

**DESIGN AND DETAILING FOR ROOF DIAPHRAGMS WITH COR-A-VENT RIDGE AND EAVE VENTS
ENGINEERED, UNBLOCKED DIAPHRAGMS**

**PART I – DETAILS
PART II – ENGINEERED BASIS OF RIDGE AND EAVE VENT DETAILS
PART III – EXAMPLE CALCULATIONS**

PREPARED FOR:

COR-A-VENT, INC.

17 NOVEMBER 2004

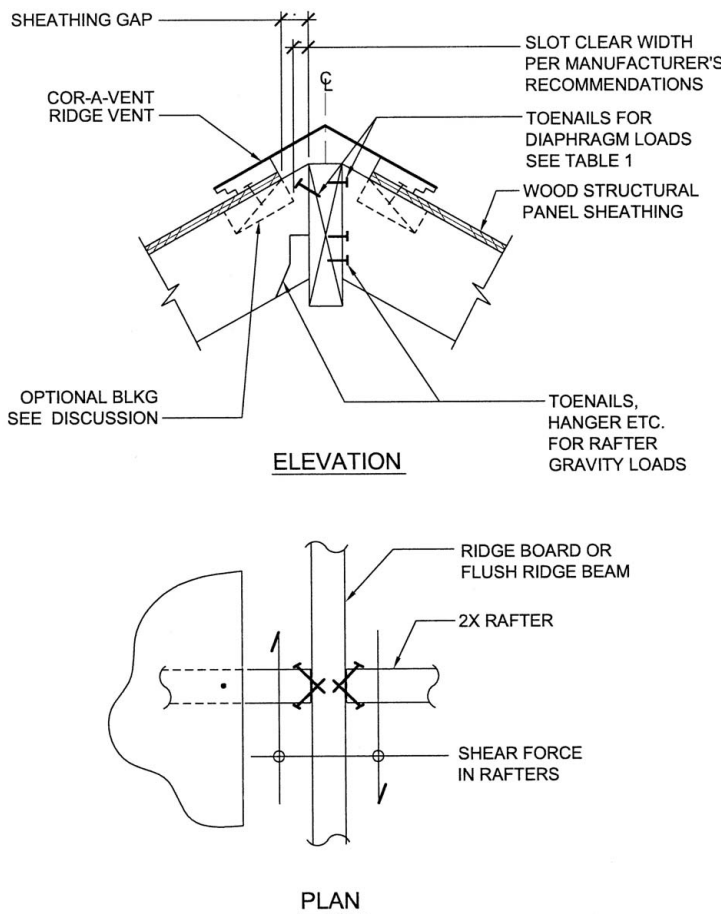
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**DETAIL 1A. CONTINUOUS RIDGE BOARD OR RIDGE BEAM AND SOLID-SAWN
RAFTERS -TOENAIL.**



An ASD shear force equal to the unit shear times the rafter member spacing is assumed to be in the rafter due to sheathing nailing. The rafter force is transferred through toenails to the ridge board or beam, and again transferred through toenails to the rafter on the far side, and into the diaphragm. Toenails for each rafter to ridge member connection are shown in Table 1. The toenails are calculated to transfer diaphragm forces only. Connection for vertical gravity forces must be provided in addition. Although blocking between rafters at the edge of the sheathing is strictly speaking not required for an unblocked diaphragm, some engineers believe that this is good practice and require blocking.

TABLE 1. ALLOWABLE DIAPHRAGM UNIT SHEAR BASED ON TOENAILED RAFTER CONNECTION^{1,2,3}

Rafter Spacing (in.)	Number of 16d Toenails Per Rafter ⁴	Allowable ASD Unit Shear (plf)			
		Sinker installed w/ framing MC≤19%	Sinker installed w/ framing MC>19%	Box installed w/ framing MC≤19%	Box installed w/ framing MC>19%
12	2	266	186	234	164
	3	320	279	320	246
16	2	200	140	176	123
	3	299	209	263	185
	4	320	279	320	246
24	2	133	93	117	82
	3	200	140	176	123
	4	266	186	234	164

