail (2"x0.099")		
		3/8	-	6d box nail (2"x0.099")	8d box nail (2 1/2" x 0.113")	8d box nail (2 1/2" x 0.113")	6d box nail (2"x0.099")	6d box nail (2"x0.099")		
Polypropylene siding ^k		Not applicable	Lap	Section 703.14.1	Section 703.14.1	Section 703.14.1	Section 703.14.1	Not allowed	As specified by the manufacturer instructions, test report or other sections of this code	

FIGURE 34 - CONTINUED WALL COVERING

TABLE R703.3(1) - continued
SIDING MINIMUM ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS (inches)	JOINT TREATMENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS ^{b,c,d}						
			Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners	
Steel ^f	29 ga.	Lap	Siding nail (1 3/4"x0.113") Staple -1 3/4"	Siding nail (2 3/4"x0.113") Staple -2 1/2"	Siding nail (2 1/2"x0.113") Staple -2 1/4"	Siding nail (1 3/4"x0.113") Staple -1 3/4"	Not allowed	Same as stud spacing	
Vinyl siding (see Section R703.11)	0.035	Lap	0.120" nail (shank) with a 0.313" head or 16-gage staple with 3/8 to 1/2 inch crown ^{h,i}	0.120" nail (shank) with a 0.313" head or 16-gage staple with 3/8 to 1/2 inch crown ^h	0.120" nail (shank) with a 0.313 head or 16-gage staple with 3/8 to 1/2 inch crown ^h	0.120" nail (shank) with a 0.313" head. Section R703.11.2	Not allowed	16 inches on center or as specified by the manufacturer instructions or test report	
Wood siding (see Section R703.3)	Wood rustic, drop	3/8 min.	6d box or siding nail (2"x0.099")	6d box or siding nail (2"x0.099")	6d box or siding nail (2"x0.099")	6d box or siding nail (2"x0.099")	8d box or siding nail (2 1/2"x0.113") Staple -2"	Face nailing up to 6" widths, 1 nail per bearing, 8" widths and over, 2 nails per bearing	
	Shiplap	19/32 average							Lap
	Bevel	7/16							Lap
	Butt tip	3/8							Lap
Wood structural panel ANSI/APA PRP-210 siding (exterior grade) (see Section R703.3)	3/8 - 1/2	Note e	2" x 0.099" siding nail	2 1/2" x 0.113" siding nail	2 1/2" x 0.113" siding nail	2 1/2" x 0.113" siding nail	2" x 0.099" siding nail	6" panel edges 12" inter. sup.	
Wood structural panel lap siding (see Section R703.3)	3/8 - 1/2	Note e Note g	2" x 0.099" siding nail	2 1/2" x 0.113" siding nail	2 1/2" x 0.113" siding nail	2 1/2" x 0.113" siding nail	2" x 0.099" siding nail	8" along bottom edge	

- a. Aluminum nails shall be used to attach aluminum siding.
- b. Aluminum (0.019 inch) shall be unbacked only where the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
- c. Shall be of approved type.
- d. Where used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
- e. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
- f. Face nailing: one 6d common nail through the overlapping planks at each stud. Concealed nailing: one 11-gage 1 1/2 inch long galv. roofing nail through the top edge of each plank at each stud in accordance with the manufacturer's installation instructions.
- g. Vertical joints, if staggered, shall be permitted to be away from the studs if applied over wood structural panel sheathing.
- h. Minimum fastener length must be sufficient to penetrate sheathing other nailable substrate and framing a total of a minimum of 1 1/4 inches or in accordance with the manufacturer's installation instructions.
- i. Where specified by the manufacturer's instructions and supported by a test report, fasteners are permitted to penetrate into or fully through nailable sheathing or other nailable substrate of minimum thickness specified by the instructions or test report, without penetrating into framing.
- j. Insulated vinyl siding shall comply with ASTM D 7793.
- k. Polypropylene siding shall comply with ASTM D 7254.
- l. Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Sections R703.15, R703.16 and R703.17.

FIGURE 35 GENERAL FRAMING DETAILS

R802.3 Framing details. Rafters shall be framed not more than 1 ½ inch offset from each other to ridge board or directly opposite from each other with a gusset plate as a tie. Ridge board shall be not less than 1 inch nominal thickness and not less in depth than the cut end of the rafter. At valleys and hips there shall be a valley or hip rafter not less than 2 inch nominal thickness and not less in depth than the cut end of the rafter. Hip and valley rafters shall be supported at the ridge by a brace to a bearing partition or be designed to carry and distribute the specific load at that point. Where the roof pitch is less than three units vertical in 12 units horizontal (25 percent slope), structural members that support rafters and ceiling joists, such as ridge beams, hips and valleys, shall be designed as beams.

R802.3.1 Ceiling joist and rafter connections. Ceiling joists and rafters shall be nailed to each other in accordance with Table R802.5.1(9), and the rafter shall be nailed to the top plate in accordance with Figure 24 or Figure 25. Ceiling joists shall be continuous or securely joined in accordance with Table R802.5.1(9) where they meet over interior partitions and are nailed to adjacent rafters to provide a continuous tie across the building when such joists are parallel to rafters.

Where ceiling joists are not connected to the rafters at the top wall plate, joists connected higher in the attic shall be installed as rafter ties, or rafter ties shall be installed to provide a continuous tie. Where ceiling joists are not parallel to rafters, rafter ties shall be installed. Rafter ties shall be a minimum of 2 inches by 4 inches, installed in accordance with the connection requirements in Table R802.5.1(9), or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided, the ridge formed by these rafters shall be supported by a wall or girder (or beam) designed in accordance with acceptable engineering practice.

Collar ties or ridge straps to resist wind uplift shall be connected in the upper third of the attic space in accordance with Figure 24 or Figure 25.

Collar ties shall be not less than 1 inch by 4 inches (nominal), spaced not more than 4 feet on center.

R802.3.2 Ceiling joists lapped. Ends of ceiling joists shall be lapped a minimum of 3 inches or butted over bearing partitions or beams and toenailed to the bearing member. Where ceiling joists are used to provide resistance to rafter thrust, lapped joists shall be nailed together in accordance with Table R802.5.1(9) and butted joists shall be tied together in a manner to resist such thrust. Joists that do not resist thrust shall be permitted to be nailed in accordance with Figure 24 or Figure 25.

R802.3.3 Blocking. Blocking shall be a minimum of utility grade lumber.

R802.6 Bearing. The ends of each rafter or ceiling joist shall have not less than 1 ½ inches of bearing on wood or metal and not less than 3 inches on masonry or concrete. The bearing on masonry or concrete shall be direct, or a sill plate of 2 inch minimum nominal thickness shall be provided under the rafter or ceiling joist. The sill plate shall provide a minimum nominal bearing area of 48 square inches.

R802.8 Lateral support. Roof framing members and ceiling joists having a depth-to-thickness ratio exceeding 5 to 1 based on nominal dimensions shall be provided with lateral support at points of bearing to prevent rotation.

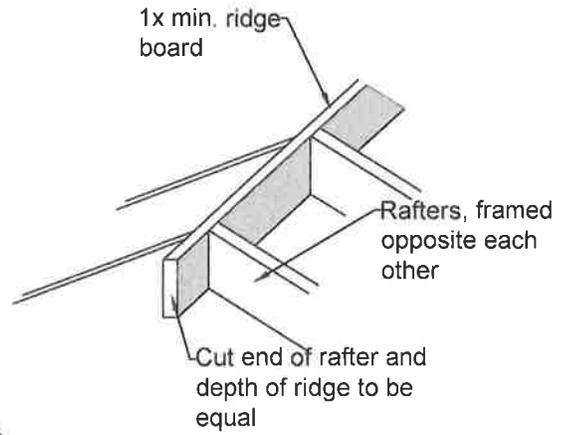
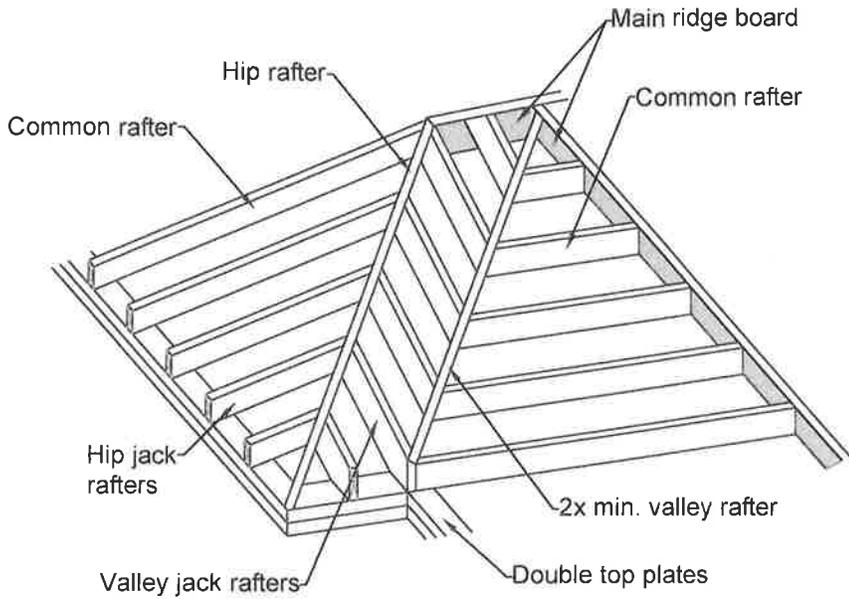
Exception: Roof trusses shall be braced in accordance with Section R802.10.3.

