



2018 Code

Thurston County Residential Plan Review and Inspection Checklist

Adopted February 1, 2021

10.14.21

- This document is part of the approved plans.
- Keep the approved plans on site for the inspector.
- Keep all work open for inspection.
- This checklist is not a complete code document.
- Applicants and any agent must comply with the code sections not listed in the document.
- The plans examiner will note the sections that they feel should be brought to your attention. All code requirements must be met regardless of being noted on the plans.
- Even though the plans may be approved, it is not to be construed as a permit for any violation of the code or other Thurston County ordinances.

Climate and Geographic Design Criteria					
Ground Snow Load	Design Wind Speed	Seismic Design	Frost Line Depth	Assumed Soil Bearing	Winter Design Temp.
20 PSF	110mph ultimate	D2	12 Inches	1500 PSF	17 Degrees Fahrenheit

The Washington State Building Code Council adopts national standards promulgated by the International Code Council (ICC) and the International Association of Plumbing and Mechanical Officials (IAPMO).

Thurston County is required to adopt the code that the state adopts. Thurston County can then make changes to all but the non-administrative portions Residential Code without approval by the State Building Code council.

- Thurston County Title 14
- IRC = International Residential Code (One- and Two-Family Dwellings and Townhomes)
- IBC = International Building Code (Structures Other Than One- and Two-Family Dwellings and Townhomes)
- IMC = International Mechanical Code
- IFC = International Fire Code
- UPC = Uniform Plumbing Code
- WSEC = Washington State Energy Code

These ICC codes can be viewed at the Building Development Center or online at: [ICCSafe.org](https://codes.iccsafe.org/codes/i-codes).
<https://codes.iccsafe.org/codes/i-codes> Roll over the code icon and choose view. The Uniform Plumbing Code can be read at <https://www.iapmo.org/publications/read-uniform-codes-online/>

To see the state amendments to those codes and the Washington State Energy Code, visit the State Building Code Council Website. <https://sbcc.wa.gov/state-codes-regulations-guidelines/state-building-code>.

For the Residential Energy Code information and forms also visit:
<http://www.energy.wsu.edu/buildingefficiency/energycode.aspx>

To see the Thurston County amendments to those code see:
https://library.municode.com/wa/thurston_county/codes/code_of_ordinances

The code sections listed have been paraphrased. These are code highlights. Please see the code for exact code language.

ADMINISTRATION

R105.1 Permit required. Any owner or owner's authorized agent shall obtain the required permits.

R106.1.2 Manufacturer's installation instructions. Manufacturer's installation instructions shall be available on the job site at the time of inspection.

R106.4 Amended construction documents. Changes to construction drawing require approval.

See your issued permit for a list of your required inspections.

R109.1.1 Foundation and footings inspection. Inspections shall be made after poles or piers are set or trenches or basement areas are excavated, forms erected, and reinforcing steel is in place and supported prior to the placing of concrete. Any required footing insulation will be verified.

R109.1.2, E104.2.3 and E104.2.4 Plumbing, mechanical, gas and electrical systems inspection. Rough inspection shall be made prior to covering or concealment, before fixtures or appliances are set or installed, and prior to framing inspection. Insulation, protection, and controls for plumbing are verified. HVAC equipment type, size, controls, insulation, R-values, leakage, thermostats, dampers, whole house ventilation and fan efficiency are verified.

E104.2.2.1 Wall insulation inspection. This inspection shall be made after all wall and cavity insulation is in place and prior to cover.

R109.1.3 Floodplain inspections. For construction in flood hazard areas, upon placement of the lowest floor, including basement, and prior to further vertical construction the elevation certificate shall be submitted.

R109.1.4 and E 104.2.2 Frame and masonry inspection. Inspection shall be made after the roof, masonry, framing, firestopping, draftstopping and bracing are in place and after the plumbing, mechanical and electrical rough inspections are approved. Air leakage controls, window R-values and proper installation are verified.

R109.1.5 Other inspections. The inspector will perform inspections for general conformance to the code and the approved plans.

R109.1.5.1 Fire-resistance-rated construction inspection. Where fire-resistance-rated construction is required between dwelling units or due to location on property.

R109.3 Inspection requests. The permit holder or their agent must call for inspection, provide access to, and means for inspection.

R109.4 Approval required. Work shall not be done beyond the point indicated in each successive inspection. Any portions that do not comply shall be corrected and remain uncovered or concealed until authorized.

R110.1 Use and occupancy. Before a structure can be used a Certificate of Occupancy is required.

Exceptions:

1. Certificates of occupancy are not required for work exempt from permits under Section R105.2.
2. Accessory buildings or structures.

BUILDING PLANNING

R301.5 Live Load. Exterior balconies and decks= 60 psf. Attics without storage = 10 psf. Attics with limited storage = 20 psf. Habitable attics and attics served with fixed stairs = 30 psf.

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

Exceptions:

1. Walls, projections, openings or 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, playhouses and similar structures exempted from permits.
4. Detached garages located within 2 feet of a lot line can have eave projections not exceeding 4 inches.
5. Foundation vents are permitted.

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

EXTERIOR WALL ELEMENT		MIN. FIRE RATING	MIN. FIRE SEPARATION DISTANCE
Walls	Fire rated	1-hour (both sides)	0 feet
	Not Fire rated	0 hours	≥ 5 feet
Projections		N/A	< 2 feet
	Fire rated	1-hour (underside) ^{a, b}	≥ 2 feet to < 5 feet
	Not Fire rated	0 hours	≥ 5 feet
Wall Openings		N/A	< 3 feet
	Max 25% wall area per story	0 hours	3 feet
	Unlimited	0 hours	5 feet

EXTERIOR WALL ELEMENT		MIN. FIRE RATING	MIN. FIRE SEPARATION DISTANCE
Penetrations	All	See Section R302.4	< 3 feet
		None required	3 feet

a. Roof eave fire-resistance rating can 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 can be reduced to 0 hours on the underside of the eave if gable vent openings are not installed.

R302.5.1 Opening protection. Openings are not permitted from a garage directly into a sleeping room. Doors between the garage and residence shall be equipped with a self-closing device and be solid wood doors not less than 1 3/8 inches in thickness, solid or honeycomb core steel doors not less than 13/8 inches thick, or 20-minute fire-rated doors.

R302.5.2 Duct penetration. Ducts shall have no openings into the garage and shall be constructed of a minimum No. 26 gage sheet steel or other approved material.

R302.6 Dwelling/garage fire separation. Separate as required by 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 all 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 required separation	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

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 1/2-inch gypsum board.

R302.11 Fireblocking. Fireblocking shall be provided to cut off both vertical and horizontal concealed draft openings and to form a fire barrier between stories, and between a top story and the roof space. Fireblocking shall be provided 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.

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 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 materials. Fireblocking shall consist of:

1. Two-inch (51 mm) nominal lumber.

2. Two thicknesses of 1-inch nominal lumber with broken lap joints.

3. One thickness of 23/32-inch wood structural panels with joints backed by 23/32-inch wood structural panels.

4. One thickness of 3/4-inch particleboard with joints backed by 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.

R302.13 Fire protection of floors. Floor assemblies, not required elsewhere in this code to be fire-resistance rated, shall be provided with a 1/2-inch gypsum wallboard membrane, 5/8-inch wood structural panel membrane, or equivalent on the underside of the floor framing member.

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Appendix Q, NFPA13D, 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 dimension 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.

5. 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.

R303.1 Habitable rooms. All habitable rooms shall be provided with aggregate glazing area of not less than 8 percent of the floor area of such rooms

Exception: The glazed areas need not be provided in rooms where artificial light is provided capable of producing an average illumination of 6 foot-candles over the area of the room at a height of 30 inches above the floor level.

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 M1505.

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.

R303.7 Interior stairway illumination. Illuminate interior stairways to one-foot candle minimum at the center of treads and landings. Provide power from the building wiring. Provide a switch at each floor level. Provide a light switch at landing when there are more than six 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.

Exception:

Lights that are continuously illuminated or automatically controlled.

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.

R303.9 Required heating. When the winter design temperature in Table R301.2(1) is below 60°F every dwelling unit shall be provided with heating facilities capable of maintaining a minimum room temperature of 68°F at a point 3 feet above the floor and 2 feet from exterior walls in all habitable rooms at design temperature. 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.

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 not be 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.

R305.1 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, at least 50 percent of the required floor area of the room must have a ceiling height of at least 7 feet and no portion of the required floor area may have a ceiling height of less than 5 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 minimum ceiling height of 6 feet 8 inches above a minimum area 30 inches by 30 inches at the showerhead.
3. Beams, girders, ducts or other obstructions in basements containing habitable space can project within 6 feet 4 inches of the finished floor.

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. All plumbing fixtures shall be connected to a sanitary sewer or to an approved private sewage disposal system.

R306.4 Water supply to fixtures. All 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.

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 of swinging, sliding and bifold doors shall be considered a hazardous location.

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 to 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 in-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.
4. Glazing that is adjacent to the fixed panel of patio doors.

R308.4 Hazardous locations. The following specific locations are hazardous for the purposes of glazing:

Doors

A. Glazing in all fixed and operable panels of swinging, sliding and bifold doors.

Exceptions:

1. Glazed openings of a size through which a 3-inch diameter (76 mm) sphere is unable to pass.
2. Decorative glazing.

B. Glazing in an individual fixed or operable panel adjacent to a door, whose bottom edge is less than 60 inches (1524 mm) above the floor or walking surface, where the nearest vertical edge is within a 24-inch (610 mm) arc of either side of the door in a closed position, or when the glazing is within 180 degrees of the door in the closed position and within 24 inches of the hinge side of the *in-swinging door*.

Exceptions:

1. Decorative glazing.
2. When there is an intervening wall or other permanent barrier between the door and the glazing.
4. Glazing adjacent to a door where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth. See R308.4.3.
5. Fixed panel adjacent to patio doors.

Windows

Glazing in an individual fixed or operable panel that meets all of the following conditions:

- 3.1. The exposed area of an individual pane is larger than 9 square feet (0.836 m²); and
- 3.2. The bottom edge of the glazing is less than 18 inches (457 mm) above the floor; and

3.3. The top edge of the glazing is more than 36 inches (914 mm) above the floor; and

3.4. One or more walking surfaces are within 36 inches (914 mm), 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 (864 to 965) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be a minimum of 1½ inches (38 mm) 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 (7620 mm) or more above *grade*, a roof, walking surfaces or other horizontal [within 45 degrees (0.79 rad) of horizontal] surface adjacent to the glass exterior.

Guards and Rails

All glazing in railings regardless of area or height above a walking surface. Included are structural baluster panels and nonstructural infill panels.

Wet Surface Areas

Glazing in enclosures or walls facing hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface. This shall apply to single glazing and all panes in multiple glazing.

Exception: Glazing that is more than 60 inches (1524mm), measured horizontally and in a straight line, from the water's edge of a hot tub, whirlpool or bathtub.

Stairs and Ramps

Glazing adjacent to stairways, landings and ramps within 36 inches (914 mm) horizontally of a walking surface when the exposed surface of the glazing is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.

Exceptions:

1. When a horizontal rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be a minimum of 1.5 inches (38 mm) in cross sectional height.

Stair Landings

Glazing adjacent to stairways less than 60 inches (1524 mm) above the nose of the tread, within 60 inches (1524 mm) of the bottom tread of a stairway in a 180-degree horizontal direction.

Exceptions:

1. The side of the stairway has a guardrail, and the plane of the glass is more than 18 inches (457 mm) from the railing.

R310.1 Emergency escape and rescue 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 egress 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 providing an unobstructive path with a width of not less than 36" that opens to a public way.

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.

R310.2.1 Minimum opening area. Emergency escape and rescue openings shall have a net clear opening of 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 of the 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 minimum 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 Section R310.2.3.

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 can 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 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 wall.

R310.2.4 Emergency escape and rescue openings under decks and porches. Emergency escape and rescue openings

under decks and porches must allow the emergency escape and rescue openings to open fully and provide a path not less than 36 inches in height to a yard or court.

R311.1 Means of egress. Provide dwellings with 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 means of egress. 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 One egress door required. Provide a minimum clear width of 32 inches when measured between the face of the door and the stop, with the door open 90 degrees with a clear opening height of 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. Provide a landing or floor on each side of each exterior door with a width of not less than the width of the door served. Provide every landing with a minimum dimension of 36 inches measured in the direction of travel. Exterior landing slope is not to exceed 1/4-unit vertical in 12 units horizontal (2%).

Exception: Exterior balconies.

R311.4 Vertical egress. Every habitable level not provided with an exterior egress door requires a ramp or a stairway to a level with an egress door.

Exception: Areas of 200 square feet or less, and not containing the primary bathroom or kitchen.

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

R311.7.1 Stairways

Width. Provide stairways not less than 36 inches in clear width at all points above the permitted handrail height and below the required headroom height. Handrails: project no more than 4 ½ inches on either side of the stairway. Clear stairway width at and below the handrail height, including treads and landings, shall be not 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.

Stairway headroom. The stairway headroom 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 nosing 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. Spiral stairs.

Vertical rise. Provide a vertical rise no larger than 151 inches between floor levels or landings.

Stair treads and risers. For the purposes of this section, surfaces shall be exclusive of carpets, rugs or runners.

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 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 if 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.

Exception:

The opening between adjacent treads is not limited on spiral stairs.

2. The riser height of spiral stairways shall be in accordance with Section R311.7.10.1.

Treads. The minimum tread depth shall be 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 3/8 inch.

Nosings for stairs treads less than 11 inches. Provide radius of the curvature equal to 9/16 inch (14mm) or a bevel not greater than ½ inch (12.7). Provide a nosing projection not less than ¾ inch (19mm) and of not more than 1 ¼ inches on stairways. The difference in the greatest projection shall not exceed the smallest nosing projection by more than 3/8 inch (9.5 mm) within a stairway.

Winders. 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 walk line and 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 walk line shall not exceed the smallest winder tread by more than 3/8 inch (9.5 mm). Consistently shaped winders at the walk line shall be allowed within the same flight, of stairs as rectangular treads and do not have to be within 3/8 inch (9.5 mm) of the rectangular tread depth.

Winder walk-line. Winder treads walk-line shall be parallelly concentric to the curved direction of travel through the turn and located 12 inches from the widest point of the clear stair width. If winders are adjacent within the flight, the point of

the widest clear stair width of the adjacent winders shall be used.

Landings for stairways. Provide a landing at the top and bottom of each stairway. The 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 walk line 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 provided a door does not swing over the stairs.

Handrails. Provide handrails on not less than one side of each continuous run of treads or flight with four or more risers.

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

Exceptions:

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

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 of not less than 1 1/2 inch between the wall and the handrails.

Exceptions:

1. Handrails can 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.

Grip size. See Thurston County Figure 12 for basic grip. Other grips are permitted. See the code for other options.

R312 Guards location. Locate guards 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. Do not use insect screening.

Guard Height. Provide guards not less than 36 inches high measured vertically above the adjacent walking surface or the line connecting the leading edges of the treads. Handrails not less than 34 inches and not more than 38 inches on stairs that

are constructed as a guard can serve as both a handrail and guard.

Opening limitations. Provide guards with openings from the walking surface to the required guard height which do not allow the passage of a sphere 4 inches in diameter.

Provide a triangular opening that does not allow passage of a sphere 6 inches diameter at the open side of a stair, formed by the riser, tread and bottom rail of a guard, shall.

2. Provide open sides of stairs guards with openings which will not allow passage of a sphere 4 3/8 inches in diameter.

R312.2.2.1 Windowsills. Operable windows in dwelling units, where the top of the sill of an operable window 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 shall comply with one of the following:

1. Provide openings that will not allow a 4-inch-diameter sphere to pass through the opening where the opening is in its largest open position.
2. Provide window fall protection devices that comply with ASTM F 2090.
3. Provide window opening control devices.

R312.2.2 Window opening control devices. The ASTM F2090 window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the net clear opening area of the window unit to less than the area required for emergency escape and rescue.

R314.1 Smoke/heat detection listing. All equipment must comply with NFPA 72. Smoke alarms must be UL 217 listed. Heat detectors must be listed for the application. Combination detectors must be UL217 and UL2034 listed.

R314.2.1 New construction. Dwelling units require smoke alarms and CO2 detections. Garages require heat detectors in attached garages where there is commercial power.

R314.2.2 Alterations, repairs and additions. Where alterations, repairs or additions requiring a permit occur, or when 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. Where an attached garage is added, a heat detector or heat alarm shall be installed.

Exceptions:

1. Work involving 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, are exempt from the requirements of this section.
2. Installation, alteration, or repairs of plumbing, electrical or mechanical systems are exempt from the requirements of this section.

R314.3 Location. Heat detectors will be centrally located per the manufacturer installation instructions. Smoke alarms shall be installed in the following locations within the guidelines from the manufacturer:

1. In each sleeping space.
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 but 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 if the lower level is less than one full story below the upper level.
4. Three feet from the door or opening of an area with a tub or shower unless it prevents other required installations.
5. In napping areas in a family home childcare.

R314.4 Power source. Interconnect smoke and heat detection devices in dwelling units and attached accessory dwelling. Smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when 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. Smoke alarms can be battery operated when installed in buildings without commercial power.
2. Hard wiring of smoke alarms in existing areas shall not be required where the alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for hard wiring without the removal of interior finishes.

R314.5 Interconnection. All devices shall be interconnected in such a manner that the actuation of one alarm will activate all the alarms. Connection to existing devices that are incapable of interconnection is not required. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm. Alarms shall be installed where they can be heard.

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 which could provide access for interconnection without the removal of interior finishes.

R315.3 Carbon monoxide (CO2) Alarm requirements. Single station CO2 alarms shall be listed as complying with UL 2034 and shall be installed in accordance with this code, NFPA 720-2012 and the manufacturer's installation instructions.

R315.2.1 New construction. Install approved CO2 alarms in new construction, outside of each separate sleeping area in the immediate vicinity of the bedroom in dwelling units and on each level of the dwelling unit and in accordance with the manufacturer's recommendations.

R315.2.2 Existing dwellings. Install CO2 detectors when alterations, repairs or additions requiring a permit occur, or when one or more sleeping rooms are added or created.

Exceptions:

1. Work involving the exterior surfaces of dwellings are exempt from the requirements of this section.
2. Installation, alteration or repairs of nonfuel burning plumbing, electrical or mechanical 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).

R317.1 Location required.

Preservatives shall be listed in Section 4 of AWP A U1. Protect wood and wood-based products from decay 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 in the following locations:

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 walls 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 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. Treat field-cut ends, notches and drilled holes of preservative-treated wood 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.

R319.1 Address numbers. Buildings shall have approved address numbers, building numbers or approved building identification placed in a position that is plainly legible and visible from the street or road fronting the property. These numbers shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall be a minimum of 4 inches high with a minimum stroke width of $\frac{1}{2}$ inch. 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.

FOUNDATIONS

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.

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.

R401.4.1 Geotechnical evaluation. In lieu of a complete geotechnical evaluation, the load-bearing values in Table R401.4.1 shall be assumed. ***A load-bearing value of 1500 pounds per square foot will be assumed for projects without other evidence submitted.***

R402.2 Concrete. Concrete shall have a minimum specified compressive strength (f'_c) as shown in Table R402.2.

**TABLE R402.2
MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF
CONCRETE**

TYPE OR LOCATIONS OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH (f'c)
Basement walls, foundations and other concrete not exposed to the weather	2500
Basement slabs and interior slabs o grade, except garage floor slabs	2500
Basement walls, foundation walls, exterior walls and other vertical concrete work exposed to the weather	3000
Porches, carport slabs and steps exposed to the weather, and garage floor slabs	3000

R403.1 General.

All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, crushed stone footings, wood foundations, or other approved structural systems which shall be of sufficient design to accommodate all loads according to Section R301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. Footings shall be supported on undisturbed natural soils or engineered fill.

R403.1.1 Minimum size. Minimum sizes for concrete and masonry footings shall be as set forth in Table R403.1 and Figure R403.1(1). *See Thurston County Figures 2,3 and 5.*

R403.1.2 Continuous footing in Seismic Design Categories D₀, D₁ and D₂. The braced wall panels at exterior and interior walls of buildings located in Seismic Design Categories D₀, D₁ and D₂ shall be supported by continuous footings. All required interior braced wall panels shall be supported on footings at intervals not exceeding 50 feet.

R403.1.3 Seismic reinforcing. Concrete footings located in Seismic Design Categories D₀, D₁ and D₂ shall have minimum reinforcement. *See Thurston County Figures 2,3 and 5.*

R403.1.3.1 Foundations with stemwalls. Foundations with stemwalls shall be provided with a minimum of one No. 4 bar within 12 inches of the top of the wall and one No. 4 bar located 3 inches to 4 inches from the bottom of the footing. *See Thurston County figures 2, 3, and 5.*

R403.1.3.2 Slabs-on-ground with turned-down footings. Slabs-on-ground with turned down footings shall have a

minimum of one No. 4 bar at the top and bottom of the footing. *See Thurston County figures 2, 3, and 5.*

R403.1.4 Minimum depth. All exterior footings shall be placed at least 12 inches below the undisturbed ground surface.

R403.1.4.2 Seismic conditions. In Seismic Design Categories D₀, D₁ and D₂, interior footings supporting bearing or bracing walls and cast monolithically with a slab on grade shall extend to a depth of not less than 12 inches below the top of the slab.

R403.1.6 Foundation anchorage. Anchor continuous foundation sill plates and walls directly supported on the foundation in accordance with this section. Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of braced wall panels at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with anchor bolts spaced a maximum of 6 feet on center. Bolts shall be at least 1/2 inch in diameter and shall extend a minimum of 7 inches into concrete or grouted cells of concrete masonry units. A nut and washer shall be tightened on each anchor bolt. There shall be a minimum of two bolts per plate section with one bolt located not more than 12 inches or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a braced wall panel shall be positively anchored with approved fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. Cold-formed steel framing systems shall be fastened to wood sill plates or anchored directly to the foundation as required in Section R505.3.1 or R603.3.1.

Exceptions:

1. Foundation anchorage, spaced as required to provide equivalent anchorage to 1/2-inch-diameter (12.7 mm) anchor bolts.
2. Walls 24 inches total length or shorter connecting offset braced wall panels shall be anchored to the foundation with a minimum of one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels at corners as shown in item 8 of Table R602.3(1).
3. Connection of walls 12 inches total length or shorter connecting offset braced wall panels to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent braced wall panels at corners as shown in item 8 of Table R602.3(1).

R403.1.6.1 Foundation anchorage in Seismic Design Categories C, D₀, D₁ and D₂. Section R403.1.6 and the following requirements apply to wood light-frame structures in Seismic Design Categories D₀, D₁ and D₂ and wood light-frame townhouses in Seismic Design Category C.

1. Provide plate washers conforming to Section R602.11.1 for all anchor bolts over the full length of required braced wall lines except where approved anchor straps are used. Properly

sized cut washers shall be permitted for anchor bolts in wall lines not containing braced wall panels.

2. Interior braced wall plates shall have anchor bolts spaced at not more than 6 feet on center and located within 12 inches of the ends of each plate section when supported on a continuous foundation.

3. Interior bearing wall sole plates shall have anchor bolts spaced at not more than 6 feet on center and located within 12 inches of the ends of each plate section when supported on a continuous foundation.

4. The maximum anchor bolt spacing shall be 4 feet for buildings over two stories in height.

5. Stepped cripple walls shall conform to Section R602.11.2.

6. Where continuous wood foundations in accordance with Section R404.2 are used, the force transfer shall have a capacity equal to or greater than the connections required by Section R602.11.1 or the braced wall panel shall be connected to the wood foundations in accordance with the braced wall panel-to-floor fastening requirements of Table R602.3(1).

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.

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.

R404.1.2 Concrete foundation walls. Concrete foundation walls that support light-frame walls shall be designed and constructed in accordance with the provisions of this section, ACI 318, ACI 332 or PCA 100. *See Thurston County figures 2,3 &5.*

R404.1.7 Backfill placement. Backfill shall not be placed against the wall until the wall has sufficient strength and has been anchored to the floor above or has been sufficiently braced to prevent damage by the backfill.

