

17.0

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L-Strap Method Specification Table									
Requirements that comply with building code provisions for the L-Bent Strap method									
Column →		1	2	3	4	5			
	Row number ↓	Exposure Category	Max 3 sec gust Basic wind speed	Spacing for right angle brackets	Spacing for screws sill plate to wall	Maximum Allowable length of Retrofit Stud Retrofit Configuration			
						A	B	C	D
Building code requirements	1	C	110	38"	19"	8'-0"	11'-3"	14'-9"	16'-0"
	2	C	120	32"	16"	7'-6"	10'-6"	13'-6"	16'-0"
	3	C	130	28"	14"	7'-0"	10'-0"	12'-3"	16'-0"
	4	C	140	24"	14"	7'-0"	10'-0"	12'-3"	16'-0"
	5	C	150	20"	10"	6'-6"	8'-9"	11'-0"	16'-0"
	6	B	110	48"	24"	8'-0"	12'-3"	16'-0"	NR
	7	B	120	40"	20"	8'-0"	11'-3"	14'-9"	16'-0"
	8	B	130	36"	16"	8'-0"	11'-3"	14'-9"	16'-0"
	9	B	140	30"	15"	7'-6"	10'-6"	13'-6"	16'-0"
	10	B	150	26"	13"	7'-0"	10'-0"	12'-3"	16'-0"
	11	Retrofit Elements				Size and number of retrofit elements			
	12	Horizontal Braces on attic floor and ceiling, size and number				2x4	2x4	2x4	2 each 2x4
	13	Retrofit Studs, size and number				2x4	2x6	2x8	2 each 2x8
	14	1-1/4" long fasteners to connect straps to retrofit studs and to horizontal brace at each end using #8 screws 1-1/2" long or 8d nails, minimum number				6	9	12	8
	15	Strap length, minimum length (this is not a building code requirement per se, but is the minimum length to get all the fasteners installed that are required in the line above)				24" flat 21" coil	36" flat 31" coil	49" flat 38" coil	30" flat 29" coil
	16	Bend L-bent straps from the middle as indicate in the row				7"	9"	11"	11"
	17	Compression block 3" fasteners secure compression blocks to horizontal braces, each block minimum number				6	8	10	12
	18	Compression block length for 2 fasteners placed side-by-side, minimum length				10"	12-1/2"	15"	17-1/2"
	19	Horizontal Brace all 2x4s 8' long, number				2	2	2	4
	20	Retrofit Stud, range of lengths				3 - 8'	10 - 12'	14 to 16'	16'
	21	Retrofit Stud assumed length for ordering				8'	12'	16'	2 each 16'
	22	Retrofit Stud size				2x4	2x6	2x8	2 each 2x8
Assumed cost each	23	Assumed Horizontal Brace, 2x4x8', cost each				\$ 3.00	\$ 3.00	\$ 3.00	\$ 3.00
	24	Assumed Retrofit Stud, cost each				\$ 3.00	\$ 7.13	\$ 12.00	\$ 12.00
	25	Assumed Strap, cost each				\$ 1.55	\$ 2.79	\$ 4.00	\$ 3.18
	26	Assumed cost of 1-1/4" fasteners, screws assumed each				\$ 0.09	\$ 0.09	\$ 0.09	\$ 0.09
	27	Assumed cost of 3" fasteners, screws assumed each				\$ 0.08	\$ 0.08	\$ 0.08	\$ 0.08
Costs	28	Cost for 1 retrofit (HB+RS+Straps+1-1/2" Fasteners+3" Fasteners)				\$ 18.02	\$ 26.67	\$ 36.00	\$ 66.48

Notes

NOT all building code requirements are included in the table or these notes.

Compression blocks are assumed to be made from scraps and lengths are base on 2 fasteners across.

Assumed costs are based on Florida June, 2010 prices without sales tax.

Not included are costs for brackets to make (Gable end wall)-to-(Wall below) connections.

3" fasteners must be 10d nails with minimum diameter of 0.148" and must be 3" long minimum OR

#8 3" long screws (drywall or other brittle metal screws are not acceptable)

1-1/4" fasteners must be 8d nails minimum 1-1/4" long OR minimum #8 minimum 1-1/2" long screws

Table 5.1. Specifications for the L-bent strap method that meet building code requirements and other helpful information. Be sure to read the notes below the table. A copy of this table is available for handy printing in Section 17.

	L-Bent Strap Method Materials Takeoff								
	Retrofit Configuration								Grand Total Number Needed
	A		B		C		D		
Item	Num @	X @	Num @	X @	Num @	X @	Num @	X @	
2x4x8' for Horizontal Braces	2		2		2		2		
2x4x8' for Retrofit Studs	1		---	---	---	---	---	---	
2x6x12' for Retrofit Studs	---	---	1		---	---	---	---	
2x8x16' for Retrofit Studs	---	---	---	---	1		2		
24" straps 20 gauge	2		---	---	---	---	---	---	
30" straps 20 gauge	---	---	---	---	---	---	4		
36" straps 20 gauge	---	---	2		---	---	---	---	
49" straps 20 gauge	---	---	---	---	2		---	---	
1-1/4" fasteners	24		36		48		64		
3" fasteners	47		59		71		150		
Pounds 1-1/2" screws	0.14		0.21		0.28		0.37		
Pounds 3" screws	0.62		0.78		0.94		1.98		
Number of retrofits for this Configuration -->	# =		# =		# =		# =		

To use this table to determine quantities:

First, in the bottom row enter the number of retrofits for each of the Configurations.

Next, multiple that number by Num @ for each row entry.

Finally, total the numbers across each row and enter that number in the Total column.

Screw weights will vary according to the particular brand and model selected.

Table 6.1. Materials takeoff form for the L-bent strap method. Instructions for use are given immediately above this caption and below the table.

U-Strap Method Specification Table									
Requirements that comply with building code provisions for the U-Bent Strap method									
Column →		1	2	3	4	5			
	Row number ↓	Exposure Category	Max 3 sec gust Basic wind speed	Spacing for right angle brackets	Spacing for screws sill plate to wall	Maximum Allowable length of Retrofit Stud			
						Retrofit Configuration			
						A	B	C	D
Building code requirements	1	C	110	38"	19"	8'-0"	11'-3"	14'-9"	16'-0"
	2	C	120	32"	16"	7'-6"	10'-6"	13'-6"	16'-0"
	3	C	130	28"	14"	7'-0"	10'-0"	12'-3"	16'-0"
	4	C	140	24"	14"	7'-0"	10'-0"	12'-3"	16'-0"
	5	C	150	20"	10"	6'-6"	8'-9"	11'-0"	16'-0"
	6	B	110	48"	24"	8'-0"	12'-3"	16'-0"	NR
	7	B	120	40"	20"	8'-0"	11'-3"	14'-9"	16'-0"
	8	B	130	36"	16"	8'-0"	11'-3"	14'-9"	16'-0"
	9	B	140	30"	15"	7'-6"	10'-6"	13'-6"	16'-0"
	10	B	150	26"	13"	7'-0"	10'-0"	12'-3"	16'-0"
	11	Retrofit Elements				Size and number of retrofit elements			
	12	Horizontal Braces on attic floor and ceiling, size and number				2x4	2x4	2x4	2 each 2x4
	13	Retrofit Studs, size and number				2x4	2x6	2x8	2 each 2x8
	14	1-1/4" long fasteners to connect straps to each of the two 1-1/2" edges of horizontal braces using #8 screws 1-1/2" long or 8d nails, minimum number				6	7	7	6
	15	Strap length, minimum length (this is not a building code requirement per se, but is the minimum length to get all the fasteners installed that are required in the line above)				30" flat 30" coil	36" flat 37" coil	49" flat 41" coil	36" flat 37" coil
	16	Bend all U-bent straps symmetrically				0	0	0	0
	17	Horizontal Brace all 2x4s 8' long, number				2	2	2	4
	18	Retrofit Stud, range of lengths				3 - 8'	10 - 12'	14 to 16'	16'
	19	Retrofit Stud assumed length for ordering				8'	12'	16'	2 each 16'
	20	Retrofit Stud size				2x4	2x6	2x8	2 each 2x8
Assumed cost each	21	Assumed Horizontal Brace, 2x4x8', cost each				\$ 3.00	\$ 3.00	\$ 3.00	\$ 3.00
	22	Assumed Retrofit Stud, cost each				\$ 3.00	\$ 7.13	\$ 12.00	\$ 12.00
	23	Assumed Strap, cost each				\$ 3.18	\$ 2.79	\$ 4.00	\$ 2.79
	24	Assumed cost of 1-1/4" fasteners, screws assumed each				\$ 0.09	\$ 0.09	\$ 0.09	\$ 0.09
	25	Assumed cost of 3" fasteners, screws assumed each				\$ 0.08	\$ 0.08	\$ 0.08	\$ 0.08
Costs	26	Cost for column (HB+RS+Straps+1-1/2" Fasteners+3" Fasteners)				\$ 20.32	\$ 24.67	\$ 32.60	\$ 59.64

Notes

NOT all building code requirements are included in the table or these notes.