R802.8.1 Bridging. Rafters and ceiling joists having a depth-to-thickness ratio exceeding 6 to 1 based on nominal dimensions shall be supported laterally by solid blocking, diagonal bracing (wood or metal) or a continuous 1 inch by 3 inch wood strip nailed across the rafters or ceiling joists at intervals not exceeding 8 feet.

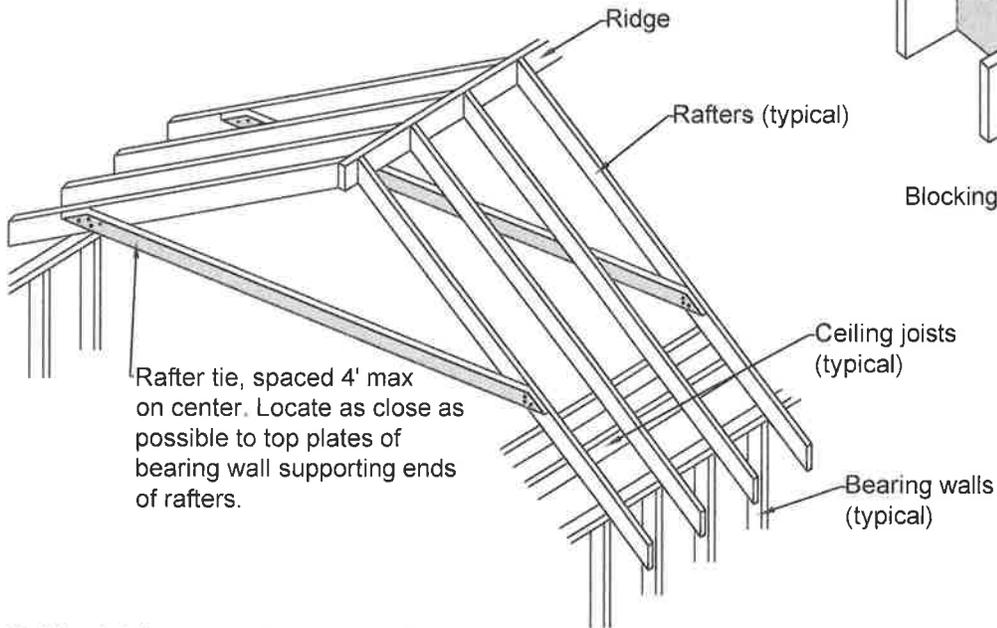
R802.9 Framing of openings. Openings in roof and ceiling framing shall be framed with header and trimmer joists. Where the header joist span does not exceed 4 feet, the header joist shall be permitted to be a single member the same size as the ceiling joist or rafter. Single trimmer joists shall be permitted to be used to carry a single header joist that is located within 3 feet of the trimmer joist bearing. Where the header joist span exceeds 4 feet, the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the ceiling joists or rafter framing into the header. Approved hangers shall be used for the header joist to trimmer joist connections where the header joist span exceeds 6 feet. Tail joists over 12 feet long shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches.

R802.10.4 Alterations to trusses. Truss members shall not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional. Alterations resulting in the addition of load such as HVAC equipment water heater that exceeds the design load for the truss shall not be permitted without verification that the truss is capable of supporting such additional loading.

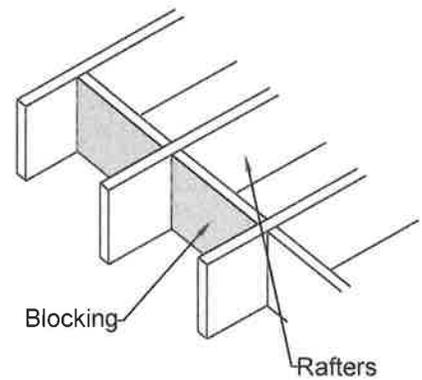
FIGURE 35 - CONTINUED GENERAL FRAMING DETAILS



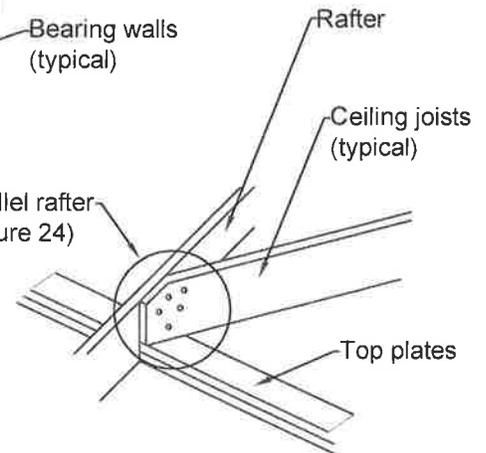
Framing-rafters at ridge



Ceiling joists perpendicular to rafters



Ceiling joists to parallel rafter connection (See Figure 24)



Rafter to ceiling joist

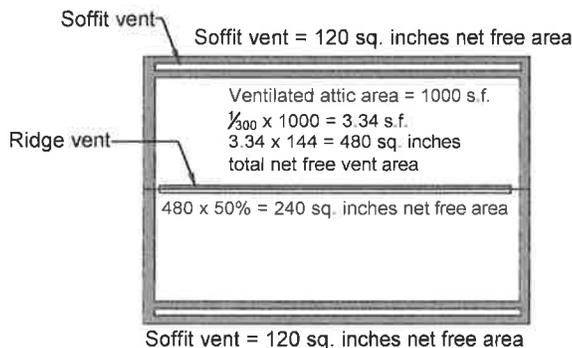
FIGURE 35 - CONTINUED GENERAL FRAMING DETAILS

R802.7 Cutting, drilling and notching. See Figure 22.

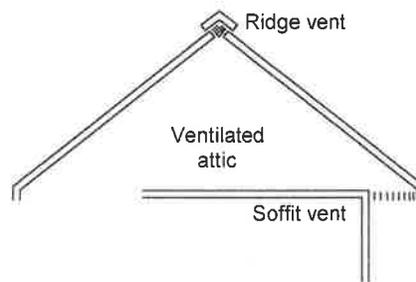
R802.10.1 Truss design drawings. Truss design drawings shall be prepared by a professional engineer, licensed in the State of Washington, and shall be provided to the Building Department and approved prior to installation. **[ALWAYS CHECK WITH THE BUILDING DEPARTMENT TO CONFIRM THE REQUIRED DESIGN LOADS. DESIGN LOADS VARY GREATLY ACROSS KLIKITAT COUNTY].**

R806. 1 Ventilation required. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilation openings shall have a least dimension of $\frac{1}{16}$ inch minimum and $\frac{1}{4}$ inch maximum. Ventilation openings having a least dimension larger than $\frac{1}{4}$ inch shall be provided with corrosion-resistant wire cloth screening, hardware cloth or similar material with openings having a least dimension of $\frac{1}{16}$ inch minimum and $\frac{1}{4}$ inch maximum. Openings in roof framing members shall conform to the requirements of Section R802.7. Required ventilation openings shall open directly to the outside air.

R806.2 Minimum vent area. The minimum net free ventilating area shall be $\frac{1}{300}$ of the area of the vented space.



Plan view of attic area



Section of attic area

R806.5 Unvented attic and unvented enclosed rafter assemblies. Unvented attics and unvented enclosed roof framing assemblies created by ceilings that are applied directly to the underside of the roof framing members and structural roof sheathing applied directly to the top of the roof framing members/rafters, shall be permitted where all of the following conditions are met:

1. The unvented attic space is **completely** contained within the building thermal envelope.
2. No interior Class I vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly or on the ceiling side of the unvented enclosed rafter assembly.
3. Where wood shingles or shakes are used, a minimum $\frac{1}{4}$ inch vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In Climate Zones 5, 6, 7 and 8, any air-impermeable insulation shall be a Class II vapor retarder, or shall have a Class II vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Insulation shall be located in accordance with the following:

5.1 Item 5.1.1, 5.1.2, 5.1.3 or 5.1.4 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.

5.1.1 Where only air-impermeable insulation is provided, it shall be applied in direct contact with the underside of the structural roof sheathing.

5.1.2 Where air-permeable insulation is provided inside the building thermal envelope, it shall be installed in accordance with Section 5.1. In addition to the air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing in accordance with the R-values in Table R806.5 for condensation control. (R-20)

5.1.3 Where both air-impermeable and air-permeable insulation are provided, the air-impermeable insulation shall be applied in direct contact with the underside of the structural roof sheathing in accordance with Item 5.1.1 and shall be in accordance with the R-values in Table R806.5 for condensation control. (R-20) The air-permeable insulation shall be installed directly under the air-impermeable insulation.

