MiTek USP Structural Connectors

IRC Intermittent Bracing Methods

Solutions for Narrow Wall Segments Including Alternate Wall Bracing (AWB) Portalframe with Holdowns (PFH) and Portal Frame at Garage (PFG)

Background: Lateral Bracing in the 2015 International Residential Code® (IRC®)

Lateral wall bracing requirements in the prescriptive building codes have remained basically unchanged for over 30 years until 2006. Catastrophic damage and financial losses from natural disasters in recent decades prompted some significant changes and stricter enforcement of building codes nationwide.

Historically, proper wall bracing construction per the IRC required a minimum of 4-feet of available wall length. With design trends calling for larger window openings and narrow garage return walls, the wall space available for bracing has been limited.

This bulletin outlines braced wall panel options for narrow wall segments (IRC R602.10).

Limitations of Prescriptive Wall Bracing and this Tech Bulletin

Wood frame buildings are often constructed by following the prescriptive building codes without a design professional. Likewise, the wall bracing and intermittent braced wall panels described in this bulletin do not require additional engineering or the use of engineered shear walls. The prescriptive provisions of the IRC do have design limitations, listed below are some highlights of these limitations:

Where the prescriptive provisions of the IRC and this document do not apply:

- Construction in regions where the ultimate design wind speeds V_{ult} exceed 130 miles per hour.
- Buildings constructed in windborne debris regions without windborne debris protection.
- Buildings constructed in Seismic Design Category E.
- Building with height exceeding three stories above grade or story height exceeding limitations of IRC R301.3.

For a complete description of design limitations see IRC R301 or check with a local building official to see which bracing options are accepted in your area.

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Portalframe with Holdowns (PFH) and Portal Frame at Garage (PFG)

Portal Frame with Embedded Strap Holdowns (IRC R602.10.6.2) Method PFH for Concrete or Reinforced Masonry Construction

Alternative Braced Wall Panel Construction Options
Portal Frame with Embedded Strap Holdowns - Construction Options for Concrete Foundations

- Can be installed anywhere along a braced wall in 1 and 2 story applications adjacent to a window or door opening with full length header.
- 16" Minimum width for 1-story buildings.
- 24" Minimum width on the 1st story of 2-story buildings.
- 10' Maximum height to top of header.

Table 1

16" - 24" Portal Frame Braced Wall Panel with Embedded Strap Holdowns (IRC R602.10.2) (See Fig. 1)

Connector as Called out in Drawing	USP Stock No.	Fastener Schedule[1,2]
3500-lb Tie-Down Device	STAD14	(28) 16d Sinker
	HPAHD22	(23) 16d Sinker
1000-lb Tie-Down Device for Single Portal Frame	LSTAD8	(16) 16d Sinker
	PAHD42	(15) 16d Sinker
Anchor Bolt 5/8" dia. x 12"	AB5812-HDG	Min. 7" Embed
3/16" x 2" x 2" Plate Washer	BP582	--
8d Common	8d Common	--
16d Sinker	16d Sinker	--

1) Specified nails for tie-downs are 16d sinker nails.
2) Minimum nail embedment shall be 1-5/8" for 16d Sinker nails.

