

The expiration date of this document has been extended until 3/31/12.



Code Compliant Repair and Protection Guide

FOR THE INSTALLATION OF UTILITIES IN WOOD FRAME CONSTRUCTION



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A WORD ABOUT BUILDING CODES

All of the major building codes feature regulations on the size and/or location of penetrations in wood members for plumbing, HVAC and electrical components. In many cases, in order to comply with the code, hardware is required to:

- Reinforce wood members
- Protect utilities within the wall

This guide is intended to illustrate the penetrations that are allowed under the various codes with and without repair or

protection. Simpson Strong-Tie® offers a range of products to help meet these code requirements.

The information in this guide is a summary of requirements from the 2003, 2006 and 2009 International Residential Code (IRC), International Building Code (IBC), International Plumbing Code (IPC), International Mechanical Code (IMC), 2006 Uniform Plumbing Code (UPC) and the 2005 National Electrical Code.

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LIMITED WARRANTY

Simpson Strong-Tie Company Inc. warrants catalog products to be free from defects in material or manufacturing. Simpson Strong-Tie Company Inc. products are further warranted for adequacy of design when used in accordance with design limits in this catalog and when properly specified, installed, and maintained. This warranty does not apply to uses not in compliance with specific applications and installations set forth in this catalog, or to non-catalog or modified products, or to deterioration due to environmental conditions.

Simpson Strong-Tie® connectors are designed to enable structures to resist the movement, stress, and loading that results from impact events such as earthquakes and high velocity winds. Other Simpson Strong-Tie products are designed to the load capacities and uses listed in this flier. Properly-installed Simpson Strong-Tie products will perform in accordance with the specifications set forth in the applicable Simpson Strong-Tie catalog. Additional performance limitations for specific products may be listed on the applicable catalog pages.

Due to the particular characteristics of potential impact events, the specific design and location of the structure, the building materials used, the quality of construction, and the

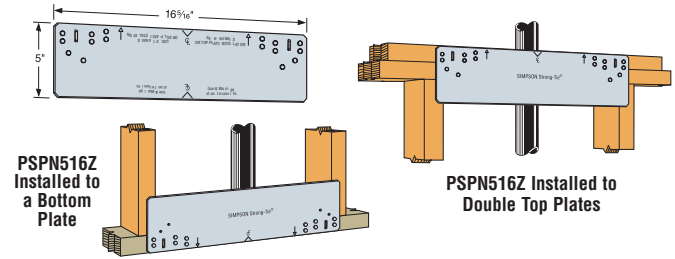
condition of the soils involved, damage may nonetheless result to a structure and its contents even if the loads resulting from the impact event do not exceed Simpson Strong-Tie catalog specifications and Simpson Strong-Tie connectors are properly installed in accordance with applicable building codes.

All warranty obligations of Simpson Strong-Tie Company Inc. shall be limited, at the discretion of Simpson Strong-Tie Company Inc., to repair or replacement of the defective part. These remedies shall constitute Simpson Strong-Tie Company Inc.'s sole obligation and sole remedy of purchaser under this warranty. In no event will Simpson Strong-Tie Company Inc. be responsible for incidental, consequential, or special loss or damage, however caused.

This warranty is expressly in lieu of all other warranties, expressed or implied, including warranties of merchantability or fitness for a particular purpose, all such other warranties being hereby expressly excluded. This warranty may change periodically – consult our website www.strongtie.com for current information.

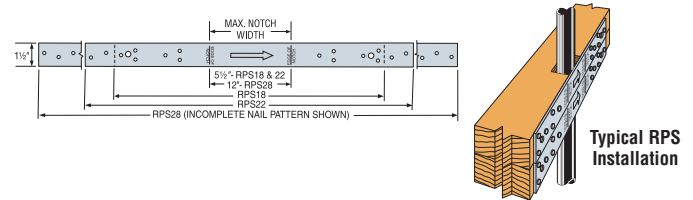
PSPN516 Repair and Shield Plate: Reinforcement and Protection

Repair and shield plates reinforce top or bottom plates drilled or cut during construction. They are 16 gauge steel, install with 16d nails, and protrude at least 2" above or below single or double plates to meet the requirements of the code for repair and protection. They are available with a standard galvanized coating or a ZMAX® galvanized coating for added corrosion resistance for use with some preservative-treated lumber. See page 11 for complete fastener and load information.



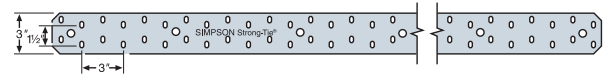
RPS Repair Strap: Reinforcement

Repair straps reinforce top and bottom plates notched or cut during construction. They are 16 gauge steel and install with 16d nails to meet the requirements of the code for repair. They are available with a standard galvanized coating or a ZMAX® galvanized coating for added corrosion resistance for use with some preservative-treated lumber. See page 11 for complete fastener and load information.



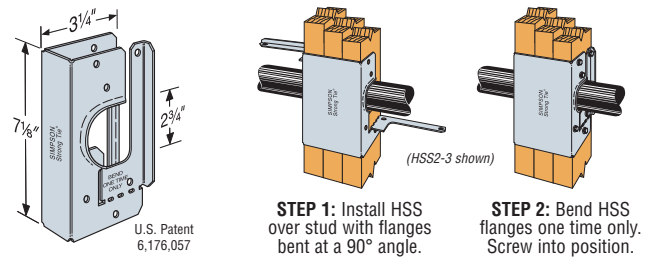
MSTC Strap: Reinforcement

MSTC straps reinforce top or bottom plates drilled or cut during construction. They are 16 gauge steel and install with 16d nails to meet the requirements of the code for repair. Recommended for applications where two plate penetrations are too close together for separate RPS straps to be installed (example: HVAC chase). See page 11 for complete fastener and load information.