Exception:

Such bracing is not required for walls supporting less than 4 feet of unbalanced backfill.

R404.3 Wood sill plates. Provide a minimum of 2-inch by 4-inch nominal lumber for sill plates.

R404.4 Retaining walls. Retaining walls not supporting a structure that are not laterally supported at the top and that retain more than 24 inches of unbalanced fill shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. Design retaining walls for a safety factor of 1.5 against lateral sliding and overturning.

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

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 top of the footing 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.

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 with a membrane extending from the top of the footing to the finished grade.

R407.3 Structural requirements. The columns shall be restrained to prevent lateral displacement at the bottom end. Wood columns shall not be less in nominal size than 4 inches by 4 inches (102 mm by 102 mm). Steel columns shall not be less than 3-inch-diameter (76 mm) Schedule 40 pipe manufactured in accordance with ASTM A 53 Grade B or approved equivalent.

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.

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 space area. Space vents evenly to provide cross ventilation. Vents may be omitted on one side. Ventilation openings shall be covered for their height and width with any of the following materials if the least dimension of the covering shall not exceed 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 grills 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 1/8 inch.

Exception: The total area of ventilation openings can be reduced to $\frac{1}{1,500}$ 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. 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.

R408.4 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 no less than 16 inches by 24 inches.

R408.5 Removal of debris. All construction materials and debris shall be removed before final.

R408.6 Underfloor 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 underfloor space shall be as high as the outside finished grade, unless an approved drainage system is provided.

FLOORS

R502.8 Drilling and notching. Structural floor members shall not be cut, bored or notched in excess of the limitations shown in Thurston County figures 10 and 11.

R502.8.2 Engineered wood products. Cuts, notches and holes bored in trusses and engineered structural wood members are prohibited except where permitted by manufacturer's recommendation or where designed by a registered design professional.

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

Exception:

A base course is not required when the concrete slab is installed on well-drained or sand-gravel mixture soils classified as Group I according to the United Soil Classification System in accordance with Table R405.1.

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 prepared subgrade.

Exception:

The vapor retarder may be omitted from garages, utility buildings and other unheated accessory structures.

R507.8 Vertical and lateral supports. 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 use 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.

R507.9.1.1 Ledger details. Deck ledgers 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 shall not support concentrated loads from beams or girders. Deck ledgers shall not be supported on stone or masonry veneer.

R507.9.1.2 Band joist details: Band joists attached by a ledger in accordance with Section R507.9 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 joist shall be fully supported by a wall or sill plate below.

R507.9.1.3 Ledger to band joist fastener details. Fasteners used in deck ledger connections in accordance with Table R507.9.1.3(1) shall be hot-dipped galvanized or stainless steel and shall be installed in accordance with Table R507.9.1.3(2) and R507.9.2.2(2).

R507.9.2 Deck lateral load connection. Install not less than two 1500 pounds hold-down tension devices per deck, within 24 inches of each end of the deck when the lateral load connection is per Figure 509.9.2(1). When using Figure R507.9.2(2), install the 750 pounds minimum hold-down tension devices in not less than four locations per deck.

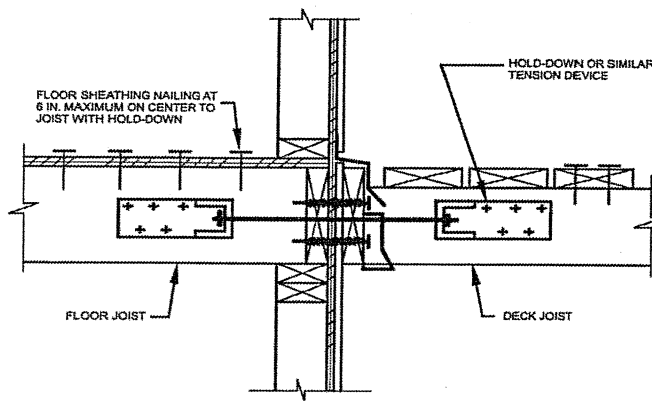


FIGURE 507.9.2(1)
DECK ATTACHMENT FOR LATERAL LOADS

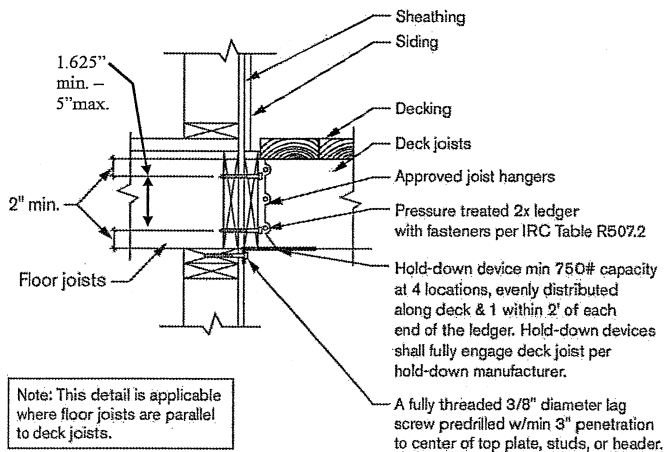


FIGURE 507.9.2(2)
DECK ATTACHMENT FOR LATERAL LOADS

WALL CONSTRUCTION

R602.1.1 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 certification of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted.

R602.2 Grade. Studs shall be a minimum No. 3, standard or stud grade lumber.

Exception:

Bearing studs not supporting floors and non-bearing studs may be utility grade lumber, provided the studs are spaced in accordance with Table R602.3(5).

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 that comply with Tables R602.7.1 and R602.7(2).

R602.3.1 Stud size, height and spacing. Size studs per Table 602.3(5) attached.

R602.3.2 Top plate. Wood stud walls shall be capped with a double top plate installed to provide overlapping at corners and intersections with bearing partitions. End joints in top plates shall be offset at least 24 inches. Plates shall be not less than 2 inches nominal thickness and have a width at least equal to the width of the studs.

Exception: A single top plate used as an alternative to a double top plate shall comply with the following:

1. The single top plate shall be tied at corners, intersecting walls, and at in-line splices in straight wall lines in accordance with Table R602.3.2.
2. The rafters or joists shall be centered over the studs with a tolerance of not more than 1 inch.
3. Omission of the top plate is permitted over headers where the headers are adequately tied to adjacent wall sections in accordance with Table R602.3.2.

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 2X or larger plate or sill having a width at least equal to the width of the studs.

R602.4 Interior load-bearing walls. Interior load-bearing walls shall be constructed, framed and fire blocked as specified for exterior walls.

R602.9 Foundation cripple walls. Foundation cripple walls shall be framed of studs not less in size than the studding above. When exceeding 4 feet in height use sizing as for an additional story. Cripple walls supporting bearing walls or exterior walls or interior braced wall panels as required in Section R403.1.2 and R602.10.9.1 with a stud height less than 14 inches shall be sheathed on at least one side with a wood structural panel that is fastened to both the top and bottom plates in accordance with Table R602.3(1), or the cripple walls

shall be constructed of solid blocking. All cripple walls shall be supported on continuous foundations.

Exception: Footings supporting cripple walls used to support interior braced wall panels as required in Sections R403.1.2 and R602.10.9.1 shall be continuous for the required length of the cripple wall and construction 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.

R602.10 Wall bracing. Buildings shall be braced in accordance with this section. Where a building, or portion thereof, does not comply with one or more of the bracing requirements in this section, those portions shall be designed and constructed in accordance with Section R301.1.

R602.10.8 Braced wall panel connections. A load path for lateral forces shall be provided between floor framing and braced wall panels located above or below a floor, as specified in Section R602.10.8.

Panel perpendicular to framing

Floor/ceiling above: 8d @ 6 inches o.c. to rim joist or full depth blocking continuous along length of braced wall panel.
Floor below: (3) 16d @ 16 inches o.c. to rim joist or full depth blocking continuous along length of braced wall panel.

Panel parallel to framing:

Floor/ceiling above: 8d @ 6 inches o.c. to rim joist aligned framing member directly above, or (3) 8d toenailed to full depth blocking @16 inches o.c. along length of braced wall panel.
Floor below: 8d @ 6 inches o.c. to rim joist aligned framing member directly below, or (3) 8d toenailed to full depth blocking @16 inches o.c. along length of braced wall panel.

R602.10.10 Panel joints. Vertical joints of panel sheathing shall occur over, and be fastened to, common studs. Horizontal joints in braced walls panels shall occur over, and be fastened to, common blocking of a minimum 1 ½ inch thickness.

Exceptions:

1. Vertical joints of panel sheathing can 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. For Gypsum wall board panels, blocking at horizontal joints shall not be required.

R609.1 General. This section prescribes performance and construction requirements for exterior window and door installed in wall. Windows and doors shall be installed and flashed in accordance with the fenestration manufacturer's written installation instructions. Window and door openings shall be flashed in accordance with Section R703.4. Written

installation instructions shall be provided by the fenestration manufacturer for each window or door.

WALL COVERING

R701.2 Installation. Products sensitive to adverse weather shall not be installed until adequate weather protection for the installation is provided. Exterior sheathing shall be dry before applying exterior cover.

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 nonabsorbent finish material shall conform to ASTM C 1396, C 1178 or C1278. 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.

Limitations. Water-resistant gypsum backing board shall not be used where there will be direct exposure to water, or in areas subject continuous high humidity.

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.

R703.2 Water-resistive barrier. One layer of No. 15 asphalt felt 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.

R703.4 Flashing. Approved corrosion-resistive flashing shall be provided in the exterior wall envelope in such a manner as 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 AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at all of 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 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.

R703.5.2 Panel Siding. 3/8-inch wood structural panel siding shall not be applied directly to studs spaced more than 16 inches on center where long dimension is parallel to studs. Wood structural panel siding 7/16 inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing. Joints in wood, hardboard or wood structural panel siding shall be made as follows unless otherwise approved. Vertical joints in panel siding shall occur over framing members, unless wood or wood structural panel sheathing is used, and shall be shiplapped or covered with a batten. Horizontal joints in panel siding shall be lapped not less than 1 inch or shall be shiplapped or shall be flashed with Z-flashing and occur over solid blocking, wood or wood structural panel sheathing. Horizontal siding.

ROOF-CEILING CONSTRUCTION

R802.4 Framing details. Rafters shall be framed not more than 1 1/2 inches 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. A ridge beam is required where collar ties are not continuous. 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 shall be designed to carry and distribute the specific load at that point. Where the roof pitch is less than 3/12, structural members that support rafters and ceiling joists, such as ridge beams, hips and valleys shall be designed as beams.

R802.10.1 Truss design drawings. Truss design drawings, prepared in conformance to Section R802.10.1, shall be provide to the building official and approved prior to installation. Truss design drawings shall be provided with the shipment of trusses delivered at the job site.

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 or 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.

R802.11. Roof tie-down. Trusses shall be attached to supporting wall assemblies by connections capable of resisting uplift forces as specified on the Truss Design Drawings or as shown on the construction documents. Rafters and trusses in buildings not exceeding 36 foot roof span and 24 inch roof overhangs shall be connected to wall plates by the use of approved connectors having a resistance to uplift of not less than 188 pounds (Exposure B) and 404 pounds (Exposure C) and shall be installed in accordance with the manufacturer's specifications. See Table R802.11.

R806.1 Roof 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. Ventilating openings shall be provided with corrosion-resistant wire mesh, with 1/16 inch minimum to 1/4-inch maximum openings.

R806.2 Minimum area. The total net free ventilating area shall not be less than 1 to 150 of the area of the vented space.

Exception: The minimum net free ventilation area shall be 1/300 of the vented space provided both 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 ventilating area is provided with ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located not more than 3 feet below the ridge or highest point of the space, measured vertically, with the balance of the required ventilation in the bottom third of the roof. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation mor 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. Not less than a 1-inch space shall be provided between the insulation and roof sheathing and at the vent.

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 not be less than 22 inches by 30 inches and shall be 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 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 ceiling members. See M1305.1.3 for access requirements where mechanical equipment is in attics.

ROOF ASSEMBLIES

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 the 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.

R903.4 Roof drainage. Unless roofs are sloped to drain over roof edges, roof drains shall be installed at each low point of the roof.

R904.4 Product identification. Roof covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels required.

R905.1 Roof covering application. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions.

R905.1.1 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 with and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches, and fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles 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.

R905.2.2 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 Section R905.1.1.

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.

R905.2.8.1 Base and cap flashing. Base and cap flashing shall be installed in accordance with manufacturer's installation instructions.

R905.2.8.2 Valleys. Valley linings shall be installed in accordance with manufacturer's installation instructions before applying shingles.

R905.2.8.3 Sidewall flashing. Base flashing against a vertical sidewall shall be continuous or step flashing and shall be not less than 4 inches in height and 4 inches in width and shall direct water away from the vertical sidewall onto the roof or into the gutter. Where siding is provided on the vertical sidewall, the vertical leg of the flashing shall be continuous under the siding.

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 ¼ 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 R902.5. Underlayment shall be installed over the drip edge along eaves and under the underlayment along rake edges.

CHIMNEYS AND FIREPLACES

R1001.2. Footings and foundations. Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry not less than 12 inches thick and shall extend at least 6 inches beyond the face of the fireplace or foundation wall on all sides.

R1001.3. Seismic reinforcing. Masonry or concrete chimneys in Seismic Design Categories D₀, D₁ and D₂ shall be reinforced.

R1001.7.1 Damper. Masonry fireplaces shall be equipped with a ferrous metal damper located at least 8 inches above the top of the fireplace opening. Dampers shall be installed in the fireplace or the chimney venting the fireplace and shall be operable from the room containing the fireplace. Fireplaces shall be provided with each of the following:

1. Tightly fitting flue dampers, operated by a readily accessible manual or approved automatic control.

Exception:

Fireplaces with gas logs shall be installed in accordance with the International Mechanical Code Section 901, except that the standards for liquefied petroleum gas installations shall be NFPA 58 (Liquefied Petroleum Gas Code) and NFPA 54 (National Fuel Gas Code).

1. An outside source for combustion air ducted into the firebox. The duct shall be at least 6 square inches, and shall be provided with an operable outside air duct damper.

2. Site built fireplaces shall have tight fitting glass or metal doors, or a flue draft induction fan or as approved for minimizing back-drafting. Factory built fireplaces shall use doors listed for the installed appliance.

R1004.2 Hearth extensions. Hearth extensions of approved factory-built fireplaces shall be installed in accordance with the listing of the fireplace. The hearth extension shall be readily distinguishable from the surrounding floor area.

R1005.1 Listing. Factory-built chimneys shall be listed and labeled and shall be installed and terminated in accordance with the manufacturer's installation instructions.

R1005.2 Decorative shrouds. Decorative shrouds shall not be installed at the termination of chimneys for factory-built fireplaces except where such shrouds are listed and labeled for use with the specific factory-built fireplace system and installed in accordance with the manufacturer's installation instructions.

1005.8 Insulation shield. Provide an insulation shield where factory-built chimneys passing through insulated assemblies, constructed of .0187 inch (26 gage) material to provide clearance between the chimney and the insulation of not less than the manufacturer's installation instructions. Terminate the shield not less than 2 inches above the insulation in the attic and secure to prevent displacement. Install chimney system products per manufacturer's instructions.

1006.6 Solid fuel burning appliances and fireplaces. Solid fuel burning appliances and fireplaces shall be provided with tight fitting metal or ceramic glass doors, and:

1. A source from outside the structure of primary combustion air, connected to the appliance as per manufacturer's specification. The air inlet shall originate at a point below the fire box. The duct shall be 4 inches or greater in diameter, not exceed 20 feet in length, and be installed as per manufacturer's instructions; or

2. The appliance and manufacturer's recommended combustion air supply, as an installed unit, shall be certified by an independent testing laboratory to have passed Test No. 11-Negative Pressure Test, Section

12.3, of ULC S627-M1984 "Space Heaters for Use with Solid Fuels," modified as follows: Negative pressure of 8 Pascal shall be initially established with the chamber sealed and the air supply, if not directly connected to the appliance, closed off. The air supply if not directly connected to the appliance, shall then be opened. The maximum allowable air exchange rate from chamber leakage and intentional air supply for the unit (appliance with combustion air supply) in the test chamber is 3.5 air changes per hour, or 28 cfm, whichever is less.

Exception:

Combustion air may be supplied to the room in which the solid fuel burning appliance is located in lieu of direct ducting, if one of the following conditions is met:

1. The solid fuel burning appliance is part of a central heating plant and installed in an unconditioned space in conformance with the International Mechanical Code; or 2. The solid fuel burning appliance is installed in existing construction directly on a concrete floor or surrounded by masonry materials as in a fireplace. The combustion air terminus shall be located as close to the solid fuel burning appliance as possible and shall be provided with a barometric damper or equivalent. The combustion air source shall be specified by the manufacturer or no less than 4 inches in diameter or the equivalent in area or as approved.

GENERAL MECHANICAL SYSTEM REQUIREMENTS

M1305.1 Appliance access for inspection, service, repair and replacement. Appliances shall be accessible for inspection, service, repair and replacement without removing permanent construction, other appliances, or any other piping or ducts not connected to the appliance being inspected, serviced, repaired or replaced. A level working space not less than 30 inches deep and 3 inches wide shall be provided in front of the control side to service an appliance.

M1305.1.1 Appliances in rooms. Appliances installed in a compartment, alcove, basement or similar space shall be accessed by an opening or door and an unobstructed passageway measuring not less than 24 inches wide and large enough to allow removal of the largest appliance in the space, provided there is a level service space of not less than 30 inches deep and the height of the appliance, but not less than 30 inches at the front or service side of the appliance with the door open.

M1305.1.2 Appliances in attics. Attics containing appliances shall be provided with an opening and a clear and unobstructed passageway large enough to allow removal of the largest appliance, but not less than 30 inches high and 22 inches wide and not more than 20 feet long measured along the centerline of the passageway from the opening to the appliance. The passageway shall have continuous solid flooring in accordance with Chapter 5 not less than 24 inches wide. A level service space at least 30 inches deep and 30 inches wide shall be present along all sides of the appliance where access is required. The clear access opening dimensions shall be a minimum of 20 inches by 30 inches, and large enough to allow removal of the largest appliance.

M1305.1.2.1 Electrical requirements. A luminaire controlled by a switch located at the required passageway opening and a receptacle outlet shall be installed at or near the appliance location. Exposed lamps shall be protected from damage by location or lamp guards.

M1305.1.3 Appliances under floors. Underfloor spaces containing appliances shall be provided with an unobstructed passageway large enough to remove the largest appliance, but not less than 30 inches high and 22 inches wide, nor more than 20 feet long measured along the centerline of the passageway from the opening to the appliance. A level service space at least 30 inches deep and 30 inches wide shall be present at the front or service side of the appliance. If the depth of the passageway or the service space exceeds 12 inches below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry extending 4 inches above the adjoining grade in accordance with Chapter 4. The rough-framed access opening dimensions shall be a minimum of 22 inches by 30 inches, and large enough to remove the largest appliance.

M1305.1.3.1 Ground clearance. Equipment and appliances supported from the ground shall be level and firmly supported on a concrete slab or other approved material extending not less than 3 inches above the adjoining ground. Such support shall be in accordance with the manufacturer's installation instructions. Appliances suspended from the floor shall have a clearance of not less than 6 inches from the ground.

M1306.1 Appliance clearance. Appliances shall be installed with the clearances from unprotected combustible materials as indicated on the appliance label and in the manufacturer's installation instructions.

M1307.2 Anchorage of appliances. Appliances designed to be fixed in position shall be fastened or anchored in an approved manner. Thermal storage units shall be anchored or strapped to resist horizontal displacement caused by earthquake motion in accordance with one of the following:

1. Anchorage and strapping shall be designed to resist a horizontal force equal to one-third of the operating weight of the water storage tank, acting in any horizontal direction.
2. The anchorage strapping shall be in accordance with the appliance manufacturer's recommendations. Seismic anchorage and strapping of water heaters shall be in accordance with Section 507.2 of the state plumbing code.

M1307.3 Elevation of ignition source. Appliances having an ignition source shall be elevated such that the source of ignition is not less than 18 inches above the floor in garages. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate with a private garage through openings shall be considered to be part of the garage.

Exception: Elevation of the ignition source is not required for appliances that are listed as flammable vapor ignition resistant.

M1307.3.1 Protection from impact. Appliances shall not be installed in a location subject to vehicle damage except where protected by approved barriers.

HEATING AND COOLING EQUIPMENT

M1401 Installation. Heating and cooling equipment and appliances shall be installed in accordance with the manufacturer's instructions and the requirements of this code.

M1401.2 Access. Heating and cooling equipment and appliances shall be located with respect to building construction and other equipment and appliances to permit maintenance, servicing, and replacement. Clearances shall be maintained to permit cleaning of heating and cooling surfaces; replacement of filters, blowers, motors, controls and vent connections; lubrication of moving parts; and adjustment.

M1401.4 Exterior installations. Equipment and appliances installed outdoors shall be listed and labeled for outdoor installation. Supports and foundations shall prevent excessive vibration, settlement or movement of the equipment. Supports and foundations shall be in accordance with Section M1305.1.4.1.

M1411.3 Condensate disposal. Condensate from cooling coils or evaporators shall be conveyed from the drain pan outlet to an approved place of disposal. Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than 1/8 unit vertical in 12 units horizontal (1-percent slope). Condensate shall not discharge into a street, alley or other areas where it would cause a nuisance.

M1411.8 Locking access port caps. Refrigerant circuit access ports located outdoors shall be fitted with locking type tamper resistant caps or shall be otherwise secured to prevent unauthorized access.

EXHAUST SYSTEMS

M1502.1 General. Clothes dryers shall be exhausted in accordance with the manufacturer's instructions.

M1502.2 Independent exhaust systems. Dryer exhaust systems shall be independent of all other systems and shall convey the moisture to the outdoors.

Exception:
This section shall not apply to listed and labeled condensing (ductless) clothes dryers.

M1502.3 Duct termination. Provide exhaust ducts not less than 12-inch square or 4 inches in diameter for the entire length of the duct and terminate on the outside of the building in accordance with the dryer manufacturer's installation instructions. When the manufacturer's instructions do not specify a termination location, terminate the duct not less than 3 feet in any direction from openings into buildings and provide a backdraft damper. Screens shall not be installed at the duct termination.

M1502.4 Dryer exhaust ducts. Dryer exhaust ducts shall conform to the requirements of Sections M1502.4.1 through M1502.4.7.

M1502.4.1 Material and size. Exhaust ducts shall have a smooth interior finish and shall be constructed of metal a minimum 0.0157-inch thick (No. 28 gage). The exhaust duct size shall be 4-inches nominal in diameter.

M1502.4.2 Duct installation. Exhaust ducts shall be supported at intervals not to exceed 12 feet and secured in place. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow. Exhaust duct joints shall be sealed in accordance with Section M1601.4 and shall be mechanically fastened. Ducts shall not be joined with screws or similar fasteners that protrude more than 1/8 inch into the inside of the duct. Do not deform ducts installed into wall cavities.

M1502.4.3 Transition duct. Transition ducts used to connect the dryer to the exhaust duct system shall be a single length that is listed and labeled in accordance with UL 2158A. Transition ducts shall be a maximum of 8 feet in length. Transition ducts shall not be concealed within construction.

M1502.4.5 Duct length. The maximum allowable exhaust duct length shall be determined by one of the methods specified in Section M1502.4.5.1 or M1502.4.5.3.

M1502.4.5.1 Specified length. The maximum length of the exhaust duct shall be 35 feet from the connection to the transition duct from the dryer to the outlet terminal. Where fittings are used, the maximum length of the exhaust duct shall be reduced in accordance with Table M1502.4.5.1.

M1502.4.5.2 Manufacturer's instructions. The size and maximum length of the exhaust duct shall be determined by the dryer manufacturer's installation instructions. The code official shall be provided with a copy of the installation instructions for the make and model of the dryer at the concealment inspection. In the absence of fitting equivalent length calculations from the clothes dryer manufacturer, Table M1502.4.5.1 shall be used.