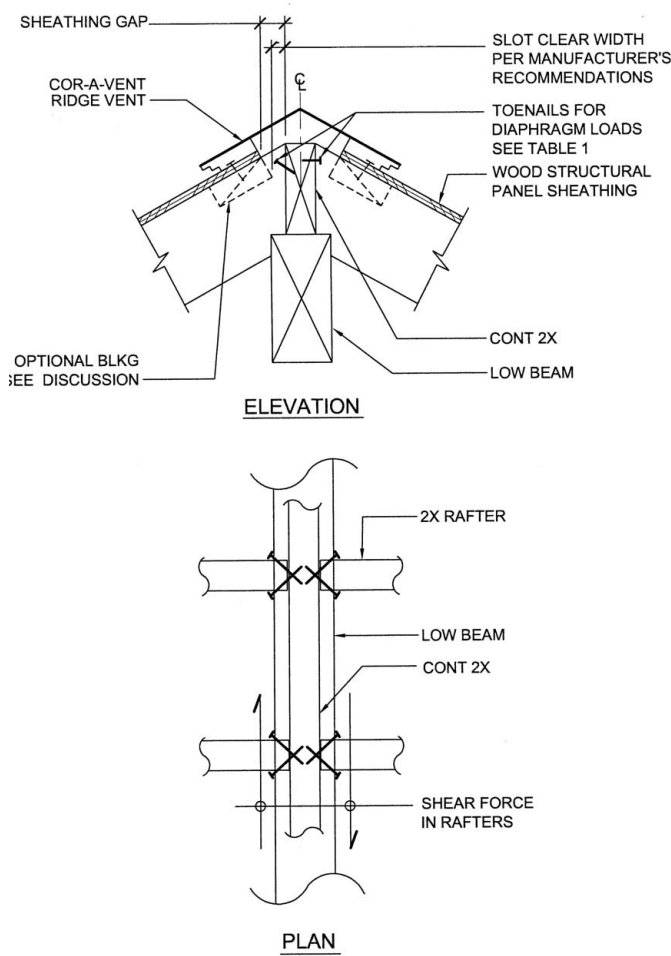
¹Tabulated allowable unit shears are based on SPF framing. An increase of 17 percent is permitted for DF-L framing. Adjustments per 2001 NDS are required for other species.

²Maximum tabulated allowable unit shear is 320 plf to match maximum unblocked diaphragm shear permitted by IBC Table 2306.3.1.

³See Part III of this report for example calculations used as basis of this table. See Part II for limitations.

⁴Toenails installed per AF&PA National Design Specification for Wood Construction. Care must be taken to avoid framing member splitting at toenails. Toenails at split framing may not be counted towards required number.

DETAIL 1B. LOW RIDGE BEAM AND SOLID-SAWN RAFTERS - TOENAIL.



Detail 1B shows an alternate to Detail 1A with the ridge beam low. Detail 1B shows a continuous 2x member at the rafter level rather than blocking between rafters. This is because toenailing the rafters to blocking is difficult. See also Detail.

An ASD shear force equal to the unit shear times the rafter member spacing is assumed to be in the rafter due to sheathing nailing. The rafter force is transferred through toenails to the ridge board, and again transferred through toenails to the rafter on the far side, and into the diaphragm. Toenails for each rafter to ridge member connection are shown in Table 1. The toenails are calculated to transfer diaphragm forces only. Connection for vertical gravity forces must be provided in addition. Although blocking between rafters at the edge of the sheathing is strictly speaking not required for an unblocked diaphragm, some engineers believe that this is good practice and require blocking.

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24	2	133	93	117	82
	3	200	140	176	123
	4	266	186	234	164