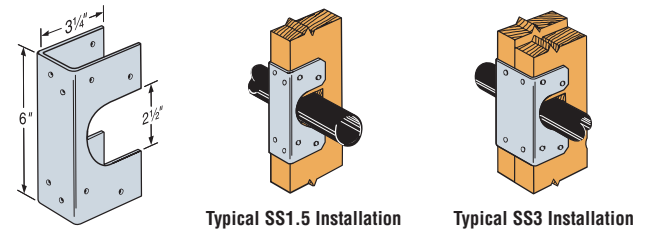
HSS Heavy-Duty Stud Shoe: Reinforcement and Protection

Heavy-duty stud shoes provide extra reinforcing to studs bored or notched during construction and protect piping within the wall. HSS install with SDS 1/4" diameter wood screws (included) and resist tension as well as compression loads. Suitable for piping with a maximum outside diameter of 2 3/8", they are available in sizes for single, double and triple 2x studs as well as single 4x studs. Made from 16 gauge steel to meet the protection requirements of the code, they feature a galvanized coating. See page 11 for complete fastener and load information.



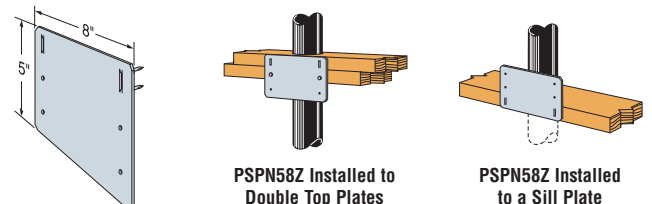
SS Stud Shoe: Reinforcement and Protection

Stud shoes reinforce studs bored or notched during construction and protect piping within the wall. Suitable for piping with a maximum outside diameter of 2 3/8", they are available in sizes for single, double and triple 2x studs as well as single 3x studs. Made from 16 gauge steel to meet the protection requirements of the code and feature a galvanized coating. Stud shoes resist compression loads only, see page 11 for complete fastener and load information.



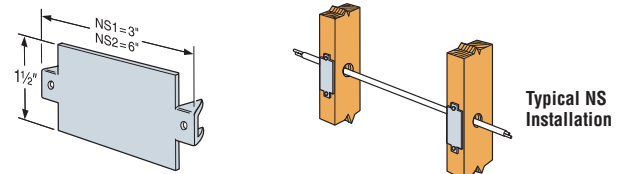
PSPN58 Shield Plate: Protection

Shield plates prevent penetration of fasteners into wiring or piping at the top and bottom plates of the walls. They are 16 gauge steel and protrude at least 2" above/below single or double plates to meet the protection requirements of the code. They are available with a standard galvanized coating or a ZMAX® galvanized coating for added corrosion resistance for use with some preservative-treated lumber.



NS Nail Stop: Protection

Nail stops prevent penetration of fasteners into wiring or piping. They are 16 gauge steel to meet the protection requirements of the code and feature a galvanized coating. Install with prongs or 8d common nails.



These products are available with a ZMAX® galvanized coating for extra corrosion protection. ZMAX coating is sometimes recommended for applications where hardware is being installed onto preservative-treated wood members such as mudsills. See the current *Wood Construction Connectors* catalog or visit www.strongtie.com/info for more details.

TOP AND BOTTOM PLATES

Building Code Analysis

When installing plumbing throughout a wood structure, the building codes address two requirements regarding top, bottom and sill plates: the reinforcement of members where material has been removed and the protection of piping within walls.

Structural repair is required when:

- A hole, cut or notch that is more than 50% of the top plate width is removed in an exterior wall, or interior load-bearing wall for piping (*except when the side of the wall with the notch or cut is covered by wood structural panel sheathing*) (IRC).
- The plates in, or partly in, a partition are cut for plumbing, heating, or other pipes (IBC).

Required repairs:

- A galvanized, 16 gauge metal tie that is at least 1½" wide (IRC, IBC).
 - This tie must be fastened with 8-16d nails on each side of the opening (IRC) or 6-16d nails on each side of the opening (IBC). 10d x 1½" (0.148 x 1½") nails satisfy the 2009 IRC requirements.
- NOTE:** Nails can be 16d box (0.135 x 3½") or 16d common (0.162 x 3½").

Protection of piping within the wall is required when:

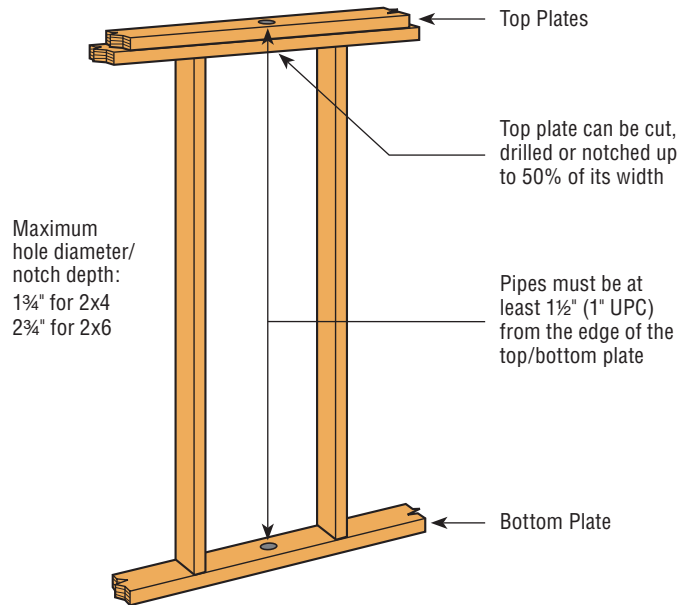
- Piping other than cast iron or galvanized steel (*e.g. PVC or ABS*) is closer than 1½" to the edge of the plate (IRC, IPC, IMC).
- Plastic and copper piping run through framing members is closer than 1" from the edge of the framing member (UPC).