M1502.4.6 Length identification. Where the exhaust duct equivalent length exceeds 35 feet, the equivalent length of the exhaust duct shall be identified on a permanent label or tag. The label or tag shall be located within 6 feet of the exhaust duct connection.

M1503 General. Range hoods shall discharge to the outdoors through a duct. The duct serving the hood shall have a smooth interior surface, shall be airtight, shall be equipped with a backdraft damper and shall be independent of all other exhaust systems. Ducts serving range hoods shall not terminate in an attic or crawl space or areas inside the building.

Exception:

Where installed in accordance with the manufacturer's installation instructions, and where mechanical or natural ventilation is otherwise provided, listed and labeled ductless range hoods shall not be required to discharge to the outdoors.

M1503.2 Duct material. Ducts serving range hoods shall be constructed of galvanized steel, stainless steel, or copper.

Exception:

Ducts for domestic kitchen cooking appliances equipped with downdraft exhaust systems can be constructed of schedule 40 PVC pipe if the installation complies with all of the following:

1. The duct shall be installed under a concrete slab poured on grade,
2. The underfloor trench in which the duct is installed shall be completely backfilled with sand or gravel,
3. The PVC duct shall extend not greater than 1 inch above the indoor concrete floor surface,
4. The PVC duct shall extend not greater than 1 inch above grade outside of the building, and
5. The PVC ducts shall be solvent cemented.

M1503.6 Makeup air required. Exhaust hood systems capable of exhausting in excess of 400 cubic feet per minute shall be mechanically or naturally provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with not less than one damper. Each damper shall be a gravity damper or an electrically operated damper that automatically opens when the exhaust system operates. Dampers shall be accessible for inspection, service, repair and replacement without removing permanent construction or any other ducts not connected to the damper being inspected, serviced, repaired or replaced.

M1505.4 Whole-house mechanical ventilation system. Each dwelling unit shall be equipped with a ventilation system. The whole-house mechanical ventilation systems shall be designed in accordance with Sections M1505.4.1 through M1505.4.4.

M1505.4.1 System design. Wholehouse mechanical ventilation system with supply and exhaust fans per Sections M1505.4.1.2, M1505.4.1.3, M1505.4.1.4, and M1505.4.1.5. Local exhaust fans are permitted to serve as part of the whole house ventilation system when provided with the proper controls per Section M1505.4.2. Design the system to exhaust and/or supply the minimum outdoor airflow rates per Section M1505.4.3 as modified by the whole house ventilation system coefficients in Section M1504.4.3.1 where applicable. Operate wholehouse fans continuously at the minimum ventilation rate determined per Section M1505.4.2 unless configured with intermittent off controls per Section M1505.4.3.2.

M1505.4.1.1 Whole house system component requirements. Whole house ventilation supply and exhaust fans must meet a minimum efficacy as prescribed in the Code

and follow the design and installation of the system or equipment in accordance with manufacturers' installation instructions. Whole house ventilation fans shall be rated for sound at no less than the minimum airflow rate required by Section M1505.4.3.1. Ventilation fans shall be rated for sound at a maximum of 1.0 sone at a minimum of 0.1 in. w.c. (25 Pa) static pressure in accordance with HVI procedures specified in Sections M1505.4.1.2 and M1505.4.1.3.

Exception: HVAC air handlers, ERV/HRV units, and remote mounted fans need not meet the sound requirements. A remote mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways, and there must be at least 4 ft (1 m) of ductwork between the fan and the intake grille.

The whole house supply fan shall provide ducted outdoor ventilation air to each habitable space within the residential unit.

Exception: Ducted outdoor air is not required when interior joining spaces provided with a 30 cfm whole house transfer fan or a permanent opening with an area of not less than 8 percent of the floor area of the interior adjoining space but not less than 25 square feet. Whole house transfer fans shall meet the sone rating of Section M1505.4.1.1 and shall have whole house ventilation controls that comply with Section M1505.4.2.

M1505.4.1.2 Exhaust fans. Duct exhaust fans to the outside. Exhaust air outlets shall be designed to limit the pressure difference to the outside and equipped with backdraft dampers or motorized dampers in accordance with the Code. Test and rate fans in accordance with the airflow and sound rating procedures of the Home Ventilating Institute (HVI 915, HVI Loudness Testing and Rating Procedure, HVI 916, HVI Airflow Test Procedure, and HVI 920, HVI Product Performance Certification Procedure as applicable). Bathroom exhaust fans that are designed for intermittent exhaust airflow rates higher than the continuous exhaust airflow rates in Table M1505.4.3(3) shall be provided with occupancy sensors or humidity sensors to automatically override the fan to the high-speed airflow rate. The exhaust fans shall be tested; and the testing results shall be submitted and posted in accordance with Section M1505.4.1.6.

M1505.4.1.3 Supply fans. Supply fans used in meeting the requirements of this section shall supply outdoor air from intake openings in accordance with IMC Sections 401.4 and 401.5. When designed for intermittent off operation, supply systems shall be equipped with motorized dampers in accordance with the Washington State Energy Code. Supply fans shall be tested and rated in accordance with the airflow and sound rating procedures of the Home Ventilating Institute (HVI 915, HVI Loudness Testing and Rating Procedure, HVI 916, HVI Airflow Test Procedure, and HVI 920, HVI Product Performance Certification Procedure as applicable). Where outdoor air is provided by supply fan systems, the outdoor air shall be filtered. The filter shall be accessible for regular maintenance and replacement. The

filter shall have a Minimum Efficiency Rating Value (MERV) of at least 8.

M1505.4.1.4 Balanced whole house ventilation system. The supply and exhaust fans shall have airflow that is within 10 percent of each other. The tested and balanced total mechanical exhaust airflow rate is within 10 percent or 5 cfm, whichever is greater, of the total mechanical supply airflow rate. The flow rate test results shall be submitted and posted in accordance with Section M1505.4.1.7. The exhaust fan shall meet the requirements of Section M1505.4.1.2. The supply fan shall meet the requirements of Section 1505.4.1.3. Balanced ventilation systems with both supply and exhaust fans in a packaged product, such as an ERV/HRV, shall meet the requirements of HVI 920, as applicable. Intermittent dryer exhaust, intermittent range hood exhaust, and intermittent toilet room exhaust airflow rates above the residential dwelling or sleeping unit minimum ventilation rate are exempt from the balanced airflow calculation.

M1505.4.1.5 Furnace integrated supply. Systems using space heating and/or cooling air handler fans require an air handler fans having multispeed or variable speed supply airflow control capability with a low speed operation not greater than 25 percent of the rated supply airflow capacity during ventilation only operation. Outdoor air intake openings must meet the provisions of Sections R303.5 and R303.6 and must include a motorized damper that is activated by the whole house ventilation system controller. The motorized damper must be controlled to maintain the outdoor airflow intake airflow within 10 percent of the whole house mechanical exhaust airflow rate. The flow rate for the outdoor air intake must be tested and verified at the minimum ventilation fan speed and the maximum heating or cooling fan speed. The results of the test shall be submitted and posted in accordance with Section M1505.4.1.7.

M1505.4.1.6 Testing. Whole-house mechanical ventilation systems shall be tested, balanced and verified to provide a flow rate not less than the minimum required by Sections M1505.4.3 and M1505.4.4. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals, outlet terminals or grilles or in the connected ventilation ducts. A written report of the results of the test shall be signed by the party conducting the test and provided to the building official and be posted in the dwelling unit per Section M1505.4.1.7.

M1505.4.1.7 Certificate. A permanent certificate shall be completed by the mechanical contractor, test and balance contractor or other approved party 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 flow rate determined from the delivered airflow of the whole-house mechanical ventilation system as installed and

the type of mechanical whole house ventilation system used to comply with Section M1505.4.3.1.

M1505.4.2 System controls.

The whole house ventilation system shall be controlled with manual switches, timers or other means that provide for automatic operation of the ventilation system with ready access by the occupant.

Whole-house mechanical ventilation system shall be provided with controls that enable manual override off of the system by the occupant during periods of poor outdoor air quality. Controls shall include permanent text or a symbol indicating their function. Recommended control permanent labeling to include text similar to the following: "Leave on unless outdoor air quality is very poor." Manual controls shall be readily accessible by the occupant.

Whole house ventilation systems shall be configured to operate continuously except where intermittent off controls and sizing are provided per Section M1505.4.3.2.

M1505.4.3 Mechanical ventilation rate. The whole-house mechanical ventilation system shall provide outdoor air at a continuous rate as determined in accordance with Table M1505.4.3(1) or Equation 15-1.

Equation 15-1

Ventilation rate in cubic feet per minute = $(0.01 \times \text{total square foot area of house}) + [7.5 \times (\text{number of bedrooms} + 1)]$ but not less than 30 cfm for each dwelling unit.

TABLE M1505.4.3(1) WHOLE-HOUSE MECHANICAL VENTILATION AIRFLOW RATE					
Dwelling Unit Floor Area (square feet)	Number of Bedrooms				
	0 - 1	2	3	4	5 or more
< 500	30	30	35	45	50
501 - 1,000	30	35	40	50	55
1,001 - 1,500	30	40	45	55	60
1,501 - 2,000	35	45	50	60	65
2,001 - 2,500	40	50	55	65	70
2,501 - 3,000	45	55	60	70	75
3,001 - 3,500	50	60	65	75	80
3,501 - 4,000	55	65	70	80	85
4,001 - 4,500	60	70	75	85	90
4,501 - 5,000	65	75	80	90	95

M1505.4.3.1 Ventilation quality adjustment. The minimum whole house ventilation rate from Section 1505.4.3 shall be

adjusted by the system coefficient in Table M1505.4.3(2) based on the system type not meeting the definition of a *balanced whole house ventilation* system and/or not meeting the definition of a *distributed whole house ventilation* system.

Equation 15-2

$Q_v = Q_r \times C_{\text{system}}$ Where:

Q_v = Quality-adjusted ventilation airflow rate in cubic feet per minute (cfm).

Q_r = Ventilation airflow rate, cubic feet per minute (cfm) from 15-1 or Table M1505.4.3(1).

C_{system} = System coefficient from Table 1505.4.3(2).

TABLE M1505.4.3(2)
SYSTEM COEFFICIENT (C_{system})

System Type	Distributed	Not Distributed
Balanced	1.0	1.25
Not balanced	1.25	1.5

M1505.4.3.2 Intermittent off operation. Provide wholehouse ventilation with advanced controls configured to operate the system with intermittent off operation shall operate for a least two hours in each four-hour segment. The whole house ventilation airflow rate determined in accordance with Section M1505.4.3 as corrected by Section M1505.4.3.1 is multiplied by the factor determined in accordance with Table M1505.4.3(3).

TABLE M1505.4.3(3)
INTERMITTENT OFF WHOLE HOUSE-MECHANICAL VENTILATION RATE FACTORS ^{a,b}

Run-time % in Each 4-hour Segment	50%	66%	75%	100%
Factor ^a	2	1.5	1.3	1.0

a. For ventilation system run-time values between those given, the factors are permitted to be determined by interpolation.

b. Extrapolation beyond the table is prohibited.

M1505.4.4 Local exhaust rates. Local exhaust systems shall be designed to have the capacity to exhaust the minimum airflow rate determined in accordance with Table M1505.4.4(1). If the local exhaust fan is included in the whole house ventilation system, in accordance with Section 1505.4.1, then the exhaust fan shall be controlled to operate as specified in Section M1505.4.2.

M1505.4.4.1 Local exhaust. Bathrooms, toilet rooms, and kitchens shall include a local exhaust system. Such local exhaust systems shall have the capacity to exhaust the minimum airflow rate in accordance with Table M1505.4.4(1). Fans required by this section shall be provided with controls that enable manual override or automatic occupancy sensor, humidity sensor or pollutant sensor controls. An "on/off"

switch shall meet this requirement for manual controls. Manual fan controls shall be readily accessible in the room served by the fan.

TABLE M1505.4.4(1)
MINIMUM LOCAL EXHAUST RATES

M1505.4.4.2 Local exhaust fans. Exhaust fans shall meet the following criteria:

1. Exhaust fans shall be tested and rated in accordance with the airflow and sound rating procedures of the Home Ventilating Institute (HVI 915, HVI Loudness Testing and Rating Procedure, HVI 916, HVI Airflow Test Procedure, and HVI 920, HVI Product Performance Certification Procedure).

Exception: Where a range hood or down draft exhaust fan is used for local exhaust for a kitchen, the device is not required to be rated per these standards.

2. Fan airflow rating and duct system shall be designed and installed to deliver at least the exhaust airflow required by Table M1505.4.4(1). The airflows required refer to the delivered airflow of the system as installed and tested using a flow hood, flow grid, or other airflow measurement device. Local exhaust systems shall be tested, balanced, and verified to provide a flow rate not less than the minimum required by this section.
3. Design and installation of the system or equipment shall be carried out in accordance with manufacturers' installation instructions.
4. Fan airflow rating and duct system shall be designed and installed to deliver at least the exhaust airflow required by Table M1505.4.4(1).

Exceptions:

- a. An exhaust airflow rating at a pressure of 0.25 in. w.g. may be used, provided the duct sizing meets the prescriptive requirements of Table M1505.4.4(2).
- b. Where a range hood or down draft exhaust fan is used to satisfy the local ventilation requirements for kitchens, the range hood or down draft exhaust shall not be less than 100 cfm at 0.10 in. w.g.

TABLE M1505.4.4(2) PRESCRIPTIVE EXHAUST DUCT SIZING

Area to Be Exhausted	Exhaust Rates	
	Intermittent	Continuous
Kitchens	100 cfm	30 cfm
Bathrooms - Toilet rooms	50 cfm	20 cfm

- a. For each additional elbow, subtract 10 feet from length.
- b. Flex ducts of this diameter are not permitted with fans of this size

Fan Tested cfm at 0.25 inches w.g.	Minimum Flex Diameter	Max. Length in Feet	Minimum Smooth Diameter	Max. Length Feet	Max. Elbows ^a
50	4 inches	25	4 inches	70	3
50	5 inches	90	5 inches	100	3
50	6 inches	No Limit	6 inches	No Limit	3
80	4 inches ^b	NA	4 inches	20	3
80	5 inches	15	5 inches	100	3
80	6 inches	90	6 inches	No Limit	3
100	5 inches ^b	NA	5 inches	50	3
100	6 inches	45	6 inches	No Limit	3
125	6 inches	15	6 inches	No Limit	3
125	7 inches	70	7 inches	No Limit	3

DUCT SYSTEMS

M1601.1.1 Above-ground duct systems. Outside stud wall cavities and spaces in fire resistive wall construction shall not be used as plenums.

M1601.4.4 Support. Factory-made ducts listed in accordance with UL 181 shall be supported in accordance with the manufacturer's installation instructions.

M1601.4.6 Duct insulation. Duct coverings shall not penetrate a fire blocked wall or floor.

M1601.4.8 Duct separation. Ducts shall be installed with not less than 4 inches separation from earth except where they meet the requirements of Section M1601.1.2.

M1602.2 Return air openings. Return air openings for heating, ventilation and air conditioning systems shall comply with all of the following:

1. Openings shall not be located less than 10 feet measured in any direction from an open combustion chamber or draft hood of another appliance located in the same room or space.
2. The amount of return air taken from any room or space shall be not greater than the flow rate of supply air delivered to such room or space.
3. Return and transfer openings shall be sized in accordance with the appliance or equipment manufacturers' installation instructions, Manual D or the design of the registered design professional.
4. Return air shall not be taken from a closet, bathroom, toilet room, kitchen, garage, mechanical room, boiler room, furnace room or unconditioned attic.

Exceptions:

1. Taking return air from a kitchen is not prohibited where such return air openings serve the kitchen only and are located not less than 10 feet from the cooking appliance.
2. Dedicated forced-air systems serving only the garage shall not be prohibited from obtaining return air from the garage.
5. Only use dehumidified pool area air for return air.
6. Taking return air from an unconditioned crawl space shall not be accomplished through a direct connection to the return side of a forced-air furnace. Transfer openings in the crawl space enclosure shall not be prohibited.
7. Return air from one dwelling unit shall not be discharged into another dwelling unit.

COMBUSTION AIR

M1701.1 Scope. Solid-fuel-burning appliances shall be provided with combustion air in accordance with the appliance manufacturer's installation instructions. Oil-fired appliances shall be provided with combustion air in accordance with NFPA 31. The methods of providing combustion air in this chapter do not apply to fireplaces, fireplace stoves and direct-vent appliances. The requirements for combustion and dilution air for gas-fired appliances shall be in accordance with Chapter 24. Fireplaces shall comply with Chapter 10.

CHIMNEYS AND VENTS

M1801.1 Venting required. Fuel-burning appliances shall be vented to the outdoors in accordance with the listing and label and manufacturer's installation instructions except appliances listed and labeled for unvented use. Venting systems shall consist of approved chimneys or vents, or venting assemblies that are integral parts of labeled appliances. Gas-fired appliances shall be vented in accordance with Chapter 24.

SPECIAL APPLIANCES, EQUIPMENT AND SYSTEMS

M1901.2 Clearances. Freestanding or built-in ranges shall have a vertical clearance above the cooking top of not less than 30 inches to unprotected combustible material. Reduced clearances are permitted in accordance with the listing and labeling of the range hoods or appliances. The installation of a listed and labeled cooking appliance or microwave oven over a listed and labeled cooking appliance shall be in accordance with Section M1504.

M1901.2 Cooking appliances. Cooking appliances shall be listed and labeled for household use and shall be installed in accordance with the manufacturer's instructions. The installation shall not interfere with the combustion air or access for operation and servicing.

WATER HEATERS

M2004.1 General. Water heaters used to supply both potable hot water and hot water for space heating shall be installed in accordance with this chapter, Chapter 24, Chapter 28 and the manufacturer's instructions.

M2005.1 General. Water heaters shall be installed in accordance with Chapter 5 of the state plumbing code, the manufacturer's instructions and the requirements of this code. Water heaters installed in an attic shall comply with the requirements of Section M1305.1.3. Gas-fired water heaters shall comply with the requirements in Chapter 24. Domestic electric water heaters shall comply with UL 174.

M2005.2 Prohibited locations. Fuel-fired water heaters shall not be installed in a room used as a storage closet. Water heaters located in a bedroom or bathroom shall be installed in a sealed enclosure so that combustion air will not be taken from the living space. Installation of direct-vent water heaters within an enclosure is not required.

M2005.2.1 Water heater access. Access to water heaters that are located in an attic or underfloor crawl space is permitted to be through a closet located in a sleeping room or bathroom where ventilation of those spaces is in accordance with this code.

HYDRONIC PIPING SYSTEMS

M2101.1 General. Hydronic piping shall conform to Table M2101.1. Approved piping, valves, fittings and connections shall be installed in accordance with the manufacturer's instructions. Pipe and fittings shall be rated for use at the operating temperature and pressure of the hydronic system.

M2101.2 System drain down. Hydronic piping systems shall be installed to permit draining of the system.

M2101.3 Protection of potable water. The potable water system shall be protected from backflow in accordance with the provisions listed in Section 603 of the state plumbing code.

M2101.4 Pipe penetrations. Openings through concrete or masonry building elements shall be sleeved.

M2101.5 Contact with building material. A hydronic piping system shall not be in direct contact with any building material that causes the piping material to degrade or corrode.

M2101.8 Expansion, contraction and settlement. Piping shall be installed so that piping, connections and equipment shall not be subjected to excessive strains or stresses. Provisions

shall be made to compensate for expansion, contraction, shrinkage and structural settlement.

M2101.9 Piping support. Hangers and supports shall be of material of sufficient strength to support the piping and shall be fabricated from materials compatible with the piping material. Piping shall be supported at intervals not exceeding the spacing specified in Table M2101.9.

M2101.10 Tests. Hydronic piping shall be tested hydrostatically at a pressure of one and one-half times the maximum system design pressure, but not less than 100 pounds per square inch for not less than 15 minutes. Gas testing PEX per manufacturers installation instructions is allowed.

FLOOR HEATING SYSTEMS

M2103.1 Piping materials. Piping for embedment in concrete or gypsum materials shall be standard-weight steel pipe, copper and copper alloy pipe and tubing, cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pressure pipe, chlorinated polyvinyl chloride (CPVC), polybutylene, cross-linked polyethylene (PEX) tubing, polyethylene of raised temperature (PE-RT) or polypropylene (PP) with a minimum rating of 100 psi at 180°F.

M2103.3 Piping joints. Copper and copper alloy systems shall be soldered per ASTM B 828. Fluxes for soldering per ASTM B 813. Brazing fluxes per AWS A5.31. Press connected joints per ASME 16.51. Piping joints that are embedded shall be installed in accordance with the following requirements:

1. Steel pipe joints shall be welded.
2. Copper tubing shall be joined by brazing complying with Section 605.3.1 of the state plumbing code.
3. Polybutylene pipe and tubing joints shall be installed with socket-type heat-fused polybutylene fittings.
4. CPVC tubing shall be joined using solvent cement joints.
5. Polypropylene pipe and tubing joints shall be installed with socket-type heat-fused polypropylene fittings.
6. Cross-linked polyethylene (PEX) tubing shall be joined using cold expansion, insert or compression fittings.
7. Raised temperature polyethylene (PE-RT) tubing shall be joined using insert or compression fittings.

M2103.4 Testing. Piping or tubing to be embedded shall be tested by applying a hydrostatic pressure of not less than 100 psi. The pressure shall be maintained for 30 minutes, during which all joints shall be visually inspected for leaks.

FUEL GAS

G2406.2 Prohibited locations. Appliances shall not be located in sleeping rooms, bathrooms, toilet rooms, storage closets or surgical rooms, or in a space that opens only into such rooms or spaces, except where the installation complies with one of the following:

1. The appliance is a direct-vent appliance installed in accordance with the conditions of the listing and the manufacturer's instructions.
2. Vented room heaters, wall furnaces, vented decorative appliances, vented gas fireplaces, vented gas fireplace heaters and decorative appliances for installation in vented solid fuel-burning fireplaces are installed in rooms that meet the required volume criteria of Section G2407.5.
3. A single wall-mounted unvented room heater is installed in a bathroom and such unvented room heater is equipped as specified in Section G2445.6 and has an input rating not greater than 6,000 Btu/h. The bathroom shall meet the required volume criteria of Section G2407.5.
4. A single wall-mounted unvented room heater is installed in a bedroom and such unvented room heater is equipped as specified in Section G2445.6 and has an input rating not greater than 10,000 Btu/h. The bedroom shall meet the required volume criteria of Section G2407.5.
5. The appliance is installed in a room or space that opens only into a bedroom or bathroom, and such room or space is used for no other purpose and is provided with a solid weather-stripped door equipped with an approved self-closing device. All combustion air shall be taken directly from the outdoors in accordance with Section G2407.6.
6. A clothes dryer is installed in a residential bathroom or toilet room having a permanent opening with an area of not less than 100 square inches that communicates with a space outside of a sleeping room bathroom toilet or storage closet.

PLUMBING:

P105.1 General. No plumbing system or portion thereof shall be concealed or put to use until inspected and approved as prescribed in this code. Plumbing systems regulated by this code shall not be connected to the water, the energy fuel supply, or the sewer system until authorized by Thurston County.

P304.1 General. Plumbing fixtures, drains, appurtenances, and appliances, used to receive or discharge liquid wastes or sewage, shall be connected properly to the drainage system of the building or premises, in accordance with the requirements of this code.

312.6 Freezing Protection. No water, soil, or waste pipe shall be installed or permitted outside of a building, in attics or crawl spaces, or in an exterior wall unless, where necessary, adequate provision is made to protect such pipe from freezing. All hot and cold water pipes installed outside the conditioned space shall be insulated to a minimum R-3.

P312.8 Waterproofing of Openings. Joints at the roof around pipes, ducts, or other appurtenances shall be made watertight by the use of lead, copper, galvanized iron, or other approved flashings or flashing material. Exterior wall openings shall be made watertight. Counterflashing shall not restrict the required internal cross-sectional area of the vent.

P312.9 Steel Nail Plates. Plastic and copper or copper alloy piping penetrating framing members to within 1 inch of the exposed framing shall be protected by steel nail plates not less than No. 18 gauge in thickness. The steel nail plate shall extend along the framing member not less than 1 ½ inches beyond the outside diameter of the pipe or tubing.