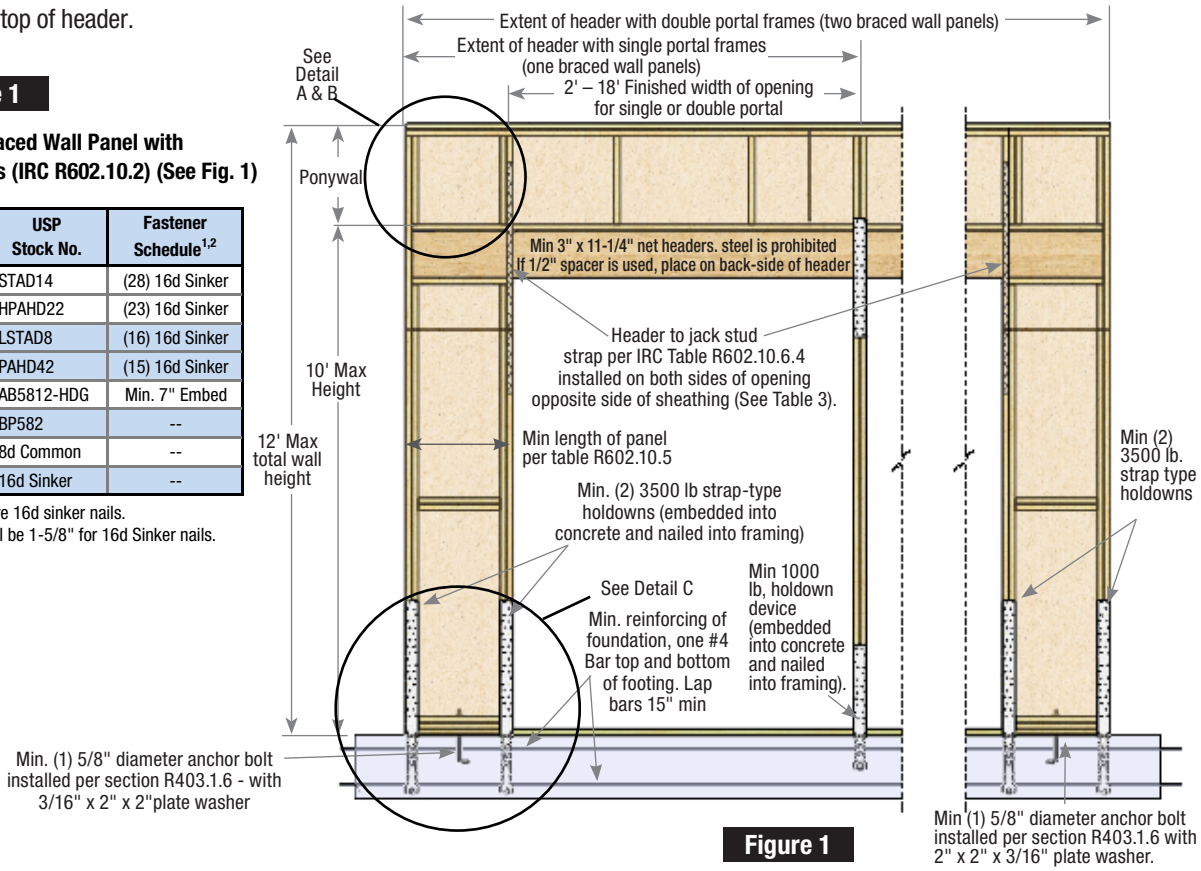
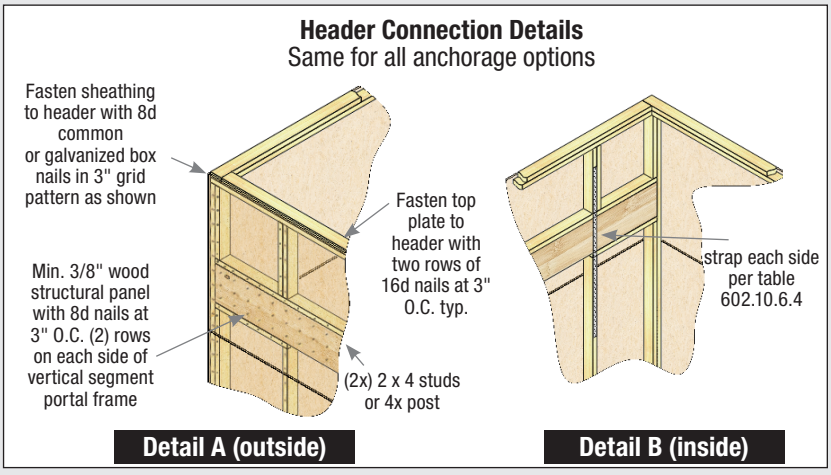
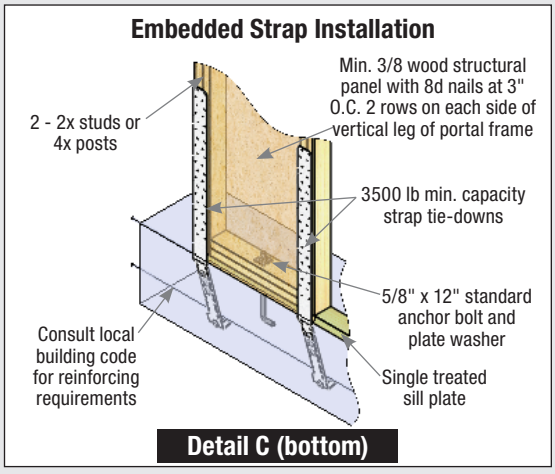