Required protection:

- A 16 gauge steel protective plate that covers the side of the plate and extend 2" above/below it (IRC, IPC, IMC).
- A steel protective plate not less than 18 gauge, that extends 1½" beyond the pipe on each side (UPC).

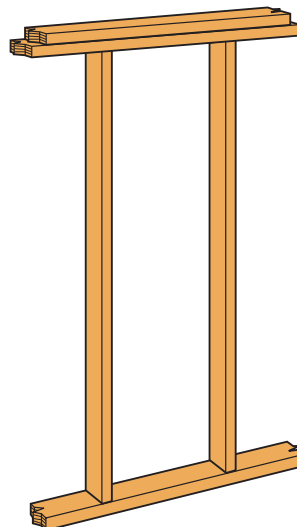
Under the various building codes, the following penetrations are allowed without any type of protection or repair to the wood members.

Allowable penetrations with no repair/protection: IRC/IPC/IMC/UPC



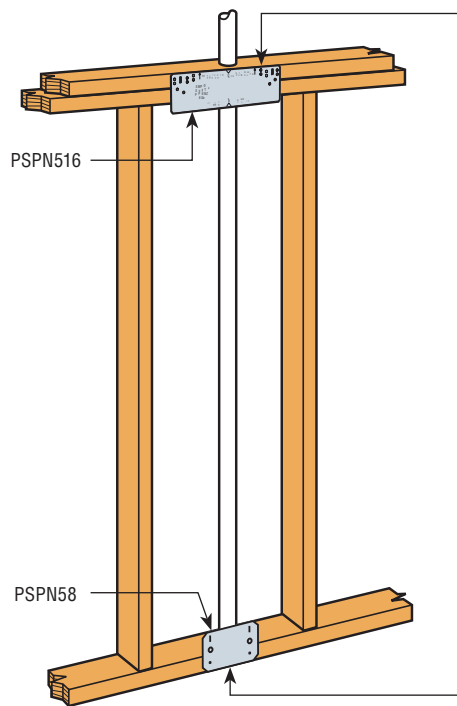
Allowable penetrations with no repair/protection: IBC

No cuts, notches or holes for plumbing, heating or other pipes are allowed in the top or bottom plates without a structural repair strap.



TOP AND BOTTOM PLATES

REPAIRS/PROTECTION – IRC (Piping other than cast iron or galvanized steel)



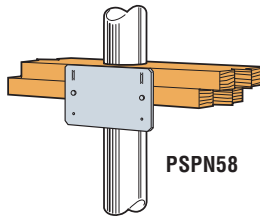
Top Plate Repair/Protection

LOAD BEARING

PSPN516 – When more than 50% of the width of the top plate is removed and piping is closer than 1½" from the edge of the top plate, a galvanized structural repair/protection plate is required. The plate must be fastened with 8-16d nails (10dx1½" nails, 2009 IRC) on each side of the cut and must extend 2" below the framing member.

INTERIOR NON-LOAD BEARING

PSPN58 – When piping is closer than 1½" from the edge of the plate, a protection plate that extends 2" below the framing member is required.



PSPN58

Bottom Plate Protection

PSPN58 – When piping is closer than 1½" from the edge of the bottom plate, a protection plate is required that extends 2" above the framing member.

Building Code References

International Residential Code (IRC)

Repair top plates and protect piping

- Sections: R602.6.1, M1308.2 and P2603.2.1
- Suitable product: PSPN516 Repair and Shield Plate

Protect piping

- M1308.2 and P2603.2.1
- Suitable product: PSPN58 Shield Plate

Repair top and bottom plates

- R602.6.1 (top plates only)
- Suitable product: RPS Repair Strap
- RPS22

International Building Code (IBC)

Repair top and bottom plates

- Section 2308.9.8
- Suitable product: RPS Repair Strap

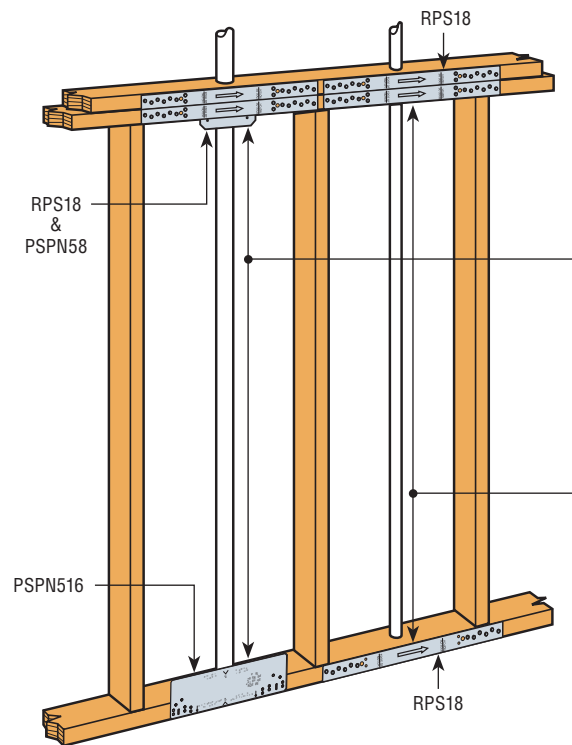
International Plumbing Code (IPC), International Mechanical Code (IMC) and Uniform Plumbing Code (UPC)

Protect piping

- IPC section: 305.8
- IMC sections: 305.5
- UPC section: 313.9
- Suitable product: PSPN58 Shield Plate or PSPN516 Repair and Shield Plate

Product recommendations based upon prescriptive requirements of the codes cited. For technical information on these products, see page 11.