P312.10 Sleeves. Sleeves shall be provided to protect piping through concrete and masonry walls and concrete floors.

Exception:

Sleeves shall not be required where openings are drilled or bored.

P313.1 General. Piping, fixtures, appliances, and appurtenances shall be supported in accordance with this code, the manufacturer's installation instructions, and in accordance with Thurston County.

**TABLE P313.1
HANGERS AND SUPPORTS (ABRIDGED)**

MATERIAL	HORIZONTAL	VERTICAL
Copper tube & pipe	<= 1 ½ in., 6 ft. >=2 in., 10 ft.	Ea. Floor, 10 ft. max.
Sched 40 PVC & ABS DWV	4 ft., allow for expansion every 30 ft.	Base & ea. Floor; provide mid-story guides; provide for expansion every 30 ft.
CPVC	<= 1 in., 3 ft. >=1 1/4 in., 4 ft.	Base & ea. Floor; provide mid-story guides
PEX	<= 1 in., 32 in. >=1 ¼ in., 4 ft.	

PLUMBING FIXTURES

402.5 Setting. Fixtures shall be set level and in proper alignment with reference to adjacent walls. No water closet or bidet shall be set closer than 15 inches from its center to any side wall or obstruction nor closer than 30 inches center to center to any similar fixture. The clear space in front of any water closet, lavatory or bidet shall be not less than 24 inches. No urinal shall be set closer than 12 inches from its center to any side wall or partition, nor closer than 24 inches center to center.

Exceptions:

1. The clear space in front of a water closet, lavatory or bidet in dwelling units and sleeping units shall be not less than 21 inches.
2. The installation of paper dispensers or accessibility grab bars shall not be considered obstructions.

P402.8 Installation. Fixtures shall be installed in accordance with the manufacturer's installation instructions.

Water Consumption. The maximum water use allowed in gallons per minute (gpm) for any of the following faucets and replacement at 60 psi u.n.o.:

Lavatory faucets	1.2 gpm
Kitchen faucets	1.8 gpm
Shower heads	1.8 gpm, 80 psi

408.6 Shower Compartments. Shower compartments, regardless of shape, shall have a minimum finished interior of 900 square inches and shall also be capable of encompassing a 30-inch circle. The minimum required area and dimensions shall be measured at a height equal to the top of the threshold and at a point tangent to its centerline. The area and dimensions shall be maintained to a point of not less than 70 inches above the shower drain outlet with no protrusions other than the fixture valve or valves, shower head, soap dishes, shelves, and safety grab bars or rails. Fold-down seats in accessible shower stalls can protrude into the 30-inch circle.

Exceptions:

- (1) Showers that are designed to comply with ICC/ANSI A117.1.
- (2) The minimum required area and dimensions shall not apply for a shower receptor having overall dimensions of not less than 30 inches in width and 60 inches in length.

P408.7.5 Tests for Shower Receptors. Shower receptors shall be tested for watertightness by filling with water to the level of the rough threshold. The test plug shall be so placed that both upper and under sides of the subpan shall be subjected to the test at the point where it is clamped to the drain.

P408.10 Water Supply Riser. A water supply riser from the shower valve to the showerhead outlet, whether exposed or not, shall be securely attached to the structure.

P409.6 Installation and Access. Bathtubs and whirlpool bathtubs shall be installed in accordance with the manufacturer's installation instructions. Access openings shall be of size and opening to permit the removal and replacement of the circulation pump.

411.2 Water Consumption. Water closets shall have a maximum consumption not to exceed 1.28 gallons (4.8 L) of water per flush in accordance with ASME A112.19.2/CSA B45.1.

414.3 Drainage Connection. Domestic dishwashing machines shall discharge indirectly through an air gap fitting in accordance with Section 807.4 into a waste receptor, a wye branch fitting on the tailpiece of a kitchen sink, or dishwasher connection of a food waste disposer.

P417.5 Separate Controls for Hot and Cold Water. Where two separate handles control the hot and cold water, the left-

hand control of the faucet facing the fixture fitting outlet shall control the hot water. Faucets and diverters shall be connected to the water distribution system so that hot water corresponds to the left side of the fixture fitting. Single-handle mixing valves installed in showers and tub-shower combinations shall have the flow of hot water correspond to the markings on the fixture fitting.

WATER HEATERS

P501.1 Applicability. The minimum capacity for storage water heaters shall be in accordance with the first hour rating listed in Table P501.1(1).

TABLE P501.1(1)
FIRST HOUR RATING

Number of Bathrooms	1 to 1.5		2 to 2.5			3 to 3.5	
Number of Bedrooms	1	2-3	2	3-4	5	3	4-6
First Hour Rating, Gallons	38	49	49	62	74	62	74

504.1 Location. Water heater installation in bedrooms and bathrooms shall comply with one of the following:

1. Fuel-burning water heaters may be installed in a closet located in the bedroom or bathroom provided the closet is equipped with a listed, gasketed door assembly and a listed self-closing device. The self-closing door assembly shall meet the requirements of Section 505.1.1. The door assembly shall be installed with a threshold and bottom door seal and shall meet the requirements of Section 505.1.2. All combustion air for such installations shall be obtained from the outdoors in accordance with the International Mechanical Code. The closet shall be for the exclusive use of the water heater.
2. Water heater shall be of the direct vent type.

P504.4 Pressure-Limiting Devices. A water heater installation shall be provided with overpressure protection by means of an approved, listed device installed in accordance with the terms of its listing and the manufacturer's installation instructions.

P504.5 Temperature-Limiting Devices. A water heater installation or a hot water storage vessel shall be provided with overtemperature protection by means of an approved, listed device installed in accordance with the terms of its listing and the manufacturer's installation instructions.

P504.6 Temperature, Pressure and Vacuum Relief Devices. Temperature, pressure and vacuum relief devices or combinations thereof, and automatic gas shutoff devices, shall be installed in accordance with the terms if their listings and the manufacturer's installation instructions. A shutoff valve shall not be placed between the relief valve and the

water heater or on discharge pipes between such valves and the atmosphere. The hourly BTU discharge capacity or the rated steam relief capacity of the device shall be not less than the input rating of the water heater.

505.2 Safety Devices. All storage-type water heaters deriving heat from fuels or types of energy other than gas, shall be provided with, in addition to the primary temperature controls, an over-temperature safety protection device constructed, listed, and installed in accordance with nationally recognized applicable standards for such devices and a combination temperature and pressure relief valve.

507.2 Seismic Provisions. Water heaters shall be anchored or strapped to resist horizontal displacement due to earthquake motion. Strappings shall be at points within the upper one-third and lower one-third of its vertical dimensions. At the lower point, a distance of not less than four (4) inches (102 mm) shall be maintained from the controls to the strapping.

507.13 Installation in Garages. Appliances in garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling unit shall be installed so that burners, burner-ignition devices and ignition sources are located not less than eighteen (18) inches above the floor unless listed as flammable vapor ignition resistant.

WATER SUPPLY

P601.1 Hot and Cold Water Required. Each plumbing fixture shall be provided with an adequate supply of potable running water piped thereto in an approved manner, so arranged as to flush and keep it in a clean and sanitary condition without danger of backflow or cross-connection. Water closets and urinals shall be flushed by means of an approved flush tank or flushometer valve.

Exceptions:

Listed fixtures that do not require water for their operation and are not connected to the water supply.

In occupancies where plumbing fixtures are installed for private use, hot water shall be required for bathing, washing, laundry, cooking purposes, dishwashing or maintenance.

603.1 General. Cross-connection control shall be provided in accordance with the provisions of this chapter. Devices or assemblies for protection of the public water system must be models approved by the Department of Health under WAC 246-290-490. The Authority Having Jurisdiction shall coordinate with the local water purveyor where applicable in all matters concerning cross-connection control within the property lines of the premises. No person shall install any water operated equipment or mechanism, or use any water treating chemical or substance, if it is found that such equipment, mechanism, chemical or substance may cause pollution or contamination of the domestic water supply. Such equipment or mechanism may be permitted only when

equipped with an approved backflow prevention device or assembly.

603.2 Approval of Devices or Assemblies. Before any device or assembly is installed for the prevention of backflow, it shall have first been approved by the authority having jurisdiction. Devices or assemblies shall be tested for conformity with recognized standards or other standards acceptable to the authority having jurisdiction. Backflow prevention devices and assemblies shall comply with Table 603.2, except for specific applications and provisions as stated in Section 603.5.1 through 603.5.21. All devices or assemblies installed in a potable water supply system for protection against backflow shall be maintained in good working condition by the person or persons having control of such devices or assemblies. Such devices or assemblies shall be tested in accordance with Section 603.4.2 and WAC 246-290-490. If found to be defective or inoperative, the device or assembly shall be replaced or repaired. No device or assembly shall be removed from use or relocated, or other device or assembly substituted, without the approval of the authority having jurisdiction. Testing shall be performed by a Washington State Department of Health certified backflow assembly tester.

P604.1 Pipe, Tube, and Fittings. Pipe, tube, fittings, solvent cements, thread sealants, solders, and flux used in potable water systems intended to supply drinking water shall be in accordance with the requirements of NSF 61.

Materials used in the water supply system, except valves and similar devices, shall be of a like material, except where otherwise approved by the Authority Having Jurisdiction.

P604.5 Flexible Connectors. Flexible water connectors shall be installed in readily accessible locations, and where under continuous pressure shall be in accordance with ASME A112.18.6/CSA B125.6.

P604.12 Flexible Corrugated Connectors. Flexible corrugated connectors of copper, copper alloy, or stainless steel shall be limited to the following connector lengths:

- | | |
|---------------------------------------|------------|
| 1. Fixture Connectors | 30 inches |
| 2. Washing Machine Connectors | 72 inches |
| 3. Dishwasher and Icemaker Connectors | 120 inches |

P604.13 Water Heater Connectors. Flexible metallic (copper and stainless steel), reinforced flexible, braided stainless steel, or polymer braided with EPDM core connectors that connect a water heater to the piping system shall be in accordance with ASME A112.18.6/CSA B125.6. Copper, copper alloy, or stainless-steel flexible connectors shall not exceed 24 inches. PEX-AL-PEX, PE-AL-PE or PE-RT tubing shall not be installed within the first eighteen inches of piping connected to a water heater.:

P606.5 Control Valve. A control valve shall be installed immediately ahead of each water-supplied appliance and immediately ahead of each slip joint or appliance supply.

Parallel water distribution systems shall provide a control valve either immediately ahead of each fixture being supplied or installed at the manifold, and shall be identified with the fixture being supplied. Where parallel water distribution system manifolds are located in attics, crawl spaces, or other locations not accessible, a separate shutoff valve shall be required immediately ahead of each individual fixture or appliance served.

P606.6 Accessible. Required shutoff or control valves shall be accessible.

P608.3 Expansion Tanks, and Combination Temperature and Pressure-Relief Valves. A water system provided with a check valve, backflow preventer, or other normally closed device that prevents dissipation of building pressure back into the water main, independent of the type of water used, shall be provided with an approved, listed, and adequately sized expansion tank or other approved device having a similar function to control thermal expansion. Such expansion tank or other approved device shall be installed on the building side of the check valve, backflow preventer, or other device and shall be sized and installed in accordance with the manufacturer's installation instructions.

Exception: Instantaneous hot water systems installed in accordance with the manufacturer's installation instructions.

P608.3.1 Combination Temperature and Pressure Relief Valve. A water system containing storage water heating equipment shall be provided with an approved, listed, adequately sized combination temperature and pressure relief valve, except for listed non-storage instantaneous heater having an inside diameter of not more than 3 inches. Each such approved combination temperature and pressure-relief valve shall be installed on the water-heating device in an approved location based on its listing requirements and the manufacturer's installation instructions. Each such combination temperature and pressure-relief valve shall be provided with a drain in accordance with Section 608.5.

608.5 Discharge Piping. The discharge piping serving a temperature relief valve, pressure relief valve, or combination of both shall have no valves, obstructions, or means of isolation and be provided with the following:

- (1) Equal to the size of the valve outlet and shall discharge full size to the flood level of the area receiving the discharge and pointing down.
- (2) Materials shall be rated at not less than the operating temperature of the system and approved for such use.
- (3) Discharge pipe shall discharge independently by gravity through an air gap into the drainage system or outside of the building with the end of the pipe not exceeding 2 feet and not less than 6 inches above the ground and pointing downwards.
- (4) Discharge in such a manner that does not cause personal injury or structural damage.
- (5) No part of such discharge pipe shall be trapped or subject to freezing.
- (6) The terminal end of the pipe shall not be threaded.

(7) Discharge from a relief valve into a water heater pan shall be prohibited.

Exception: Where no drainage was provided, replacement water heating equipment shall only be required to provide a drain pointing downward from the relief valve to extend between 2 feet and 6 inches from the floor. No additional floor drain need be provided.

P609.2 Trenches. Water pipes shall not be run or laid in the same trench as building sewer or drainage piping constructed of clay or materials that are not approved for use within a building unless both of the following conditions are met:

1. The bottom of the water pipe, shall be not less than 12 inches above the top of the sewer or drain line.
2. The water pipe shall be placed on a solid shelf excavated at one side of the common trench with a clear horizontal distance of not less than 12 inches from the sewer or drain line. Water pipes crossing sewer or drainage piping constructed of clay or materials that are not approved for use within a building shall be laid not less than 12 inches above the sewer or drainpipe.

P609.4 Testing. Upon completion of a section or of the entire hot and cold-water supply system, it shall be tested and proved tight under a water pressure not less than the working pressure under which it is to be used. The water used for tests shall be obtained from a potable source of supply. Except for plastic piping, a 50 psi air pressure can be substituted for the water test. In either method of test, the piping shall withstand the test without leaking for 15 minutes. PEX, PP or PE-RT can be air test if manufacturer specifies the test requirements.

P609.10 Water Hammer. Building water supply systems where quick-acting valves are installed shall be provided with water hammer arresters to absorb high pressures resulting from the quick closing of these valves. Water hammer arresters shall be approved mechanical devices in accordance with ASSE 1010 or PDI-WH 201 and shall be installed as close as possible to quick-acting valves.

P610.1 Size. The size of each water meter and each potable water supply pipe from the meter or other source of supply to the fixture supply branches, risers, fixtures, connections, outlets, or other uses shall be based on the total demand and shall be determined according to the methods and procedures outlined in this section. Water piping systems shall be designed to ensure that the maximum velocities allowed by the code and the applicable standard are not exceeded.

DRAINS

P701.1 Drainage material shall be cast iron, galvanized steel or wrought iron, lead, copper, brass, Stainless Steel 304 or 316L, schedule 40 ABS DWV, or Schedule 40 PVC DWV. Galvanized pipe shall be kept at least 6" above ground.

701.2 Drainage Piping. Materials for drainage piping shall be in accordance with one of the referenced standards in Table 701.1 except that:

1. No galvanized wrought-iron or galvanized steel pipe shall be used underground and shall be kept not less than 6 inches above ground.
2. ABS and PVC DWV piping installations shall be installed in accordance with applicable standards in Table 1701.1. Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, when tested in accordance with ASTM E-84 and UL 723.
3. No vitrified clay pipe or fittings shall be used above ground or where pressurized by a pump or ejector. They shall be kept not less than 12 inches below ground.
4. Copper tube for drainage and vent piping shall have a weight of not less than that of copper drainage tube type DWV.
5. Stainless steel 304 pipe and fittings shall not be installed underground and shall be kept not less than 6 inches above ground.
6. Cast-iron soil pipe and fittings shall be listed and tested in accordance with standards referenced in Table 1701.1. Such pipe and fittings shall be marked with country of origin and identification of the original manufacturer in addition to markings required by referenced standards.

P706.1 Approved Fittings. Changes in direction of drainage piping shall be made by the appropriate use of approved fittings and shall be of the angles presented by 1/16 bend; 1/8 bend; 1/6 bend; or other approved fittings of equivalent sweep.

P706.2 Horizontal to Vertical. Horizontal drainage lines, connecting with a vertical stack, shall enter through 45-degree wye branches, 60 degree wye branches, combination wye and 1/8 bend branches, sanitary tee or sanitary tapped tee branches, or other approved fittings of equivalent sweep. No fitting having more than one inlet at the same level shall be used unless such fitting is constructed so that the discharge from one inlet cannot readily enter any other inlet. Double sanitary tees can be used where the barrel of the fitting is at least two pipe sizes larger than the largest inlet.

P706.3 Horizontal to Horizontal. Horizontal drainage lines connecting with other horizontal drainage lines shall enter through 45-degree wye branches, combination wye and 1/8 bend branches, or other approved fittings of equivalent sweep. Branches or offsets of 60 degrees can be used where installed in a true vertical position.

P706.4 Vertical to Horizontal. Vertical drainage lines connecting with horizontal drainage lines shall enter through 45-degree wye branches, combination wye and 1/8 bend branches, or other approved fittings of equivalent sweep. Branches or offsets of 60 degrees can be used where installed in a true vertical position.

P707.4 Cleanout Location. Each horizontal drainage pipe shall be provided with a cleanout at its upper terminal, and each run of piping, that is more than 100 feet in total developed length, shall be provided with a cleanout for each 100 feet, or fraction thereof, in length of such piping. An additional cleanout shall be provided in a drainage line for each aggregate horizontal change of direction exceeding 135 degrees.

Exceptions:

1. Cleanouts can be omitted on a horizontal drain line less than 5 feet in length unless such line is serving sinks or urinals.
2. Cleanouts can be omitted on a horizontal drainage pipe installed on a slope of 72 degrees or less from the vertical angle.
3. Excepting the building drain, its horizontal branches, and urinals, a cleanout shall not be required on a pipe or piping that is above the floor level of the lowest floor of the building.
4. An approved type of two-way cleanout fitting, installed inside the building wall near the connection between the building drain and the building sewer or installed outside of a building at the lower end of a building drain and extended to grade, can be substituted for an upper terminal cleanout.

P708.1 General. Horizontal drainage piping shall be run in practical alignment and a uniform slope of not less than $\frac{1}{4}$ inch per foot or 2 percent toward the point of disposal unless first approved by the Authority Having Jurisdiction.

P712.1 Media. The piping of the plumbing, drainage, and venting systems shall be tested with water or air except that plastic pipe shall not be tested with air.

P712.2 Water Test. The water test shall be applied to the drainage and vent systems either in its entirety or in sections. Openings in the piping shall be tightly closed, except the highest opening, and the system filled with water to point of overflow. The water shall be kept in the system, or in the portion under test, for not less than 15 minutes before inspection starts. The system shall then be tight at all points.

P712.3 Air Test. The air test shall be made by attaching an air compressor testing apparatus to a suitable opening and, after closing all other inlets and outlets to the system, forcing air into the system until there is a uniform gauge pressure of 5 psi. The pressure shall be held without introduction of additional air for a period of not less than 15 minutes.

P804.1 Standpipe Receptors. Plumbing fixtures or other receptors receiving the discharge of indirect waste pipes shall be approved for the use proposed and shall be of such shape and capacity as to prevent splashing or flooding and shall be located where they are readily accessible for inspection and cleaning. No standpipe receptor for a clothes washer shall extend more than 30 inches, or not less than 18 inches above its trap. No trap for a clothes washer standpipe receptor shall

be installed below the floor but shall be roughed in not less than 6 inches and not more than 18 inches above the floor. No indirect waste receptor shall be installed in a toilet room, closet, cupboard, or storeroom, nor in a portion of a building not in general use by the occupants thereof; except standpipes for clothes washers can be installed in toilet and bathroom areas where clothes washer is installed in the same room.

P807.3 Domestic Dishwashing Machine. No domestic dishwashing machine shall be directly connected to a drainage system or food waste disposer without the use of an approved dishwasher air gap fitting on the discharge side of the dishwashing machine. Listed air gaps shall be installed with the flood-level (FL) marking at or above the flood level of the sink or drainboard, whichever is higher.

VENTS

P901.2 Vents Required. Each plumbing fixture trap, except as otherwise provided in this code, shall be protected against siphonage and backpressure, and air circulation shall be ensured throughout all parts of the drainage system by means of vent pipes installed in accordance with the requirements of this chapter and as otherwise required by this code.

P904.1 Size. The size of vent piping shall be determined from its length and the total number of fixture units connected thereto, in accordance with Table 703.2. The diameter of an individual vent shall be not less than $1\frac{1}{4}$ inches nor less than $\frac{1}{2}$ the diameter of the drain to which it is connected. In addition, the drainage piping of each building and each connection to a public sewer or a private sewage disposal system shall be vented by means of one or more vent pipes, the aggregate cross-sectional area of which shall be not less than that of the largest required building sewer, as determined from Table 703.2. Vent pipes from fixtures located upstream from pumps, ejectors, backwater valves, or other devices that obstruct the free flow of air and other gases between the building sewer and the outside atmosphere shall not be used for meeting the cross-sectional area venting requirements of this section.

P904.2 Length. Not more than $\frac{1}{3}$ of the total permitted length, in accordance with Table 703.2, of a minimum sized vent shall be installed in a horizontal position.

Exception.

Where a minimum sized vent is increased one pipe size for its entire length, the maximum length limitation shall not apply.

P905.1 Grade. Vent and vent branch pipes shall be free from drops or sags, and each such vent shall be level, or shall be so graded as to drop back by gravity to the drainage pipe it serves.

P905.3 Vent Pipe Rise. Unless prohibited by structural conditions, each vent shall rise vertically to a point not less

than 6 inches above the flood-level rim of the fixture served before offsetting horizontally, and where two or more vent pipes converge, each such vent pipe shall rise to a point not less than 6 inches in height above the flood-level rim of the fixture it serves before being connected to any other vent. Vents less than 6 inches above the flood-level rim of the fixture shall be installed with the approved drainage fittings, material and grade to the drain.

P905.4 Vent Termination. Vent pipes shall extend undiminished in size above the roof, or shall be reconnected with a soil or waste vent of proper size.

P906.1 Roof termination. Each vent pipe or stack shall extend through its flashing and shall terminate vertically not less than 6 inches above the roof nor less than 1 foot from a vertical surface.

P906.2 Clearance. Each vent shall terminate not less than 10 feet from, or less than 3 feet above, an openable window, door opening, air intake, or vent shaft, or not less than 3 feet in every direction from a lot line, alley and street excepted.

P906.5 Joints. Joints at the roof around vent pipes shall be made watertight by the use of approved flashings or flashing material.

TRAPS

P1001.1 Where required. Each plumbing fixture shall be separately trapped by an approved type of liquid seal trap. This section shall not apply to fixtures with integral traps. Not more than one trap shall be permitted on a trap arm. Each domestic clothes washer and each laundry tub shall be connected to a separate and independent trap, except that a trap serving a laundry tub shall be permitted to also receive the waste from a clothes washer set adjacent thereto. The vertical distance between a fixture outlet and the trap weir shall be as short as practicable, but in no case shall the tailpiece from a fixture exceed 24 inches in length. One trap can serve a set of not more than 3 single compartment sinks or laundry tubs of the same depth or 3 lavatories immediately adjacent to each other and in the same room where the waste outlets are not more than 30 inches apart and the trap is centrally located where three compartments are installed.

ENERGY CODE For more information see www.energy.wsu.

The energy code also uses "R" prefix to code section to avoid confusion. E=R for the energy code section call out.

E103.2 Information on construction documents. Review the energy code credits for information that is required on the plans at submittal. Details shall include, but are not limited to, the following as applicable:

1. Insulation materials and their R-values.
2. Fenestration U-factors and SHGCs.

3. Area-weighted U-factor and SHGC calculations.
4. Mechanical system design criteria.
5. Mechanical and service water heating system and equipment types, sizes and efficiencies.
6. Equipment and systems controls
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.

E103.2.1 Building thermal envelope depiction. The building's thermal envelope shall be represented on the construction documents.

E103.4 Amended construction documents. Changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.

E104.1 General. The applicant is responsible for all work, requiring a permit, to remain accessible and exposed for inspection purposes until approved and for any cost in exposing work that is covered without inspection.

