

## WOOD FRAMING INFORMATION

The following information is intended as a guide, and is based on the Minnesota State Building Code and good building practice. Although every attempt has been made to verify accuracy in the handout, no guarantees are made to its accuracy. As the Minnesota State Building Code includes over 500 pages of building requirements, this document cannot include all information that might be relevant to your project. Responsibility for compliance with applicable codes belongs to the permit holder. For specific questions regarding the code requirements, refer to the applicable codes or contact us.

### FLOOR FRAMING (R502)

#### GIRDERS

- Girder end joints must bear on supports or on hangers (R502.6).
- Minimum bearing 1½" on wood, 3" on masonry or concrete (R502.6).
- Posts supporting beams and girders require positive connections (R502.9).
- Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls, or partitions more than the joist depth (R502.4).
- Notching and boring of sawn lumber must be done in accordance with Figure R502.8.
- Notching and boring of engineered lumber must be done according to manufacturer's instructions.

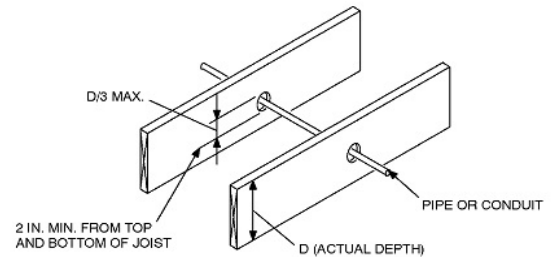
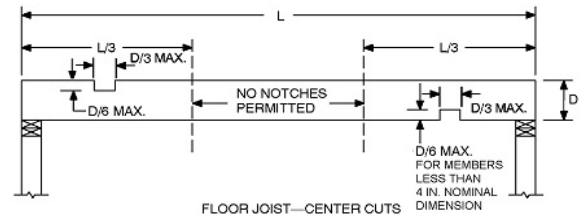


Fig. 1: Cutting, notching and drilling

#### JOISTS

- Minimum bearing 1½" on wood or metal, 3" on concrete (R502.6).
- Joists into side of girder requires hanger or minimum 2" x 2" ledger (R502.6.2).
- Joist lap minimum 3" fastened with (3) 10d face nails or equivalent metal or wood splice (R502.6.1).
- Joists shall be supported laterally at ends (R502.7).
- Manufactured lumber requires lateral restraints in accordance to manufacturer's installation instructions.
- Notches and holes per Table 1 (below) and Figure 1 (above).

TABLE 1	JOIST SPAN, NOTCHING & BORING					
	Spans-10 lb. Dead Load, 40 lb. Live Load			Notch Depth		Boring
SIZE <sup>A</sup>	12 in. O.C.	16 in O.C.	24 in O.C.	End	Outer 1/3	2 in. to edge
DF 2x6	10'-9"	9'-9"	8'-3"	1 3/8"	7/8"	1 ½"
SP 2x6	10'-3"	9'-4"	7'-7"			
DF 2x8	14'-2"	12'-9"	10'-5"	1 13/16"	1 3/16"	2 3/8"
SP 2x8	1'-6"	11'-10"	9'-8"			
DF 2x10	18'-0"	15'-7"	12'-9"	2 5/16"	1 ½"	3 1/16"
SP 2x10	16'-2"	14'-0"	11'-5"			
DF 2x12	20'-11"	18'-1"	14'-9"	2 7/8"	1 7/8"	3 ¾"
SP 2 x12	19'-1"	16'-6"	13'-6"			

A. "DF"= Douglas Fir-Larch #2, "SP"= Southern Pine #2

## FIRE PROTECTION

- 1/2" gypsum board or equivalent under floor framing (R302.13).