REPAIRS/PROTECTION – IBC/IPC/IMC/UPC/UMC



Top and Bottom Plate Repair/Protection – Piping closer than 1½" to edge of plate

RPS18 – Whenever the soles or plates are cut, a galvanized structural repair plate that is 16 gauge x 1½" wide is required that is fastened with 6-16d nails on each side of the cut (IBC).

PSPN58 – If piping is closer than 1½" to the edge of the lumber, a repair plate is required that extends 2" above/below the framing member (IPC, IMC). When plastic and copper piping penetrates framing members to within 1" of the edge, a steel nail plate not less than 18 gauge, that extends 1½" beyond the pipe or tubing on each side, is required (UPC).

PSPN516 – See both references above.

Top and Bottom Plate Repair – Piping further than 1½" (1" UPC) from the edge of the plate (no protection required)

RPS18 – Whenever the soles or plates are cut, a galvanized structural repair strap that is 16 gauge x 1½" is required and is to be fastened with 6-16d nails on each side of the cut (IBC).



Some of the products shown are available with a ZMAX® galvanized coating for extra corrosion protection. ZMAX coating is sometimes recommended for applications where hardware is being installed onto preservative-treated wood members such as mudsills. See the current Wood Construction Connectors catalog or visit www.strongtie.com/info for more details.

STUDS

Building Code Analysis

When installing plumbing throughout a wood structure, the building codes address two requirements regarding studs: the reinforcement of members where material has been removed and the protection of piping within walls.

Structural repair is required when:

- A stud is notched to a depth greater than 25% of the width in bearing walls, or 40% in non-bearing partitions (IRC, IBC, IMC).
- A hole is bored to a diameter exceeding 40% of the stud width in bearing walls, or 60% in non-bearing partitions (IRC, IBC, IMC).
 - In no case shall the edge of the bored hole be closer than $\frac{5}{8}$ " from the edge of the stud.
 - Bored holes shall not be located at the same section of stud as a cut or notch.
 - Exception: a hole may be drilled between 40-60% of the stud diameter in bearing walls if the bored stud is doubled and not more than two successive doubled studs are bored.

Required repairs:

- If maximum hole/notch specifications are exceeded:
 - A suitable stud shoe, approved by the building official, must be installed (IRC).
 - It is the responsibility of the Designer to provide an engineered solution (IBC). See page 11 for technical information on stud shoes.

Protection of piping within the wall is required when:

- Piping other than cast iron or galvanized steel (e.g. PVC or ABS) is closer than $1\frac{1}{2}$ " to the edge of the stud (IRC, IPC, IMC).
- Plastic and copper piping run through framing members is closer than 1" from the edge of the framing member (UPC).

Required protection:

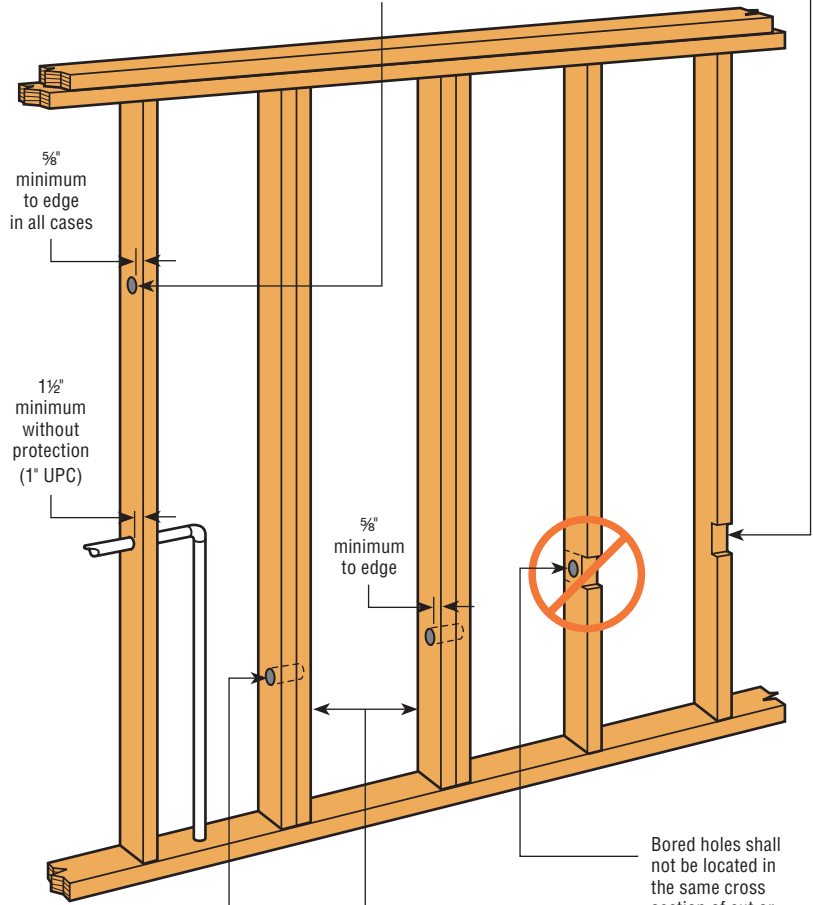
- A 16 gauge steel shield plate that covers the area of the pipe where the member is notched or bored (IRC, IPC, IMC).
- A steel protective plate not less than 18 gauge, that extends $1\frac{1}{2}$ " beyond the pipe on each side (UPC).