Figure 1





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Portal Frame Construction using common holdowns with anchor bolts.

16"-24" Portal Frame Braced Wall Panel with Holdowns

Retro-fit Option alternate to Method PFH

- This method is not described in the IRC, but is accepted in certain jurisdictions at the local level. Check with a local building official to see if it is approved for use in your area.
- Can be installed anywhere along a braced wall in 1 and 2-story applications adjacent to a window or door opening (i.e. garage door) with full length header.
- A standard holdown with an embedded anchor bolt is used.
- Threaded rod with epoxy may be used for retro-fit if foundation is already in place.
- Masonry foundation must be reinforced and tied to the footing.

Table 2

Portal Frame Holdowns and Retro-Fit Connection Options

Connector as Called Out in Drawing		USP Stock No.	Fastener / Installation Schedule[1]
3500-lb Tie-Down Device		PHD4A	(10) WS3 Wood Screws (Incl.); 5/8" Anchor Bolt
		HTT16	(18) 10d; 5/8" Anchor Bolt
1000-lb Tie-Down Device for Single Portal Frame		DTB-TZ	(8) WS15 Wood Screws (Incl.); 1/2" Anchor Bolt
		PHD2A	(6) WS3 Wood Screws (Incl.); 5/8" Anchor Bolt
		TDX2-TZ	(2) 5/8" Through Bolts 5/8" Anchor Bolt
Tie-Down Anchoring Options	Cast-in-Place	STBL16	Concrete Embed
	Retro-Fit	THR5816-HDG	5/8" Threaded Rod (9" Embed), CIA-GEL 7000 Epoxy or CIA-EA Epoxy Acrylate
5/8" Sill Plate Anchorage	Cast-in-Place	STB16	Concrete Embed
		AB5812-HDG	7" Minimum Embed
	Retro-Fit	THR5816-HDG	5/8" Threaded Rod (9" Embed), CIA-GEL 7000 Epoxy or CIA-EA Epoxy Acrylate
		GEL7-10 or GEL7-22	
		EA-10	
3/16" x 2" x 2" Plate Washer		BP582	--
10d Common		10d Common	--
10d x 1-1/2		NA9D	--
16d Common		16d Common	--

1) Minimum nail embedment shall be 1-5/8" for 16d nails and 1-1/2" for 10d nails.