### EXCLUSIONS

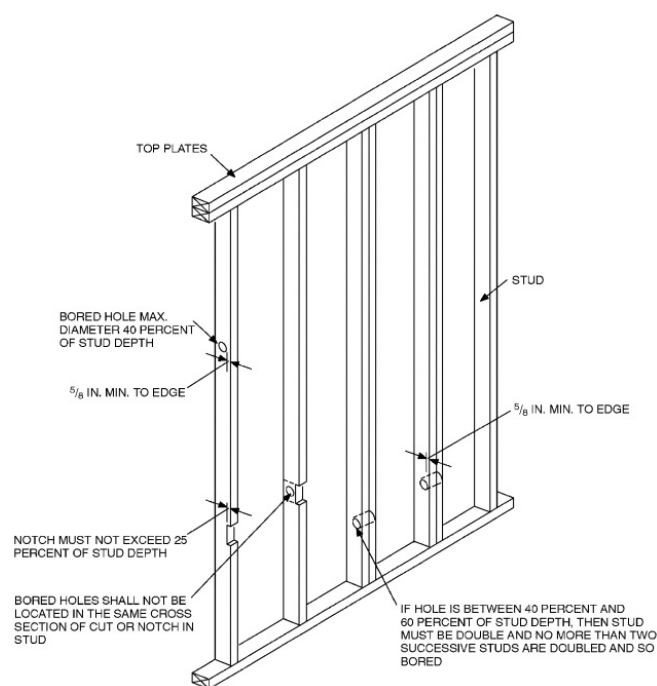
- ✓ Floors over sprinkler-protected space or unused crawl spaces that are not used to the storage or installation of fuel-fired or electric heating appliances.
- ✓ Dimension lumber (not I-joists) minimum 2x10 nominal dimension.

## WALL FRAMING (R602)

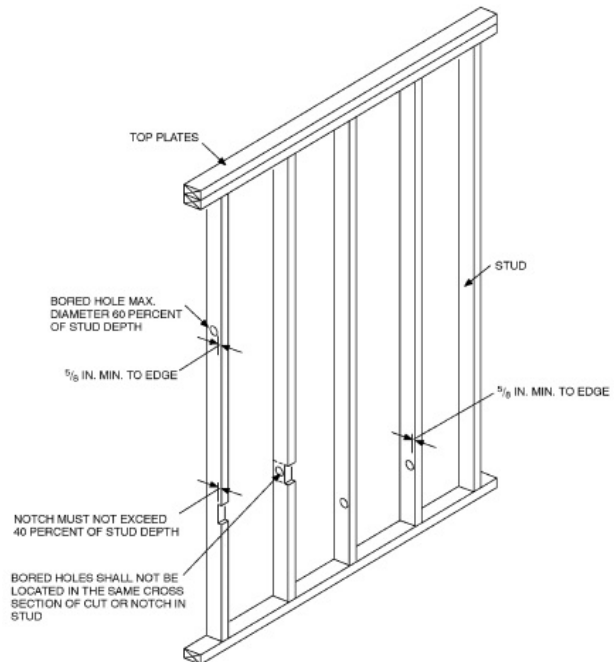
### Stud Framing

- Stud spacing, notching and boring per Table 2 and Figures 2 and 3.

TABLE 2	STUD SIZING, SPACING, NOTCHING & BORING		
Stud Size	2x4	3x4	2x6
<b>Bearing walls (to 10'-0" high)</b>			
Supporting roof & ceiling	24" O.C. <sup>B</sup>	24" O.C.	24" O.C.
Roof & ceiling + 1 floor	16" O.C. <sup>B</sup>	24" O.C.	24" O.C.
Roof & ceiling + 2 floors	n/a	16" O.C.	16" O.C.
Notching R602.6(1) <sup>A</sup>	7/8"	7/8"	1 3/8"
Boring R602.6(1) <sup>A</sup>	1 3/8"	1 3/8"	2 3/16"
Boring 2 doubled consecutive	2"	2"	3 1/4"
<b>Nonbearing walls</b>			
Notching R602.6(2) <sup>A</sup>	1 3/8"	1 3/8"	2 3/16"
Boring R602.6(2) <sup>A</sup>	2"	2"	3 1/4"
A. Approved stud shoes are allowed for notching and boring that exceed this table			
B. Limited to roof spans ≤ 32'-0"			