Under the various building codes, the following penetrations are allowed without repair of the wood members.

Allowable penetrations with no repair/protection: IRC/IBC/IPC/IMC/UPC

Maximum Bored Hole Diameter/Notch Depth

Stud Size (in)	Application	Maximum Hole Diameter (in)	Maximum Notch Depth (in)
2x4	Interior / Non-Bearing	$2\frac{1}{8}$	$1\frac{3}{8}$
	Exterior / Bearing	$1\frac{1}{8}$	$\frac{7}{8}$
2x6	Interior / Non-Bearing	$3\frac{1}{4}$	$2\frac{3}{16}$
	Exterior / Bearing	$2\frac{3}{16}$	$1\frac{3}{8}$



Boring Exception for Load Bearing Walls

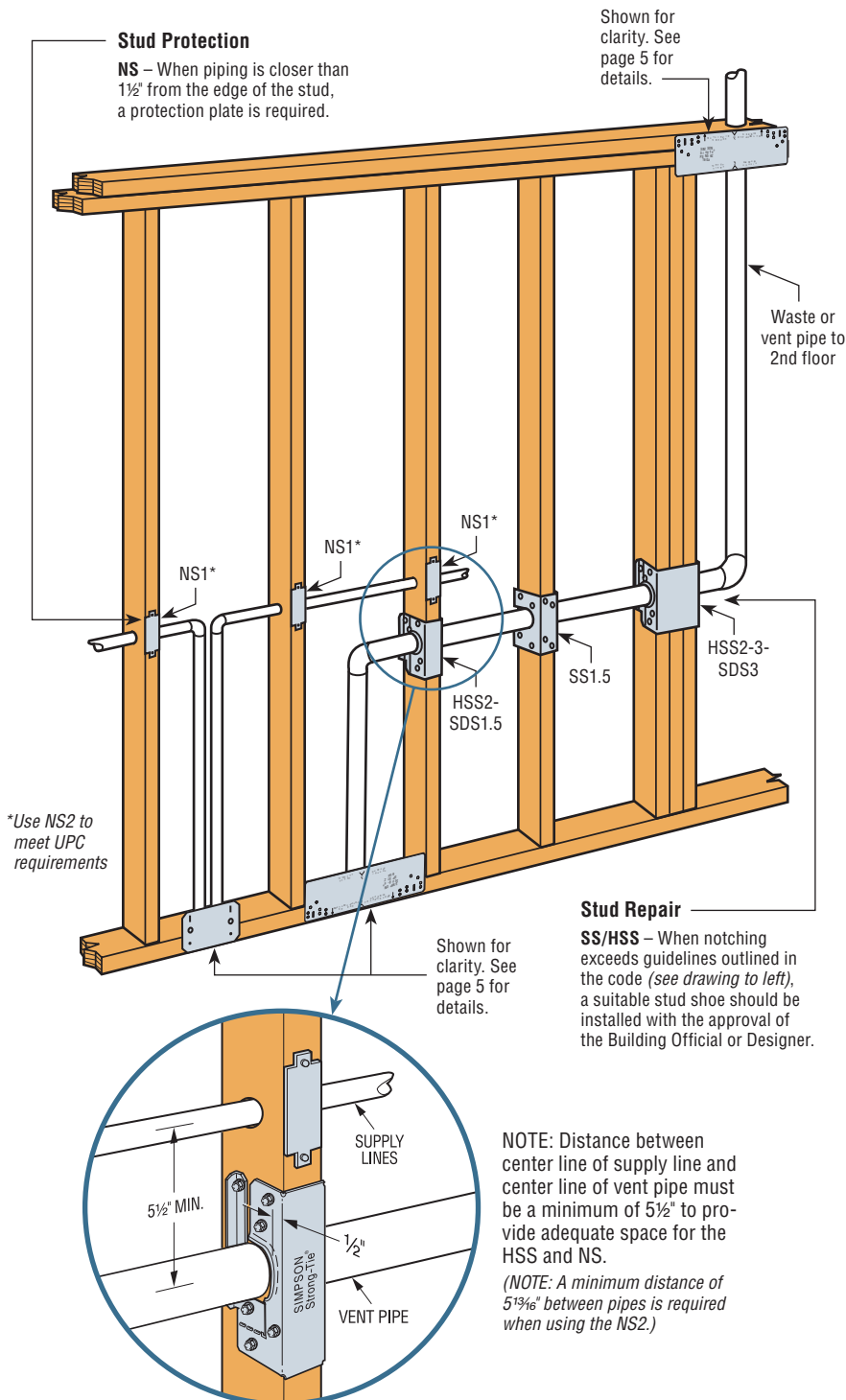
If hole is between 40% and 60% of stud depth, then stud must be doubled and no more than two successive doubled studs are bored.

Studs doubled to meet requirements of code relating to allowable drilled hole diameter.

Bored holes shall not be located in the same cross section of cut or notch in stud.