E104.5 Inspection requests. It shall be the duty of the holder of the permit or their duly authorized agent to notify the code official when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

E104.6 Reinspection and testing. When a test is failed, the work must be corrected, and the test repeated until it passes.

E303.1 Identification. Materials, systems and equipment shall be identified to determine compliance with this code. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and R-value of insulation installed in each element of the building thermal envelope. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be listed on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered, and R-value of installed thickness shall be listed on the certification. For insulated siding, the R-value shall be labeled on the product's package and shall be listed on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

E303.1.1.1 Blown or sprayed roof/ceiling insulation. Install insulation markers at least one for every 300 square feet (28 m²) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum of 1 inch (25 mm) in height. Each marker shall face the attic access opening.

E303.2.1 Protection of exposed foundation insulation. Exterior Insulation shall have a rigid, opaque and weather-

resistant protective covering. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches below grade.

E401.3 Certificate (Mandatory). See the sample certificate at www.energy.wsu.

E402.2.3 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 or greater than the size of the vent. The baffle shall extend over the top of the attic insulation. The baffle can be any solid material.

E402.2.4 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weather-stripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Accessways cannot damage or compress the insulation. Loose fill insulation must be contained by a sufficiently deep barrier to contain insulation.

Exception: Vertical doors shall meet wall insulation values.

E402.2.7 Floors. Insulation supports shall be installed so spacing is no more than 24-inches on center and designed to maintain permanent contact with the underside of the subfloor decking. Foundation vents shall be placed so that the top of the vent is below the lower surface of the floor insulation.

Exceptions:

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° 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.

E402.4.1.2 Testing. Testing for an air leakage rate not exceeding 5 air changes per hour (ACH), shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Use the volume of the home conditioned floor area in ft² (m²) multiplied by 8.5 feet (2.6 m). Testing shall be conducted by an approved third party and results provided to the code official. Test after all penetration have been made.

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.

E402.4.5 Recessed lighting. Recessed luminaires installed in the building thermal envelope shall be labeled as Type IC-rated and certified under ASTM E283 with an air leakage rate not more than 2.0 cfm when tested at a 1.57 psf pressure

differential. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

E403.3.1 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.

E403.3.3 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.

E403.3.5 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.

E403.3.6 Ducts buried within ceiling insulation. Where supply and return air ducts are partially or completely buried in ceiling insulation, such ducts shall comply with all of the following:

1. The supply and return ducts shall have an insulation R-value not less than R-8.
2. At all points along each duct, the sum of the ceiling insulation R-value against and above the top of the duct, and against and below the bottom of the duct, shall be not less than R-19, excluding the R-value of the duct insulation.

Exception: Sections of the supply duct that are less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

E403.5.3 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.

E403.5.5 Electric water heater insulation. Insulate electric water heaters in unheated spaces or on concrete floors with an incompressible, insulated surface of R-10 minimum.

E403.7.1 Electric resistance zone heated units.

All detached one- and two-family using electric zonal heating as the primary heat source shall install an inverter-driven ductless mini-split heat pump in the largest zone in the dwelling.

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

E404.1 Lighting equipment (Mandatory). A minimum of 90 percent of lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

E501.1.1 Additions, alterations, or repairs. Unaltered portions of the existing building or building supply system shall not be required to comply with this code.

E502.1 General. 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 E502.1.1 or E502.1.2.

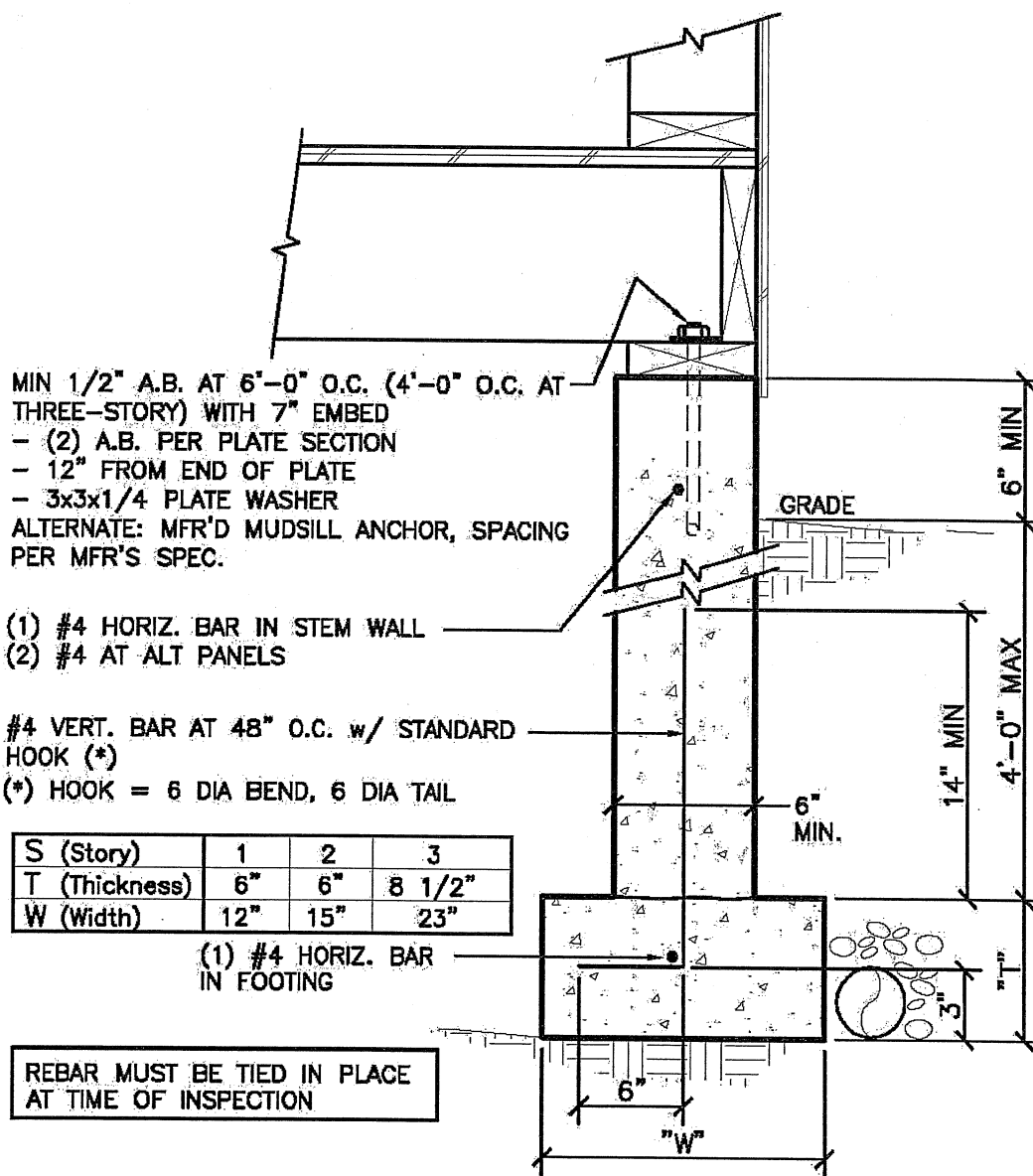
E503.1 General. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not 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 the alteration. Alterations to existing buildings shall comply with Section E503.1.1 through E503.2. 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:

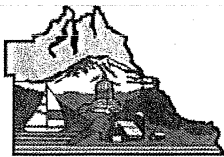
1. The alteration improves the energy efficiency of the building; or
2. The alteration is energy efficient and is necessary for the health, safety, and welfare of the general public.

E505.1 Change in occupancy or use. Any space not a residential space which is converted to residential must fully comply with this code. Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Any space that is converted to a dwelling unit or portion thereof from another use or occupancy shall comply with this code.

Exception: Where the simulated performance option in Section E405 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 E405.3.

TC Figure 2 Typical Foundation Wall





THURSTON COUNTY
WAASHILL COUNTY
SINCE 1852

Thurston County Development Services

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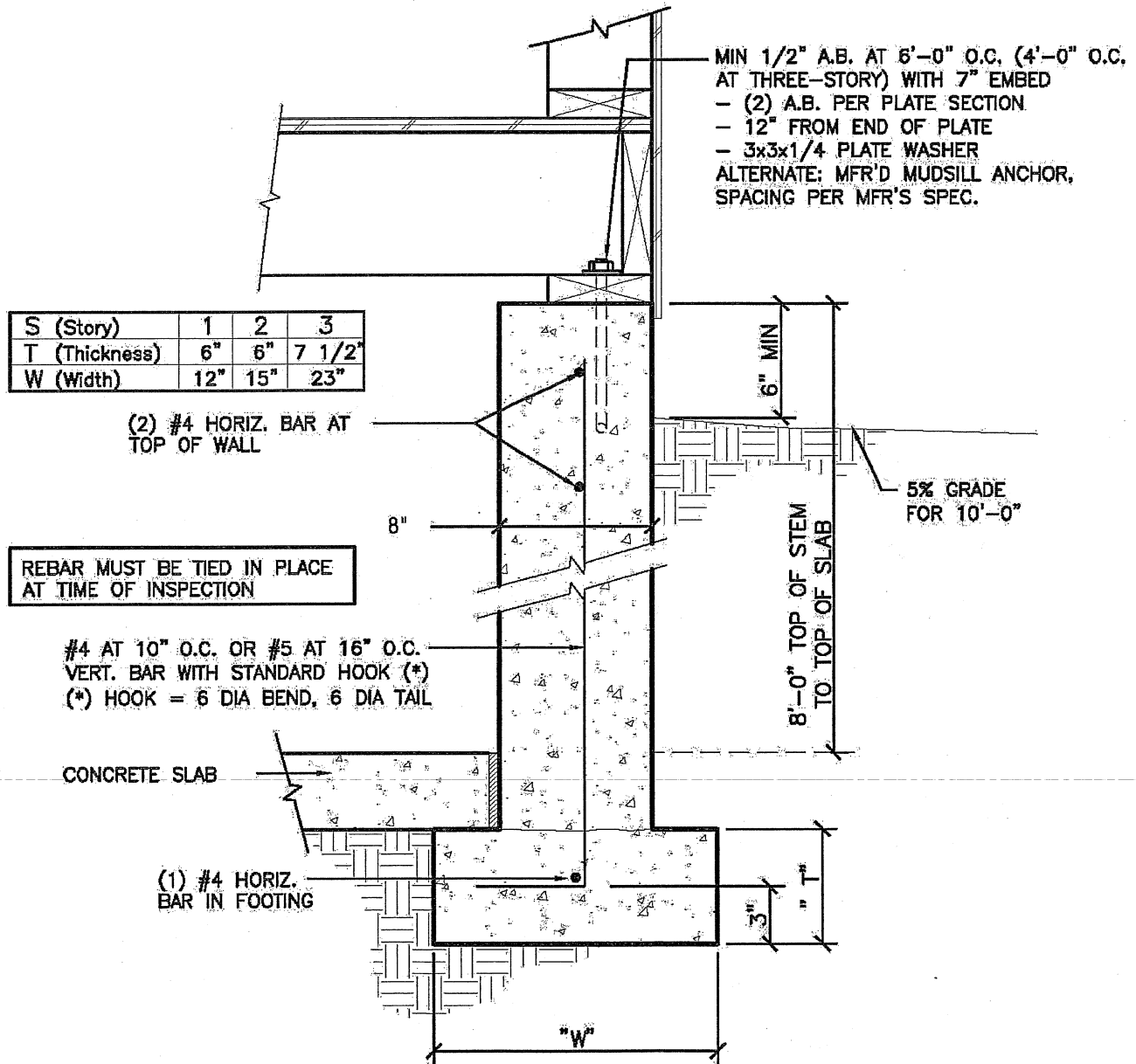
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FAX (360) 754-2939

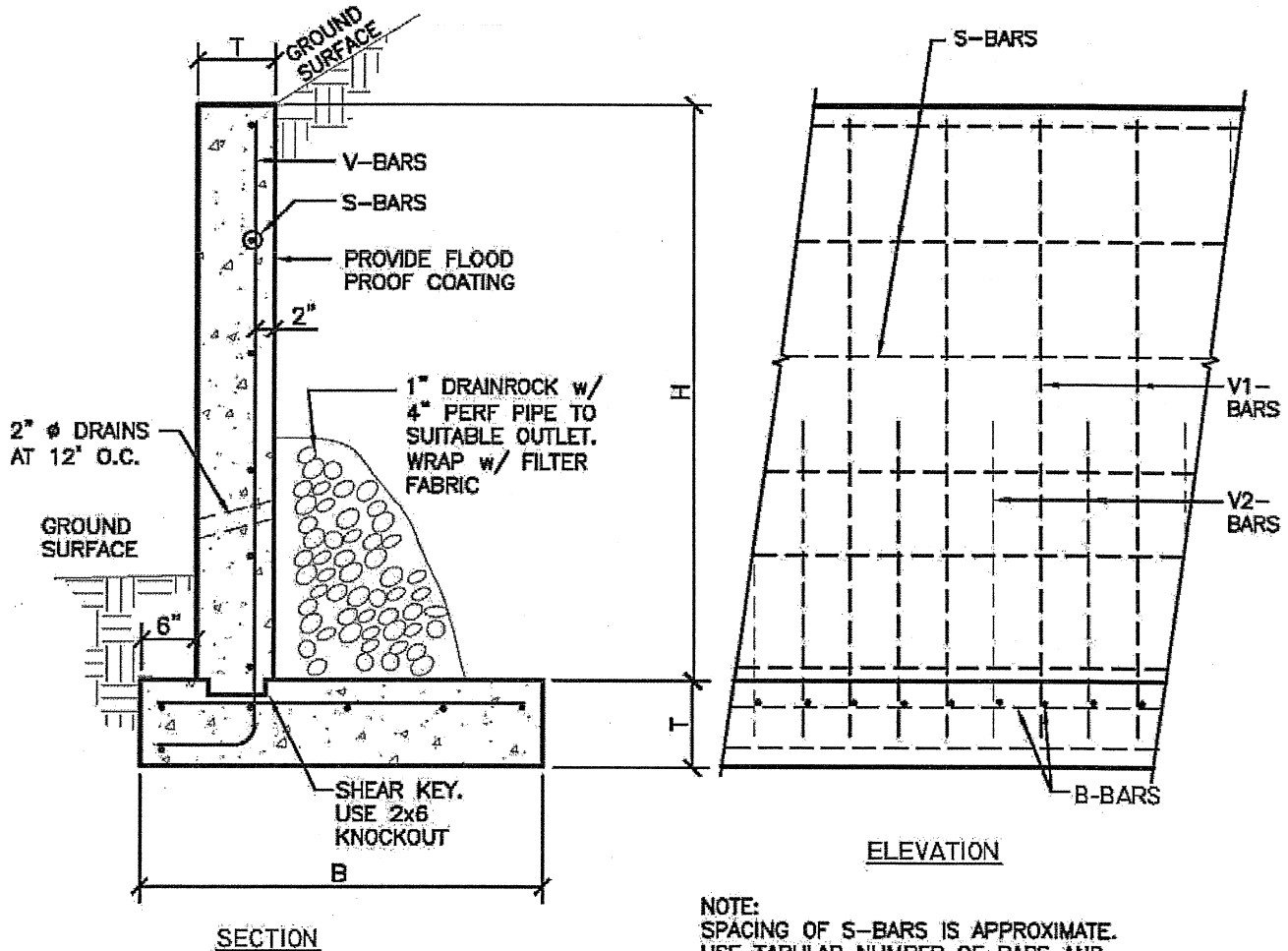
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TC Figure 3 Reinforced Foundation Wall



TC Figure 4 Concrete Retaining Wall

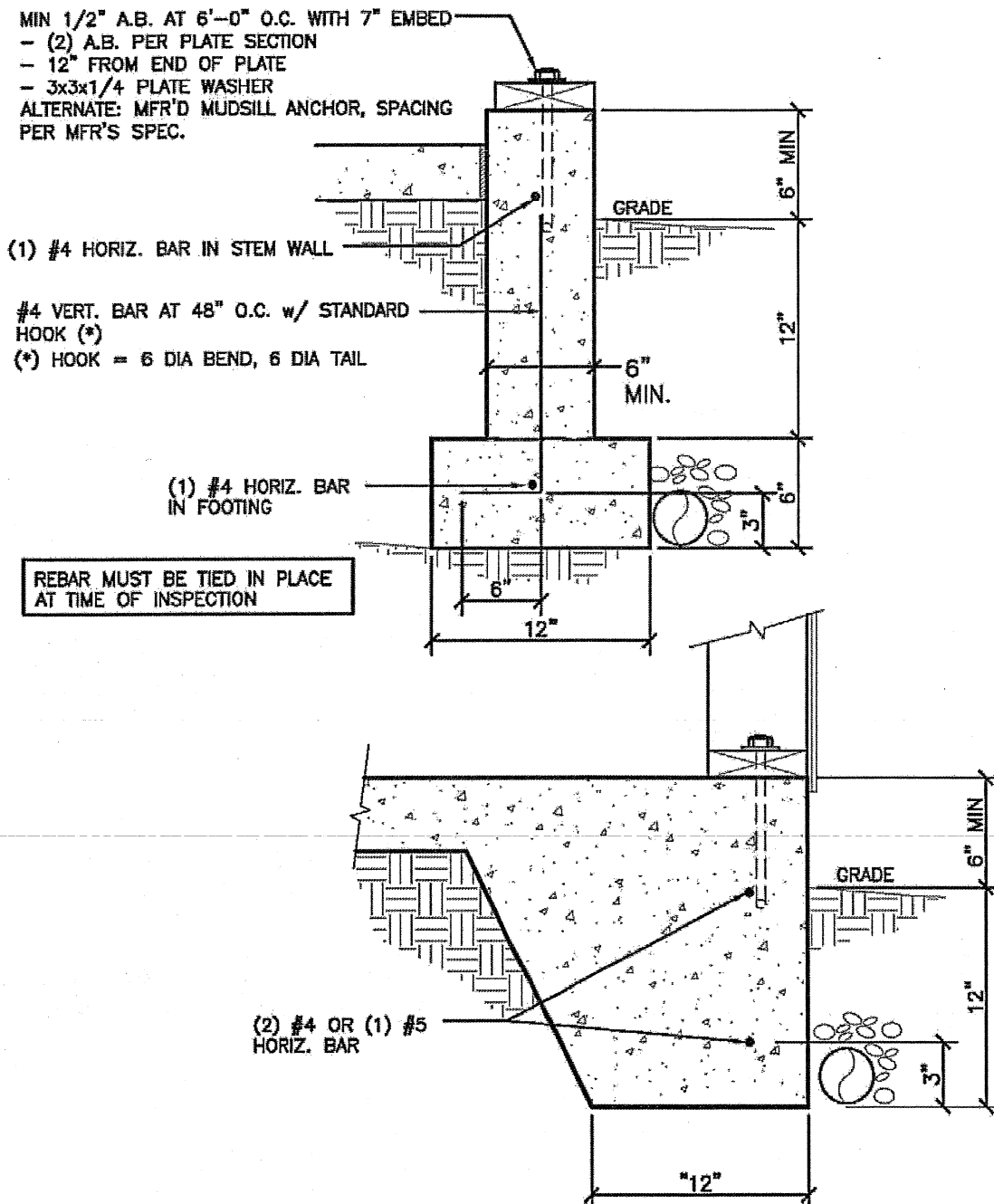


REBAR MUST BE TIED IN PLACE
AT TIME OF INSPECTION

NOTE:
SPACING OF S-BARS IS APPROXIMATE.
USE TABULAR NUMBER OF BARS AND
SPACE EVENLY w/ 2" COVER

H	B	T	VOL CONC	V-BARS	LENGTHS	B-BARS	S-BARS	REINFORCEMENT
FT	FT-IN	IN	YDS ³ / FT	SIZE SPACING	V1-BARS V2-BARS	SIZE SPACING LENGTH	# SIZE SPACING	LBS PER FT
5	3-6	10	0.25	3/8" 10"	6'-4" —	3/8" 10" 3'-2"	9 3/8" 12"	7.7
6	4-3	10	0.30	1/2" 10"	7'-4" —	1/2" 10" 3'-10"	11 3/8" 12"	13.1
7	5-0	10	0.35	1/2" 7"	8'-4" —	1/2" 7" 4'-8"	13 3/8" 12"	19.8
8	6-0	12	0.47	5/8" 9"	9'-8" 6'-0"	5/8" 9" 5'-8"	15 3/8" 12"	24.4
9	7-0	13.5	0.59	5/8" 7"	11'-0" 6'-8"	5/8" 7" 6'-8"	17 3/8" 12"	34.1
10	7-9	15	0.71	3/4" 9"	12'-2" 6'-10"	3/4" 9" 7'-4"	19 3/8" 12"	40.9

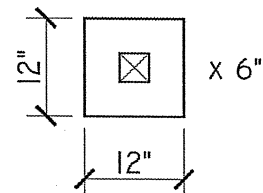
TC Figure 5 Typical Accessory Foundations



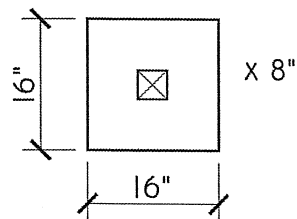
TC Figure 6 Isolated Footings

MAX LOAD	1,500#	2,500#	6,000#
T (THICKNESS)	6"	8"	12"
W (WIDTH)	12"	16"	24"