**Fig 2: Notching and bored hole limitations for exterior walls and bearing walls**

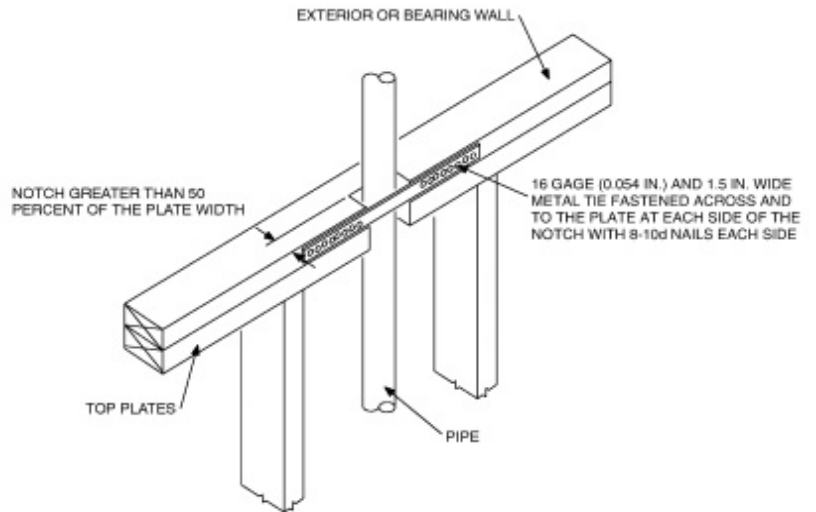


**Fig 3: Notching and bored hole limitations for interior nonbearing walls**

- Studs must fully bear on minimum 2x nominal sole plate (R602.3.4).
- Corners require (3) studs minimum (Fig. R602.3(2)).
- Studs shall be continuous from support at the sole plate to a support at the top plate (R602.3).

### Top Plates

- Bearing wall intersections and corners must overlap (R602.3.2).
- End joints must offset 24" minimum (R602.3.2).
- Joints need not be over studs (R602.3.2).
- Minimum 16 gauge 1½" strap with minimum (8)-10d nails, with minimum 6" past each side of notches or holes > 50% of plate width (see Figure 4) (R602.6.1).



**Fig. 4: Top plate framing to accommodate piping**

### Cripple Walls

- Cripple walls <14" shall be continuously sheathed or solidly blocked (R602.9).
- Studs must be ≥ studs above them. Walls > 4'-0" sized as additional story (R602.9).
- All cripple walls shall be supported on continuous foundations (R602.9).

### Wood Structural Wall Sheathing

- Panels require grade stamp from approved agency and must conform to Table 3 (R602.3).

TABLE 3 [R602.3(3)] MINIMUM NAIL		MINIMUM WOOD STRUCTURAL PANEL SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (INCHES)	MAXIMUM WALL STUD SPACING	PANEL NAIL SPACING		Ultimate Design Wind Speed		
					EDGES (INCHES O.C.)	FIELD (INCHES O.C.)	WIND EXPOSURE CATEGORY		
SIZE	PENETRATION (INCHES)						B	C	D
6d	1.5	24/0	3/8	16	6	12	140	115	110
8d	1.75	24/16	7/16	16	6	12	170	140	135
				24	6	12	140	115	110

- Fasten direct to framing members in accordance with Table 4 (R602.3).

TABLE 4 [R602.3(1)] FASTENER SCHEDULE FOR STRUCTURAL MEMBERS		
CONNECTION	NUMBER & TYPE OF FASTENER <sup>A</sup>	LOCATION
<b>ROOF</b>		
Blocking between joists or rafters to top plate	4-8d box (2 ½"x 0.113") 3-8d common (2 ½"x 0.131") 3-10d box (3"x 0.128") 3-3" x 0.131 nails	Toe nail
Ceiling joists to plate	4-8d box (2 ½"x 0.113") 3-8d common (2 ½"x 0.131") 3-10d box (3"x 0.128") 3-3" x 0.131 nails	Toe nail per joist
Ceiling joists not attached to parallel rafter, laps over partitions	4-10d box (3"x 0.128") 3-16d common (3 ½"x 0.162) 4-3" x 0.131" nails	Face nail
Ceiling Joist attached to parallel rafter (heel joint)	See Section 802.5.2	Face Nail
Collar tie to rafter face nail or 1 ¼" x 20 ga. ridge strap to rafter	4-10d box (3"x 0.128") 3-10d common (3 x 0.148") 4-3" x 0.131" nails	Face nail each rafter