Assumed costs are based on Florida June, 2010 prices without sales tax.

Not included are costs for brackets to make (Gable end wall)-to-(Wall below) connections.

3" fasteners must be 10d nails with minimum diameter of 0.148" and must be 3" long minimum OR

#8 3" long screws (drywall or other brittle metal screws are not acceptable)

1-1/4" fasteners must be 8d nails minimum 1-1/4" long OR minimum #8 minimum 1-1/2" long screws

Table 5.2. Specifications for the U-bent strap method that meet building code requirements and other helpful information. Be sure to read the notes below the table. A copy of this table is available for handy printing in Section 18.

U-Bent Strap Method Materials Takeoff									
Item	Retrofit Configuration								Grand Total Number Needed
	A		B		C		D		
	Num @	X #	Num @	X #	Num @	X #	Num @	X #	
2x4x8' for Horizontal Braces	2		2		2		4		
2x4x8' for Retrofit Studs	1		---	---	---	---	---		
2x6x12' for Retrofit Studs	---	---	1		---	---	---	---	
2x8x16' for Retrofit Studs	---	---	---	---	1		2		
24" straps 20 gauge	---	---	---	---	---	---	---	---	---
30" straps 20 gauge	2	---	---	---	---	---	---	---	
36" straps 20 gauge	---	---	2	---	---	---	4		
49" straps 18 gauge	---	---	---	---	2		---	---	
1-1/4" fasteners, screws	24		28		28		48		
3" fasteners, screws	75		83		91		182		
Pounds 1-1/4" screws	0.14		0.16		0.16		0.28		
Pounds 3" screws	0.99		1.09		1.20		2.40		
Number of retrofits for this Configuration -->	# =		# =		# =		# =		

To use this table to determine quantities:

First, in the bottom row enter the number of retrofits for each of the Configurations.

Next, multiple that number by Num @ for each row entry.

Finally, total the numbers across each row and enter that number in the Total column.

Screw weights will vary according to the particular brand and model selected.

Table 7.1. Materials takeoff form for the U-bent strap method. Instructions for use are given immediately above this caption and below the table.

1		2	3	4	5	6	7		8	9	10	11	Wall-to-Wall connections Spacing from Table 1 or 2 =	
Stud Num	Retrofit Stud on Left / Right	Retrofit Stud length	L-bent or U-bent	Config A, B, C, or D	Retrofit Stud width	Strap Length	Bend L from middle	# of fasteners for straps	Minimum Length	# of fasteners				
1	4/B	55	L	A										
2	"	49	L	A										
3	4	163	L	"										
4	4	127	L	"										
5	4	102	L	"										
6	"	80	L	"										
7	"	55	L	"										

Sketch checklist

- Truss or rafter
- Webbs on truss Yes/No
- Sketch in each stud 36" and longer
- Indicate length of existing stud
- Indicate where Horizontal Braces are limited
- Indicate sides for Retrofit Studs with check marks
- Indicate gable end vents
- Indicate obstacles
- Indicate dropped end wall with outriggers or outlookers

Example of sketch made in attic

Gable End Sketch & Worksheet for West end gable end

Wall-to-Wall connections Spacing from Table 1 or 2 = 36												
1 Stud Num	2 Retrofit Stud on Left / Right	3 Retrofit Stud length	4 L-bent or U-bent	5 Config A, B, C, or D	6 Retrofit Stud width	7		8		9 # of fasteners for straps	10 Minimum Length	11 # of fasteners
						Strap Length	Bend L from middle					
1	L/R	55	L	A	2x4	24	7			6	16	6
2	"	49	L	A	2x4	24	7			6	16	6
3	"	107	L	B	2x6	36	9			9	12x	8
4	"	127	L	B	2x6	36	9			9	12x	8
5	"	162	L	B	2x6	36	9			9	12x	8
6	"	80	L	A	2x4	24	7			6	16	6
7	"	55	L	A	2x4	24	7			6	16	6

Example of Worksheet

Sketch checklist

- Truss or rafter
- Webs on truss Yes/No
- Sketch in each stud 36" and longer
- Indicate length of existing stud
- Indicate where Horizontal Braces are limited
- Indicate sides for Retrofit Studs with check marks
- Indicate gable end vents
- Indicate obstacles
- Indicate dropped end wall with outriggers or outlookers

6.28.10

Gable End Sketch & Worksheet for Wardend gable end

ATTIC INSPECTION CHECKLIST

Gable end location on house. [Front], [Back], [Left], [Right], _____

===== Checklist of things to take into the attic=====

1. Print the *Wall-to-Wall Connection Details* figure so you can use it as a guide to what you may find.
2. Print the *Sample Gable End Sketch* page
3. Print several copies of the *Gable End Sketch* page, at least one for each gable end. Taking more than one page up for each gable end will be helpful so that when a sketch becomes too cluttered you can just use another page to finish up.
4. Tape measure
5. Flashlight (battery halogen is ideal) or other lighting
6. Pad of paper for making notes
7. Pen for taking notes
8. Clip board so you have firm surface for writing and a way to keep papers together.
9. Digital camera, if you have one.

===== Observations in the attic =====

First step: General observations

101. Roof system. Circle one [Truss] or [Rafters/ceiling joists]
(Trussed gable ends have studs flat wise to the wall. Trusses have metal plates connecting the component pieces of lumber together. Usually the lumber is 2x4 except that sometimes the top one will be 2x6 or bigger.)
(Raftered gable ends have studs with their edges to the wall. Rafters are usually bigger than 2x4s. Rafters usually have collar ties, i.e. horizontal 1x4s or 2x4s that run between rafters on opposite side of the peak and are located within a few feet of the peak. There may be diagonal members that connect rafters and ceiling joists. Most likely they will not be attached with metal plates, but instead just with nails.
102. Studs: Circle all that apply
[Flat face] (usually 3-1/2" wide) against the gable end wall] or
[Edge] (1-1/2" narrow edge) against wall]
[Both with one flat and the other on edge] There may be both types where there are two studs at a location with one flat and other edge wise.
[No studs] Siding may be just nailed to diagonal members of webbed trusses.
103. Truss webs are present? YES / NO
104. Stud spacing on gable end wall. Circle one: 16", 24", 32", 48"

Second step: Sketch in general information

201. Sketch all the studs 3' and longer by drawing a simple vertical line as suggested on *Sample Gable End Sketch* page. The precise locations are not important.
202. For each existing stud that is 3' or longer measure its length accurate to within a couple inches. Measure from the bottom of the stud to its highest point.
203. If webs are present on truss sketch them. Very rough approximate locations are good enough. The *Sample Gable End Sketch* page will help give you an idea about what you need to draw and note on your sketch page

204. It is optional to note the slope of the roof. Slope: _____ : 12 or
_____ vertically by _____ horizontally

Third step: Sketch information about feasibility of installing retrofit studs

301. For each existing stud location: can retrofit studs be installed?. If not place an 'X' on the side or sides that prevents installation of a retrofit stud. Note the reason, e.g. electrical pipe, plumbing pipe, bathroom exhaust pipe, gable end vent. Bear in mind that retrofit studs can be placed on either side of existing studs.
302. If an existing stud is not full length because it has been interrupted make a note of that and the reason for the interruption, e.g. gable end vent. If an existing stud has been cut for some reason, it is relatively ineffective, but the day can be salvaged by regarding it just as something to nail a retrofit stud AND another stud, a third stud. At each stud location there need to be two structurally sound studs.