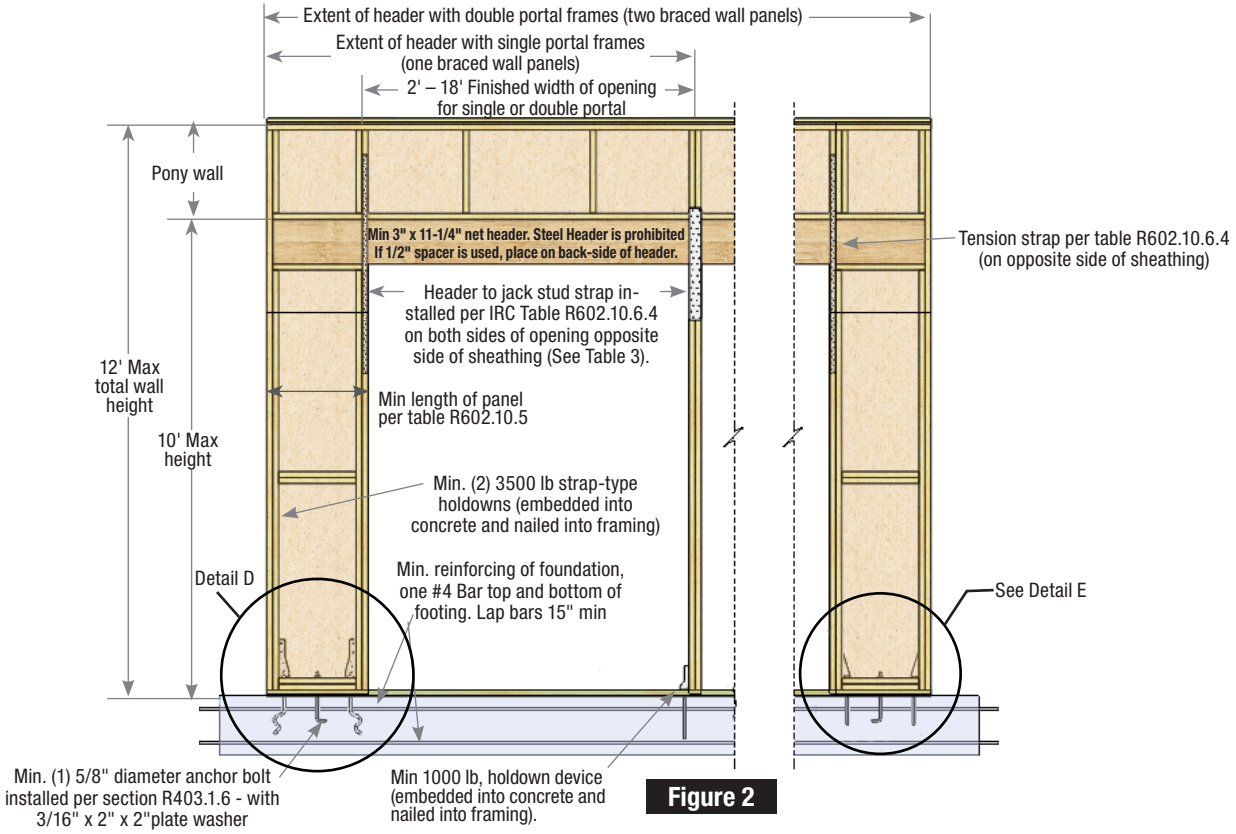

Figure 2

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IRC Intermittent Bracing Methods

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Portalframe with Holdowns (PFH) and Portal Frame at Garage (PFG)

TABLE 3

Allowable Tension Straps for Resisting Wind Pressures Perpendicular to Methods PFH, PFG, and CS-PFG Braced Wall Panels

Wall Stud Framing (Nominal Size and Grade)	Pony[7] Wall Height (ft)	Total Wall Height (ft)	Opening Width (ft)	MiTek - USP® Tension Strap Required[1,2,3,6]					
				Exposure B			Exposure C		
				Ultimate Design Wind Speed V_{ult} (mph)			Ultimate Design Wind Speed V_{ult} (mph)		
				110	115	130	110	115	130
2 x 4 No. 2 Grade	0	10	18	Group A	Group A	Group A	Group A	Group A	LSTA18
	1	10	9	Group A	Group A	Group A	Group A	Group A	MSTA30
			16	Group A	RS250	MSTA36	RS14	RS14	MSTC40
			18	Group A	MSTA21	RS14	RS14	MSTC28	DR[4]
	2	10	9	Group A	Group A	HTP37-TZ	HTP37-TZ	MSTA36	MSTC28[5]
			16	MSTA30	RS14	MSTC40	MSTC40	MSTC40	DR[4]
			18	MSTC28	RS14	MSTC40	MSTC40	DR	DR[4]
	2	12	9	LSTA21	LSTA30	MSTC28	MSTC28	MSTC28[5]	DR[4]
			16	MSTC28	MSTC40	DR[4]	DR[4]	DR[4]	DR[4]
			18	MSTC40	MSTC40	DR[4]	DR[4]	DR[4]	DR[4]
2 x 6 No. 2 Grade	2	12	9	Group A	Group A	RS150	RS150	MSTA36	MSTC28[5]
			16	MSTA36	RS14	MSTC28[5]	MSTC28[5]	MSTC40	DR[4]
			18	RS14	RS14	MSTC40	MSTC40	DR[4]	DR[4]

