ICC-ES Evaluation Report

ESR-2648

Reissued June 2016
Revised September 2016
This report is subject to renewal June 2018.

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 05 23.13—Nails

REPORT HOLDER:

HY-TEK FASTENERS, INC.
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EVALUATION SUBJECT:

HY-TEK NAILS

1.0 EVALUATION SCOPE

Compliance with the following codes:

* ■ ~~2015,~~ 2012 and 2009 *International Building Code*® (IBC)
* ■ ~~2015,~~ 2012 and 2009 *International Residential Code*® (IRC)
* ■ ~~2013 *Abu Dhabi International Building Code* (ADIBC)†~~

~~†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.~~

Properties evaluated:

- Compliance with requirements of ASTM F1667
- Bending yield strength
- Lateral connection strength
- Withdrawal strength
- Use in diaphragms and shear walls
- Use as alternates to the nails prescribed in fastening schedules in the codes.

2.0 USES

Hy-Tek nails are used in engineered wood framing connections and engineered connections of wood structural panels to wood framing. They are also used for prescriptive wood framing connections.

Hy-Tek nails are used in engineered horizontal wood structural sheathing panel / sawn lumber floor diaphragm applications under the IBC as alternatives to the code prescribed nails addressed in Tables 4.2A, 4.2B and 4.2C of the ANSI/AWC Special Design Provisions for Wind and Seismic (AWC SDPWS).

Hy-Tek nails are used as substitutes for the nails prescribed in the IBC and IRC for use in attaching floor sheathing to framing.

3.0 DESCRIPTION

3.1 Nails:

Hy-Tek nails have full round heads and are available in lengths from $1^1/_2$ to 6 inches (38 to 152 mm). The top third of the nail length has a smooth shank and the bottom two-thirds have a helical screw shank. Refer to Table 1 for Hy-Tek nail designations and descriptions, including bending yield strength, head and shank diameters, and tip styles. See Figure 1 for a depiction of the nails.

The nails are manufactured from SAE J403 low-carbon steel wire, grade 1015-1030. The nails are available with a bright finish, a galvanized coating complying with ASTM A641 Class 1, or a hot-dip galvanized coating complying with ASTM A153, Class D. Hy-Tek nails are supplied in strips, coils or in bulk.

3.2 Connected Materials:

Wood framing members must be sawn lumber complying with the ANSI/AWC National Design Specification for Wood Construction (NDS) and must have an assigned specific gravity as shown in the tables in this report.

Wood structural panel sheathing must be Structural I, Sheathing or Single-Floor grade panels complying with DOC PS-1 or PS-2.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 Engineered Framing Connections: The Hy-Tek nails comply with the strength requirements of IBC Section 2303.6. Reference lateral and withdrawal design values for the Hy-Tek nails are given in Tables 2 and 3, respectively. These design values are based on normal load duration and dry conditions of use. Tabulated reference design values must be multiplied by all applicable adjustment factors in the NDS to obtain adjusted design values for the nails.

4.1.2 Prescribed Framing Connections: The Hy-Tek nails listed in Table 4 comply with the bending yield strength requirements of IBC Section 2303.6, and have been compared to the indicated code-prescribed nails on the basis of lateral connection strength and withdrawal resistance. The Hy-Tek nails listed in Table 4 may be used as direct substitutes for the code-prescribed nails indicated in Table 4, in framing connections prescribed in * ~~2015 IBC Table 2304.10.1~~ (2012 and 2009 IBC Table 2304.9.1) and IRC Table R602.3(1).

4.1.3 Engineered Sawn Lumber Floor Diaphragms: Diaphragms described in this report are recognized for use

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in all Seismic Design Categories. Hy-Tek Fasteners nails may be used to attach wood structural panel sheathing to sawn lumber framing to create floor diaphragms, as direct substitutes for the code prescribed nails addressed in Tables 4.2A, 4.2B and 4.2C of the AWC SDPWS, in accordance with Table 5. Allowable shear strengths for diaphragms consisting of wood structural sheathing panels attached to Douglas fir–larch or Southern pine lumber framing are shown in Tables 6 and 7, based on the applicable values in the AWC SDPWS. Diaphragm deflection may be determined in accordance with Section 4.2.2 of the AWC SDPWS, using the G_a value given in Tables 4.2A, 4.2B or 4.2C of the AWC SDPWS for the comparable code prescribed nail.