STUDS

REPAIRS/PROTECTION – IRC/IBC/IPC/IMC/UPC



Building Code References

International Residential Code (IRC)

Repair stud and protect piping

- Sections: R602.6, M1308.2 and P2603.2.1
- Suitable products:
SS Stud Shoe
HSS Heavy Stud Shoe

Protect piping

- Sections: M1308.2 and P2603.2.1
- Suitable product:
NS Nail Stop

International Building Code (IBC)

Repair stud

- Sections: 2308.9.10 and 2308.9.11
- Suitable products
(as determined by Designer):
SS Stud Shoe
HSS Heavy Stud Shoe

International Plumbing Code (IPC), International Mechanical Code (IMC) and Uniform Plumbing Code (UPC)

Protect piping

- IPC section: 305.8
- IMC sections: 305.5
- UPC section: 313.9
- Suitable product:
NS Nail Stop

Product recommendations based upon prescriptive requirements of the codes cited. For technical information on these products, see page 11.



Some of the products shown are available with a ZMAX® galvanized coating for extra corrosion protection. ZMAX coating is sometimes recommended for applications where hardware is being installed onto preservative-treated wood members such as mudsills. See the current *Wood Construction Connectors* catalog or visit www.strongtie.com/info for more details.

TOP AND BOTTOM PLATES

Building Code Analysis

When installing HVAC throughout a wood structure, the building codes address the reinforcement of top and bottom plates where material has been removed to allow the passage of ductwork.

Structural repair is required when:

- A hole or notch that is more than 50% of the top plate width is removed in an exterior wall, or interior load-bearing wall for piping or ductwork, unless the entire side of the wall with the notch or cut is covered by wood structural-panel sheathing (IRC).
- The soles or plates in, or partly in, a partition are cut for ductwork (IBC).

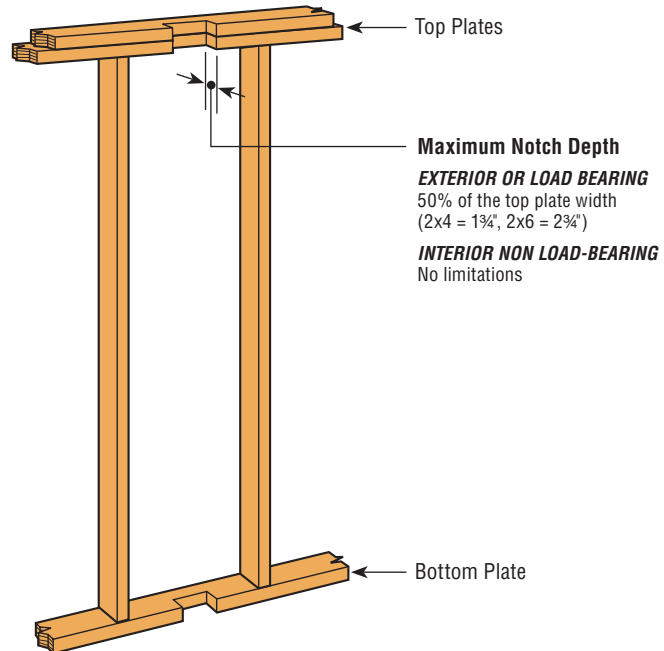
Required repair:

- A galvanized, 16 gauge metal tie that is at least 1½" wide is required on one or more of the top plates (IRC).
- A galvanized, 16 gauge metal tie that is at least 1½" wide is required on both top plates and on the bottom plate (IBC).
- When the entire top plate is removed for ductwork a 16 gauge metal tie should be installed on both sides of the cut plate (*load bearing wall only in IRC*).
- Where the top plate has been removed from two consecutive bays, a 3" wide strap that spans both bays is one possible method.
- These ties must be fastened with 6-16d nails on each side of the opening (IBC) or 8-16d nails on each side of the opening (IRC).

NOTE: Nails can be 16d box (0.135x3½") or 16d common (0.162x3½"). See page 11 for more information on fasteners.

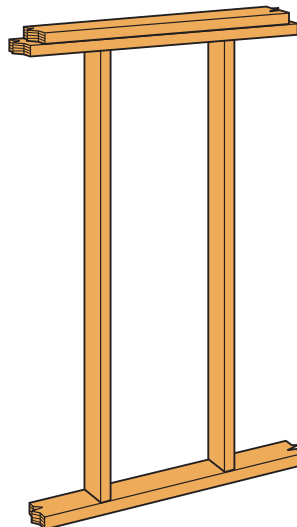
Under the various building codes, the following penetrations are allowed without any type of repair to the wood members.

Allowable penetrations with no repair/protection: IRC



Allowable penetrations with no repair/protection: IBC

No cuts, notches or holes for plumbing, heating or other pipes are allowed in the top or bottom plates without a structural repair strap.



TOP AND BOTTOM PLATES

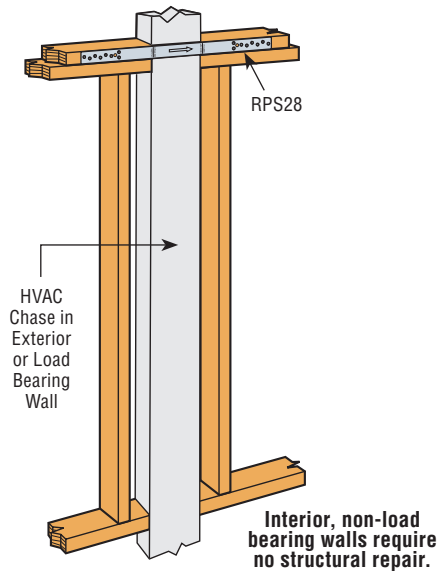
HVAC REPAIRS – IRC

Top Plate Repair

EXTERIOR OR LOAD BEARING

RPS28 – When more than 50% of the width of the top plate is removed, a galvanized structural repair strap that is not less than 16 gauge x 1½" wide is required. The strap must be installed on the uppermost plate, and fastened on either side of the cut with 8-16d nails.

NON-LOAD BEARING – No repair required.