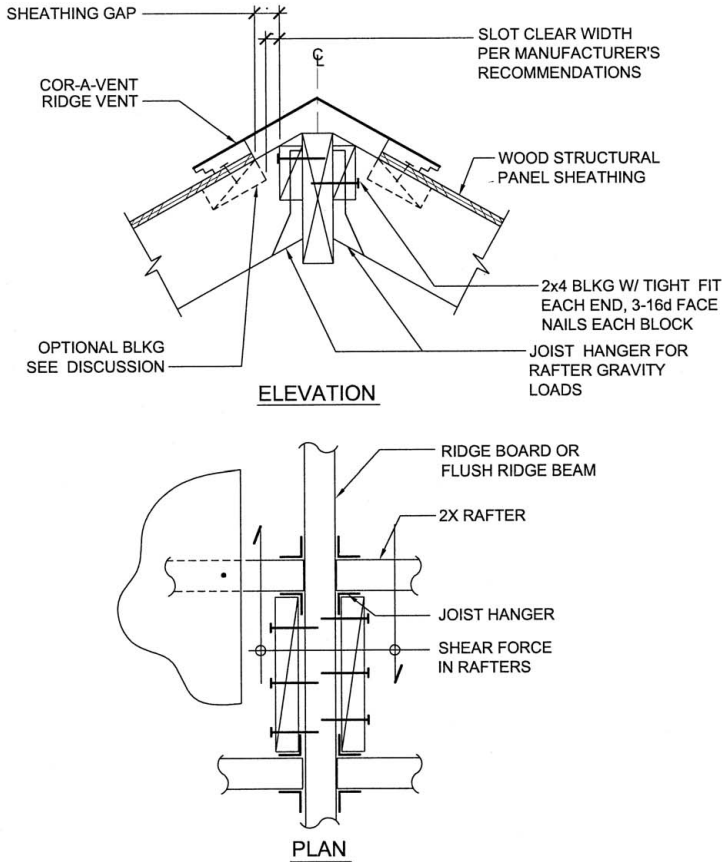
¹Tabulated allowable unit shears are based on SPF framing. An increase of 17 percent is permitted for DF-L framing. Adjustments per 2001 NDS are required for other species.

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³See Part III of this report for example calculations used as basis of this table. See Part II for limitations.

⁴Toenails installed per AF&PA National Design Specification for Wood Construction. Care must be taken to avoid framing member splitting at toenails. Toenails at split framing may not be counted towards required number.

**DETAIL 1C. CONTINUOUS RIDGE BEAM OR RIDGE BOARD AND SOLID-SAWN RAFTERS -
BLOCKING.**

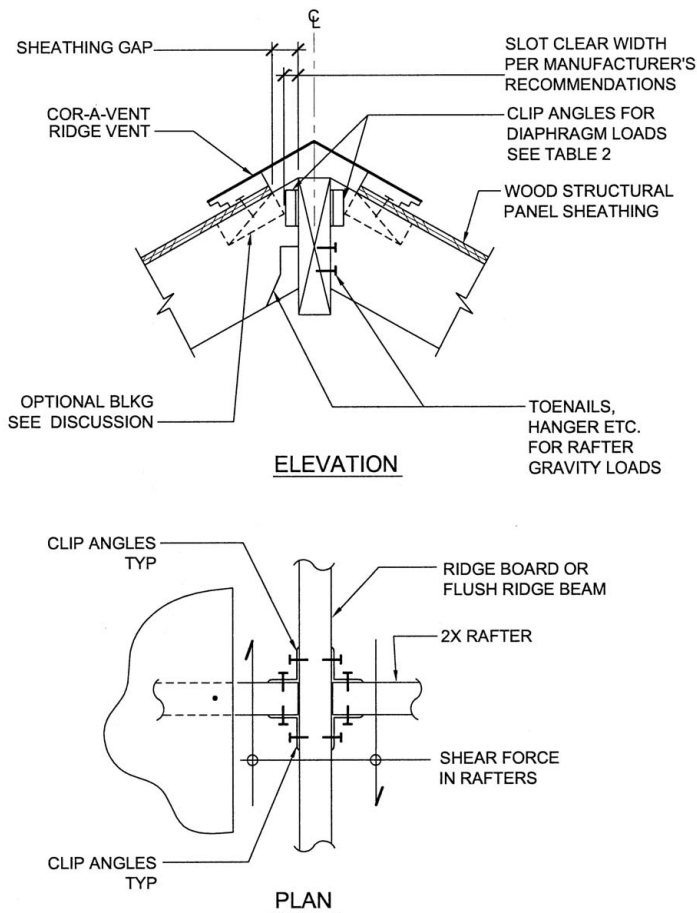


Detail 1C shows an alternate to Detail 1A with face nailed blocking substituted for toenails. This detail should be used where there is concern regarding adequate installation of toenails. It is important that the blocking between joists be located near the joist top and have a tight fit against the joist hanger at each end.