4.1.4 Engineered Shear Walls: Shear walls described in this report are recognized for use in all Seismic Design Categories. Hy-Tek Fasteners nails may be used to attach wood structural panel sheathing to sawn lumber framing to create shear walls, as direct substitutes for the code prescribed nails addressed in Table 4.3A of the AWC SDPWS, in accordance with Table 5. Shear wall deflection may be determined in accordance with Section 4.3.2 of the AWC SDPWS, using the G_a value given in Table 4.3A of the AWC SDPWS for the comparable code prescribed nail.

4.1.5 Prescriptive Sheathing Attachment: Hy-Tek nails may be directly substituted for common nails prescribed in * ~~2015 IBC Table 2304.10.1~~ (2012 and 2009 IBC Table 2304.9.1) and IRC Table R602.3(1) for attachment of floor sheathing and wall sheathing to framing, as shown in Table 5.

4.2 Installation:

The nails must be installed in accordance with the Hy-Tek Fasteners published installation instructions and this evaluation report. Edge distances, end distances, and spacings must be sufficient to prevent splitting of the wood and must not be less than the minimum edge and end distances specified in the ICC-ES evaluation report for the applicable engineered lumber products. Nail installation must also comply with applicable requirements in Section 12.1.6 of the 2015 NDS [Section 11.1.6 of the NDS-12 (Section 11.1.5 of the NDS-05 for the 2009 IBC)]. The nails are driven either pneumatically or manually.

4.3 Special Inspection:

Special inspection of high-load diaphragms is required in accordance with IBC Section 1705.5.1. Periodic inspection of shear walls and diaphragms for wind resistance may be * required in accordance with ~~2015 IBC Section 1705.11.1~~ (2012 IBC Section 1705.10.1). Periodic inspection of shear walls and diaphragms for seismic resistance may be * required in accordance with ~~2015 IBC Section 1705.12.2~~ (2012 IBC Section 1705.11.2).

5.0 CONDITIONS OF USE

The Hy-Tek nails described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 Design of the connections and installation of Hy-Tek nails must comply with this report, the manufacturer's published installation instructions and the applicable code. In the event of a conflict between this report and the manufacturer's published installation instructions, this report governs.

5.2 Calculations demonstrating that the applied loads do not exceed the adjusted design values specified in this report must be submitted to the code official for approval. Calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.3 Nails which have a bright finish or have a coating complying with ASTM A641 Class 1 must not be used in preservative-treated or fire-retardant treated wood.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Nails (AC116), dated June 2014 (editorially revised April 2015) including data in accordance with the ICC-ES Acceptance Criteria for Wood-frame Horizontal Diaphragms, Vertical Shear Walls and Braced Walls with Alternative Fasteners (AC120), dated June 2014 (editorially revised April 2015).

7.0 IDENTIFICATION

The nails are packaged in cartons bearing labels that provide the manufacturer name (Hy-Tek Fasteners); nail designation, nail description (type, length, and smooth-shank diameter); the minimum bending yield strength; and the evaluation report number (ESR-2648). Packages of galvanized nails must be labeled "ASTM A153, Class D".

TABLE 1—HY-TEK SCREW SHANK NAILS

NAIL DESIGNATION	SMOOTH SHANK DIAMETER (inch)	SCREW MAJOR SHANK DIAMETER (inch)	HEAD DIAMETER (inch)	TIP STYLE	SPECIFIED F_{yb} (psi)
0.120	0.120	0.130	0.280	Diamond tapered	100,000
0.120M	0.120	0.135	0.280	Blunt diamond	100,000
0.135	0.135	0.141	0.280	Diamond tapered	100,000
0.148	0.148	0.156	0.280	Diamond tapered	90,000

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa.