FIGURE 35 - CONTINUED GENERAL FRAMING DETAILS

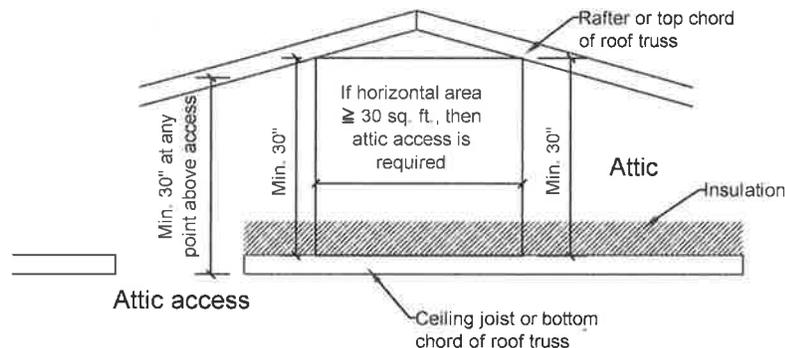
5.1.4 Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45 degrees F. For calculation purposes, an interior air temperature of 68 degrees F is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.. **FOR ADDITIONAL INFORMATION ON UNVENTED ATTIC ASSEMBLIES, CONTACT THE BUILDING DEPARTMENT.**

R807.1 Attic access. Buildings with combustible ceiling or roof construction shall have an attic access opening to attic areas that have a vertical height of 30 inches or greater over an area of not less than 30 square feet. The vertical height shall be measured from the top of the ceiling framing members to the underside of the roof framing members.

The rough-framed opening shall be not less than 22 inches by 30 inches and shall be located in a hallway or other readily accessible location. Where located in a wall, the opening shall be not less than 22 inches wide by 30 inches high. Where the access is located in a ceiling, a minimum unobstructed headroom in the attic space shall be 30 inches at some point above the access measured vertically from the bottom of ceiling framing members. See Section M1305.1.3 for access requirements where mechanical equipment is located in attics.

R302.14 Combustible insulation clearance. Combustible insulation shall be separated a minimum of 3 inches from recessed luminaires, fan motors and other heat-producing devices.

Exception: Where heat-producing devices are listed for lesser clearances, combustible insulation complying with the listing requirements shall be separated in accordance with the conditions stipulated in the listing.



R202 Attic, habitable. A finished or unfinished area, not considered a story, complying with all of the following requirements:

1. The occupiable area is at least 70 square feet, in accordance with Section R304 (Section 3).
2. The occupiable floor area has a ceiling height in accordance with Section R305 (Section 3), and
3. The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.

Habitable attics shall have at least one operable emergency escape and rescue opening in compliance with Figure 5. Egress from habitable attics not provided with an egress door in accordance with Section 3 and Figure 8 shall be by a ramp in compliance with Figure 8A or stair in compliance with Figure 7. Habitable attics shall be provided with a Smoke Alarm per Figure 12. Sill height shall be in compliance with Figure 3 and Figure 5.

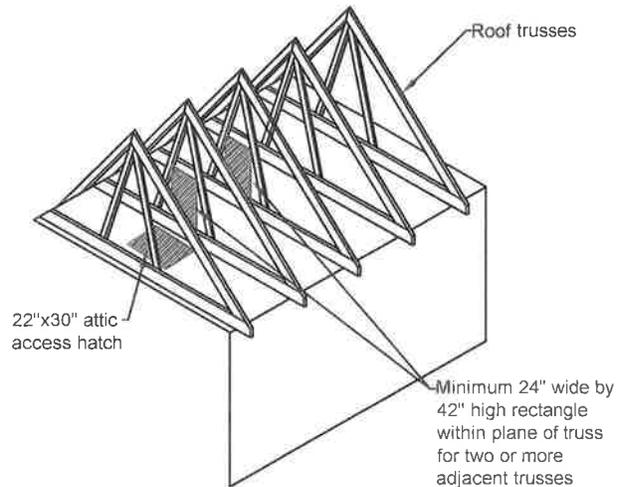
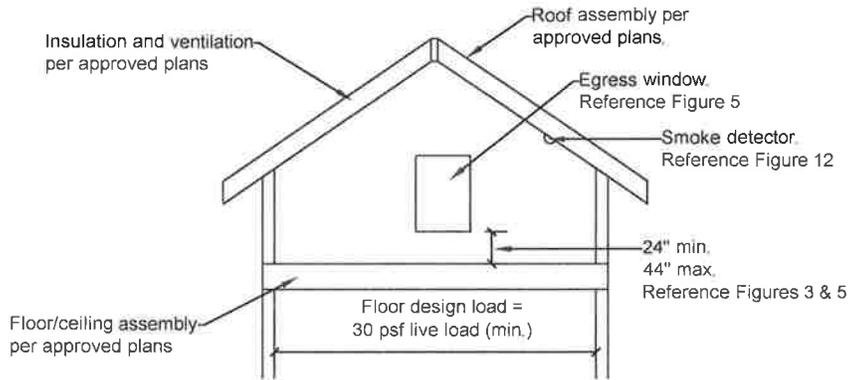
The attic does not have to be floored to be considered a habitable attic. Habitable attics shall be required to have a floor system that is designed the same as a regular habitable area. If an attic area meets the above criteria in the definition, it will be considered a habitable attic whether the plans designate it as such or not.

Attics shall be designated as habitable or uninhabitable. Attics other than habitable attics shall be labeled as uninhabitable attic with limited storage, or uninhabitable attic without limited storage. For trusses, the determination is based upon a 24 inch by 42 inch rectangle.

FIGURE 35 - CONTINUED GENERAL FRAMING DETAILS

**TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
(in pounds per square foot)**

USE	LIVE LOAD
Uninhabitable attics without storage ^b	10
Uninhabitable attics with limited storage ^{b,g}	20
Habitable attics and attics served with fixed stairs	30
Balconies (exterior) and decks ^e	60
Fire escapes	40
Guardrails and handrails ^d	200 ^h
Guardrail in-fill components ^f	50 ^h
Passenger vehicle garages ^a	50 ^a
Rooms other than sleeping room	40
Sleeping rooms	30
Stairs	40 ^c

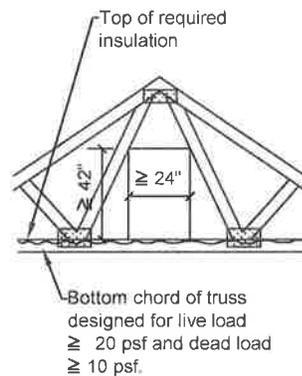


- a. Elevated garage floors shall be capable of supporting a 2,000 pound load applied over a 20 square inch area.
- b. Uninhabitable attics without storage are those where the maximum clear height between joists and rafters is less than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches high by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
- c. Individual stair treads shall be designed for the uniformly distributed live load or a 300 pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.
- d. A single concentrated load applied in any direction at any point along the top.
- e. See Section R502.2.2 for decks attached to exterior walls.
- f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirements.
- g. Uninhabitable attics with limited storage are those where the maximum clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:

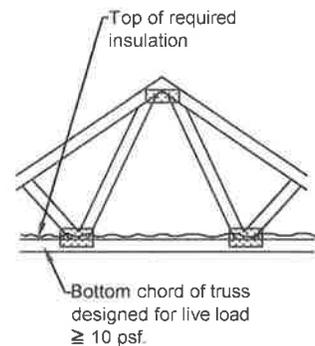
1. The attic area is accessible from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is a minimum of 30 inches.
2. The slopes of the joists or truss bottom chords are no greater than 2 inches vertical to 12 units horizontal.
3. Required insulation depth is less than the joist or truss bottom chord member depth.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed live load of not less than 10lb/ft².

- h. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.



Uninhabitable attic with limited storage



Uninhabitable attic without limited storage

Minimum uniformly distributed live loads for attic trusses

FIGURE 36 ROOF SHEATHING

R803.1 Lumber sheathing. Allowable spans for lumber used as roof sheathing shall conform to Table R803.1. Spaced lumber sheathing shall conform to Section 9.

**TABLE R803.1
MINIMUM THICKNESS OF LUMBER ROOF SHEATHING**

RAFTER OR BEAM SPACING (inches)	MINIMUM NET THICKNESS (inches)
24	5/8
48 ^a	1 ½ T & G
60 ^b	
72 ^c	

- a. Minimum 270 F_b , 340,000 E .
- b. Minimum 420 F_b , 660,000 E .
- c. Minimum 600 F_b , 1,150,000 E .