An ASD shear force equal to the unit shear times the rafter member spacing is assumed to be in the rafter due to sheathing nailing. The rafter force is transferred from the rafter to the blocking due to bearing. From the blocking the force is transferred to the ridge board or beam through face nailing. From the ridge board or beam the force is transferred to blocking and to the rafter on the far side, and finally back into the diaphragm

Three 16 penny face nails, common, box or sinker, are adequate to transfer force between blocking and ridge member for the maximum unblocked diaphragm forces tabulated by the IBC.

DETAIL 2A. CONTINUOUS RIDGE BOARD OR RIDGE BEAM AND SOLID-SAWN RAFTERS – ANGLE CLIP.



An ASD shear force equal to the unit shear times the rafter member spacing is assumed to be in the rafter due to sheathing nailing. The rafter force is transferred through an angle clip to the ridge board or beam, and again transferred through an angle clip to the rafter on the far side, and into the diaphragm. Angle clips for each rafter to ridge member connection are shown in Table 2. The angles are calculated to transfer diaphragm forces only. Connection for vertical gravity forces must be provided in addition. Although blocking between rafters at the edge of the sheathing is strictly speaking not required for an unblocked diaphragm, some engineers believe that this is good practice and require blocking.

TABLE 2. ALLOWABLE DIAPHRAGM UNIT SHEAR BASED ON CLIP ANGLE RAFTER CONNECTION^{1,2,3,4}

Rafter Spacing (in.)	Allowable ASD Unit Shear (plf)					
	L30 installed w/ framing MC≤19%	L30 installed w/ framing MC>19%	L50 installed w/ framing MC≤19%	L50 installed w/ framing MC>19%	L70 installed w/ framing MC≤19%	L70 installed w/ framing MC>19%
12	166	116	312	218	320	275
16	125	87	234	164	295	206
24	83	58	156	109	197	138

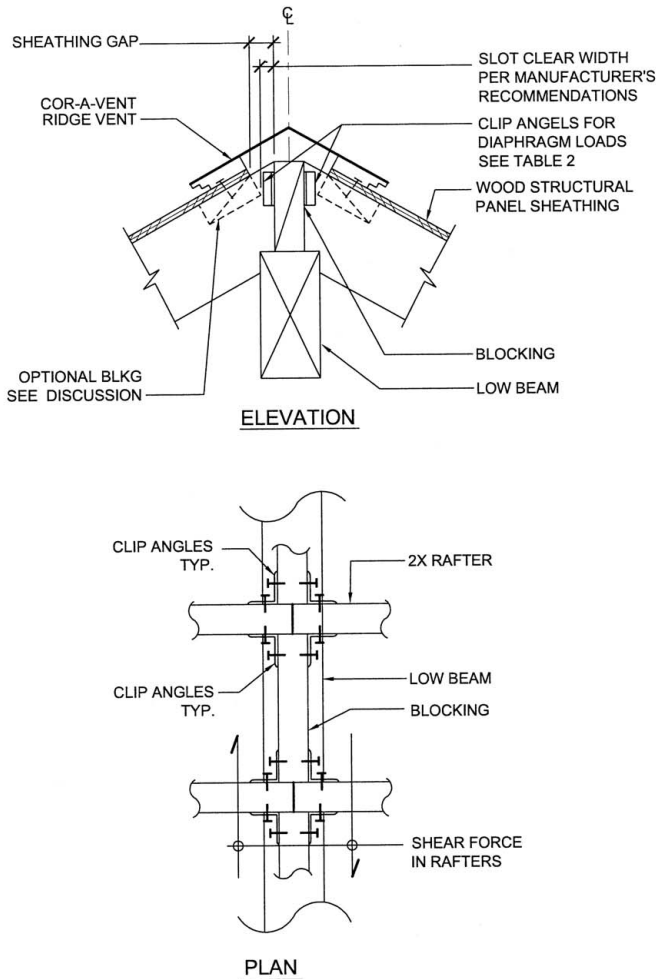
¹Tabulated allowable unit shears are based on installation with 10-penny common nails with a penetration on 1-1/2 inches.

²Tabulated allowable unit shears are based on SPF framing. An increase of 15 percent is permitted with DF-L framing. Adjustments per 2001 NDS are required for other species.