Fourth step: Sketch information about feasibility of installing horizontal braces

At each location where studs are 3' or longer look for obstructions and impediments. The *Sample Sketch* suggests ways of making your sketch and of taking notes.

401. At each location draw in a diagonal line to represent each horizontal brace top and bottom. The reason for doing this is it intended to force you to evaluate for each horizontal brace (top and bottom and at each stud location) whether there is anything to prevent a horizontal brace from being installed in a straightforward way.
402. Evaluate each such existing stud to determine if horizontal brace that is at least 6-feet plus 2-1/2" long can actually be installed that will line up with both the existing stud and the location of the retrofit stud. Remember that the retrofit stud can be installed on either side of the existing stud. If a brace can be installed then indicate it with a little √ checkmark. This includes braces that may take some work to fish them under a wire, air conditioning duct, or something, or running the brace a bit non perpendicular to the wall to skirt something like a recessed light. As a reminder you might add a little note to yourself indicating what the obstruction was. Take a few pictures of the situation.
- Can a 6' horizontal brace be installed? **YES / NO**. If no, then answer the 2 questions below.
 - If **NO**, take pictures. How long can the brace be? _____ inches and how many framing members can it be secured to? **0, 1, 2, 3**. Indicate the number on the *Sketch Page*.
 - If the horizontal brace will have to be less than 4-feet long, how long can it be and can you install a piece of plywood decking that would span across the short brace and reach to longer braces on either side? Can plywood decking be added? **YES / NO**.
 - If a 6' Horizontal Brace cannot be installed, can a brace that is 4-feet long be installed? **YES / NO**. If yes, then circle:

Fifth step: Wall-to-Wall connection observations of lower wall

501. The lower wall is **Wood frame / Concrete block or concrete**

502. Lower wall: Observe construction of wall below. Find the drawings on **Figure 101 and 201** that closely matches what you see.
503. Upper wall. Observe the construction of the gable end wall above. Find a drawing found in the previous step that best reflects what you see. Circle it.
504. Take photos to show and remind you of what you see.
505. Note and photograph any existing fastening between the gable end wall and the wall below. Again, photos will help refresh your memory.
 - **Straps in concrete** are **16", 24", 32", 48" o.c.**
 - **Wood frame straps or hurricane ties** are **16", 24", 32", 48" o.c.**
 - **Bolts on top plate** are **2", 4", 6", or _____ o.c.**
 - All bolts have washers and nuts? **YES / NO.**
 - All bolts extend all the way to the top of the plate without the plate having to be chipped out? **YES / NO.**

Sixth step: Type of wall siding.

601. Circle what kind of material is applied to the outside of the gable end wall: Don't worry about whether there is felt paper, Tyvek®, or some other water barrier.
 - Plywood siding.
 - Plywood with an exterior finish on the outside such as board, vinyl, or aluminum.
 - Hardboard in 4x8' sheets
 - Thermo-ply®
 - Just board or hardboard type siding made of numerous individual pieces about 8 to 12" wide (high)
 - Just vinyl or aluminum siding
 - Other _____

Before leaving this gable end: When you have gotten to this point, a review of your observations may save you another trip into the attic. It is recommended that for each existing stud that is to be retrofitted you look carefully to determine that horizontal braces can be installed and that a retrofit stud can be installed. An effective way to do this is to simply start at one end of the attic, starting where the existing stud is 3' or longer, and ask yourself 1) can I install a Horizontal Brace on the attic floor in a straight forward manner, 2) can I install a Horizontal Brace on the bottom of the roof framing in a straight forward manner, and 3) can I install a Retrofit Stud in the usual manner. If the answer is yes to all three then that is great. That will be the usual case. However in practically every attic there will be something or another that requires a little adapting. Making notes on the sketch of installation issues will make planning easier and reduce the chance of forgetting details. You can see how that was done on the *Sample Sketch*. And there is nothing like pictures to answer those questions you have after leaving the attic.

Recommended Strap Lengths and Bending Locations for L-Bent Straps

Configuration as shown on Table 1	Number of fasteners at each end of each strap	Minimum length of LSTA or MSTA flat straps Table 1	Recommended length of coil strap Model Simpson CS20 or USP RS20-R	Bending location This takes into account the 2-1/2" up the retrofit stud, the depth of that stud, and an inch for space to place a fastener on horizontal braces
A	6	24"	21"	Bend 7" from middle
B	9	36"	31"	Bend 9" from middle
C	12	49"	38"	Bend 11" from middle
D	8	30"	29"	Bend 11" from middle

Recommended Strap Lengths and Bending Locations for U-Bent Straps

Configuration as shown on Table 2	Number of fasteners at each end of each strap	Minimum length of LSTA or MSTA flat straps Table 2	Recommended length of coil strap Model Simpson CS20 or USP RS20-R	Bending location for U-bent straps. This takes into account the 2-1/2" on each side of horizontal braces and wrapping around the retrofit stud, and an inch for the diagonal
A	6	30"	30"	Bend 3/4" from middle
B	7	36"	37"	Bend 3/4" from middle
C	7	49"	41"	Bend 3/4" from middle
D	6	36"	37"	Bend 3/4" from middle

Notes for using the tables.

1. When installing straps the key is to have at least the minimum number of fasteners installed at each end in accordance with the first column of the table.
2. For L-bent straps the bend location is in relation to the stud (not brace) end of the strap. The short leg of a L-bent strap always goes on the retrofit stud.
3. Where a strap is cut compared to where the holes are makes a difference, but the worst case is taken into account in specifying both the needed minimum of length strap and the bend location.
4. Some manufacturers of connectors and straps add 'Z' to the end of the model to indicate that the connector is more rust resistant. This is probably not important for straps in attics, but of course it does no harm.
5. Fasteners should not be placed closer than 2-1/2" from the end of a retrofit stud.

Step-by-Step

Installing retrofit studs and straps:

Measure: With the braces in place it is relatively easy to measure the length for the retrofit studs. If you are going to install the retrofit stud along the taller side (side towards the roof's ridge) of the existing stud, measure from the top of the lower horizontal brace along the edge of the existing stud up to the point where that edge lines up with the bottom of the upper horizontal brace. If you are going to install the retrofit stud along the shorter side (the side towards the eave of the roof) of the existing stud, you will need to hold the tape measure 1-1/2 inches away from the shorter edge of the existing stud and measure from the top of the horizontal brace up to the bottom of the upper horizontal brace. If you know the slope of the roof, you can measure along the short side of the existing stud and reduce the length by multiplying the width of the retrofit stud by the slope ratio. For example, if you found that the roof slope was 5 in 12 (5 inches rise in 12 inches width or 5 feet rise in 12 feet of width) you can multiply the width of the retrofit stud (1-1/2") times 5 and divide by 12 to get a length reduction of 5/8". A snug fit at the top is preferred but be sure to leave a little space for the bottom strap. Note that if you are installing retrofit studs on a gable truss with diagonals, you will either have to select the next size up 2x member and notch it around the diagonal, or align the retrofit stud so that its narrow edge butts up against the face of the existing stud and one face of the retrofit stud lines up flush with one of the edges of the existing stud. The second alternative will allow you to attach the retrofit stud to the existing stud using mending plates.

Cut: Cut the stud to length. It will probably be easiest to cut a stud in the attic just after having measured for it. Then, before you install the straps, check the length by placing the retrofit stud in the desired location and make sure that it will fit snugly against the existing stud.

If you use coil strap you will have to cut it. You can use a tin snips or score the strap with a hacksaw and then bend the strap back and forth until it snaps. With coil strapping you will need to straighten it out somewhat and then make the bend at the appropriate length indicated in Table 5. Remember that the shorter length of the bent strap is the part that you will attach up the back of the retrofit stud and the longer portion will run under the retrofit stud and extend along the horizontal brace.