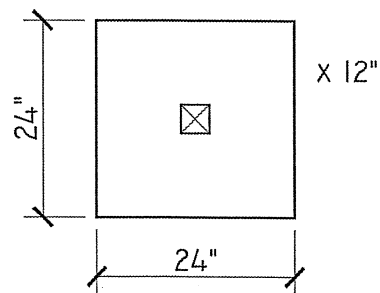
MAX LOAD
1,500#



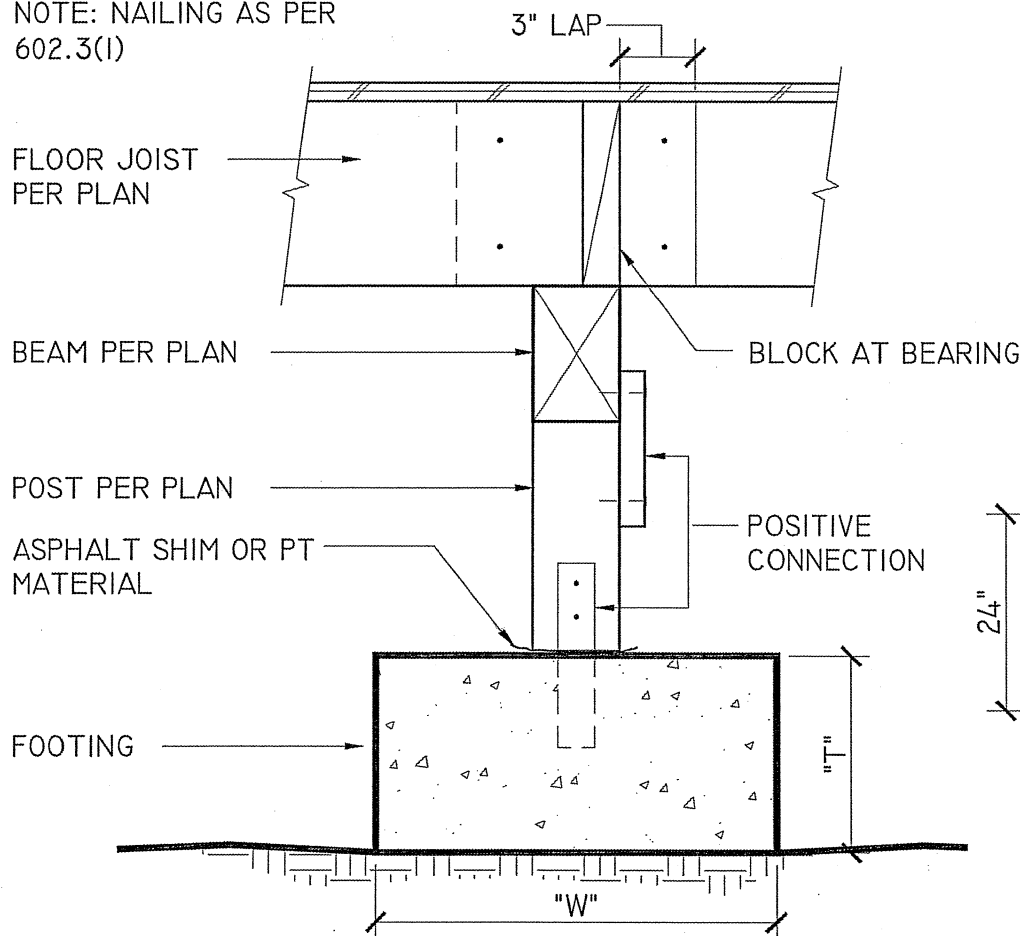
MAX LOAD
2,500#



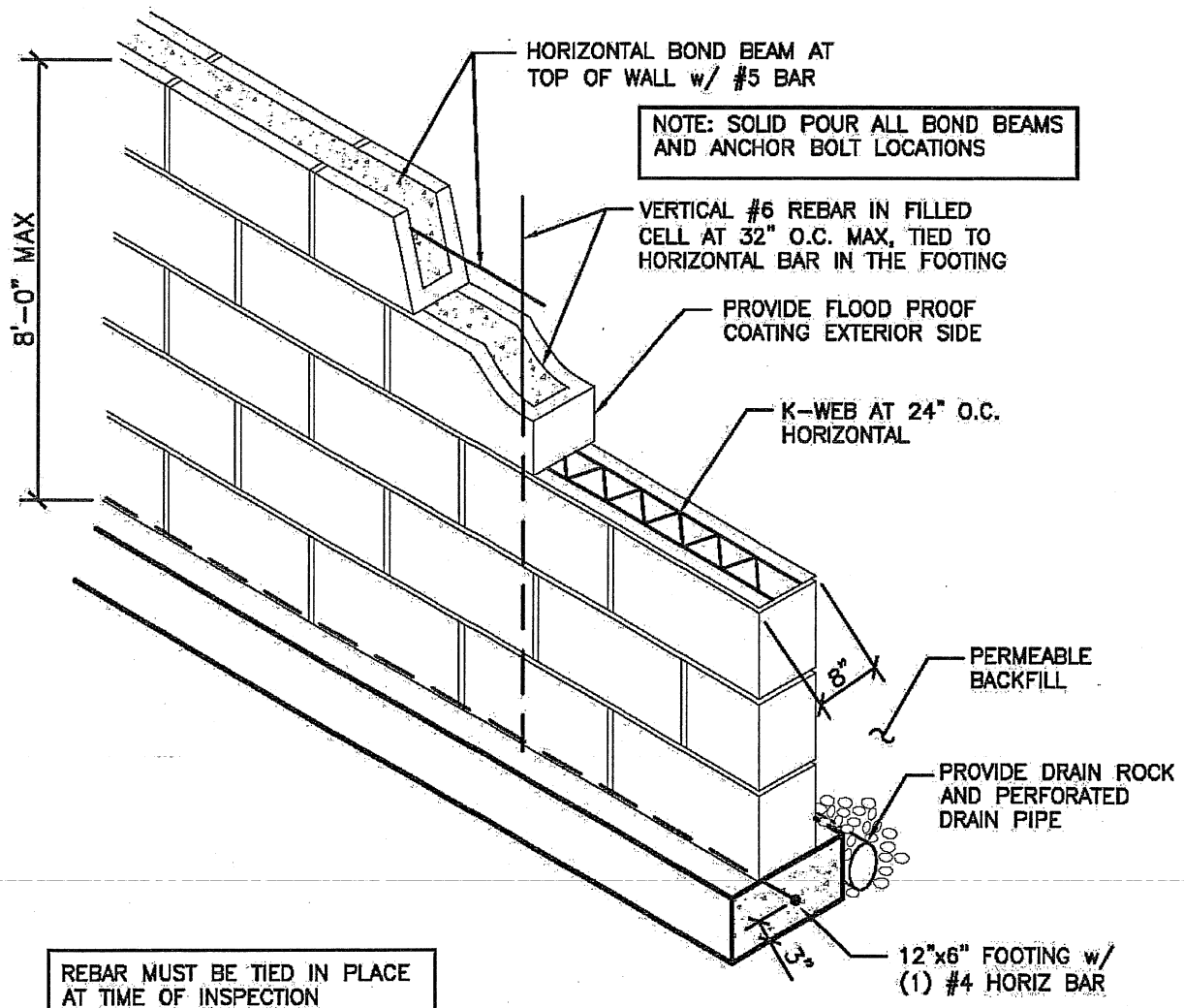
MAX LOAD
6,000#



NOTE: NAILING AS PER
602.3(I)



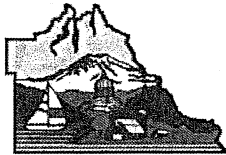
TC Figure 7 Concrete Masonry Unit Wall



NOTES:

FOR WALL LESS THAN 4'-0" HIGH VERTICAL #4 AT 4'-0" O.C. HORIZONTAL K-WEB AT 16" O.C. NO BOND BEAM REQUIRED FOR WALLS LESS THAN 4'-0" HIGH

UNBALANCED BACKFILL HEIGHT SHALL NOT EXCEED 4'-0". DESIGN PER TABLE 404.1.1.(2) B"



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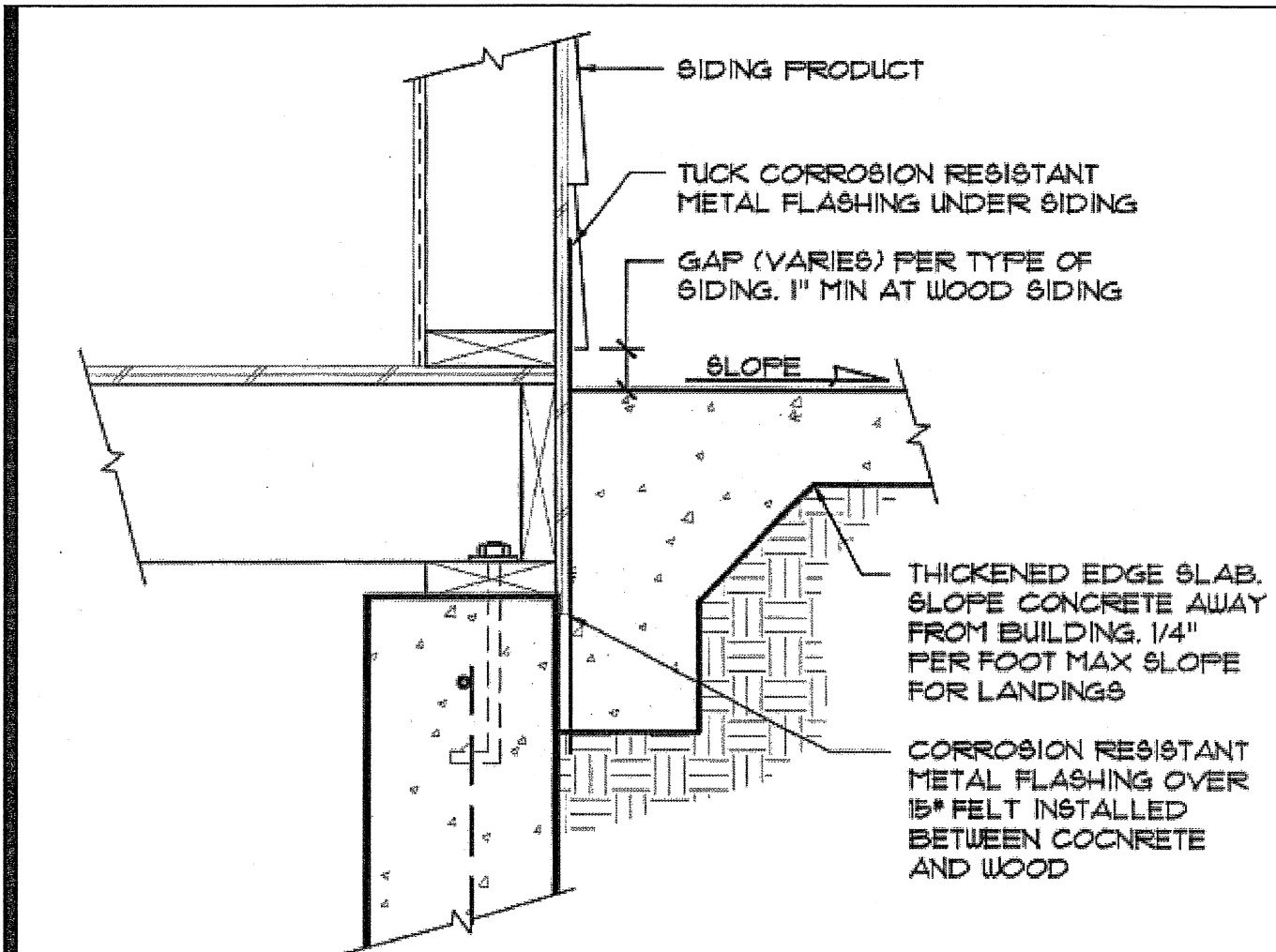
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2.10.21

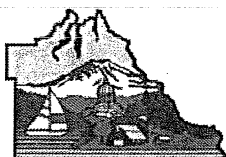
TC Figure 9 Wood to Concrete Separation



Concrete cannot be poured directly against non-pressure treated wood nor can concrete be poured against manufactured siding.

Concrete can be poured against non-pressure treated wood when flashing and felt paper have been applied over the wood. With wood siding a 1" vertical clearance has to be maintained between the siding and the concrete and with manufactured siding the minimum vertical distance has to be maintained as stated in the manufacturer's installation guide.

WOOD TO CONCRETE SEPARATION



THURSTON COUNTY
WASHINGTON
SINCE 1892

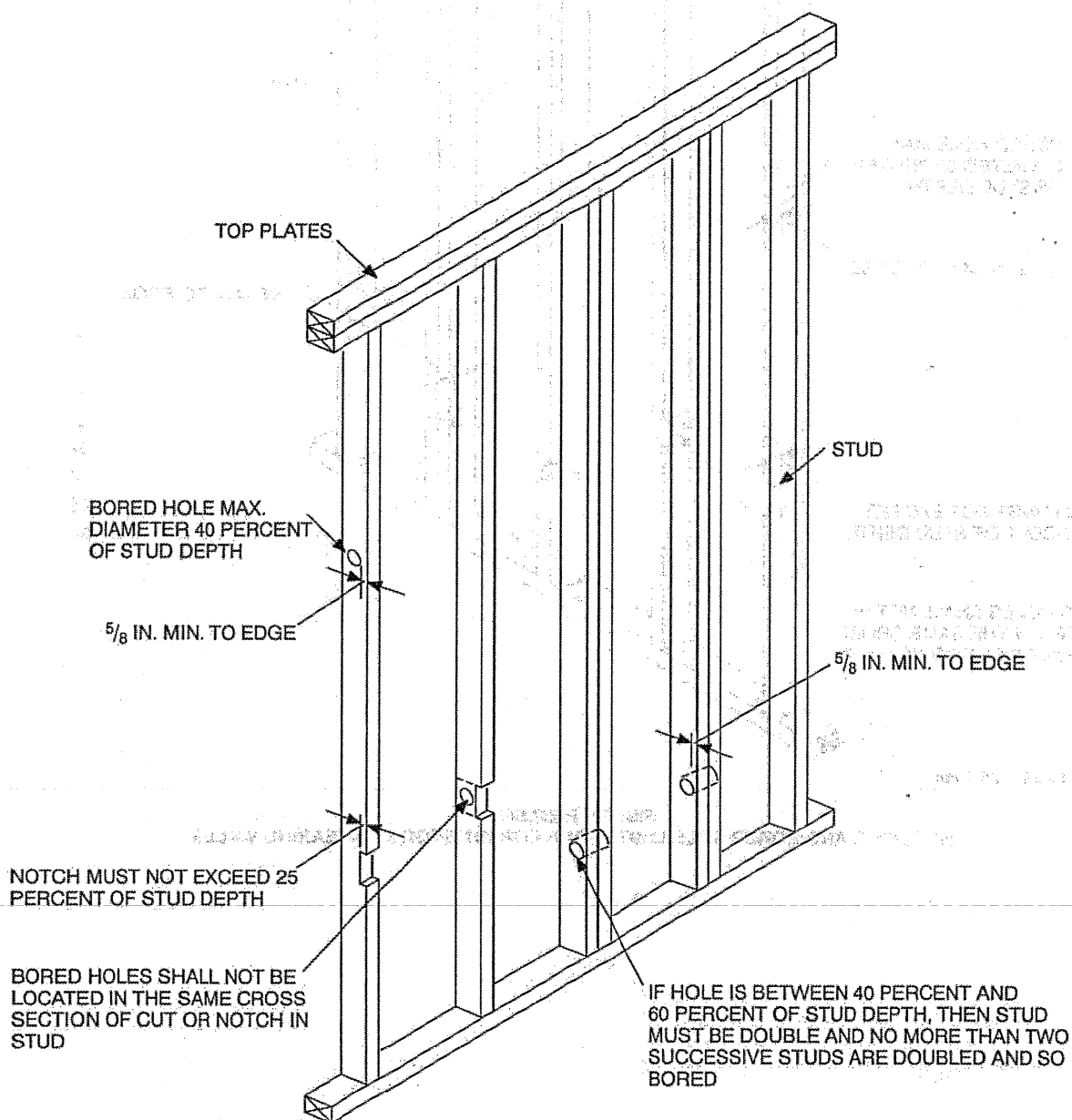
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2/10/2021

TC Figure 10 Cutting & Notching Wall Studs

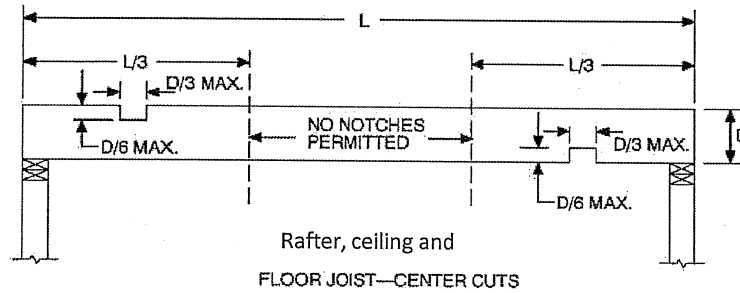


For SI: 1 inch = 25.4 mm.

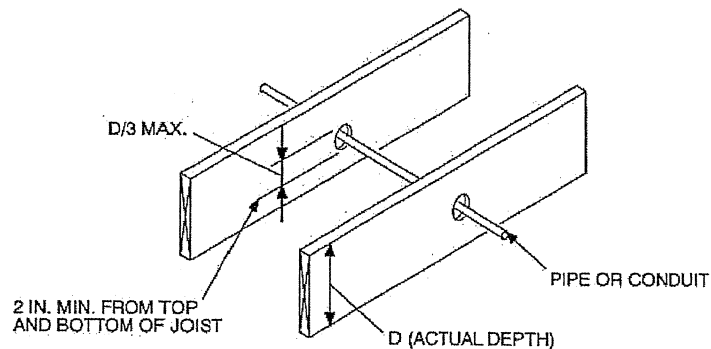
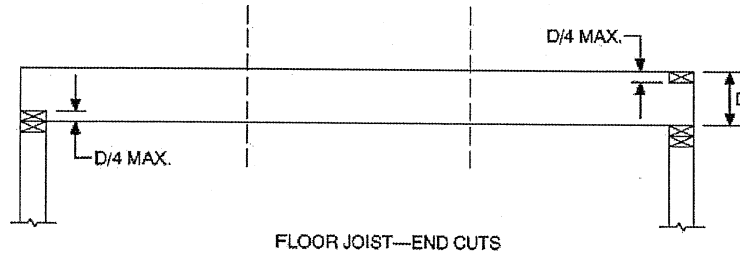
Note: Condition for exterior and bearing walls.

FIGURE R602.6(1)
NOTCHING AND BORED HOLE LIMITATIONS FOR EXTERIOR WALLS AND BEARING WALLS

TC Figure 11 Cutting & Notching Floor Joists



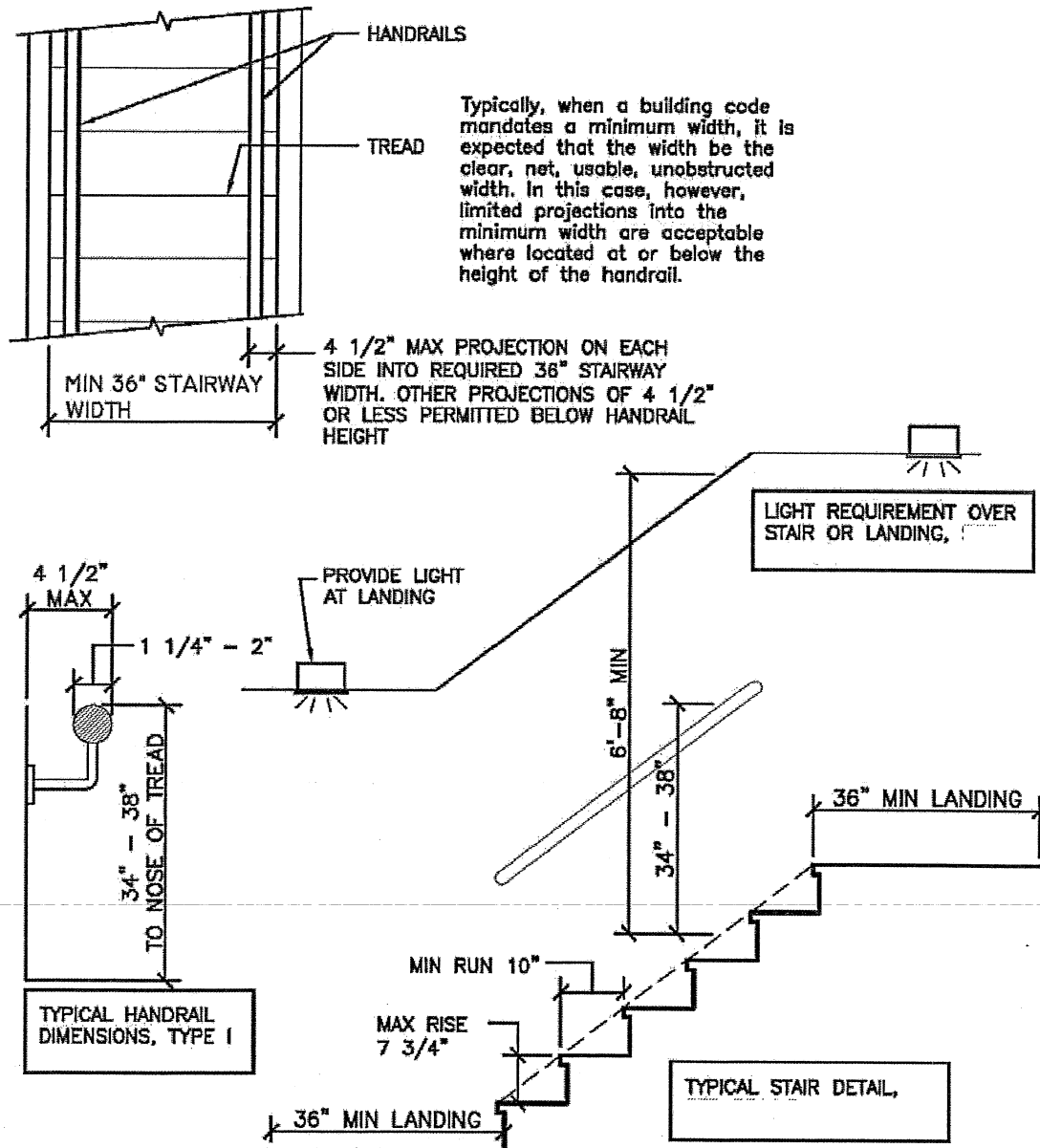
For rafter cantilever and tails refer to the code.



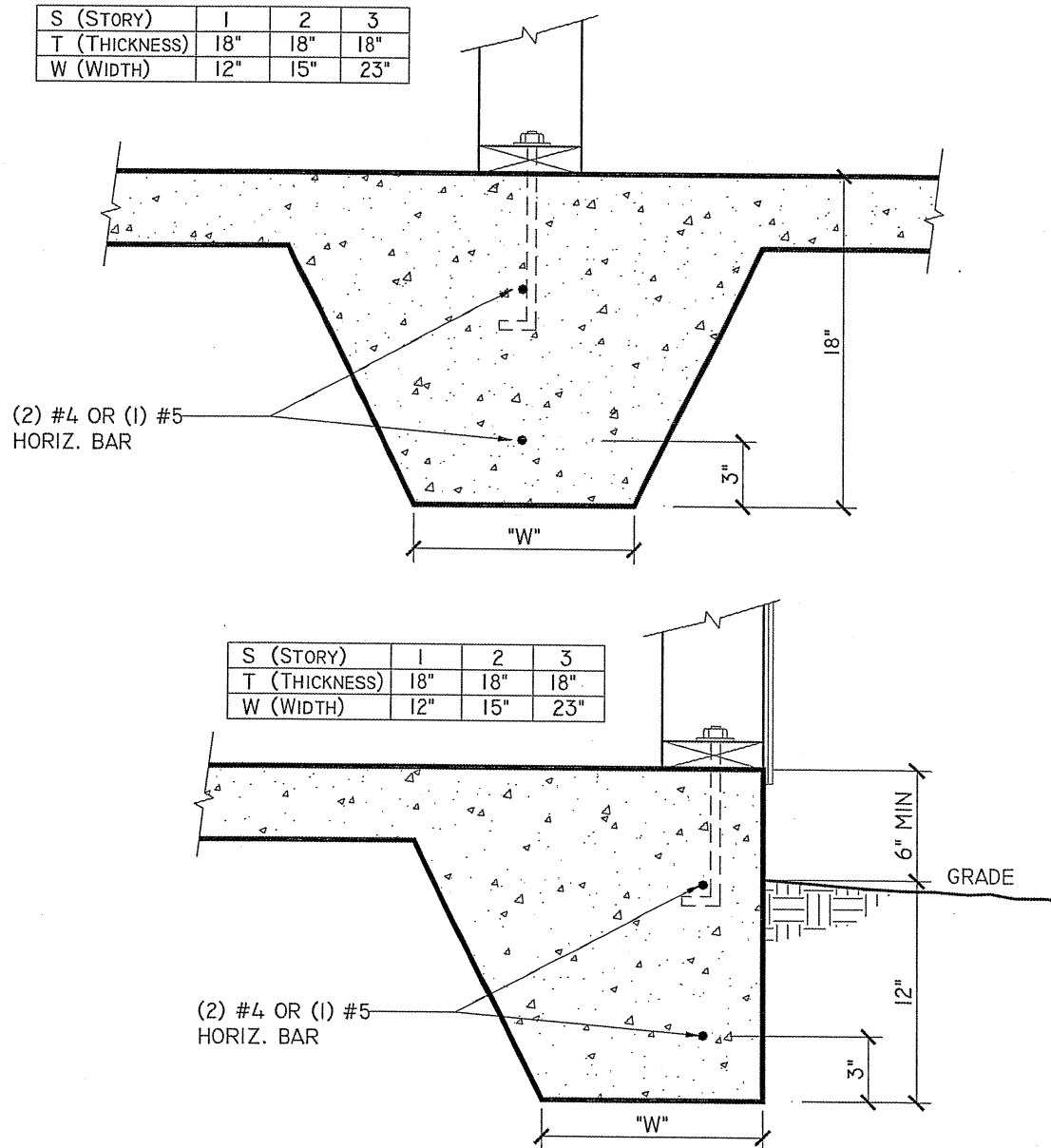
For SI: 1 inch = 25.4 mm.

FIGURE R502.8
CUTTING, NOTCHING AND DRILLING

TC Figure 12 Stair / Handrail



TC Figure 13 Monopour Foundation





TC Figure 14 2018 Residential Code Fire Resistance Exterior Wall Construction

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

Exceptions:

1. Walls, projections, openings or 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, playhouses and similar structures exempted from permits.
4. Detached garages located within 2 feet of a lot line can have eave projections not exceeding 4 inches.
5. Foundation vents are permitted.