R803.2 Wood structural panel sheathing. Allowable spans, based on allowable live loads for location of construction project shall conform to the Table below. **PRIOR TO USE OF THIS TABLE, YOU MUST CONFIRM, WITH THE BUILDING DEPARTMENT, THE ACTUAL LIVE LOAD (SNOW LOAD) FOR THE PROPOSED AREA OF CONSTRUCTION.**

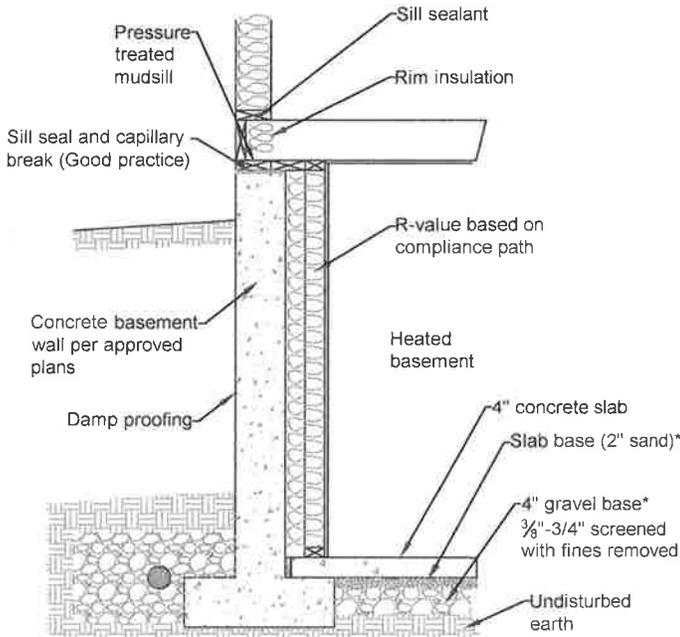
RECOMMENDED UNIFORM ROOF LIVE LOADS FOR APA RATED SHEATHING ^(a) AND APA RATED STURD-I-FLOOR WITH STRENGTH AXIS PERPENDICULAR TO SUPPORTS ^(b)

Panel Span Rating	Minimum Panel Performance Category	Maximum Span (in.)		Allowable Live Loads (psf) ^(d)							
		With Edge Support (c)	Without Edge Support	Spacing of Supports Center-to-Center (in.)							
				12	16	20	24	32	40	48	60
APA RATED SHEATHING ^(a)											
12/0	3/8	12	12	30							
16/0	3/8	16	16	70	30						
20/0	3/8	19.2	19.2	120	50	30					
24/0	3/8	24	19.2 ^(e)	190	100	60	30				
24/16	7/16	24	24	190	100	65	40				
32/16	15/32	32	28	300	165	110	65	30			
40/20	19/32	40	32	—	275	195	120	60	30		
48/24 ^(f)	23/32	48	36	—	—	270	175	95	45	30	
60/32 ^(f)	7/8	60	40	—	—	—	305	165	100	70	35
60/48	1 1/8	60	48	—	—	—	305	165	100	70	35
APA RATED STURD-I-FLOOR ^(g)											
16 oc	19/32	24	24	185	100	65	40				
20 oc	19/32	32	32	270	150	100	60	30			
24 oc	23/32	48	36	—	240	160	100	50	30	20	
32 oc	7/8	48	40	—	—	295	185	100	55	35	
48 oc	1-3/32	60	48	—	—	—	290	160	100	65	40

- (a) Includes APA RATED SHEATHING/CEILING DECK
- (b) Applies to APA RATED SHEATHING and APA RATED STURD-I-FLOOR panels 24 inches or wider applied over two or more spans.
- (c) Tongue-and-groove edges, panel edge clips (one midway* between each support, except two equally spaced between supports 48 inches on center or greater), lumber blocking, or other. For low slope roofs, see Table 31.
- (d) 10 psf dead load assumed.
- (e) 19.2 inches for Performance category 3/8 and 7/16 panels. 24 inches for Performance Category 15/32 and 1/2 panels.
- (f) Check with supplier to C-C Plugged grade plywood.
- (g) Also applies to C-C Plugged grade plywood.
- * No established tolerance.

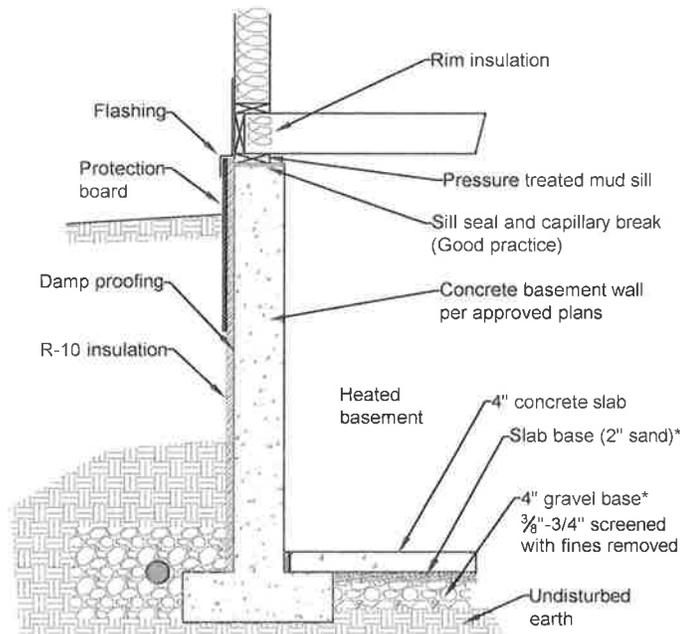
FIGURE 37 ENERGY CODE & VENTILATION DEPICTIONS

The Washington State Energy Code website outlines acceptable construction practices that meet the current code requirements. Use of information provided could reduce delays and added expense of reinspections. Visit: www.energy.wsu.edu/BuildingEfficiency/EnergyCode



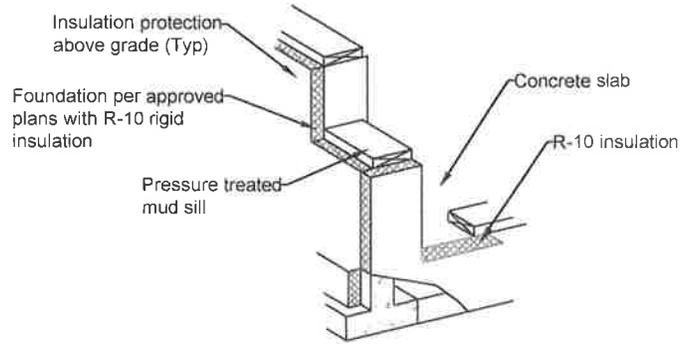
* Good practice. Required only in higher risk radon Counties.

Heated Basement: Interior Insulation

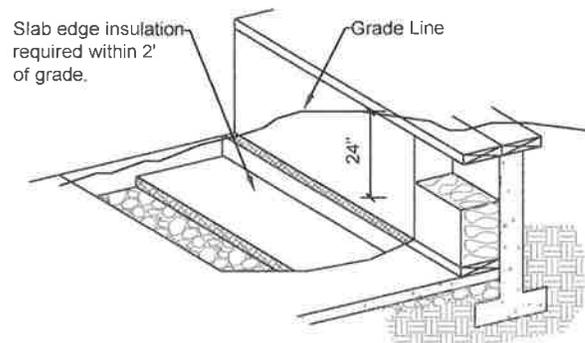


* Good practice. Required only in higher risk radon Counties.