Install the straps: Select one of the 1-1/2" wide edges of the retrofit stud and install a strap at each end. If you have pre-bent the strap, make sure the bent leg wraps across the end of the stud as shown in Figure 18. When fastening the strap to the 1-1/2" edge of the stud, it is important that every fastener required by the table is installed and that the strap is centered on the edge of the retrofit stud. There are two critical distances that need to be respected to achieve the full strength of the connection. One is the edge distance between a fastener and the edge of the retrofit stud. That distance needs to be no less than 3/8". Placement of the strap in the middle of the 1-1/2" edge of the stud is critical because the placement of holes in commonly available straps results in the holes being exactly 3/8" from the edge. Installing a fastener closer than 3/8" to the edge of the stud reduces its effectiveness. Installing the fastener too close to the edge can create a split along the edge which would make those fasteners almost completely ineffective. To minimize the chance of splitting it is suggested that fasteners be installed at an angle towards the center of the stud. This will keep most of the fastener away from the edge. The other critical distance is that no fasteners should be closer to the end of a retrofit stud than 2-1/2".

Stud-to-stud connection: Now you are ready to connect the retrofit stud to the existing stud. This will tie the two together so that you double or more than double the strength of the existing stud. To do this you need to place 3" fasteners no more than 6" apart along the length of the retrofit stud. If the existing stud has its wide face parallel to the gable end wall (truss stud) then install the fasteners through the back portion of the retrofit stud and into the middle of the 1-1/2" edge of the existing stud. Keep the top and bottom fasteners at least 2-1/2" from the ends of the retrofit stud in order to minimize chances of splitting the end of the retrofit stud and to make the fastener fully effective when it is stressed by wind loads. The retrofit stud and existing stud combination will increase the strength of the wall and help it resist the wind forces pushing or pulling on the wall. Its effectiveness will be limited in the pull mode unless the wall sheathing is well attached to the existing stud. In homes built prior to 2002 it is likely that the attachment is not adequate. If your gable end wall has plywood siding on it you may be able to spot the nail heads from outside the house and be able to check the nail spacing. Ideally the nails would be on average 6" or less apart.

Applying construction adhesive to the 1-1/2" edge of the retrofit that will be in contact with the sheathing will help restrain the sheathing from getting pulled off (Figure 19). Applying a bead of construction adhesive along the edge of the existing stud where it meets the sheathing on the opposite side from where the retrofit stud is to be installed will help as well. It is not known how many years construction adhesive will be effective in hot attics, but it is so easy and inexpensive to do that one can hardly go wrong. Be warned that some people may find the fumes offensive, but in a hot attic they will dramatically dissipate in a day or two. There is more information about using construction adhesive in Section 14.

Where you want to push a retrofit stud into place, you may find nails or staples coming through the siding that prevent pushing the stud against the siding. You may be able to

bend them against the sheathing/siding or you may be able to snip them off with a pair of nippers or wire cutters. It is okay if the retrofit stud is as far as 1/4 inch from the siding. It will still be just as effective. However, if the distance can be kept short then you can gain the important structural advantage of being to apply construction adhesive to help hold the wall sheathing/siding onto the wall.

Installing straps on braces: Once the retrofit stud is securely fastened to the existing stud, you are left with the easy task of securing the straps coming from top and bottom of the retrofit stud to the two horizontal braces. The only heads up issue is to route the strap along the horizontal brace, away from the edge of the brace, so that you maintain an edge distance of least 1/2" between the fasteners and the edge of the brace. Experience has shown that to help assure the strap does not wonder off at too great an angle it is a good idea to install the first fastener near the retrofit stud and then install the next one at the end of the strap.

Installation of compression blocks: Installing compression blocks is the final step. The lengths specified in the table are minimum lengths so it is perfectly okay to use scraps of 2x4s, 2x6s, or 2x8s that are longer without having to cut them to precise lengths. The minimum size for lumber used as blocking is a 2x4. A key issue with compression blocks is to butt them snugly against the retrofit studs so they can act in compression with minimum movement of the wall studs. Another key issue is to be sure you install all of the fasteners so they are fully effective. That means positioning them a minimum of 1/2" from the edge of the block and horizontal brace, at least 2-1/2" apart along the length of the block, and a minimum of 1" apart in the cross block direction (across the grain). Depending on how the strap runs on the horizontal brace you may need longer compression blocks in order to maintain the fastener spacing requirements.

With the installation of compression blocks complete you are finished with the gable end retrofit. That leaves only the wall-to-wall connection, unless you have already done it.

===== **SHOPPING LIST FOR WALL-TO-WALL CONNECTIONS** =====

Special order items

Right angle gusset brackets HGA10KT. (There Number of kits order _____
HGAM10KT. Number of kits to order _____

Off the shelf items

1/4" x 4-1/2" wood screws. Lag bolts, Simpson SDS25412, USP WA450
4 are needed for HGA where there are 3 2x4s to go through. Some may be
needed to tie walls.....Number needed _____

Connectors

H2.5 or
SP1 or SPT22

Fasteners

Screws: #8 x 1-1/4"
Screws: #8 x 3"
Nails: 8d or 10d 1-1/2", e.g. N8 or NA8 or NA11 or N10 or NA9 or NA10
10d _____
Nails: 10d common (0.148 diameter and 3" long) _____
Screws: 1/4" X 4 1/2" wood screws (Simpson SDS, USP xxx, lag bolts)
Washers for 1/4" bolts
Washers for 1/2" bolts

Note: Model numbers are suggestive only and are given for several brands.

===== **SHOPPING LIST FOR LADDERS (MISSED RETROFIT STUDS)** =====

Connectors

H2.5
Simpson A21

Lumber

2x4x8' No 2 SPF for the ladder. Reminder: 4' long ladder pieces may not be long
enough depending on the sides of the existing studs the retrofit studs will be applied to.
Retrofit studs. Reminder: Retrofit studs will need to be the next larger than what would
otherwise be used.

Fasteners

#8 x 1-1/4" screws
#8 x 3" screws
N10
10d
1/4" X 4 1/2" wood screws (Simpson SDS, USP xxx, lag bolts)
Washers for 1/2" bolts

Current Drawings

The numbering on these drawings correspond to those in the 2012 *International Existing Building Code* and are similar to those in the 2012 (or 2013) *Florida Existing Building Code*.