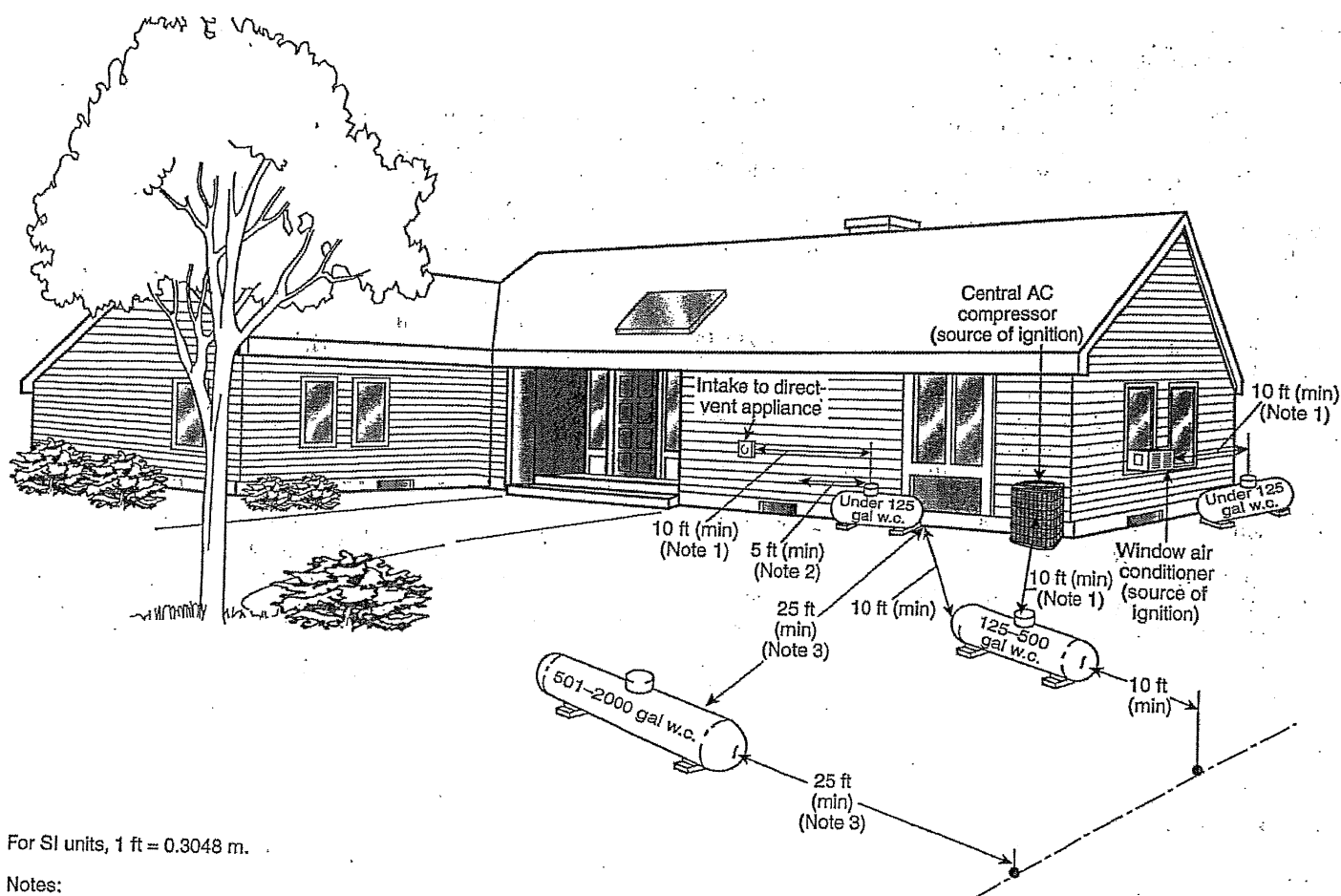
**TABLE R302.1(1)
EXTERIOR WALLS**

EXTERIOR WALL ELEMENT		MIN. FIRE RATING	MIN. FIRE SEPARATION DISTANCE
Walls	Fire rated	1-hour (both sides)	0 feet
	Not Fire rated	0 hours	≥ 5 feet
Projections		N/A	< 2 feet
	Fire rated	1-hour (underside) ^{a, b}	≥ 2 feet to < 5 feet
	Not Fire rated	0 hours	≥ 5 feet
Wall Openings		N/A	< 3 feet
	Max 25% wall area per story	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	See Section R302.4	< 3 feet
		None required	3 feet

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

b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where ventilation openings are not installed in the rake overhang or in walls that are common to attic areas.

TC Figure 15 Liquid Propane Setbacks



For SI units, 1 ft = 0.3048 m.

Notes:

- (1) Regardless of its size, any ASME container filled on site must be located so that the filling connection and fixed maximum liquid level gauge are at least 10 ft from any external source of ignition (e.g., open flame, window AC, compressor), intake to direct-vented gas appliance, or intake to a mechanical ventilation system. Refer to 6.3.4.4.
- (2) Refer to 6.3.4.3.
- (3) This distance can be reduced to no less than 10 ft for a single container of 1200 gal (4.5 m³) water capacity or less, provided such container is at least 25 ft from any other LP-Gas container of more than 125 gal (0.5 m³) water capacity. Refer to 6.3.1.3.

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TC Figure 20 Deck Construction

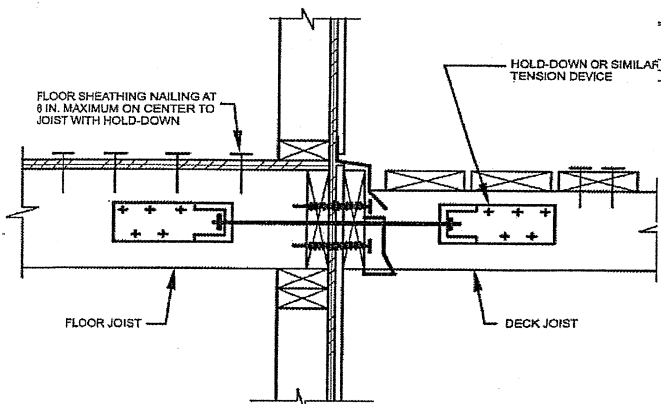
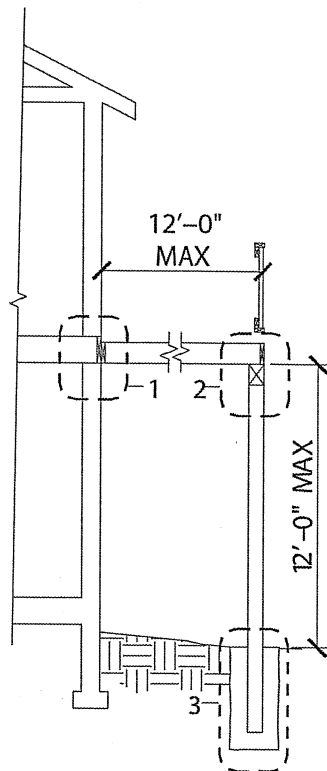
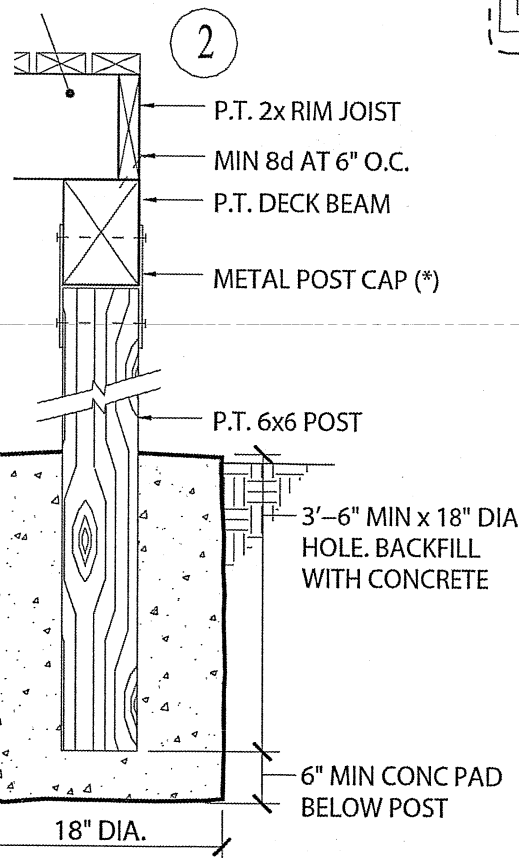
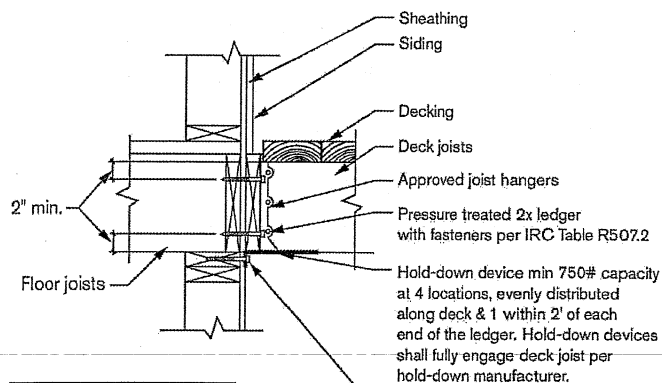
R507.2.4 Deck lateral load connection. The lateral load connection required by Section R507.1 can be in accordance with Figure R507.2.3(1) or 507.2.3(2). Where the lateral load connection is provided in accordance with Figure R507.2.3(1), hold-down tension devices shall be installed in not less than 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 1500 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.

Exception:

Decks not more than 30 inches above grade at any point may be unattached.

Detail 1 - For attachment to the primary structure see detail TC Figure 20A

See TC fig 20B for Joist Span





TC Figure 20 A Deck Ledger Requirements

TABLE R507.9.1.3(1)
DECK LEDGER CONNECTION TO BAND JOIST

Load ^c (psf)	Joist Span ^a (feet)	On-Center Spacing of Fasteners ^b (inches)		
		1/2-inch diameter lag screw with 1/2-inch maximum sheathing ^{d,e}	1/2-inch diameter bolt with 1/2-inch maximum sheathing ^e	1/2-inch diameter bolt with 1-inch maximum sheathing ^f
60 Live Load or 70 Ground Snow Load	6	22	36	35
	8	16	31	26
	10	13	25	21
	12	11	20	17
	14	9	17	15
	16	8	15	13
	18	7	13	11

- a. Interpolation permitted. Extrapolation is not permitted.
b. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.
c. Dead load = 10 psf. Snow load shall not be assumed to act concurrently with live load.
d. The tip of the lag screw shall fully extend beyond the inside face of the band joist.
e. Sheathing shall be wood structural panel or solid sawn lumber.
f. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to 1/2-inch thickness of stacked washers shall be permitted to substitute for up to 1/2 inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

TABLE R507.9.1.3(2)
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	3/4 inch	2 inches ^b	1 5/8 inches ^b
Band Joist ^c	3/4 inch	2 inches	2 inches ^b	1 5/8 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 R507.9.1.3(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 or bolts to the top edge of the ledger shall be in accordance with Figure R507.9.1.3
e. The 2 inches may be reduced to 3/4 inch when the band joist is directly supported by a mudsill, a header or by the double wall plates

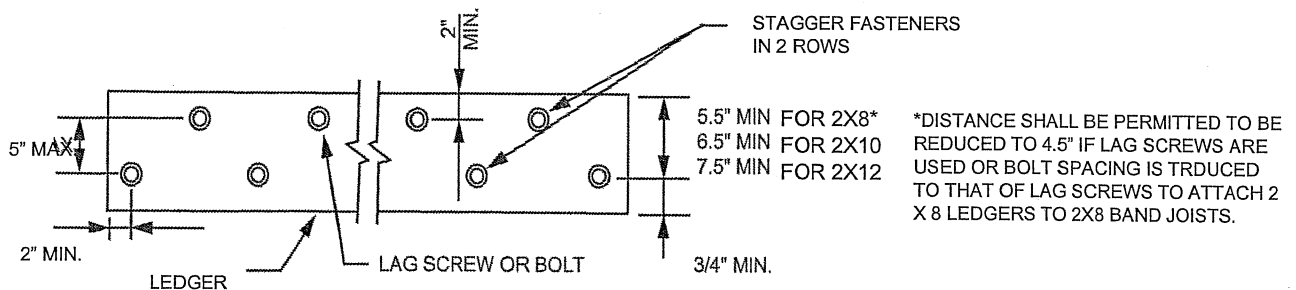


FIGURE R507.9.1.3(1)
PLACEMENT OF LAG SCREWS AND BOLTS IN LEDGERS



TC Figure 20B Common Lumber Deck Joist Spans

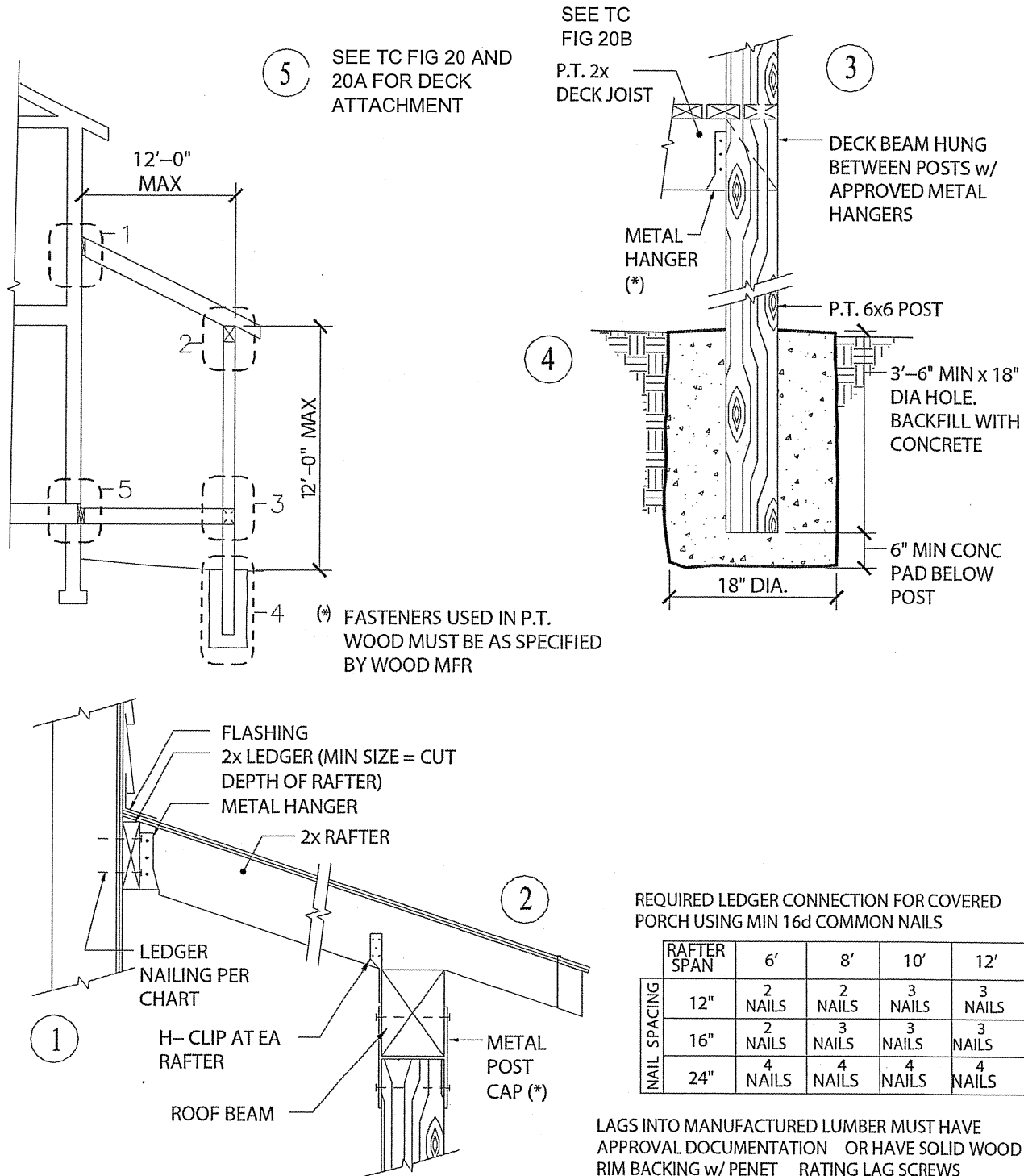
TABLE R507.6 MAXIMUM DECK JOIST SPANS

Load ^a (psf)	Joist Species ^b	Joist Size	Allowable Joist Span ^c (feet-inches)			Maximum Cantilever ^d (feet-inches) Adjacent Joist Span ^e						
			Joist Spacing (inches)			Joist Back Span ^e (feet)						
			12	16	24	4	6	8	10	12	14	16
60 Ground Snow Load	Douglas Fir, Hem-fir ^e ,	2x6	8-4	7-6	6-2	1-0	1-6	1-4				
		2x8	10-11	9-11	8-3	1-0	1-6	2-0	2-2			
		2x10	13-11	12-4	10-0	1-0	1-6	2-0	2-6	2-10		
		2x12	16-6	14-3	11-8	1-0	1-6	2-0	2-6	3-0	3-5	3-5
	Redwood ^f , Western Cedars ^f Ponderosa Pine ^f Red Pine ^f	2x6	7-9	7-0	6-2	1-0	1-4					
		2x8	10-2	9-3	7-11	1-0	1-6	2-0	1-11			
		2x10	13-0	11-9	9-7	1-0	1-6	2-0	2-6	2-7		
		2x12	15-9	13-8	11-2	1-0	1-6	2-0	2-6	3-0		
70 Ground Snow Load	Douglas Fir ^e , Hem-fire, SPF ^e	2x6	7-11	7-1	5-9	1-0	1-6					
		2x8	10-5	9-5	7-9	1-0	1-6	2-0	2-1			
		2x10	13-3	11-6	9-5	1-0	1-6	2-0	2-6	2-8		
		2x12	15-5	13-4	10-11	1-0	1-6	2-0	2-6	3-0	3-3	
	Redwood ^f , Western Cedars ^f Ponderosa Red Pine ^f	2x6	7-4	6-8	5-10	1-0	1-4					
		2x8	9-8	8-10	7-4	1-0	1-6	1-11				
		2x10	12-4	11-0	9-0	1-0	1-6	2-0	2-6	2-6		
		2x12	14-9	12-9	10-5	1-0	1-6	2-0	2-6	3-0	3-0	
Load ^a (psf)	Joist Species ^b	Joist Size	Allowable Joist Span ^{b,c} (feet-inches)			Maximum Cantilever ^{e,g} (feet-inches)						
			Joist Spacing (inches)			Adjacent Joist Back Span ^e (feet)						
			12	16	24	4	6	8	10	12	14	
60 Live Load or 70 Ground Snow Load	Douglas fir-larch ^e , Hem-fir ^e , Spruce pine-fir ^e	2x6	7-11	7-1	5-9	1-0	1-6					
		2x8	10-5	9-5	7-8	1-0	1-6	2-0	2-1			
		2x10	13-3	11-6	9-5	1-0	1-6	2-0	2-6			
		2x12	15-5	13-4	10-11	1-0	1-6	2-0	2-6	3-0	3-3	
	Redwood ^f , Western Cedars ^f , Ponderosa Pine ^f , Red Pine ^f	2x6	7-4	6-8	5-10	1-0	1-4					
		2x8	9-8	8-10	7-4	1-0	1-6	1-11				
		2x10	12-4	11-0	9-0	1-0	1-6	2-0	2-6			
		2x12	14-9	12-9	10-5	1-0	1-6	2-0	2-6	3-0		

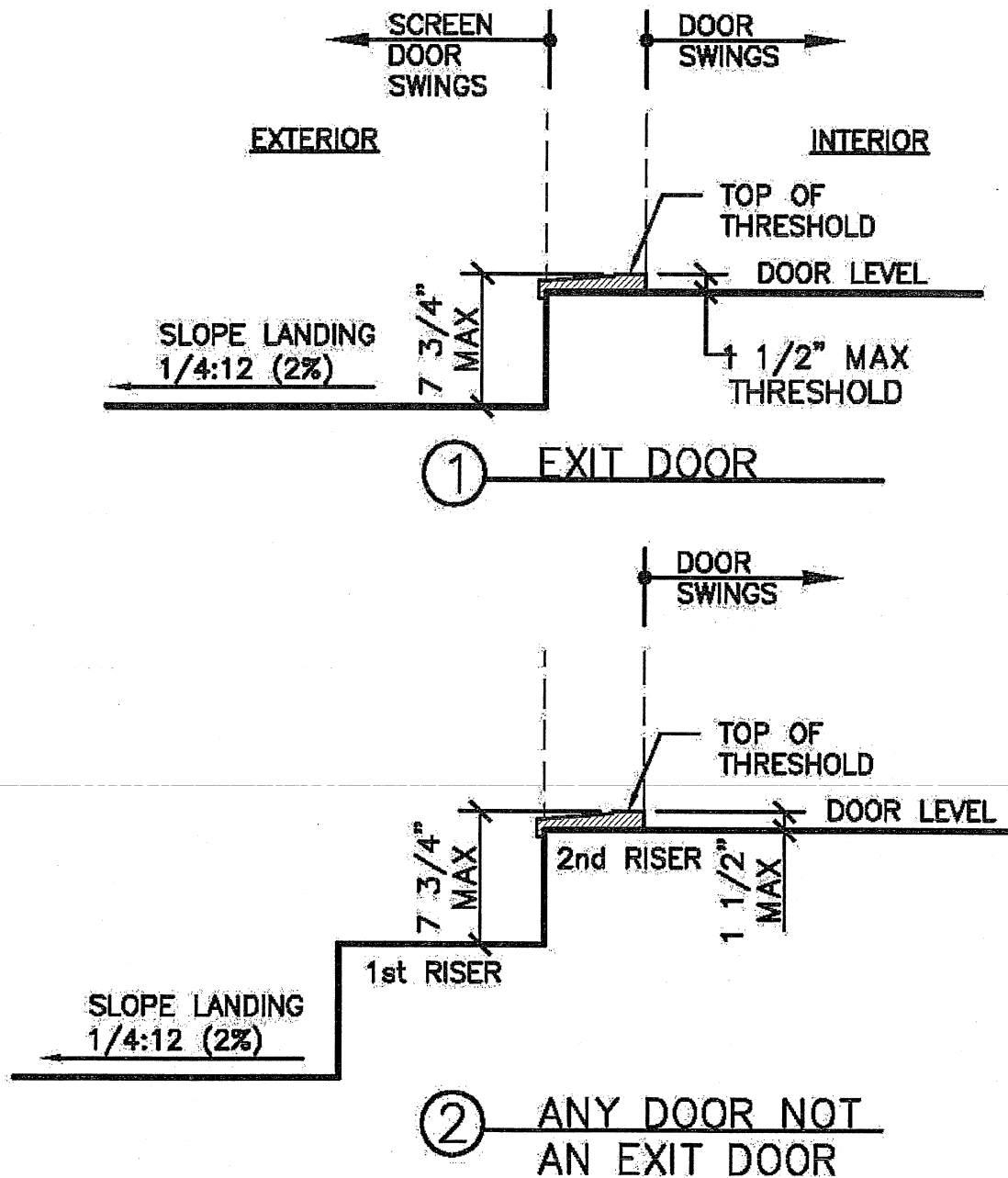
- Dead load = 10 psf dead load. Snow load not assumed to be concurrent with live load.
- No. 2 grade, wet service factor included.
- L/Delta=360 at main span.
- L/Delta = 180 at cantilever with 220-pound point load applied to end.
- Includes incising factor.
- Incising factor not included.
- Interpolation permitted. Extrapolation not permitted.