³Maximum tabulated allowable unit shear is 320 plf to match maximum unblocked diaphragm shear permitted by IBC Table 2306.3.1.

⁴See Part III of this report for example calculations. See Part II for limitations.

DETAIL 2B. LOW RIDGE BEAM AND SOLID-SAWN RAFTERS – ANGLE CLIP.



Detail 2B shows an alternate to Detail 2A with the ridge beam low. Detail 2B shows blocking between rafters. The angle clips may be visible if this detail is used for an open-beam ceiling. An ASD shear force equal to the unit shear times the rafter member spacing is assumed to be in the rafter due to sheathing nailing. The rafter force is transferred through an angle clip to the ridge blocking, and again transferred through an angle clip to the rafter on the far side, and into the diaphragm. Angle clips for each rafter to ridge member connection are shown in Table 2. The angles are calculated to transfer diaphragm forces only. Connection for vertical gravity forces must be provided in addition. Although blocking between rafters at the edge of the sheathing is strictly speaking not required for an unblocked diaphragm, some engineers believe that this is good practice and require blocking.

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12	166	116	312	218	320	275
16	125	87	234	164	295	206
24	83	58	156	109	197	138

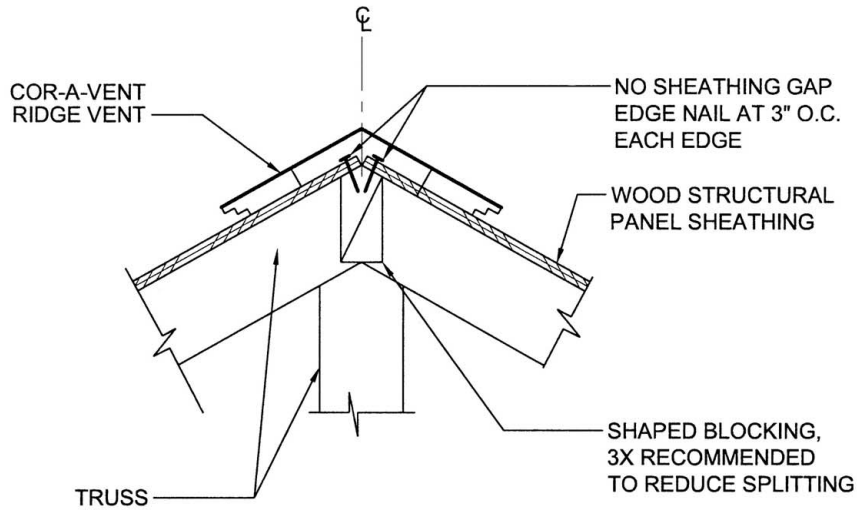
¹Tabulated allowable unit shears are based on installation with 10-penny common nails with a penetration on 1-1/2 inches.

²Tabulated allowable unit shears are based on SPF framing. An increase of 15 percent is permitted with DF-L framing. Adjustments per 2001 NDS are required for other species.

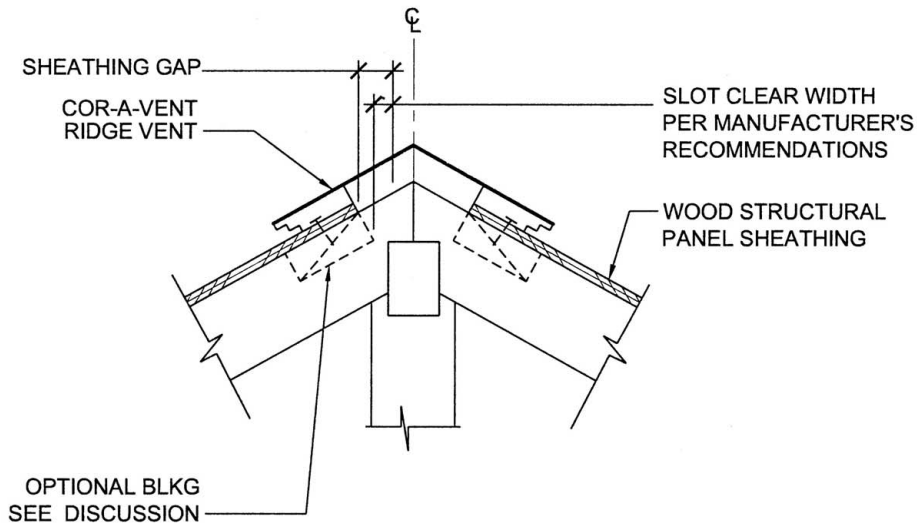
³Maximum tabulated allowable unit shear is 320 plf to match maximum unblocked diaphragm shear permitted by IBC Table 2306.3.1.