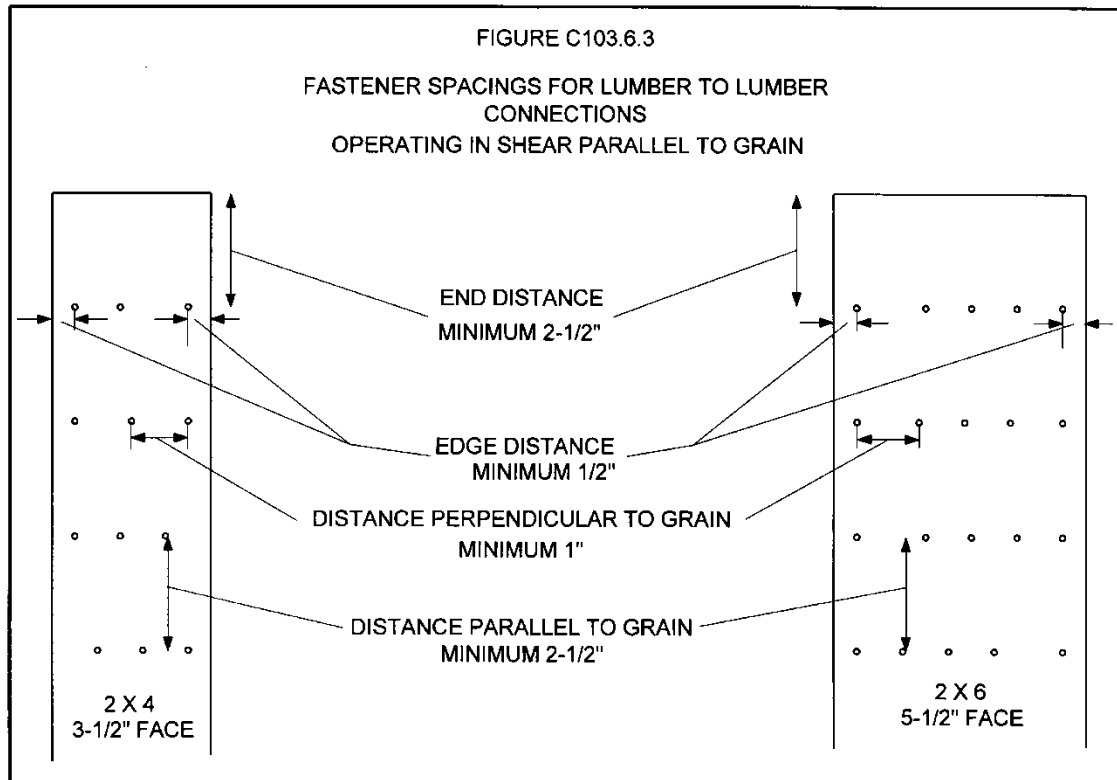
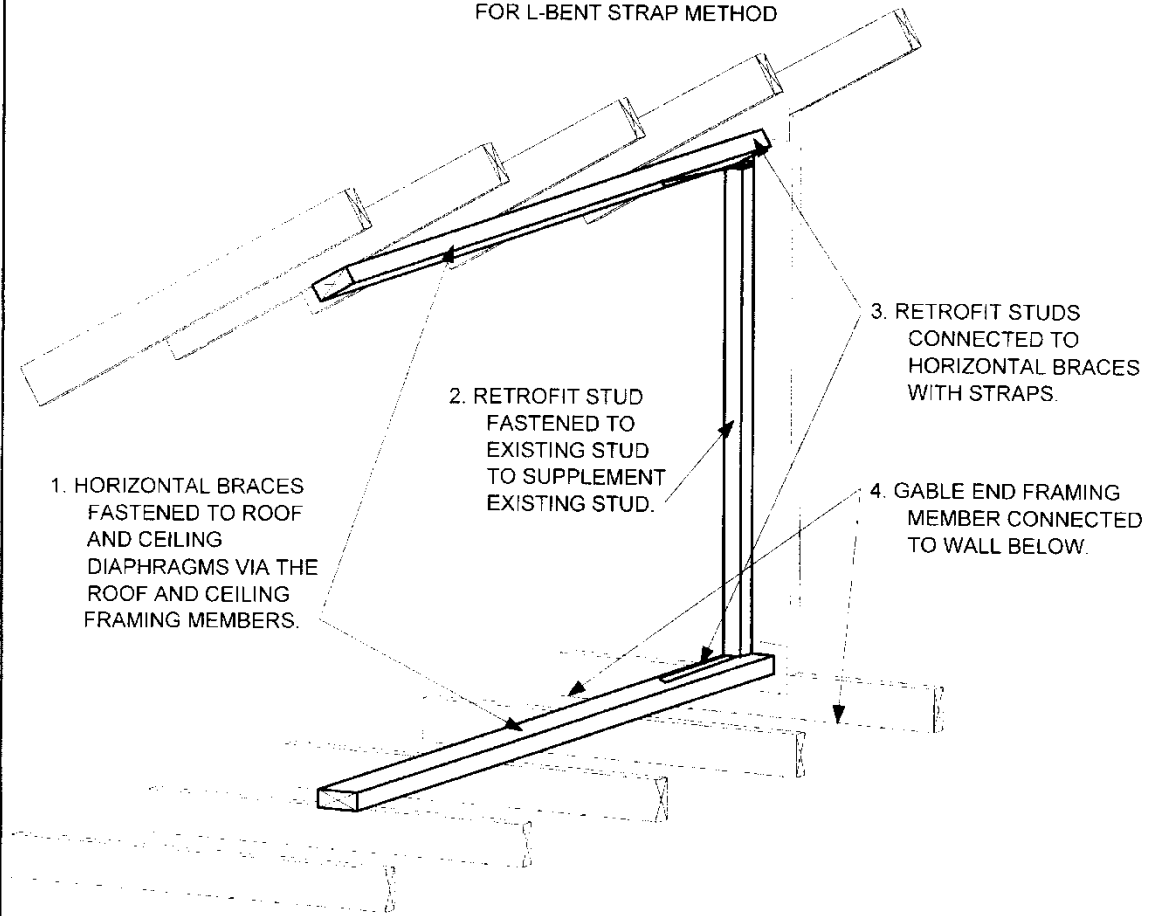
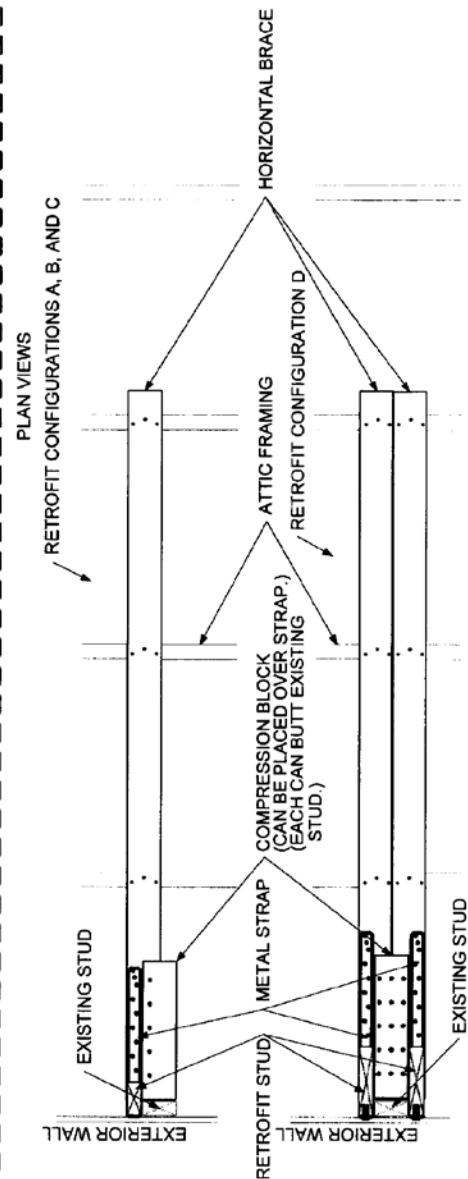
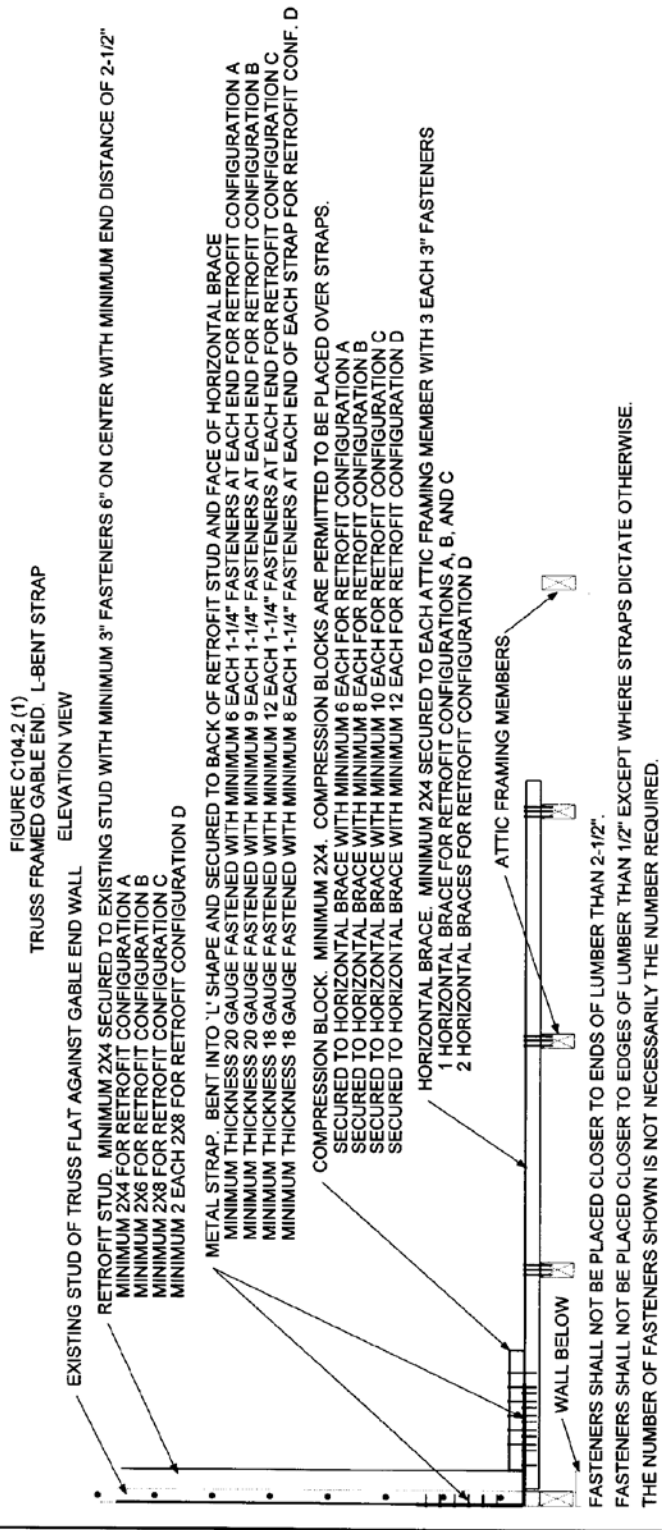