1) Connector suggestion is based on closest strap to the needed capacity. Geometry should be confirmed.
2) Minimum nail embedment shall be 1-1/2" for 16d Sinker nails and 1-1/2" for 10d nails.
3) Minimum quantity of fasteners to be installed with equal fasteners at each end of the connection.
4) DR = Design Required.
5) MSTC28 must be installed with 16d nails.
6) Allowable Tension Loads are for Doug-Fir, Southern Pine, Spruce-Pine-Fir and Hem Fir.
7) 4' pony wall loads are available in the 2015 IRC.

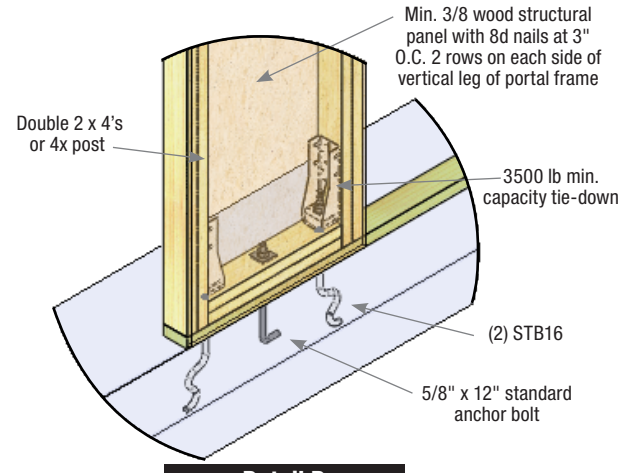
Strap Options

Group A		
Strap	**Fasteners**	**Min Length**
LSTA18	(14) 10d	18"
LSTA21	(16) 10d	21"
ST18	(14) 16d	17-3/4"
RS100	(18) 10d	16"
RS150	(22) 10d	18"

Not in Group A		
RS14	(22) 10d	24"

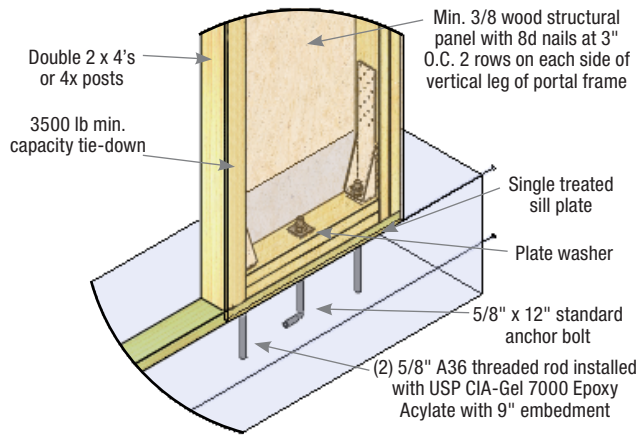
Portal Frame Construction Options for Concrete or Reinforced Masonry Foundations

Cast in Place Installation



Detail D

Retrofit Epoxy Installation



Detail E

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Alternate Wall Bracing Methods (IRC Table R602.10.6.1)

Method ABW - Alternate Braced Wall Panel

- Either two holdown or two straps per table R602.10.6.1 may be used. (one of each shown in image for clarity)
- Can be installed anywhere along a braced wall in 1 and 2-story applications adjacent to a window or door opening (i.e. garage door) with full length header.
- A standard holdown with an embedded anchor bolt may be used.
- Threaded rod with epoxy may be used for retro-fit if foundation is already in place.
- Masonry foundation must be reinforced and tied to the footing.