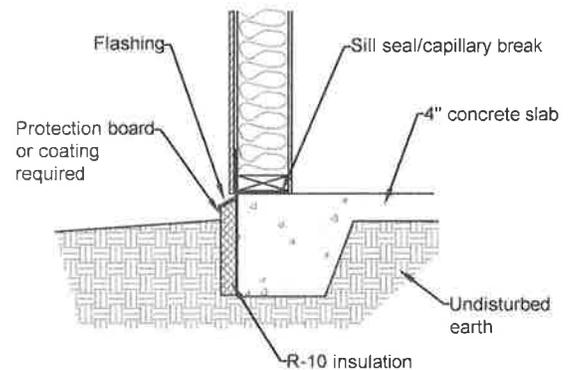
Heated Basement: Exterior Insulation



Heated Daylight Basement: Exterior Insulation

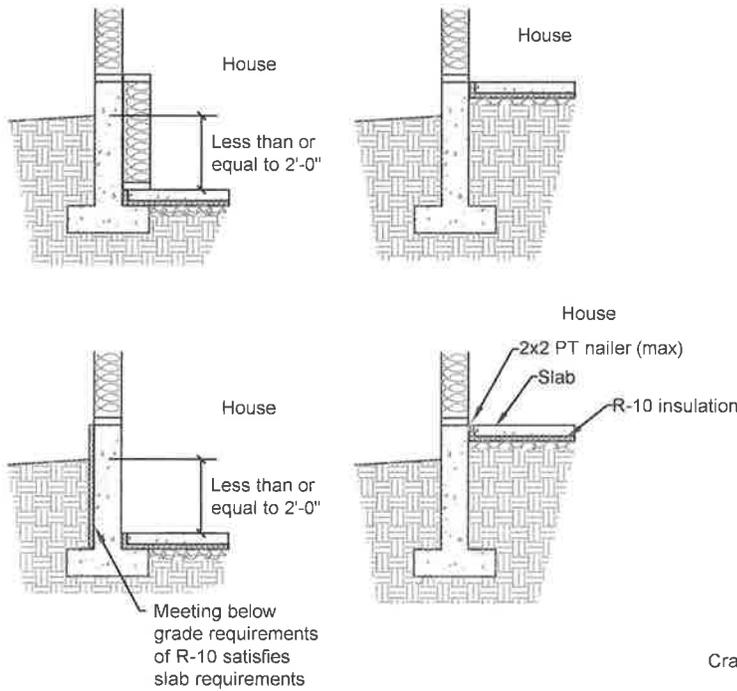


Heated Daylight Basement: Interior Insulation

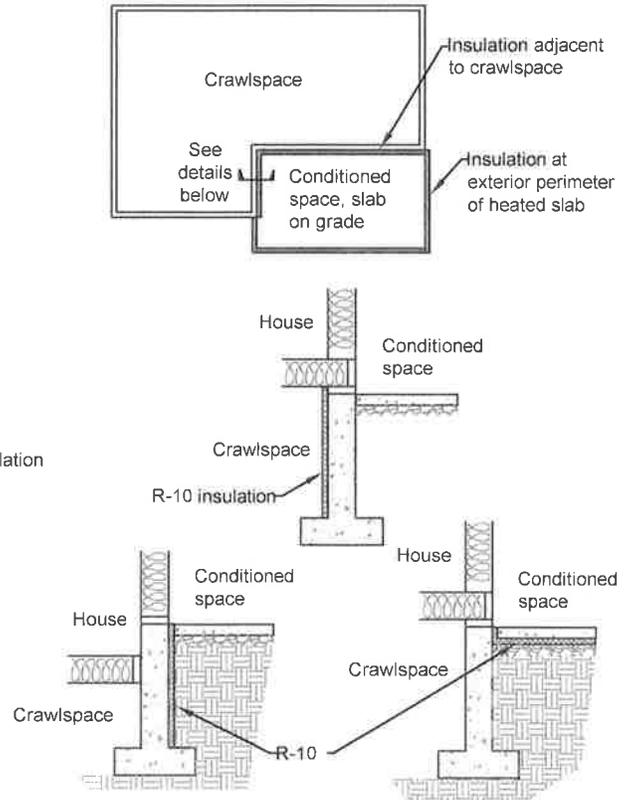


Slab -on-Grade (Monolithic)

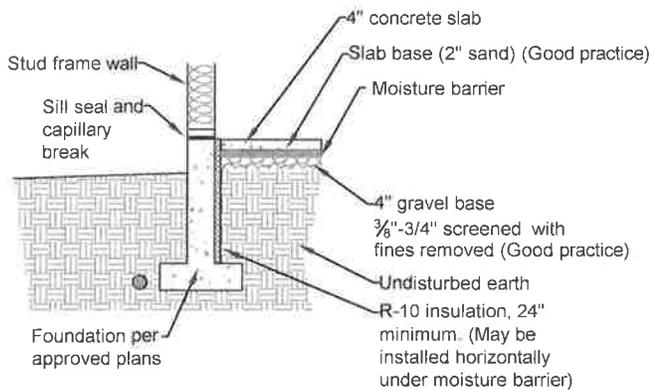
FIGURE 37 - CONTINUED ENERGY CODE & VENTILATION DEPICTIONS



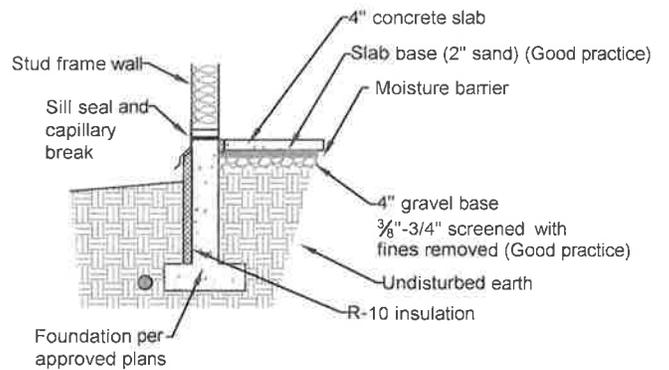
Slab Construction Perimeter Insulation



Thermal Breaks/Perimeter Insulation

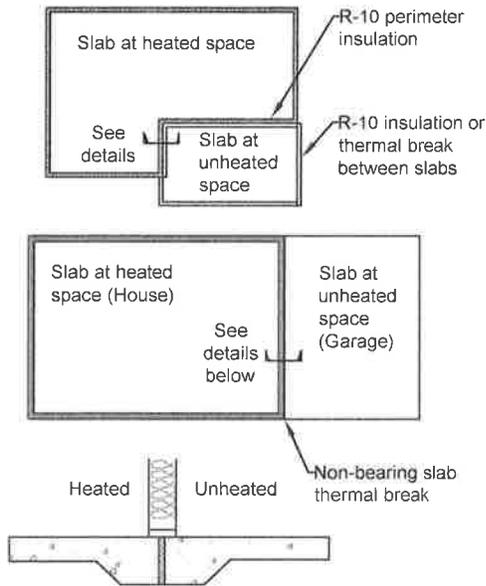


Interior Insulation

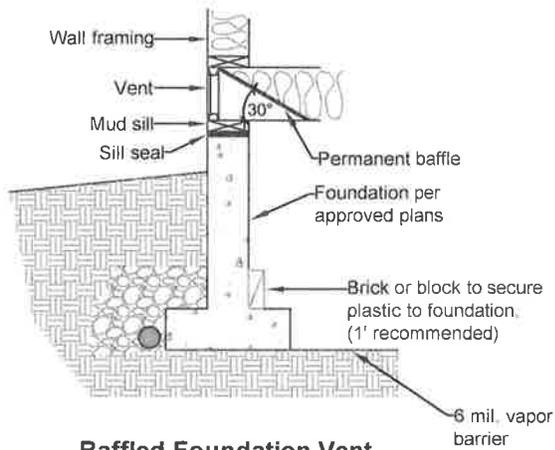


Exterior Insulation

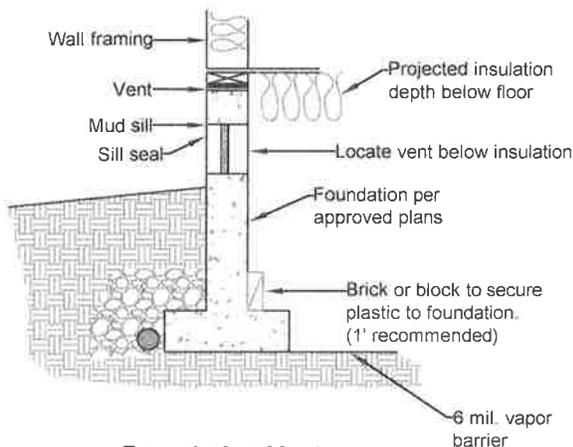
FIGURE 37 - CONTINUED ENERGY CODE & VENTILATION DEPICTIONS



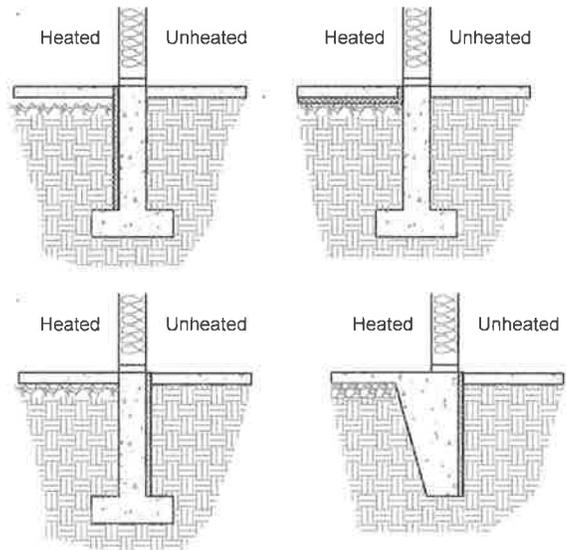
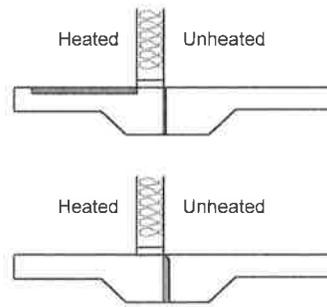
Non-Bearing Slab Thermal Break