FIGURE C104.1.1
BASIC GABLE END RETROFIT METHODOLOGY
FOR L-BENT STRAP METHOD



THIS FIGURE SHOWS A TRUSS GABLE END.
THE METHODOLOGY FOR A CONVENTIONALLY FRAMED GABLE END IS SIMILAR.
THE NUMBERS INDICATE A TYPICAL SEQUENCE OF INSTALLATION.
IN ORDER TO SHOW STRAPS COMPRESSION BLOCKS ARE NOT SHOWN.



ELEVATION VIEW

Diagram illustrating the retrofit configurations for exterior walls. The diagram shows two vertical wall sections: **EXISTING STUD** on the left and **RETROFIT STUD** on the right. Both walls are supported by an **EXTERIOR WALL** at the base. The **RETROFIT STUD** section shows additional components: **METAL STRAP** (connecting the stud to the exterior wall), **COMPRESSION BLOCK (CAN BE PLACED OVER STRAP) (EACH CAN BUTT EXISTING STUD.)**, **ATTIC FRAMING**, and **RETROFIT CONFIGURATION D**. A **HORIZONTAL BRACE** is shown at the top, connecting the two wall sections.

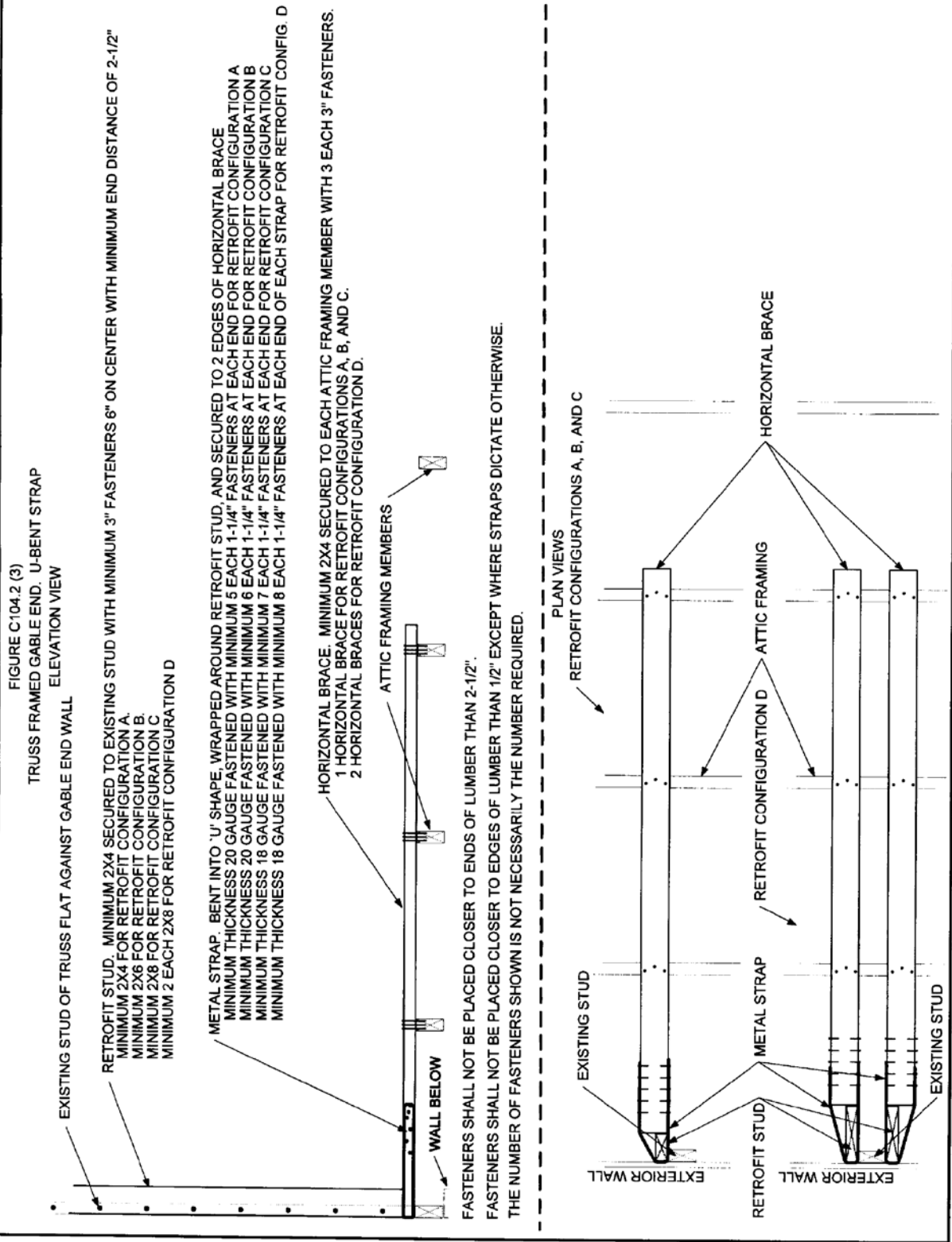
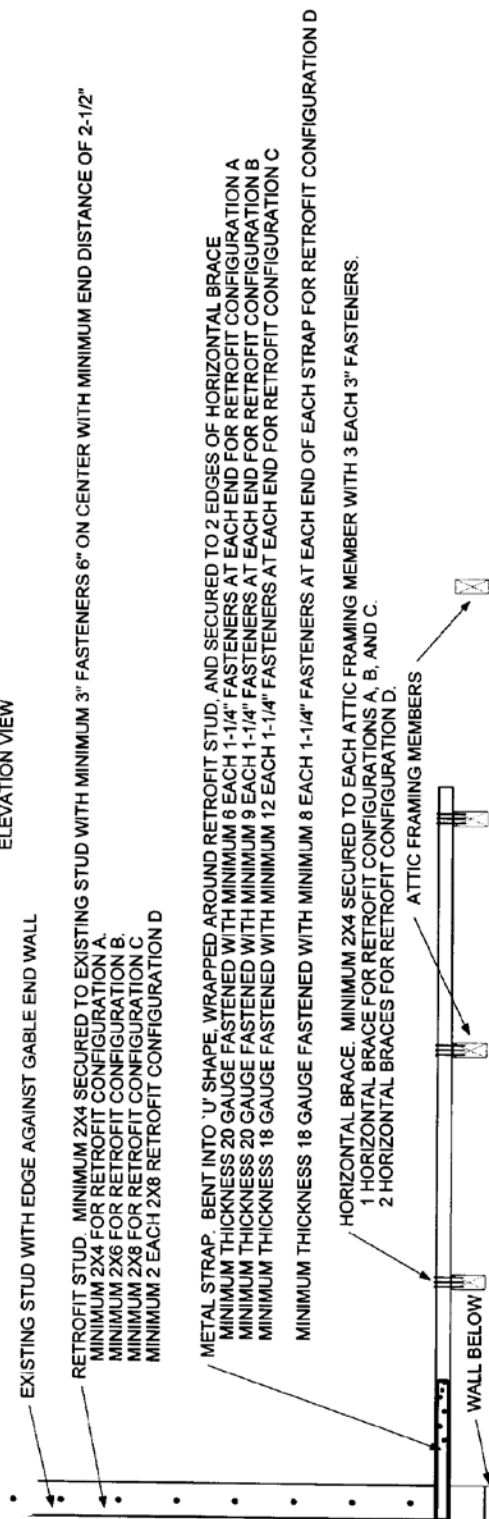


FIGURE C104.2 (4)

CONVENTIONALLY FRAMED GABLE END. U-BENT STRAP

ELEVATION VIEW



FASTENERS SHALL NOT BE PLACED CLOSER TO ENDS OF LUMBER THAN 2-1/2".