Rafter or roof truss to plate	3-16d box nails (3 1/2" x 0.135") 3-10d common nails(3"x0.148") 4-10d box nails (3"x0.128") 4-3"x 0.131" nails	2 toenails on one side & 1 toenail on opposite side of each rafter or truss
Roof rafters to ridge, valley, or hip rafters or to minimum 2" ridge beam	4-16d (3 1/2" x 0.135") 3-10d common (3"x0.148") 4-10d box (3"x0.128") 4-3"x 0.131" nails	Toe nail
	3-16d box (3 1/2" x 0.135") 2-16d common (3 1/2" x 0.162") 3-10d box (3"x0.128") 3-3"x 0.131" nails	End Nail
<b>WALL</b>		
Stud to stud (not braced wall panels)	16d common (3 1/2" x 0.162")	24" o.c
	10d box (3"x0.128") 3"x 0.131" nails	16" o.c
Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box nails (3 1/2" x 0.135") 3"x 0.131" nails	12" o.c
	16d common (3 1/2" x 0.162")	16" o.c
Built-up header 2" to 2" w/ 1/2" spacer	16d common (3 1/2" x 0.162")	16" o.c each edge face nail
	16d box nails (3 1/2" x 0.135")	12" o.c each edge face nail
Continuous header to stud	5-8d box (2 1/2" x 0.113") 4-8d common (2 1/2" x 0.131") 4-10d box (3"x 0.128")	Toe nail
Top plate to top plate	16d common (3 1/2" x 0.162")	16" o.c
	10d box (3"x0.128") 3"x 0.131" nails	12" o.c
Double top plates, minimum 24" offset of end joints in lapped area	8-16d common (3 1/2" x 0.162") 12-16d box nails (3 1/2" x 0.135") 12-10d box (3"x 0.128") 12-3"x 0.131" nails	Face nail on each side of end joint
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
	16d box nails (3 1/2" x 0.135") 3"x 0.131" nails	12" o.c
Bottom plate to joist, rim joist, band joist or blocking (at braced wall panels)	3-16d box nails (3 1/2" x 0.135") 2-16d common (3 1/2" x 0.162") 4-3"x 0.131" nails	3 ea. 16" o.c 2 ea. 16" o.c 4 ea. 16" o.c
Top or bottom plate to stud	4-8d box (2 1/2" x 0.113") 3-16d box (3 1/2" x 0.135") 4-8d common (2 1/2" x 0.131") 4-10d box (3"x 0.128") 4-3"x 0.131" nails	Toe nail
	3-16d box nails (3 1/2" x 0.135") 2-16d common (3 1/2" x 0.162") 3-10d box (3"x0.128") 3-3"x 0.131" nails	End Nail
Top plates, laps at corners and intersections	3-10d box nails (3 x 0.128") 2-16d common (3 1/2" x 0.162") 3-3"x 0.131" nails	Face Nail
1" brace to each stud and plate	3-8d box (2 1/2" x 0.113") 2-8d common (2 1/2" x 0.131") 2-10d box nails (3 x 0.128") 2 staples, 1 3/4"	Face nail
1"x6" Sheathing to each bearing	3-8d box (2 1/2" x 0.113") 2-8d common (2 1/2" x 0.131") 2-10d box nails (3 x 0.128") 2 staples, 1' crown, 16ga., 1 3/4"	Face Nail
1" x 8" and wider sheathing to each bearing	3-8d box (2 1/2" x 0.113") 3-8d common (2 1/2" x 0.131") 3-10d box nails (3 x 0.128") 3 staples 1 3/4"	Face Nail
	Wider than 1"x8" 4-8d box (2 1/2" x 0.113") 3-8d common (2 1/2" x 0.131") 3-10d box nails (3 x 0.128") 4 staples, 1" crown, 16ga., 1 3/4"	

<b>Floors</b>		
Joist to sill, top plate or girder	4-8d box (2 ½" x 0.113") 3-8d common (2 ½" x 0.131") 3-10d box nails (3 x 0.128") 3-3" x 0.131" nails	Toe Nail
Rim joist, band joist or blocking to sill or top plate (roof application also)	8d box (2 ½" x 0.113")	4" o.c Toe Nail
	8d common (2 ½" x 0.131") 10d box nails (3 x 0.128") 3-3" x 0.131" nails	6" o.c Toe Nail
1" x 6" subfloor or less to each joist	3-8d box (2 ½" x 0.113") 2-8d common (2 ½" x 0.131") 3-10d box nails (3 x 0.128") 2 staples, 1" crown, 16ga., 1 3/4"	Face Nail
2" subfloor to joist or girder	3-16d box nails (3 ½" x 0.135") 2-16d common (3 1/2" x 0.162")	Blind and Face
2" planks (plank and beam-floor or roof)	3-16d box nails (3 ½" x 0.135") 2-16d common (3 1/2" x 0.162")	At Each Bearing
Band or Rim Joist	3-16d box nails (3 ½" x 0.135") 2-16d common (3 1/2" x 0.162") 3-10d box (3" x 0.128") 3-3" x 0.131" nails	
Built-up girders and beams, 2" lumber layers	10d	32" o.c. top & bottom staggered + 2 @ ends & splices
Ledger strip supporting joists or rafters	3-16d	At each joist or rafter
<b>WOOD STRUCTURAL PANELS, SUBFLOOR, ROOF &amp; INTERIOR WALL SHEATHING TO FRAMING &amp; PARTICLEBOARD WALL SHEATHING TO FRAMING</b>		
3/8" – ½"	6d common nail (subfloor, wall)	6" o.c. edges
	8d common nail (roof)	12" o.c. field
19/32" – 1"	8d common nail	6" o.c. edges 12" o.c. field
1-1/8" to 1 ¼"	10d common nail or 8d deformed nail	6" o.c. edges 12" o.c. field
<b>A. Common or box nails unless otherwise noted</b>		