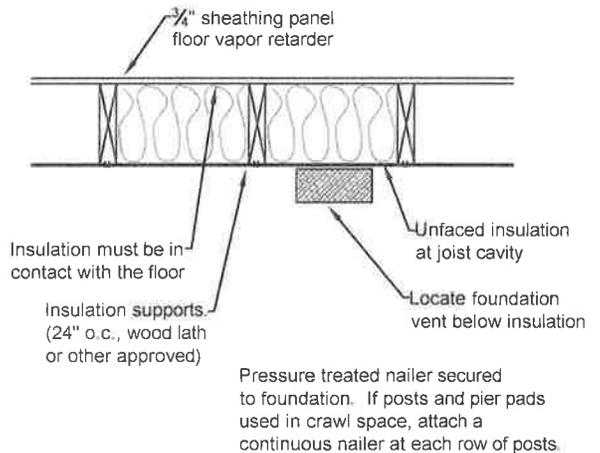
Baffled Foundation Vent



Foundation Vent

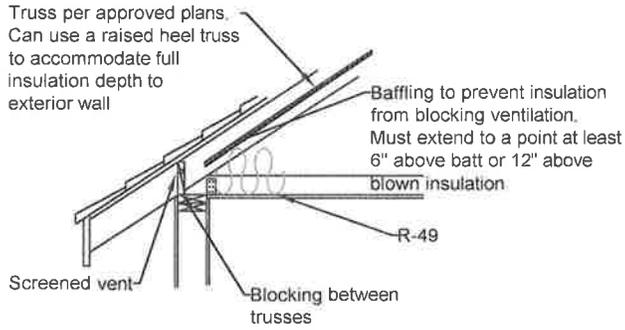


Possible Slab Insulation Details

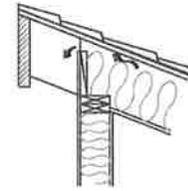


Floor Insulation Supports

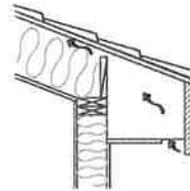
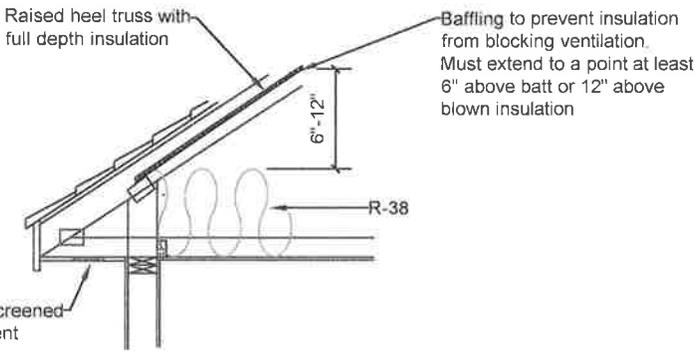
FIGURE 37 - CONTINUED ENERGY CODE & VENTILATION DEPICTIONS



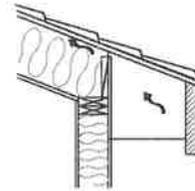
Shed Peak With Soffit



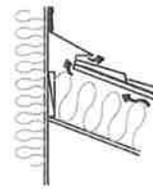
Shed Peak Without Soffit



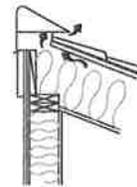
Eave With Soffit



Eave Without Soffit

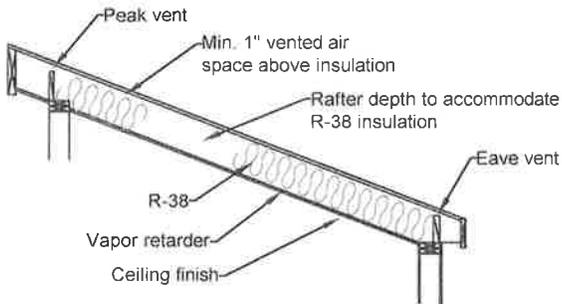


Shed Roof at Wall

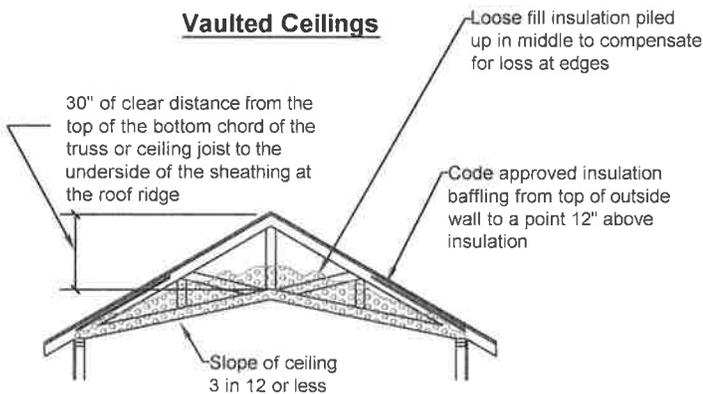


Shed Peak No Overhang

Attic Baffles/Insulation Details

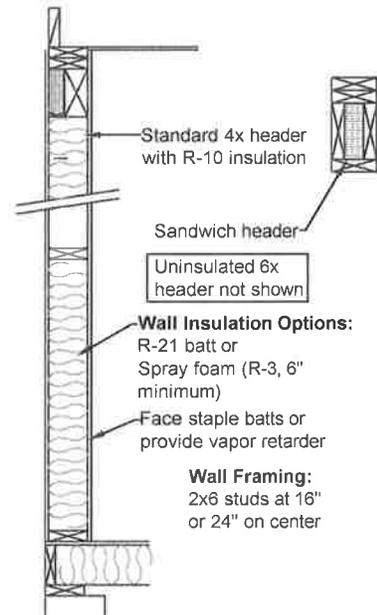


Vaulted Ceilings



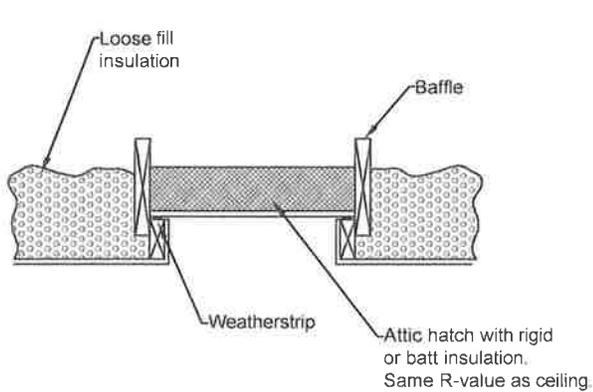
Vaulted Ceilings

Venting Vaulted Ceilings

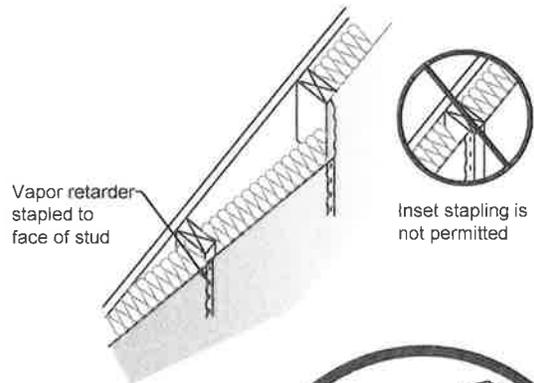


Acceptable R-21 Walls

FIGURE 37 - CONTINUED ENERGY CODE & VENTILATION DEPICTIONS



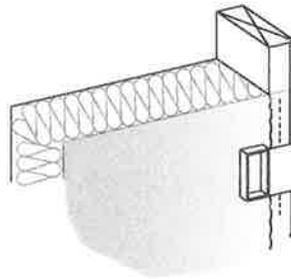
Attic Hatch



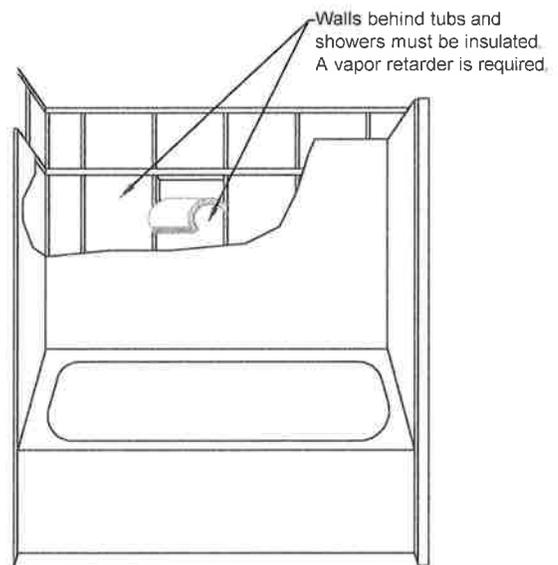
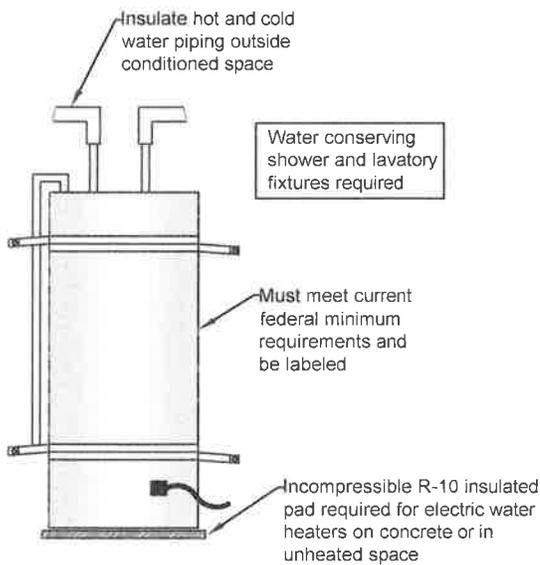
Wrong!
Insulation is smashed behind the junction box



Correct.
Insulation is carefully cut to fit behind the junction box and snugly at sides.