TABLE 2—REFERENCE LATERAL DESIGN VALUES (Z) FOR SINGLE FASTENER CONNECTIONS[1,2]

SIDE MEMBER THICKNESS (inches)	SIDE MEMBER MATERIAL	NAIL DESIGNATION	FOR WOOD MAIN MEMBER WITH A SPECIFIC GRAVITY OF 0.50 (lbf)	MINIMUM APPLICABLE NAIL LENGTH (inches)
$^{15}/_{32}$	OSB[3]	0.120	76	2
		0.120M	91	2
		0.135	103	2
$^{25}/_{32}$	Plywood[3]	0.120	82	2
		0.135	112	$2^1/_8$
		0.148	180	$2^1/_4$
$1^1/_2$	Wood member	0.120M	131	3
		0.148	180	3

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N.

[1]Tabulated lateral design values (Z) must be multiplied by all applicable adjustment factors in accordance with the NDS.
[2]Tabulated lateral design values are for nails inserted in side grain with axis perpendicular to wood fiber.
[3]Wood structural panel side members with specific gravity (G) = 0.50 or greater.

TABLE 3—REFERENCE WITHDRAWAL DESIGN VALUES (W) IN POUNDS PER INCH FOR SINGLE FASTENER CONNECTIONS[1,2]

NAIL DESIGNATION	FOR SPECIFIC GRAVITY OF 0.50 (lbf/in)
0.120	35
0.120M	44
0.135	50
0.148	45

For **SI:** 1 inch = 25.4 mm, 1 lbf/in = 175 N/m.

[1]Tabulated withdrawal values must be multiplied by all applicable adjustment factors in accordance with the NDS.
[2]Tabulated withdrawal values are for nails driven into the side grain of the main member, with the nail axis perpendicular to the wood fibers.

TABLE 4—SUBSTITUTION OF HY-TEK NAILS FOR NAILS PRESCRIBED FOR USE IN FRAMING CONNECTIONS IN IBC TABLE 2304.9.1 AND IRC TABLE R602.3(1)

CODE PRESCRIBED NAIL	HY-TEK NAILS WHICH MAY BE DIRECTLY SUBSTITUTED	APPLICABLE RANGE OF HY-TEK NAIL LENGTHS (inches)
8d box ($2^1/_2$" x 0.113")	0.120	$2^1/_2$ - 3
8d common ($2^1/_2$" x 0.131")	0.120	$2^1/_2$ - 3
3" x 0.131"	0.120	3 - $3^1/_4$
10d box (3" x 0.128")	0.120	3 - $3^1/_4$
10d common (3" x 0.148")	0.120M, 0.135	3 - $3^1/_4$

For **SI:** 1 inch = 25.4 mm.

TABLE 5—SUBSTITUTION OF HY-TEK NAILS FOR NAILS PRESCRIBED FOR USE IN ENGINEERED DIAPHRAGMS, ENGINEERED SHEAR WALLS AND PRESCRIPTIVE SHEATHING ATTACHMENT

CODE PRESCRIBED NAIL	SHEATHING THICKNESS (inch)	HY-TEK NAILS WHICH MAY BE DIRECTLY SUBSTITUTED	MINIMUM APPLICABLE NAIL LENGTH (inches)
8d common ($2^1/_2$" x 0.131")	$^3/_8$ to $^1/_2$	0.120	$2^1/_8$
10d common (3" x 0.148")	$^1/_2$	0.120M	$2^1/_4$
		0.135, 0.148	2
10d common (3" x 0.148")	$^3/_4$	0.120M	$2^1/_4$
		0.135, 0.148	$2^1/_4$

For **SI:** 1 inch = 25.4 mm.