FASTENERS SHALL NOT BE PLACED CLOSER TO EDGES OF LUMBER THAN 1/2" EXCEPT WHERE STRAPS DICTATE OTHERWISE.

THE NUMBER OF FASTENERS SHOWN IS NOT NECESSARILY THE NUMBER REQUIRED.

PLAN VIEWS

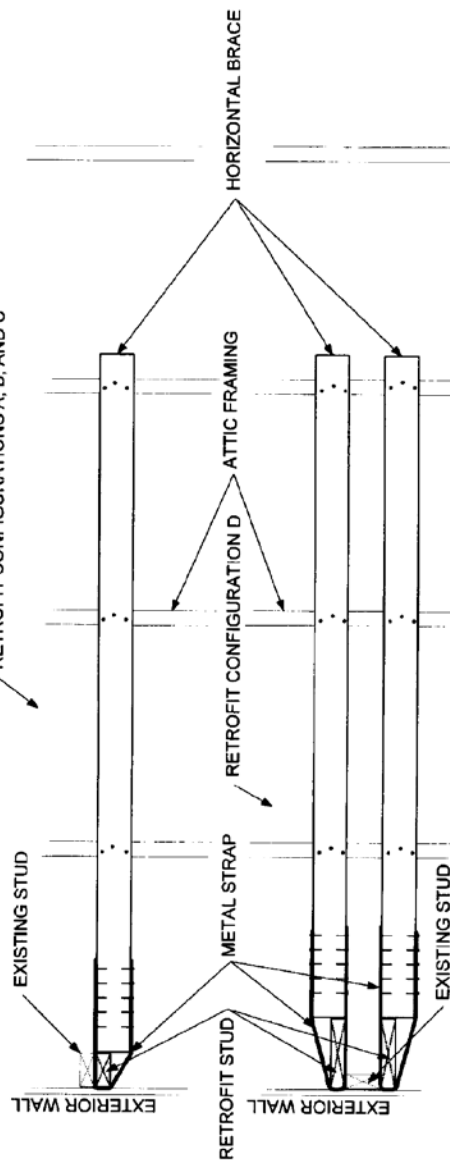
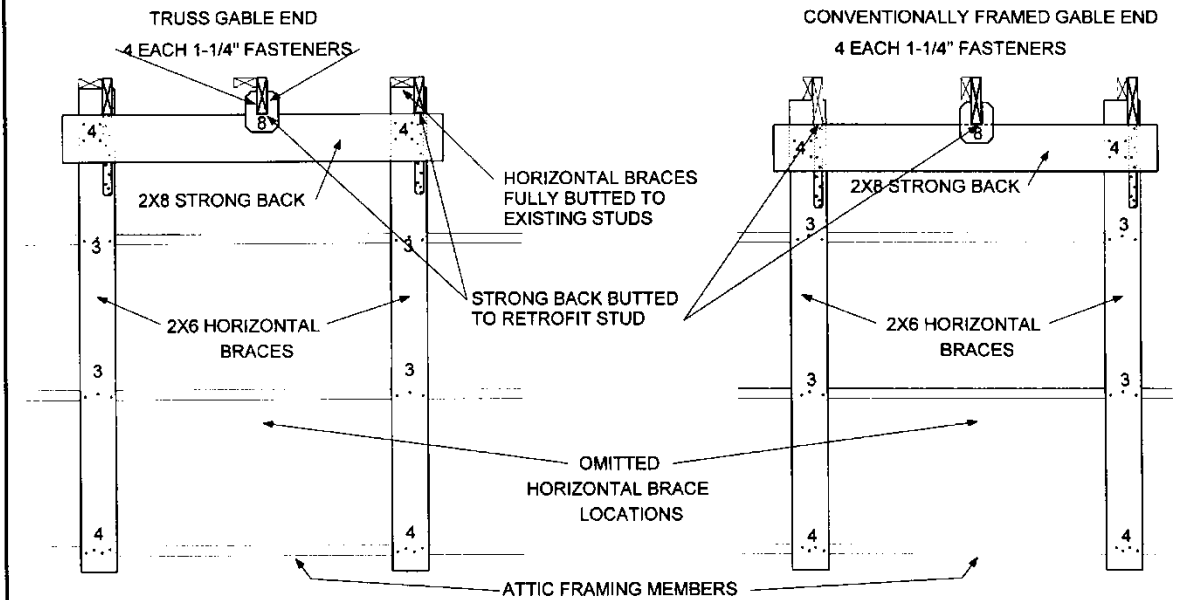
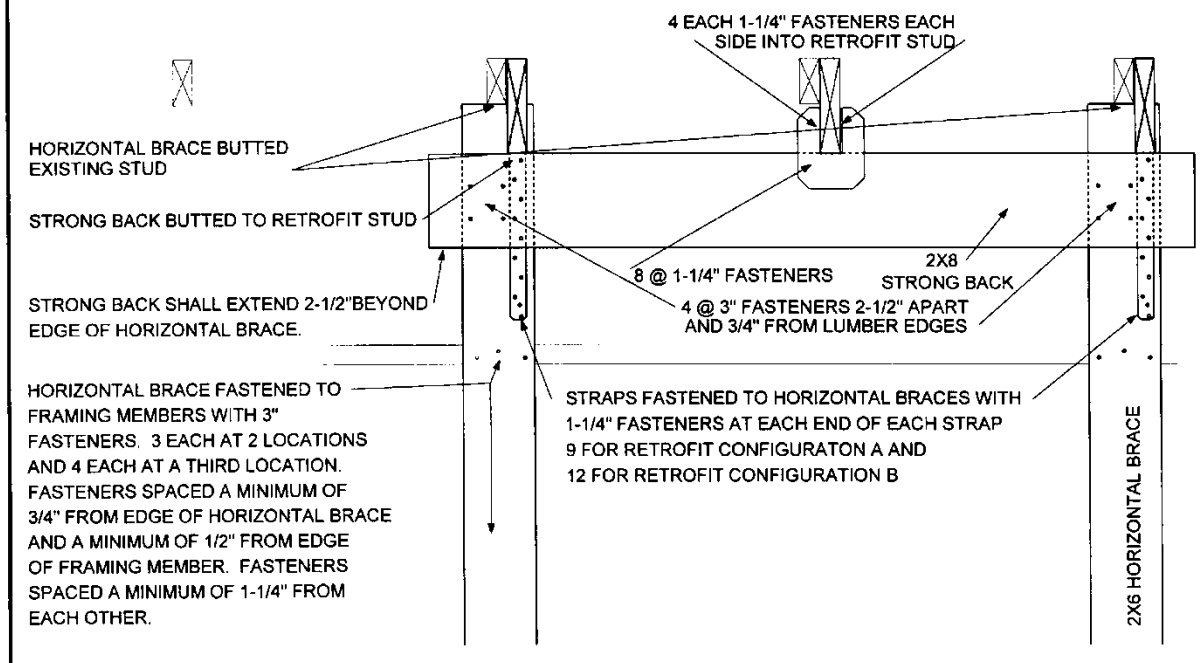


FIGURE C104.2.3
OMITTED HORIZONTAL BRACE
OVERVIEW

PLAN VIEWS
RETROFIT CONFIGURATION A AND B ONLY
NOT ALLOWED FOR RETROFIT CONFIGURATION C OR D
UNIDENTIFIED NUMBERS INDICATE THE NUMBER OF FASTENERS.