## WALL BRACING FOR WOOD FRAME BUILDINGS (R602.10)

### Locations

- Length of a braced wall line shall be the distance between its ends (R602.10.1.1).
- Angled corners w/ diagonal ≤8'-0" shall be permitted to angle out of plane (R602.10.1.4).
- All exterior walls parallel to a braced wall line shall be offset not more than 4'-0" (R602.10.1.2).
- Braced wall panel max. 20'-0" between adjacent edges.
- Braced wall panels must start within 10' of a corner (R602.10.2.2).

### Methods (R602.10.4)

- All buildings require bracing by one of the following methods:
  - ✓ Intermittent bracing methods
  - ✓ Continuous sheathing
  - ✓ Simplified wall bracing method
- Intermittent braced wall panels minimum 48" in length excludes the following:
  - ✓ Alternate braced wall panels
  - ✓ Portal frame with hold-downs
- Portal frame at garage door openings (PFG)
  - ✓ Only allowed in single story or supporting one story + roof
  - ✓ Counts as 1.5x its width for bracing
  - ✓ Constructed as Alternate Brace Wall with following provisions:
    - Minimum width-24", maximum height 10'-0"
    - Minimum 7/16" sheathing extends over solid or glue-lam garage header
    - Sheathing nailed with 8d common or galvanized box nails, 3" o.c.
    - Minimum 1,000lb. strap, header to inner studs opposite side of sheathing
    - BWP directly on foundation with (2) ½" bolts with plate washers

- Portal frame with hold-downs at garage door openings (PFH)
  - ✓ Only allowed in single story or supporting one story + roof
  - ✓ Contributing length 48"
  - ✓ Constructed as Alternate Brace Wall with following provisions:
    - Supporting roof only - minimum width 16", maximum height 10'-0"
    - Supporting one story + roof - minimum width 24", maximum height 10'-0"
    - Minimum 3/8" sheathing extends over solid or glue-lam garage header
    - Sheathing nailed with 8d common or galvanized box nails, 3" o.c.
    - Minimum (2) 4,200 lb strap-type hold downs per each side of opening, embedded into concrete
    - Minimum tension strap capacity as required in Table 5

**TABLE 5 [R602.10.6.4] TENSION STRAP CAPACITY FOR RESISTING WIND PRESSURES PERPENDICULAR TO METHOD PFH, PFG & CS-PF BRACED WALL PANELS**

Min. wall stud framing nominal size and grade	Maximum pony wall height (feet) (height over top of header)	Maximum total wall height (feet)	Maximum opening width (feet)	Tension strap capacity required (pounds)
				Basic wind speed 90 mph, Exposure C
2 x 6 Stud Grade	2	12	9	1,750
			16	3,550
			18	4,100
	4	12	9	2,775
			16	Design Required
			18	Design Required

**Panel joints in Braced Wall Panels (BWPs) (R602.10.10)**

- Vertical joints shall occur over, and be fastened to, common studs. Horizontal joints shall occur over, and be fastened to, common blocking, minimum 1½" thick.