TABLE 6—ALLOWABLE SHEAR (plf) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS WITH FRAMING OF DOUGLAS FIR–LARCH OR SOUTHERN PINE FOR WIND OR SEISMIC LOADING[1,2,3,4,5,6,7]

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	HY-TEK NAIL DESIGNATION	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	NOMINAL WIDTH OF FRAMING MEMBERS AT ADJOINING PANEL EDGES AND BOUNDARIES (inches)	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS	
					FASTENERS SPACING (INCHES) AT DIAPHRAGM BOUNDARIES (ALL CASES) AT CONTINUOUS PANEL EDGES PARALLEL TO LOAD (CASES 3, 4), AND AT ALL PANEL EDGES (CASES 5, 6)				FASTENERS SPACED 6 INCHES MAXIMUM AT SUPPORTED EDGES	
					6	4	$2^1/_2$	2	CASE 1	CASES 2, 3, 4, 5, & 6
					FASTENER SPACING (INCHES) AT OTHER PANEL EDGES (CASES 1,2,3,4)					
					6	6	4	3		
Structural 1	$^3/_8$	0.120	$1^3/_8$	2	270	360	530	600	240	180
				3	300	400	600	675	265	200
	$^{15}/_{32}$	0.120M, 0.135, 0.148	$1^1/_2$	2	320	425	640	730	285	215
				3	360	480	720	820	320	240
Sheathing and Single-Floor	$^3/_8$	0.120	$1^3/_8$	2	240	320	480	545	215	160
				3	270	360	540	610	240	180
	$^7/_{16}$	0.120	$1^3/_8$	2	255	340	505	575	230	170
				3	285	380	570	645	255	190
	$^{15}/_{32}$	0.120	$1^3/_8$	2	270	360	530	600	240	180
				3	300	400	600	675	265	200
	$^{15}/_{32}$	0.120M, 0.135, 0.148	$1^1/_2$	2	290	385	575	655	255	190
				3	325	430	650	735	290	215
	$^{19}/_{32}$	0.120M, 0.135, 0.148	$1^1/_2$	2	320	425	640	730	285	215
				3	360	480	720	820	320	240

For **SI:** 1 inch = 25.4 mm, 1 plf = 14.6 N/m.

[1]Diaphrgms must be constructed in general accordance with the requirements of Section 4.2 of the AWC SDPWS.
[2]For framing of other species, the allowable diaphragm shear capacity is found by (1) Determining the specific gravity for the applicable species of lumber in the NDS, (2) Finding the allowable diaphragm shear value from the table above, and (3) multiplying this value by the Specific Gravity Adjustment Factor = [1 - (0.5 – G)], where G = Specific Gravity of the framing lumber. This adjustment factor must not be greater than 1.
[3]Framing at adjoining panel edges must be 3 inches nominal or wider, and nails must be staggered where both of the following conditions are met: (1) 0.120M, 0.135-inch or 0.148 screw shank nails having penetration into framing of more than $1^1/_2$ inches and (2) panel edge nail spacing is 3 inches o.c. or less.
[4]For shear loads of normal or permanent load duration as defined by the NDS, the values in the table above must be multiplied by 0.63 or 0.56, respectively.
[5]The values in the table may be increased by 40 percent for wind design.
[6]See Figure 2 for case patterns.
[7]LRFD factored resistance may be determined by multiplying the applicable tabulated value, modified by applicable footnotes, by a factor of 2 and then by a resistance factor of 0.80.

TABLE 7—ALLOWABLE SHEAR (plf) FOR WOOD STRUCTURAL PANEL BLOCKED DIAPHRAGMS UTILIZING MULTIPLE ROWS OF FASTENERS (HIGH LOAD DIAPHRAGMS) WITH FRAMING OF DOUGLAS FIR–LARCH OR SOUTHERN PINE FOR WIND OR SEISMIC LOADING[1,2,3,4,5,6,7,8]