⁴See Part III of this report for example calculations. See Part II for limitations.

DETAIL 3. METAL PLATE TRUSSES WITH BLOCKING ALTERNATE BAYS.



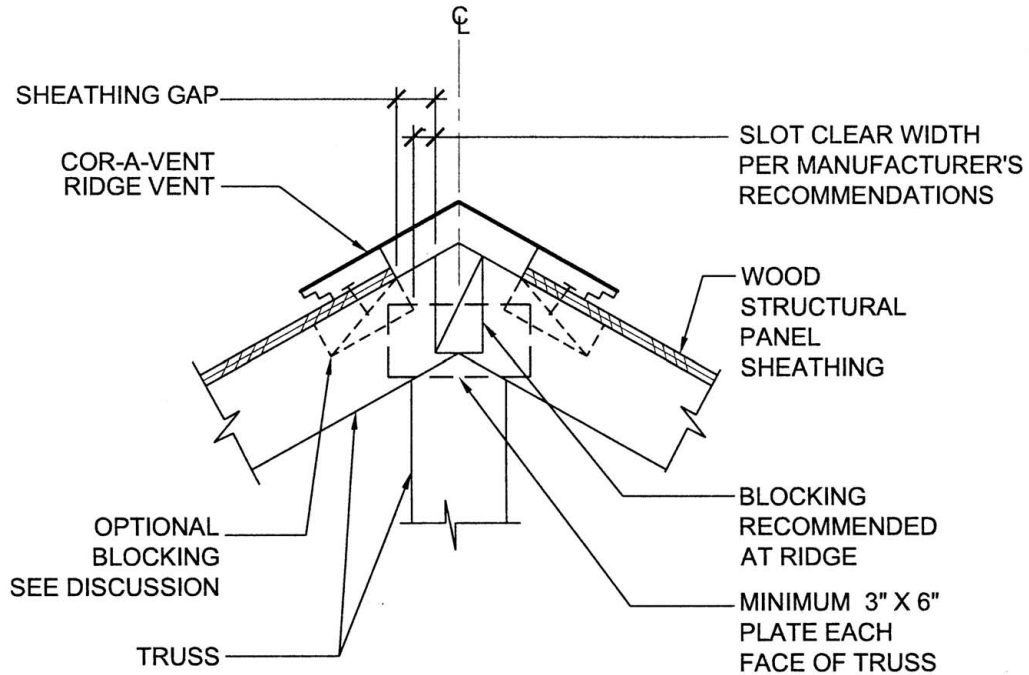
DETAIL 3A. SECTION AT BLOCKED TRUSS BAY



DETAIL 3B. SECTION AT VENTED TRUSS BAY

Where metal plate roof trusses are to be used as shown in Detail 3, it is recommended that ridge blocking with edge nailing be provided in every alternate truss bay. Roof sheathing edge nailing at three inches on center is required at blocked bays. Although blocking between rafters at the edge of the sheathing is strictly speaking not required for an unblocked diaphragm, some engineers believe that this is good practice and require blocking. Detail 4 provides an alternate for trusses when very low diaphragm loads occur.

DETAIL 4. METAL PLATE TRUSSES WITHOUT BLOCKING.



Where metal plate roof trusses are to be used as shown in Detail 4, it is recommended that ridge blocking be provided, even though not nailed to the sheathing. Use of Detail 4 is recommended only for very low load and simple diaphragms. It is suggested that the designer specify a minimum plate size of 3 x 6 inches (each face) for the ridge plate, matching the available testing. Although blocking between rafters at the edge of the sheathing is strictly speaking not required for an unblocked diaphragm, some engineers believe that this is good practice and require blocking. See Part II of this report for additional considerations in using Detail 4.