**TRUSSES (R802.10)**

- Design drawings must be approved by Building Official prior to installation (R802.10.1).
- Design drawings must be included with truss shipment at jobsite.
- Design drawing must include following information:
  - ✓ Slope or depth, span, and spacing
  - ✓ Location of all joints
  - ✓ Required bearing widths
  - ✓ Design loads, including top chord live and dead loads, bottom chord live and dead loads, concentrated loads, and wind and earthquake loads
  - ✓ Adjustments to connector design values for conditions of use
  - ✓ Each reaction force and direction
  - ✓ Joint connector type and description
  - ✓ Lumber size, species, and grade for each member
  - ✓ Connection requirements
  - ✓ Calculated deflection ratio
  - ✓ Maximum axial compression forces (for design of lateral bracing)
  - ✓ Required permanent bracing locations
- No alterations without approval of registered design professional (R802.10.4).
- No added loads (such as HVAC) without verification of capacity (R802.10.4).
- Bearing point connectors required with uplift rating greater than 200 pounds (R802.11.1).

## RAFTERS AND CEILING JOISTS (R802.3)

- Roofs <3:12 slope design ridges, valleys, and hips as beams (R802.3)
- Rafter horizontal spans per Table 6 for ceiling attached to rafters, (for other scenarios contact inspection department)
- Rafter span can be measured from purlin support (R802.5)
- Purlins must be ≥ dimension of rafters they support (R802.5.1)
- Purlin supports minimum 2 x 4, max spacing 48" o.c. (R802.5.1)
- Purlin supports minimum 45 degrees from horizontal (R802.5.1)
- Ridge minimum 1x material and full depth of cut rafter ends (R802.3)
- Valleys and hip rafters minimum 2x material and full depth of cut rafter ends (R802.3)
- Hip and valley rafters adequate to support load: max deflection L/180
- End of each rafter or joist minimum 1½" bearing on wood, 3" on masonry (R802.6)
- Notching and boring same as floor joists and girders (R802.7.1)
- Cantilevered eave rafters ≤ 2'-0" max notch ¼ depth of rafter (R802.7.1.1)
- Ceiling joist end cuts max ¼ joist depth at inside face (R802.7.1.2)
- Rafter ties required if ceiling joists do not create tie to parallel rafters (R802.3.1)
- Rafter ties minimum 2 x 4 in lower 1/3 of every rafter pair (R802.3.1)
- Collar ties for wind uplift in upper 1/3, max 4'-0" o.c., can be 1x4 (R802.3.1)
- Headers and trimmers >4'-0" doubled, hardware for headers > 6'-0"

TABLE 6	RAFTER HORIZONTAL SPANS [T802.5.1(6)] 10LB. DEAD LOAD, 50LB. GROUND SNOW LOAD								
	SIZE	DOUGLAS FIR-LARCH #2—SPACING O.C.				SOUTHERN PINE #2—SPACING O.C.			
		12"	16"	19.2"	24"	12"	16"	19.2"	24"
2X4	7-3	6-7	6-1	5-5	7-3	6-7	6-2	5-9	
2X6	11-3	9-9	8-11	7-11	11-5	10-2	9-4	8-4	
2X8	14-3	12-4	11-3	10-1	15-0	13-2	12-0	10-9	
2X10	17-5	15-1	13-9	12-4	18-2	15-9	14-4	12-10	
2X12	20-2	17-6	15-11	14-3	21-3	18-5	16-10	15-1	

## ROOF VENTILATION (R806)

- Enclosed attics and enclosed rafter spaces shall have cross ventilation for each separate space (R806.1).
- Dimension of ventilation openings minimum 1/16", maximum ¼" (R806.1)
- Openings > ¼" requires 1/16" to ¼" mesh screening (R806.1)
- Minimum net opening area 1:150 of vented area with the following exceptions (R806.2)
  - ✓ Reduction to 1:300 if 40%-50% of vents in upper half and ≤ 3'-0" below ridge, measured vertically, with the balance of the required ventilation provided by eave or cornice vents, or
  - ✓ Reduction to 1:300 Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling
- Insulation minimum 1" clearance to sheathing and vents (R806.3)
- Vent openings in accordance to manufacturer's installation instructions (R806.4)

## ATTICS (R807)

- Buildings with combustible roof or ceiling construction shall have an attic access opening if:
  - 1) attic area is > 30 sq. ft., and
  - 2.) vertical height ≥ 30".
- If access is required, the rough opening must be a minimum 22" x 30".
- If access is required, there must be 30" headroom measured vertically from the bottom of the ceiling framing members to some point above the access.
- Opening must be large enough to remove mechanical equipment, if any is installed.