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	NAIL DESIGNATION	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBER AT ADJOINING PANEL EDGES AND BOUNDARIES	LINES OF FASTENERS	BLOCKED DIAPHRAGMS			
						CASE 1 AND 2[6]			
						NAIL SPACING PER LINE AT BOUNDARIES (inches)			
						4		$2^1/_2$	
						NAIL SPACING PER LINE AT OTHER PANEL EDGES (inches)			
						6	4	4	3
Structural 1	$^{15}/_{32}$	0.120M, 0.135, 0.148	$1^1/_2$	3	2	605	815	875	1,150
				4	2	700	915	1,005	1,290
				4	3	875	1,220	1,285	1,395
	$^{19}/_{32}$	0.120M, 0.135, 0.148	$1^1/_2$	3	2	670	880	965	1,255
				4	2	780	990	1,110	1,440
				4	3	965	1,320	1,405	1,790
	$^{23}/_{32}$	0.120M, 0.135, 0.148	$1^1/_2$	3	2	730	955	1,050	1,365
				4	2	855	1,070	1,210	1,565
				4	3	1,050	1,430	1,525	1,800
Sheathing and Single-Floor	$^{15}/_{32}$	0.120M, 0.135, 0.148	$1^1/_2$	3	2	525	725	765	1,010
				4	2	605	815	875	1,105
				4	3	765	1,085	1,130	1,195
	$^{19}/_{32}$	0.120M, 0.135, 0.148	$1^1/_2$	3	2	650	860	935	1,225
				4	2	755	965	1,080	1,370
				4	3	935	1,290	1,365	1,480
	$^{23}/_{32}$	0.120M, 0.135, 0.148	$1^1/_2$	3	2	710	935	1,020	1,335
				4	2	825	1,050	1,175	1,445
				4	3	1,020	1,400	1,480	1,565

For **SI:** 1 inch = 25.4 mm, 1 plf = 14.6 N/m.

[1]Diaphrgms must be constructed in general accordance with the requirements of Section 4.2 of the AWC SDPWS.
[2]For framing of other species, the allowable diaphragm shear capacity is found by (1) Determining the specific gravity for the applicable species of lumber in the NDS, (2) Finding the allowable diaphragm shear value from the table above, and (3) multiplying this value by the Specific Gravity Adjustment Factor = [1 - (0.5 – G)], where G = Specific Gravity of the framing lumber. This adjustment factor must not be greater than 1.
[3]For shear loads of normal or permanent load duration as defined by the NDS, the values in the table above must be multiplied by 0.63 or 0.56, respectively.
[4]The values in the table may be increased by 40 percent for wind design.
[5]This table gives shear values for Cases 1 and 2. The values shown are applicable to Cases 3, 4, 5 and 6 provided fasteners at all continuous panel edges are spaced in accordance with the boundary fastener spacing. See Figure 2 for case patterns.
[6]High load diaphragms are subject to special inspection in accordance with ~~2015 and~~ 2012 IBC Section 1705.5.1 (2009 IBC Section 1704.6.1).
[7]See Figure 3 for nailing requirements.
[8]LRFD factored resistance may be determined by multiplying the applicable tabulated value, modified by applicable footnotes, by a factor of 2 and then by a resistance factor of 0.80.

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TABLE 8—ALLOWABLE SHEAR (plf) FOR WOOD STRUCTURAL PANEL SHEAR WALLS WITH FRAMING OF DOUGLAS FIR–LARCH OR SOUTHERN PINE FOR WIND OR SEISMIC LOADING[1,2,4,5,6,7]

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inches)	NAIL LENGTH (inches)	PANEL APPLIED DIRECTLY TO FRAMING				
			NAIL DESIGNATION	NAIL SPACING AT PANEL EDGE (inches)			
				6	4	3	2
Structural 1	3/8	2 1/8	0.120	230[3]	360[3]	460[3]	610[3]
	7/16			255[3]	395[3]	505[3]	670[3]
	15/32			280	430	550	730
	15/32	2 1/4	0.120M	340	510	665[5]	870
Other grades[6]	3/8	2 1/8	0.120	220[3]	320[3]	410[3]	530[3]
	7/16			240[3]	350[3]	450[3]	585[3]
	15/32			260	380	490	640
	15/32	2 1/4	0.120M	310	460	600[5]	770

For **SI:** 1 inch = 25.4 mm, 1 plf = 14.6 N/m.