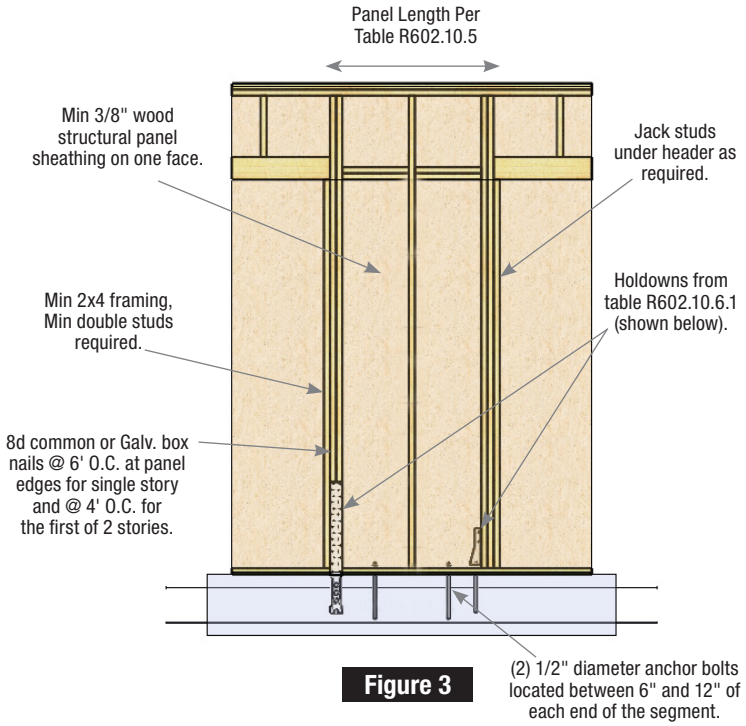

Figure 3

TABLE 4

Minimum Holdown Forces for Method ABW Braced Wall Panels Based on Table R602.10.6.1 (2015 IRC)

Seismic Design Category / Wind Speed	Supporting / Story	MiTek-USP® Embedded Strap Required[2,3] Height of Braced Wall Panel				
		8-ft	9-ft	10-ft	11-ft	12-ft
Embedded Straps						
SDC A, B and C Ultimate design wind speed < 140 mph	One Story	LSTAD8	LSTAD8	LSTAD8	HPAHD22	HPAHD22
	First of Two Stories	STAD14	STAD14	STAD14	STAD14	STAD14
SDC D_0, D_1 and D_2 Ultimate design wind speed < 140 mph	One Story	HPAHD22	HPAHD22	HPAHD22	NP[1]	NP[1]
	First of Two Stories	STAD14	STAD14	STAD14	NP[1]	NP[1]
Holdowns						
Seismic Design Category / Wind Speed	Supporting / Story	MiTek-USP® Holdown Required[2,3,4] Height of Braced Wall Panel				
		8-ft	9-ft	10-ft	11-ft	12-ft
SDC A, B and C Ultimate design wind speed < 140 mph	One Story	PHD2A	PHD2A	PHD2A	PHD2A	PHD2A
	First of Two Stories	PHD4A	PHD4A	PHD4A	PHD4A	PHD4A
SDC D_0, D_1 and D_2 Ultimate design wind speed < 140 mph	One Story	PHD2A	PHD2A	PHD2A	NP[1]	NP[1]
	First of Two Stories	PHD4A	PHD4A	PHD4A	NP[1]	NP[1]

1) NP = Not Permitted
2) Connectors are based on a corner installation in cracked concrete.
3) Allowable tension loads are for Doug-Fir, Southern Pine, Spruce-Pine-Fir and Hem Fir.
4) TDX2-TZ may be substituted for PHD2A when a bolted connection is preferred.