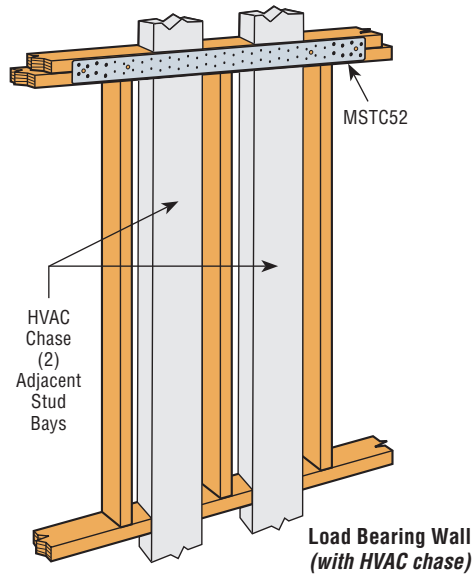


Top Plate Repair – Side-by-Side Ductwork

LOAD BEARING

MSTC52 – When more than 50% of the width of the top plate is removed, a galvanized structural repair strap that is not less than 16 gauge x 1½" wide is required. In this application a 3" wide strap provides equivalent tension capacity as long as it is fastened on each side of the cut with 8-16d nails.

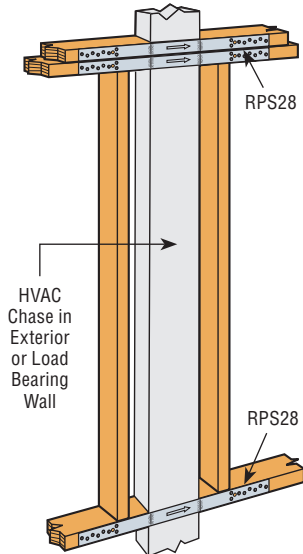
NON-LOAD BEARING – No repair required.



HVAC REPAIRS – IBC

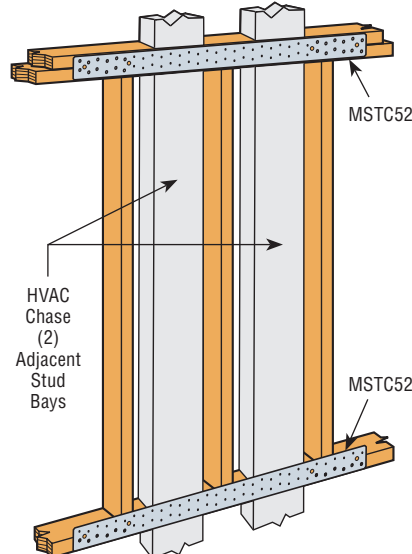
Top and Bottom Plate Repair

RPS28 – Whenever the soles or plates are cut, a galvanized structural repair strap that is not less than 16 gauge x 1½" wide is required on each plate and is to be fastened with 6-16d nails on each side of the cut.



Top and Bottom Plate Repair – Two Consecutive Bays

MSTC52 – Whenever the soles or plates are cut, a galvanized structural repair strap that is not less than 16 gauge x 1½" wide is required on each plate. In this application a 3" wide strap provides equivalent tension capacity as long as it is fastened on each side of the cut with 6-16d nails per plate.



Building Code References

International Residential Code (IRC)

Repair top plates

- R602.6.1
- Suitable product: RPS and MSTC Repair Straps

International Building Code (IBC)

Repair top and bottom plates

- Section 2308.9.8
- Suitable product: RPS and MSTC Repair Straps

Product recommendations based upon prescriptive requirements of the codes cited. For technical information on these products, see page 11.



Some of the products shown are available with a ZMAX® galvanized coating for extra corrosion protection. ZMAX coating is sometimes recommended for applications where hardware is being installed onto preservative-treated wood members such as mudsills. See the current *Wood Construction Connectors* catalog or visit www.strongtie.com/info for more details.

TOP PLATE, BOTTOM PLATE AND STUDS

Building Code Analysis

When installing electrical wiring throughout a wood structure the building codes require protection of the wiring to prevent damage.

Protection of wiring within the wall is required when:

- A hole is closer than 1¼" to the edge of a wood member (IRC, N.E.C.).

Required protection:

- A 16 gauge protective steel plate that covers the area of the wiring (IRC, N.E.C.).

While the codes do not specifically address top or bottom plate repair for electrical applications, Simpson Strong-Tie recommends that the guidelines shown on page 5 be considered. This will help ensure that plates perform as intended after electrical is installed.

Building Code References

International Residential Code (IRC) and National Electric Code (NEC)

Protect wiring

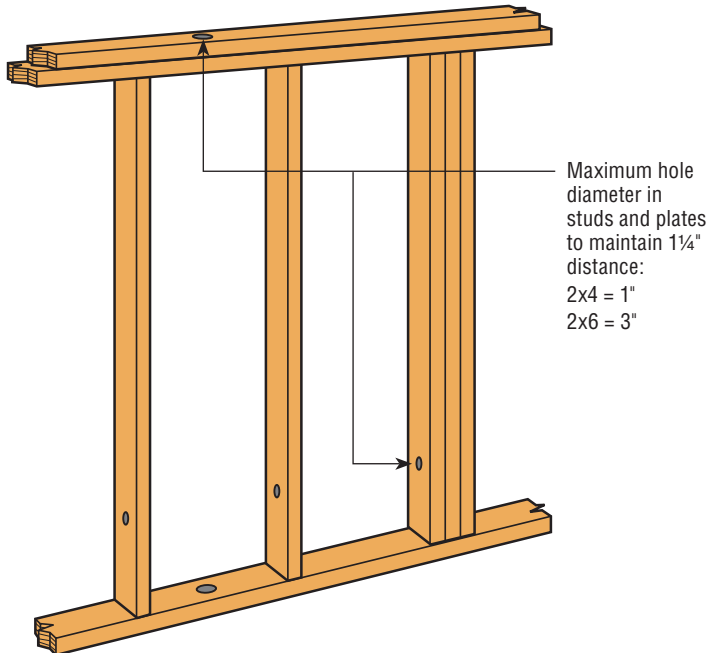
- IRC Table E3702.1
- NEC Section 300.4
- Suitable product: NS Nail Stops

Product recommendations based upon prescriptive requirements of the codes cited. For technical information on these products, see page 11.