[1]Shear walls must be constructed in general accordance with the requirements of Section 4.3 of the AWC SDPWS.
[2]For framing of other species, the allowable diaphragm shear capacity is found by (1) Determining the specific gravity for the applicable species of lumber in the NDS, (2) Finding the allowable diaphragm shear value from the table above, and (3) multiplying this value by the Specific Gravity Adjustment Factor = [1 - (0.5 – G)], where G = Specific Gravity of the framing lumber. This adjustment factor must not be greater than 1.
[3]Allowable shear values are permitted to be increased to values shown for 15/32-inch sheathing with same nailing provided (a) studs are spaced a maximum of 16 inches on center, or (b) panels are applied with long dimension across studs.
[4]Framing at adjoining panel edges must be 3 inches nominal or wider, and nails must be staggered where both of the following conditions are met: (1) 0.120M nails having penetration into framing of more than 1 1/2 inches and (2) panel edge nail spacing is 3 inches o.c. or less.
[5]For shear loads of normal or permanent load duration as defined by the NDS, the values in the table above must be multiplied by 0.63 or 0.56, respectively.
[6]See Figure 3 for nailing requirements.
[7]LRFD factored resistance may be determined by multiplying the applicable tabulated value, modified by applicable footnotes, by a factor of 2 and then by a resistance factor of 0.80.