TABLE 4A TEST DATA FOR METAL PLATES¹

TABLE 4B SUGGESTED ALLOWABLE UNIT SHEARS¹

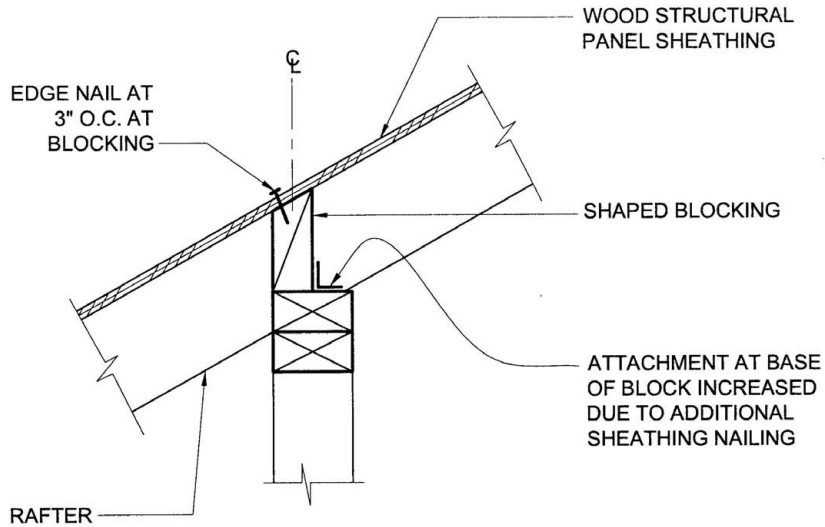
Average of maximum test load at mid-span test member (lbs), test member parallel to plate	898
Standard deviation of maximum test load at mid-span test member (lbs), test member parallel to plate	28
Average of maximum test load at mid-span test member (lbs), test member perpendicular to plate	765
Standard deviation of maximum test load at mid-span test member (lbs), test member perpendicular to plate	103

Truss Spacing (in.)	Allowable ASD Unit Shear (plf) suggested by Alpine Testing ¹
12	100
16	75
24	50

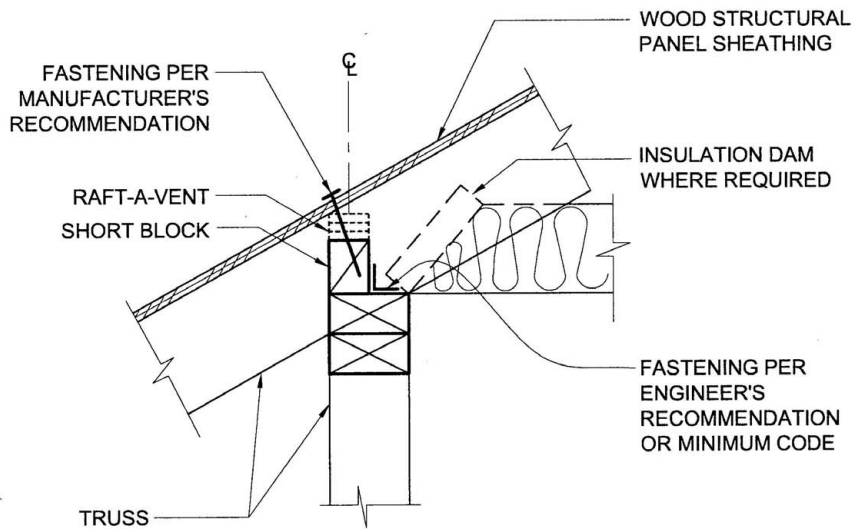
¹Based on test results from "Alpine Engineered Products, Inc., Research & Development Department, Report of Joint Tests," dated January 29, 1993. See Part II of this report for discussion and limits.

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DETAIL 5. EAVE VENT WITH BLOCKING AT ALTERNATE BAYS.



DETAIL 5A. SECTION AT BLOCKED EAVE



DETAIL 5B. SECTION AT VENTED EAVE

Where eave venting is needed, as shown in Detail 5, it is recommended that eave blocking with edge nailing be provided in every alternate roof framing bay. Roof sheathing edge nailing at three inches on center is required at blocked bays. This approach can also be applied to solid sawn framing and truss framing. Nailing required at the vented bays (Detail 5b) should not be used to reduce nailing in the blocked bays (Detail 5a).