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TC Figure 21 Porch Construction



TC Figure 23 Exterior Door Landings



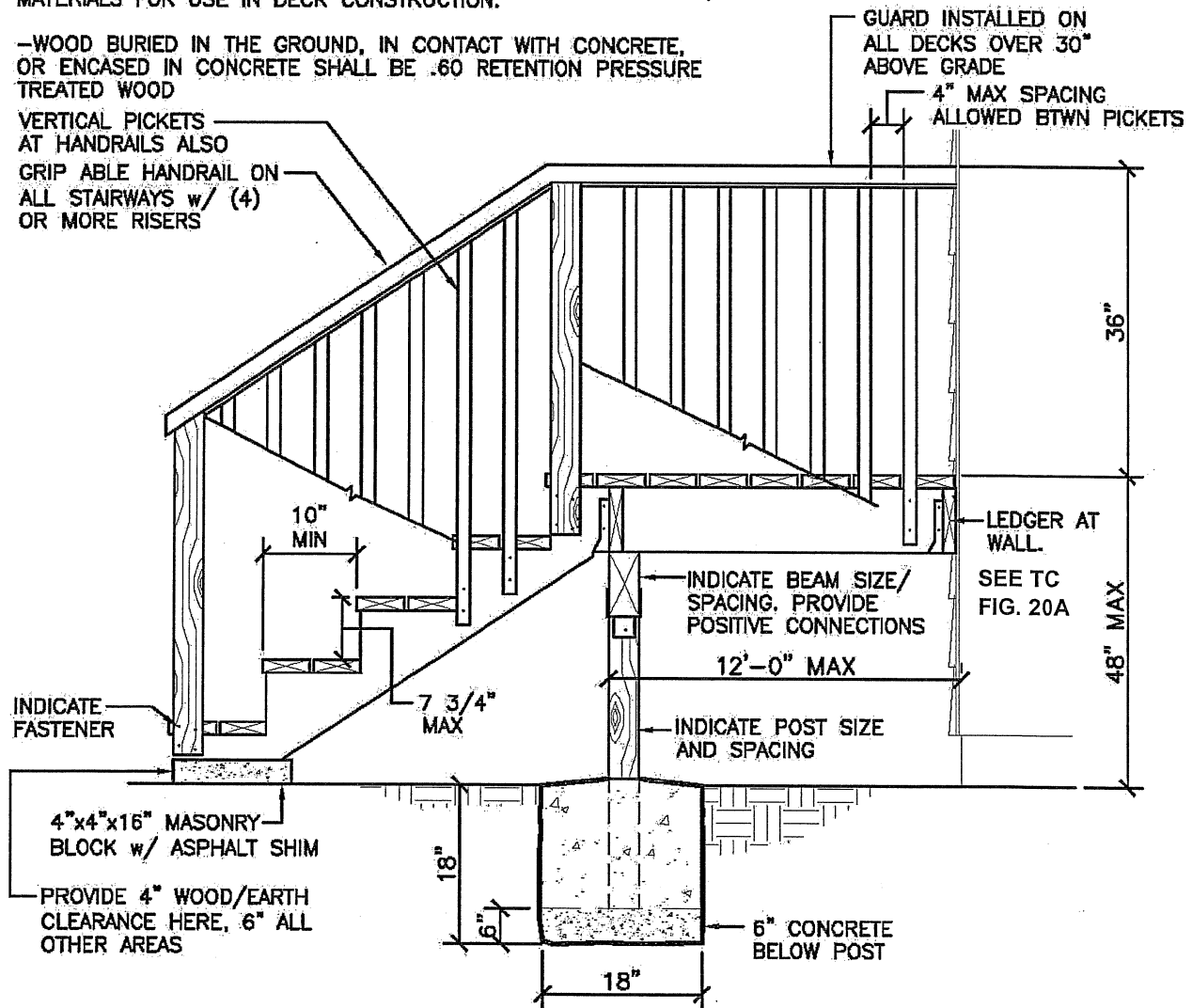
TC Figure 24 Landing Construction

CONSTRUCTION MATERIALS

— CEDAR, REDWOOD, SUNWOOD, WOLMANIZED WOOD AND .40 RETENTION PRESSURE TREATED WOOD ARE ALL ACCEPTABLE MATERIALS FOR USE IN DECK CONSTRUCTION.

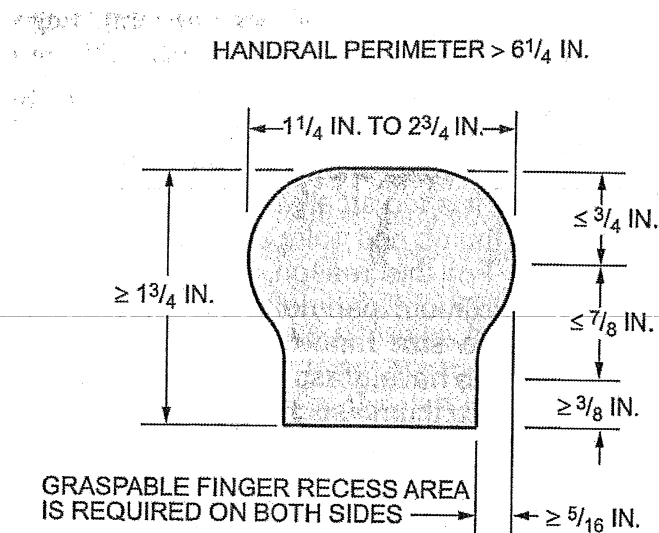
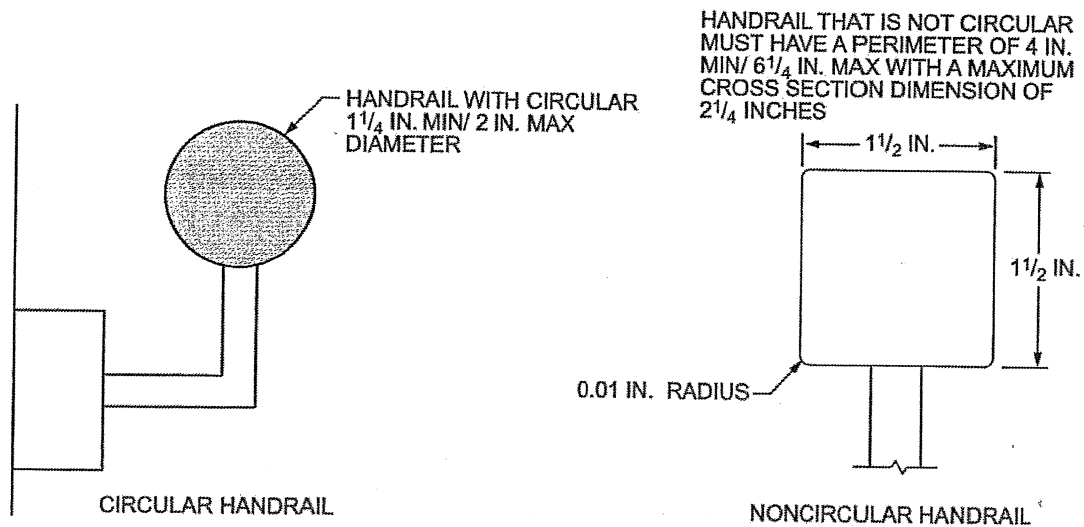
—WOOD BURIED IN THE GROUND, IN CONTACT WITH CONCRETE, OR ENCASED IN CONCRETE SHALL BE .60 RETENTION PRESSURE TREATED WOOD

VERTICAL PICKETS AT HANDRAILS ALSO
GRIP ABLE HANDRAIL ON ALL STAIRWAYS w/ (4) OR MORE RISERS





TC Figure 25 Handrail Grip



For SI: 1 inch = 25.4 mm.



TC Figure 33 Nailing Schedule

TABLE R602.3(1)

FASTENING SCHEDULE ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{ab c}	SPACING AND LOCATION
Roof			
1	Blocking between ceiling joists or rafters to top plate	4-8d box (2 1/2" x 0.113") or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3 " x 0. 128 or 3-3 x 0.131 " nails	Toe nail
2	Ceiling joists to top plate	4-8d box (2 1/2" x 0.113") or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3 " x 0. 128 or 3-3 x 0.131 " nails	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section R802.5.2 and Table R802.5.2)	4-10d box (3 " x 0.128") or 3-16d common (3 1/2 " x 0.162 "); or 4-3 " x 0.131 " nails	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section R802.5.2 and Table R802.5.2)	Table R802.5.2	Face nail
5	Collar tie to rafter, face nail or 1 1/4 " x 20 ga. ridge strap to rafter	4-10d box (3 " x 0.128") or 3-16d common (3 1/2 " x 0.162 "); or 4-3 " x 0.131" nails	Face nail each rafter
6	Rafter or roof truss to plate	3-16d box nails (3 1/2" x 0.135"); or 3-10d common nails (3 " x 0.148 "); or 4-10d box (3" x 0.128"); or 4-3 " x 0.131 " 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 " X 0.135") or 3-10d common (3 " x 0.148") or 4-10d box (3 " x 0.128"); or 4-3 " x 0.131" nails	Toe nail
		4-16d (3 1/2 " X 0.135") or 3-10d common (3 " x 0.148") or 4-10d box (3 " x 0.128"); or 4-3 " x 0.131" nails	
		3-16d box 3 1/2" x 0.135"); or 2-16d common (3 1/2 " x 0.162"); or 3-10d box (3 " x 0.128") or 3-3 " x 0.131 " nails	End nail
Wall			
8	Stud to stud (not at braced wall panels)	16d common (3 1/2 " x 0.162")	24" o.c. face nail
		10d box (3 " x 0.128") or 3 " x 0.131 " nails	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" x 0. 135"); or 3" x 0.131 " nails	12" o.c. face nail
		16d common (3 1/2 " x 0.162")	16" o.c. face nail
10	Built-up header (2 " to 2" header with 1/2" spacer)	16d common (3 1/2 " x 0.162")	16 " o.c. each edge face nail
		16d box (3 1/2" x 0.135")	12" o.c. each edge face nail
11	Continuous header to stud	5-8d box (2 1/2" x 0.113"); or 4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128")	Toe nail
12	Top plate to top plate	16d common (3 1/2 " x 0.162")	16" o.c. face nail
		10d box (3 " x 0.128") or 3" x 0.131 " nails	12" o.c. face nail
13	Double top plate splice	8-16d common (3 1/2 " x 0.162"); or 12-16d box (3 1/2" x 0.135") or 12-10d box (3 " x 0.128"); or 12-3" x 0.131 " nails	Face nail on each side of end joint (minimum 24 " lap splice length each side of end joint)

(continued)

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FASTENING SCHEDULE ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{ab 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" x 0.162")	16" o.c. face nail
		16d box (3 1/2" x 0.135") or 3" x 0.131" 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" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 4-3" x 0.131" 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" x 0.113"); or 3-16d box (3 1/2" x 0.135"); or 4-8d common (2 1/2" x 0.131") or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	Toe nail
		3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	End nail
17	Top plates, laps at corners and intersections	3-10d box (3" x 0.128") or 2-16d common (3 1/2" x 0.162"); or 3-3" X 0.131" nails	Face nail
18	1" brace to each stud and plate	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128") or 2 staples 1 3/4"	Face nail
19	1" x 6" sheathing to each bearing	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128"); or 2 staples, 1" crown, 16 gage, 1 3/4" long	Face nail
20	1" x 8" and wider sheathing to each bearing	3-8d box (2 1/2" x 0.113") or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3 staples, 1" crown, 16 ga., 1 3/4" long	Face nail
		Wider than 1" x 8" 4-8d box (2 1/2" x 0.113") or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128") 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" x 0.113") or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	Toe nail
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box (2 1/2" x 0.113)	4" o.c. toe nail
		8d common (2 1/2" x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails	6" o.c. toe nail
23	1" x 6" subfloor or less to each joist	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 2 staples, 1" crown, 16 ga., 1 3/4" long	Face nail

FASTENING SCHEDULE ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{abc}	SPACING AND LOCATION	
24	2 " subfloor to joist or girder	3-16d box (3 1/2 " x 0.135"); or 2-16d common (3 1/2 " x 0.162 ")	Blind and face nail	
25	2 " planks (plank & beam—floor & roof)	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2 " x 0.162 ")	At each bearing, face nail	
26	Band or rim joist to joist	3-16d common (3 1/2 " x 0.162") 4-10 box (3 x 0.128") or 4-3 " x 0.131 " nails; or 4-3 " x 14 ga. staples, 7/16" crown	End nail	
27	Built-up girders and beams, 2-inch lumber layers	20d common (4" x 0.192 "); or	Nail each layer as follows: 32 " o.c. at top and bottom and staggered.	
		10d box (3 " x 0.128"); or 3" x 0.131") nails	24 " o.c. face nail at top and bottom staggered on opposite sides	
		And: 2-20d common (4" x 0.192"); or 3-10d box (3 " x 0.128"); or 3-3 " x 0.131 " nails	Face nail at ends and at each splice	
28	Ledger strip supporting joists or rafters	4-16d box (3 1/2 " x 0.135"); or 3-16d common (3 1/2" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3 " x 0.131 " nails	At each joist or rafter, face nail	
29	Bridging or blocking to joist	2-10d box (3" x 0.128 "), or 2-8d common (2 1/2" x 0.131" or 2-3" x 0.131") nails	Each end, toe nail	
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 sheathing to wall framing]				
30	3/8"-1/2"	6d common (2"x0.113") nail (subfloor, wall) ⁱ 8d common (2 1/2 " x 0.131 ") nail (roof); or RSRS01 (2 3/8 x 0.113") nail (roof)	6	12 ^f
31	19/32"-1"	8d common nail (2 1/2" x 0.131"); or RSRS-01, (2 3/8" x 0.113") nail (roof) ^j	6	12 ^f
32	1 1/8"- 1 1/4"	10d common (3" x 0.148") nail; or 8d (2 1/2" x 0.131") 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 1/4" long 16 ga. staple with 7/16" or 1 " crown	3	6
34	25/32" structural cellulosic fiberboard sheathing	1 3/4" galvanized roofing nail, 7/16 " head diameter, or 1 1/2" long 16 ga. staple with 7/16 " or 1 " crown	3	6
35	1/2 " gypsum 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 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" x 0.120") nail; or 8d common (2 1/2 " x 0.131 ") nail	6	12
38	7/8" - 1"	8d common (2 1/2" x 0.131") nail; or 8d deformed (2 1/2 " x 0.120") nail	6	12

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FASTENING SCHEDULE ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{ab c}	SPACING AND LOCATION	
39	1 1/8" - 1 1/4"	10d common (3" x 0.148") nail; or 8d deformed (2 1/2" x 0.120") nail	6	12

For SI: 1 inch — 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

- 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 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. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 6 inches on center where the ultimate design wind speed is less than 130 mph and shall be spaced 4 inches on center where the ultimate design wind speed is 130 mph or greater but less than 140 mph.
- g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C208.
- 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 applies to 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.
- j. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1 667



TC Figure 34 Alternate Fastener Schedule

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

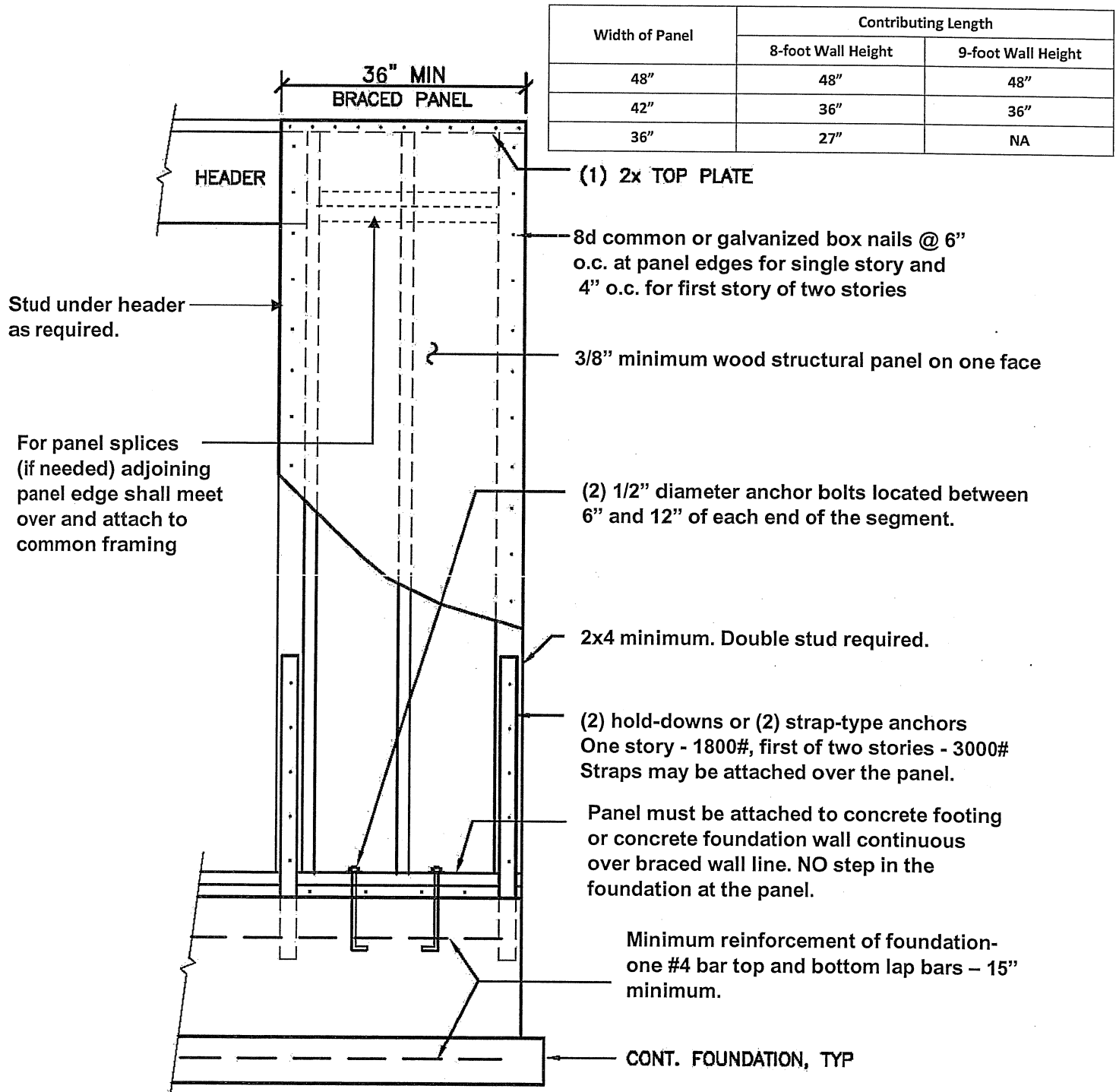
NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a, b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches)	Intermediate supports (inches)
Wood structural panels subfloor, roof ^a and wall sheathing to framing and particleboard wall sheathing to framing ^f			
Up to 1/2	Staple 15 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
1	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 -fiber-cement ^h			
Fiber-cement			
1/4	3d, corrosion-resistant, ring shank nails (finished flooring other than tile)	3	6
	Staple 18 ga., 7/8 long, 1/4 crown (finished flooring other than tile)	3	6
	1 1/4 long x .121 shank x .375 head diameter corrosion-resistant (galvanized or stainless steel) roofing nails (for tile finish)	8	8
	1 1/4 long, No. 8 x .375 head diameter, ribbed wafer-head screws (for tile finish)	8	8
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 3/4	1 1/4 ring or screw shank nail-minimum 12 1/2 ga. (0.099 shank diameter	6	
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

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Hardboard ^t			
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 shall be permitted to be T-head, modified round head or round head.
- b. Staples shall have a minimum crown width of 7/16-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 inches 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 8336, Category C.

TC Figure 36 IRC Alternate Braced Panel

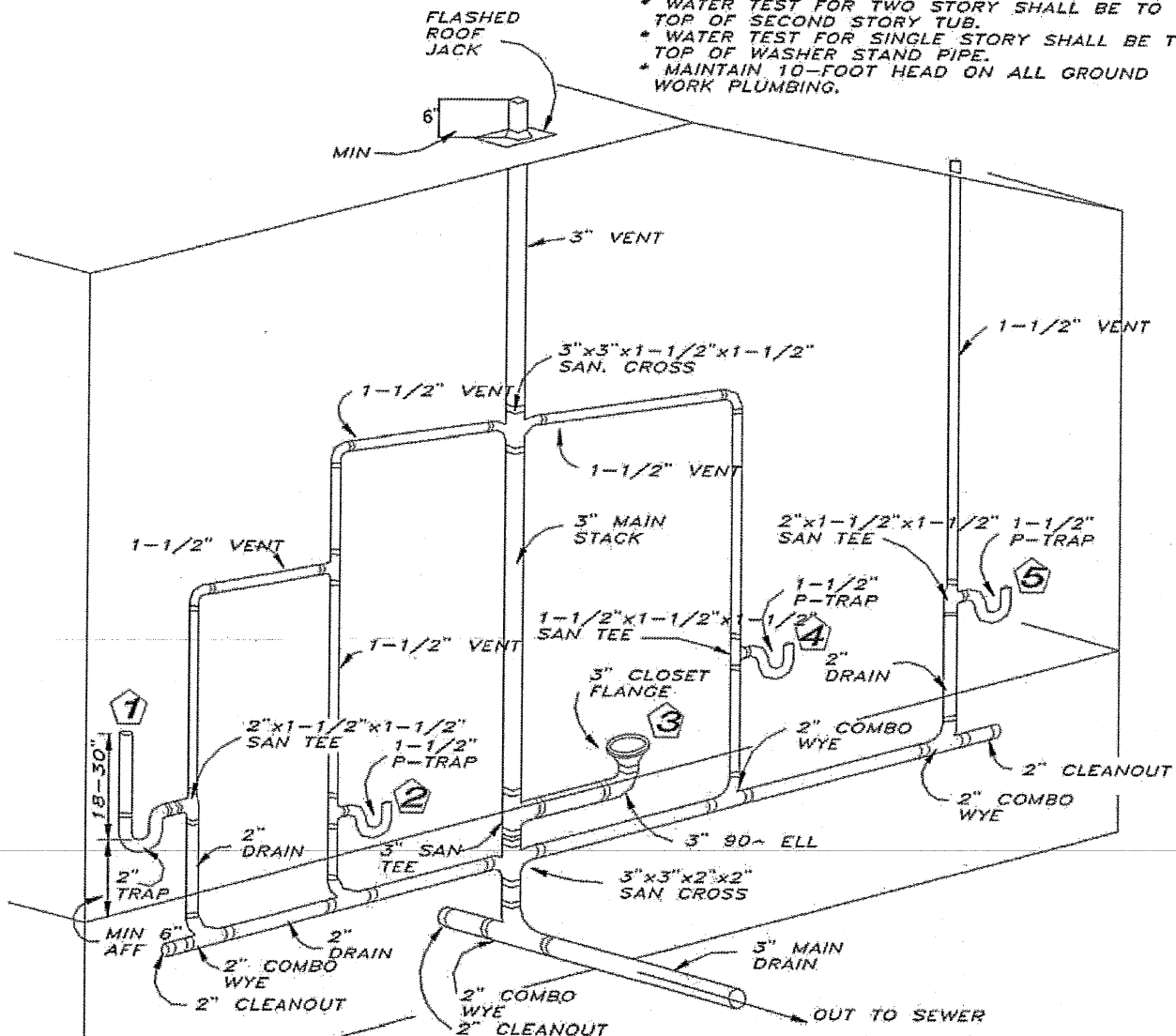




TC Figure 40 Plumbing Drain and Waste

DRAIN WASTE AND VENT TESTING

- * WATER TEST FOR TWO STORY SHALL BE TO TOP OF SECOND STORY TUB.
- * WATER TEST FOR SINGLE STORY SHALL BE TO TOP OF WASHER STAND PIPE.
- * MAINTAIN 10-FOOT HEAD ON ALL GROUND WORK PLUMBING.



NOTE:

ALL REVENTS TO BE 6" ABOVE HIGHEST WATER LEVEL IN HOUSE (NORMALLY 6" ABOVE KITCHEN SINK)

DRAINS MUST HAVE 1/4" FALL PER. FOOT

- 1 CLOTHESWASHER STANDPIPE
- 2 SHOWER
- 3 WATER CLOSET
- 4 LAVATORY
- 5 KITCHEN SINK

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