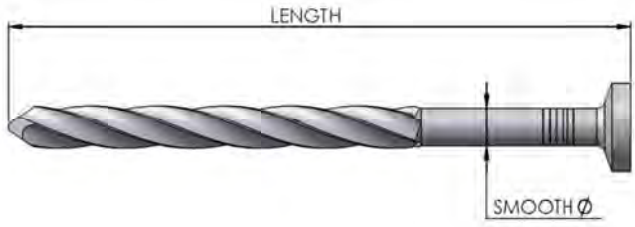


FIGURE 1—HY-TEK SCREW SHANK NAILS

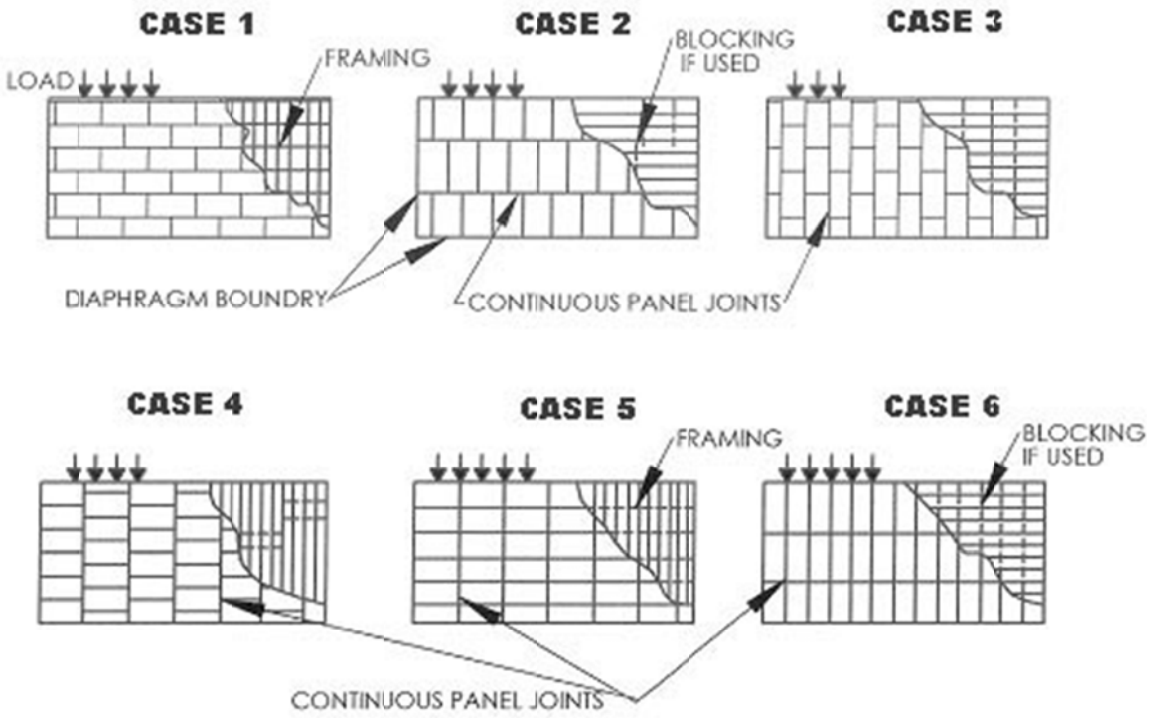
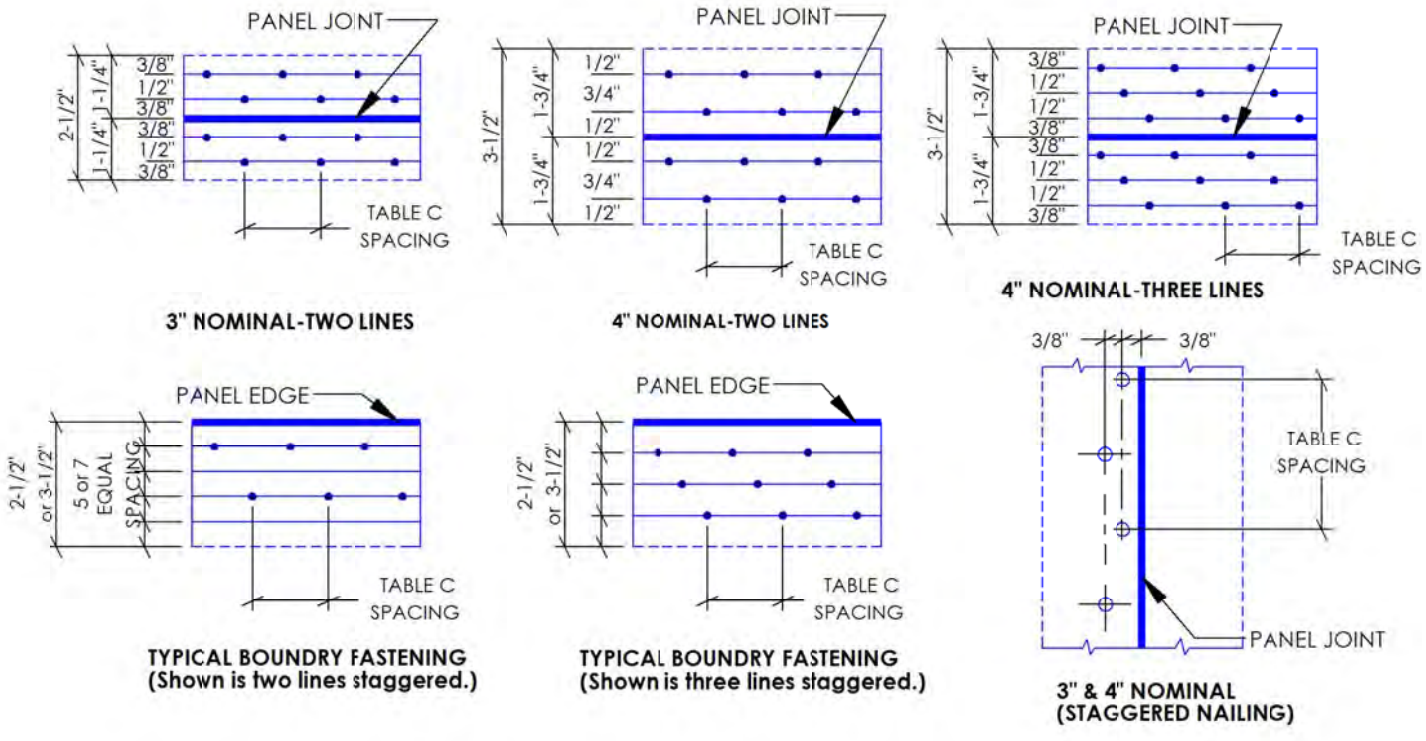


FIGURE 2—DIAPHRAGM CASES



Note: Space panel end and edge joints $^{1}/_{8}$ inch (3.175 mm). Reduce spacing between lines of nails as necessary to maintain minimum $^{3}/_{8}$ inch (9.5 mm) fastener edge margins, minimum spacing between lines is $^{3}/_{8}$ inch (9.5 mm).

FIGURE 3—NAILING PATTERNS FOR HIGH-LOAD DIAPHRAGMS AND STAGGERED NAILING