DETAILS OF CONVENTIONALLY FRAMED GABLE



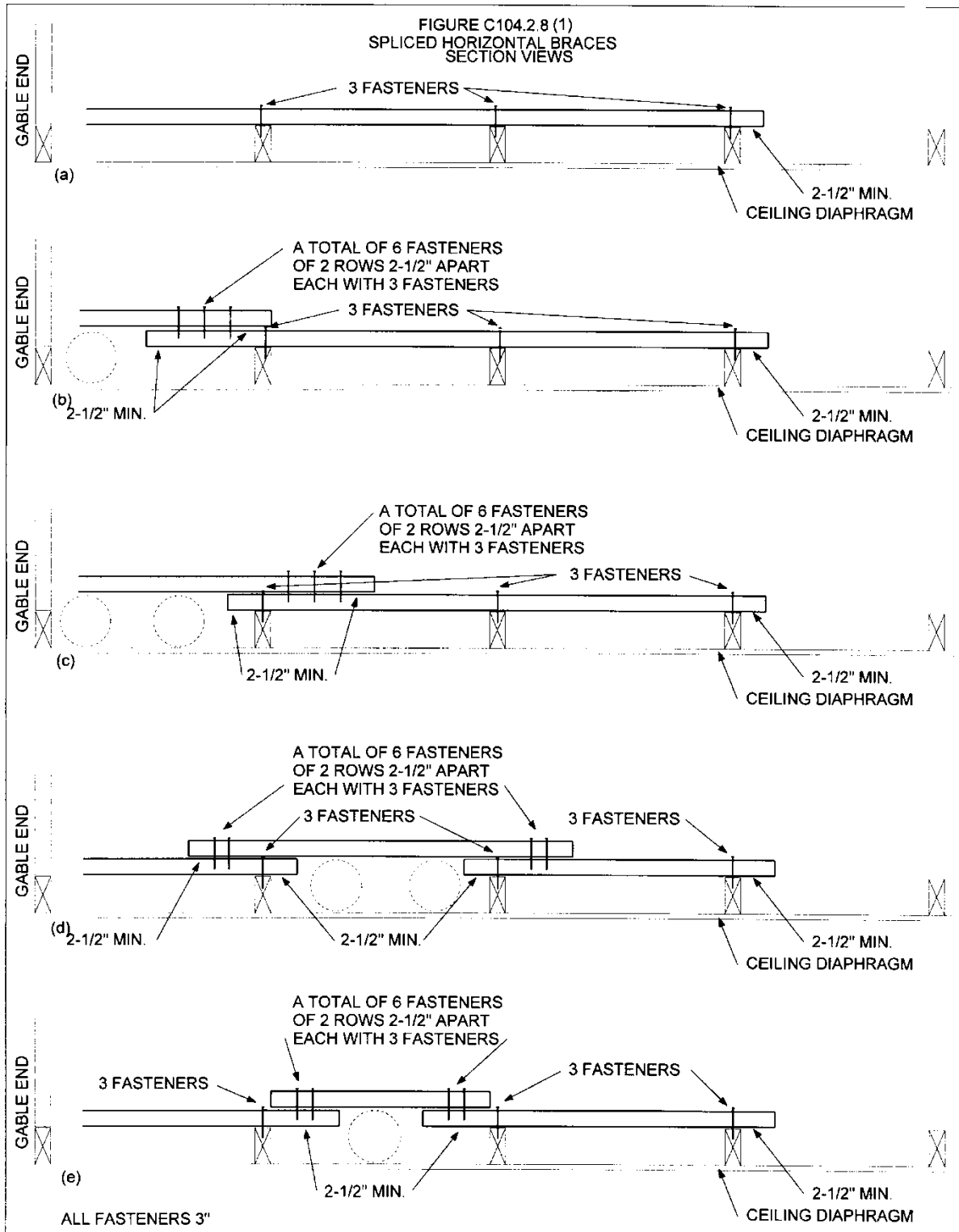


FIGURE C104.2.8 (2)
 SPLICED HORIZONTAL BRACES
 SECTION VIEWS

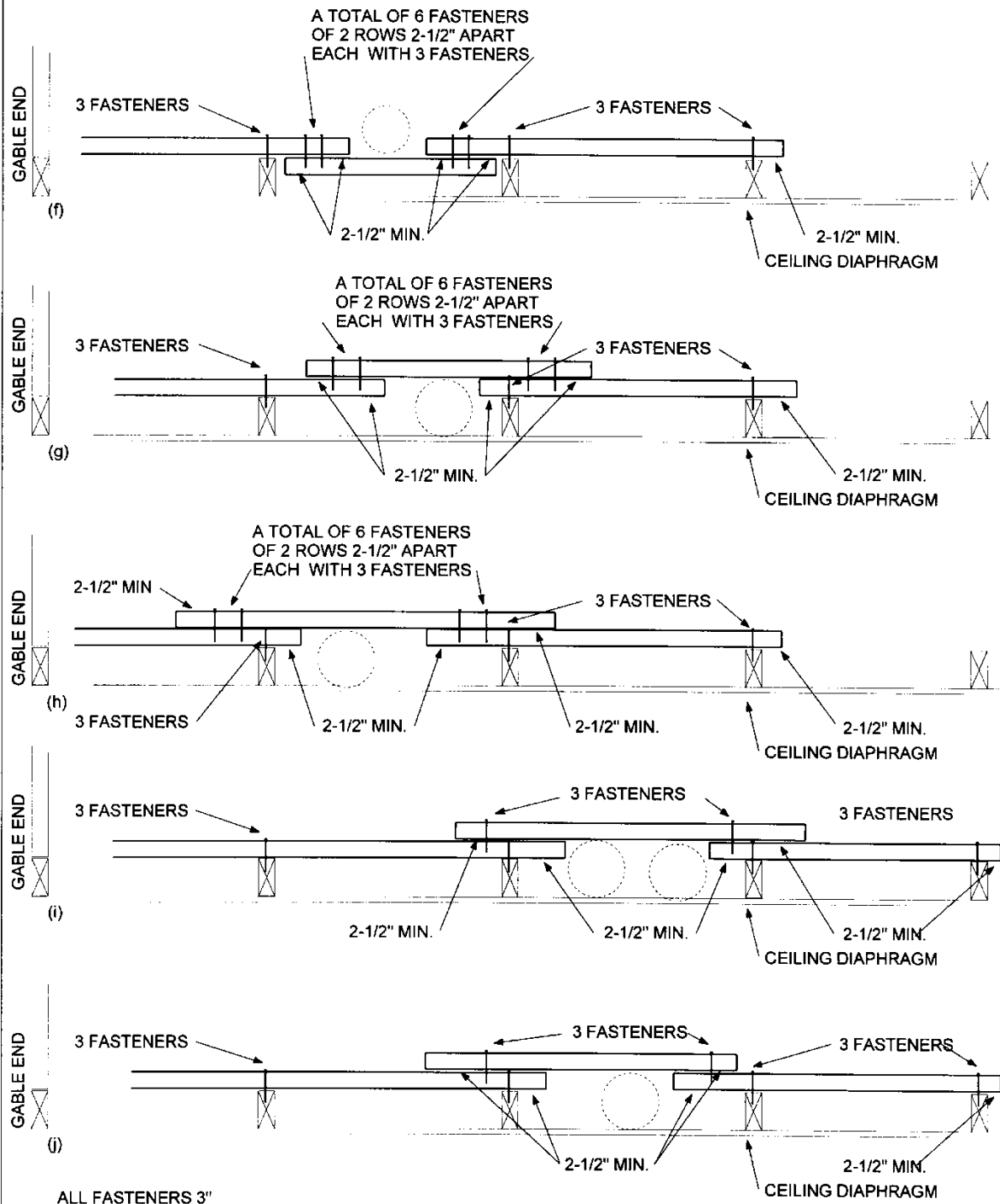


FIGURE C104.2.8 (3)
SPliced HORIZONTAL BRACES
SECTION VIEWS