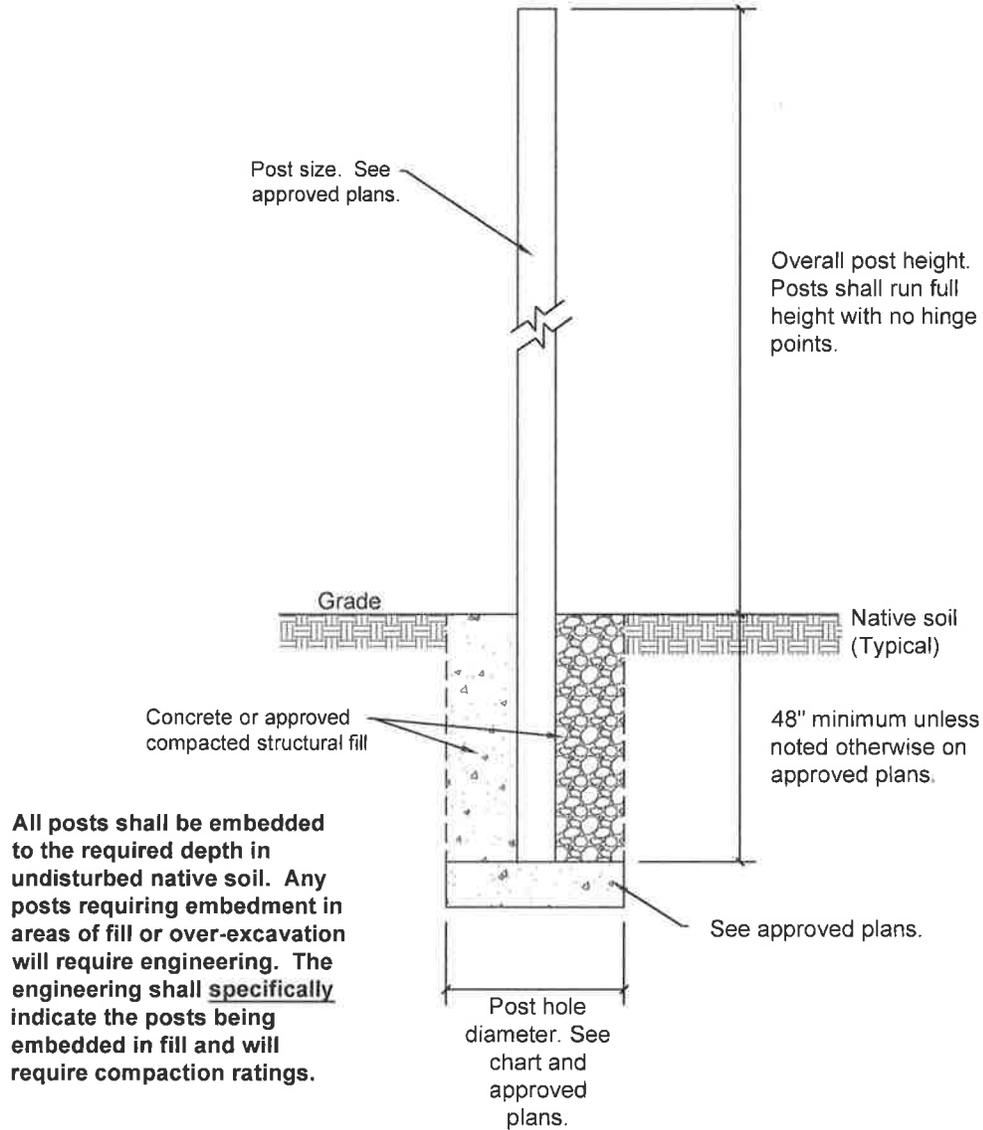
Face Stapling



Plumbing Requirements

FIGURE 38 POST DETAIL

NOTE: The following are unique to each project: Post size, post hole diameter, post length, depth of post embedment and pad thickness and rebar.

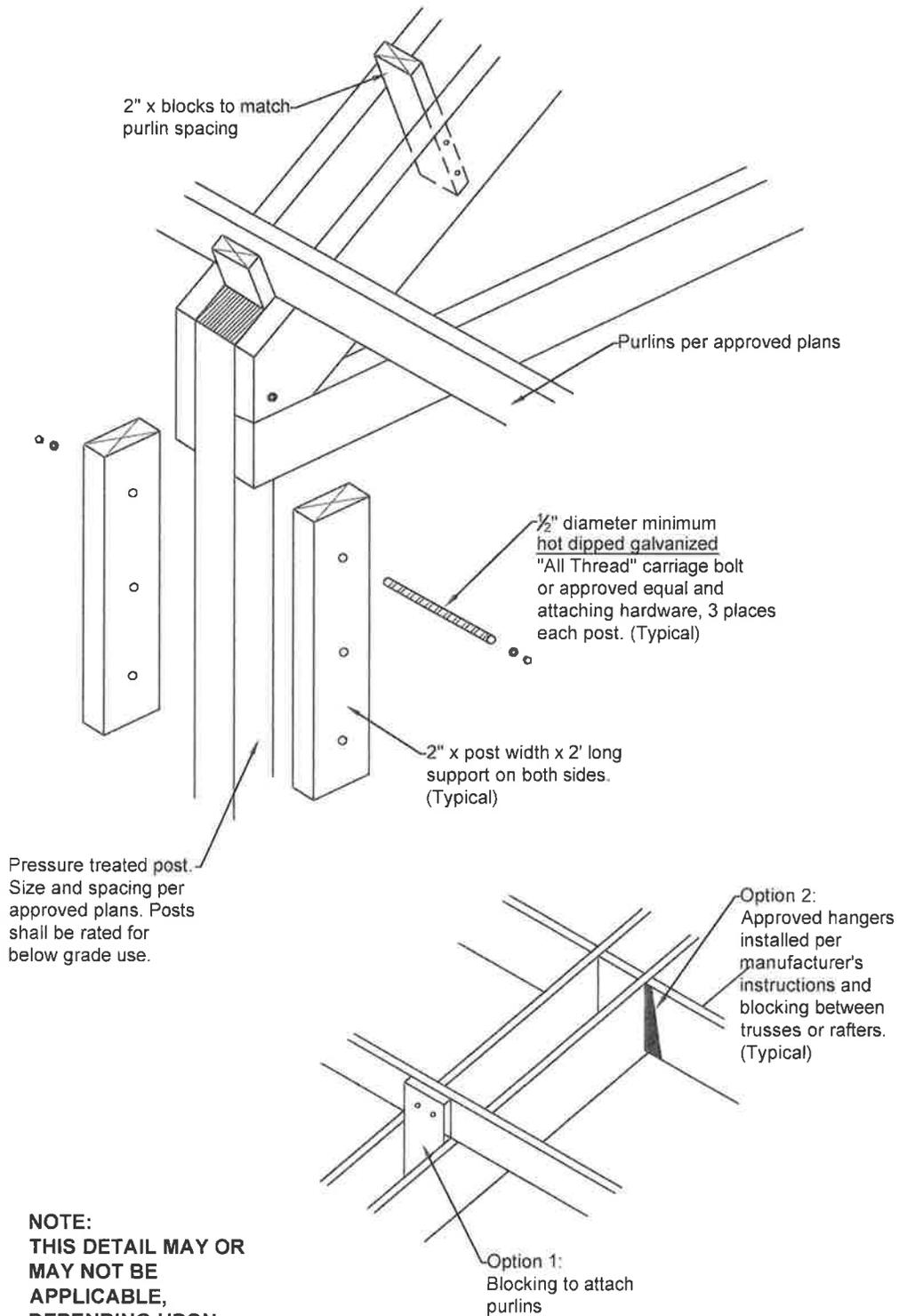


All posts shall be embedded to the required depth in undisturbed native soil. Any posts requiring embedment in areas of fill or over-excavation will require engineering. The engineering shall specifically indicate the posts being embedded in fill and will require compaction ratings.

**** TO BE FILLED OUT BY THE BUILDING DEPARTMENT****

POST HOLE DIAMETER _____
POST SIZE _____ (PRESSURE TREATED UC4B FOR BELOW GRADE USE)
DEPTH OF EMBEDMENT _____

FIGURE 39 POLE BARN DETAIL



**NOTE:
THIS DETAIL MAY OR
MAY NOT BE
APPLICABLE,
DEPENDING UPON
CERTAIN CONDITIONS.**

FIGURE 40 DECK/LEDGER ATTACHMENT

R507.1 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. For decks with cantilevered framing members, connections to exterior walls or other framing members, shall be designed and constructed to resist uplift resulting from the full live load specified in Table R301.5 acting on the cantilevered portion of the deck.