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Method PFG
Portal frame at garage door openings (IRC Figure R602.106.3)

Portal Frame Construction Options for Concrete or Reinforced Masonry Foundations

16"-24" Portal Frame Braced Wall Panel with Holdowns and a Retro-fit Option

- Method PFG braced wall panel shall be permitted on either side of garage door openings.
- Designed for seismic design catagories A, B and C.
- Threaded rod with epoxy may be used for retro-fit.

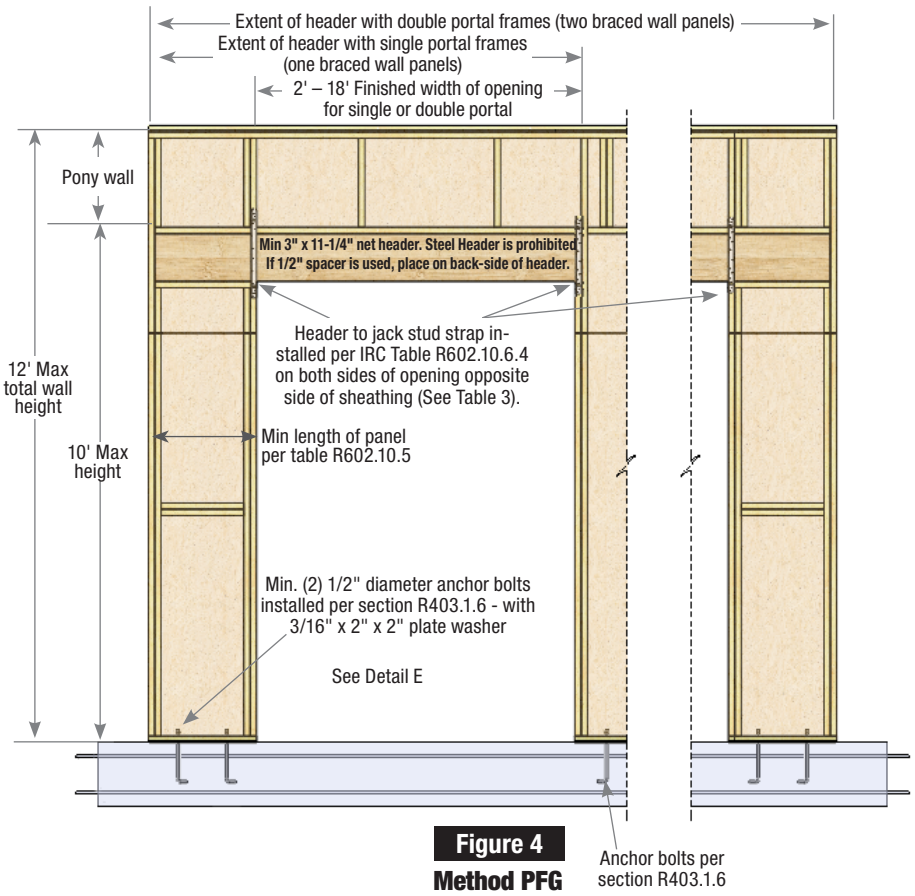

Figure 4
Method PFG

Connection Options for Portal Frame Narrow-Wall Bracing Method Without Holdowns (Fig. 4)

Connector as Called Out in Drawing		USP Stock No.	Fastener / Installation Schedule[1,2]
Anchor Bolt per R403.1.6	Cast-in-Place	AB1212-HDG	Min 7" Embed
	Retro-Fit Option	– –	1/2" Threaded Rod (7" Embed), CIA-GEL 7000 or CIA-GEL 7000C Epoxy

1) Minimum nail embedment shall be 1-1/2" for 10d nails.
2) Minimum quantity of fasteners to be installed with equal fasteners at each end of the connection.