R507.2 Deck ledger connection to band joist. Deck ledger connections to band joists shall be in accordance with this section, Tables R507.2 and R507.2.1, and Figures R507.2.1(1) and R507.2.1(2). For other grades, species, connection details and loading conditions, deck ledger connections shall be designed in accordance with Section R301.

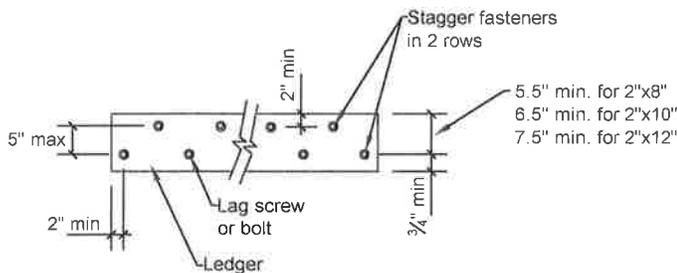
R507.2.1 Ledger details. Deck ledgers installed in accordance with Section R507.2 shall be a minimum 2 inch by 8 inch nominal, pressure-preservative-treated southern pine, incised pressure-preservative-treated Hem-fir, or approved, naturally durable, No. 2 grade or better lumber. Deck ledgers installed in accordance with Section R507.2 shall not support concentrated loads from beams or girders. Deck ledgers shall not be supported on stone or masonry veneer.

R507.2.2 Band joist details. Band joists attached by a ledger in accordance with Section R507.2 shall be a minimum 2 inch nominal, solid-sawn, spruce-pine-fir lumber or a minimum 1 inch by 9 1/2 inch dimensional, Douglas fir, laminated veneer lumber. Band joists attached by a ledger in accordance with Section R507.2 shall be fully supported by a wall or sill plate below.

R507.2.3 Ledger to band joist fastener details. Fasteners used in deck ledger connections in accordance with Table R507.2 shall be hot-dipped galvanized or stainless steel and shall be installed in accordance with Table R507.2.1 and Figures R507.2.1(1) and R507.2.1(2).

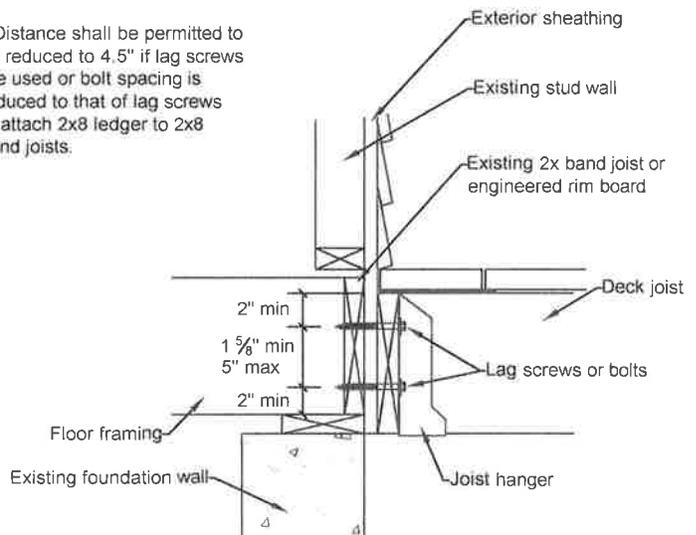
R507.2.4 Deck lateral load connection. The lateral load connection required by Section R507.1 shall be permitted to be in accordance with Figure R507.2.3(1) or R507.2.3(2). Where the lateral load connection is provided in accordance with Figure R507.2.3(1), hold-down tension devices shall be installed in not less than two locations per deck, within 24 inches of each end of the deck. Each device shall have an allowable stress design capacity of not less than 1,500 pounds. Where the lateral load connections are provided in accordance with Figure R507.2.3(2), the hold-down tension devices shall be installed in not less than four locations per deck, and each device shall have an allowable stress design capacity of not less than 750 pounds.

R507.3 Plastic composite deck boards, stair treads, guards, or handrails. Plastic composite exterior deck boards, stair treads, guards and handrails shall comply with the requirements of ASTM D 7032 and the requirements of Section 507.3. **For additional requirements, contact the Building Department.**



**FIGURE R507.2.1(1)
PLACEMENT OF LAG SCREWS AND BOLTS IN
LEDGERS**

* Distance shall be permitted to be reduced to 4.5" if lag screws are used or bolt spacing is reduced to that of lag screws to attach 2x8 ledger to 2x8 band joists.



**FIGURE R507.2.1(2)
PLACEMENT OF LAG SCREWS AND BOLTS IN
BAND JOISTS**

FIGURE 40-CONTINUED DECK/LEDGER ATTACHMENT

**TABLE 507.2.1
PLACEMENT OF LAG SCREWS AND BOLTS IN DECK LEDGERS AND BAND JOISTS**

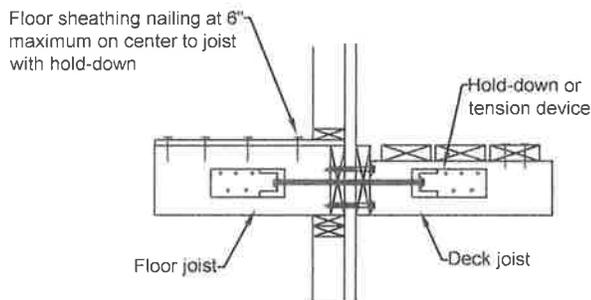
MINIMUM END AND EDGE DISTANCES AND SPACING BETWEEN ROWS				
	TOP EDGE	BOTTOM EDGE	ENDS	ROW SPACING
Ledger ^a	2 inches ^d	¾ inch	2 inches ^b	1 ⅝ inches ^b
Band joist ^c	¾ inch	2 inches ^e	2 inches ^b	1 ⅝ inches ^b

- a. Lag screws or bolts shall be staggered from the top to the bottom along the horizontal run of the deck ledger in accordance with Figure R507.2.1(1).
- b. Maximum 5 inches.
- c. For engineered rim joists, the manufacturer's recommendations shall govern.
- d. The minimum distance from bottom row of lag screws to the top edge of the ledger shall be in accordance with Figure R507.2.1(1).
- e. The 2 inches may be reduced to ¾ inch when the band joist is directly supported by a mudsill, a header or by double top wall plates.

**TABLE 507.2
DECK LEDGER CONNECTION TO BAND JOIST^{a,b}**
(Deck live load = 40 psf, deck dead load = 10 psf, snow load ≤ 40 psf)

JOIST SPAN	6' and less	6'-1" to 8'	8'-1" to 10'	10'-1" to 12'	12'-1" to 14'	14'-1" to 16'	16'-1" to 18'
Connection details	On-center spacing of fasteners ^{d,e}						
½ inch diameter lag screws with ½ inch maximum sheathing ^{c,d}	30	23	18	15	13	11	10
½ inch diameter bolt with ½ inch maximum sheathing ^d	36	36	34	29	24	21	19
½ inch diameter bolt with 1 inch maximum sheathing ^e	36	36	29	24	21	18	16

- a. Ledgers shall be flashed in accordance with Section R703.8 to prevent water from contacting the house band joist.
- b. Snow load shall not be assumed to act concurrently with live load.
- c. The tip of the lag screw shall fully extend beyond the inside face of the band joist.
- d. Sheathing shall be wood structural panel or solid sawn lumber.
- e. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to ½ inch thickness of stacked washers shall be permitted to substitute for up to ½ inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.



**FIGURE R507.2.3(1)
DECK ATTACHMENT FOR
LATERAL LOADS**

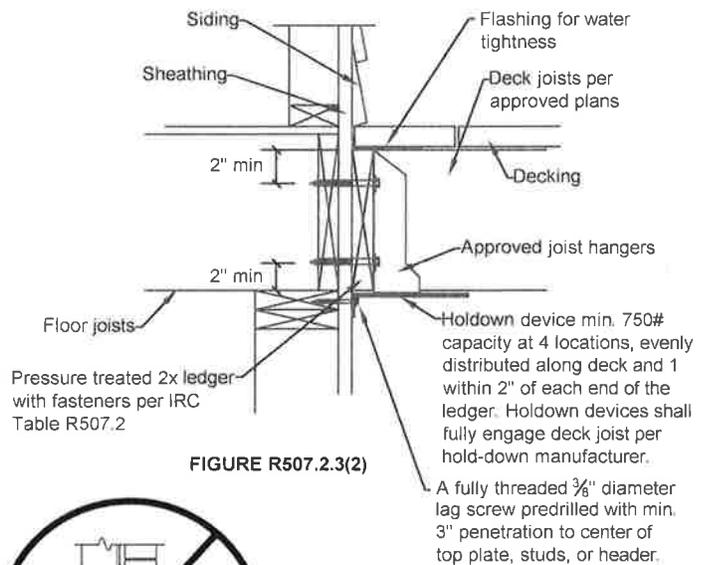


FIGURE R507.2.3(2)



Note:
This detail is applicable where floor joists are parallel to deck joists.