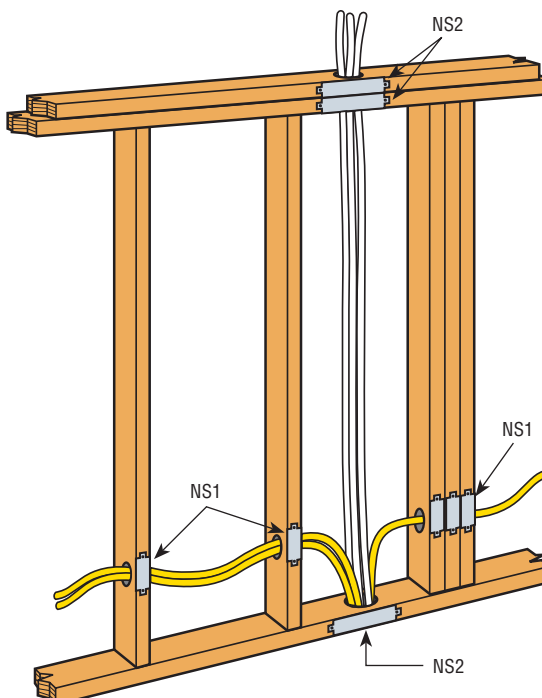


Some of the products shown are available with a ZMAX® galvanized coating for extra corrosion protection. ZMAX coating is sometimes recommended for applications where hardware is being installed onto preservative-treated wood members such as mudsills. See the current *Wood Construction Connectors* catalog or visit www.strongtie.com/info for more details.

Allowable penetrations with no repair/protection



Electrical Protection



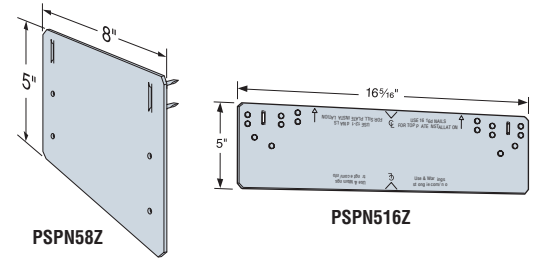
Stud and Plate Protection

NS – When a hole is closer than 1¼" from the edge of a wood member (due to diameter or placement) a protective steel plate is required.

PSPN Repair and Shield Plates

Model No.	Ga	Dimensions		Fasteners (Total)	Allowable Tension Load DF/SP	Allowable Tension Load SPF/HF
		W	L		(160)	(160)
PSPN58Z	16	5	8	2-8d	—	—
PSPN516Z	16	5	16 ⁵ / ₁₆	12-16d	1365	1180
				16-16d	1820	1575

- Unless otherwise noted "16d" refers to 16d common nails. To meet the prescriptive IRC requirement 16d box nails (0.135" dia. x 3¹/₂") may be used. Allowable tension load is 0.75 of table loads when installed with 16d box nails. 10dx1¹/₂" (0.148" dia. x 1¹/₂") may be used to meet the 2009 IRC prescriptive requirement.
- NAILS:** 16d common = 0.162" dia. x 3¹/₂" long.

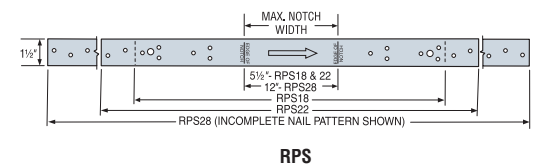


RPS Repair Strap

CODES: ICC-ESR-2608; City of L.A. RR25281; Florida FL 10864

Model No.	Ga	Dimensions		Notch Width	Fasteners (Total)	Allowable Tension Loads (DF/SP)	Allowable Tension Loads (SPF/HF)
		W	L			(160)	(160)
RPS18	16	1 ¹ / ₂	18 ⁵ / ₁₆	≤ 5 ¹ / ₂ "	12-16d	1380	1190
RPS22		1 ¹ / ₂	22 ⁵ / ₁₆	≤ 5 ¹ / ₂ "	12-16d	1380	1190
		1 ¹ / ₂	22 ⁵ / ₁₆		16-16d	1805	1585
RPS28		1 ¹ / ₂	28 ⁵ / ₁₆	≤ 12"	12-16d	1380	1190
	1 ¹ / ₂	28 ⁵ / ₁₆	16-16d		1805	1585	

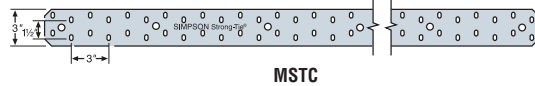
- To meet the prescriptive IRC requirement 16d box nails (0.135" dia. x 3¹/₂") may be used. Allowable tension load is 0.75 of table loads when installed with 16d box nails. 10dx1¹/₂" (0.148" dia. x 1¹/₂") may be used to meet the 2009 IRC prescriptive requirement.
- Install with 12 fasteners to meet IBC requirement, and 16 to meet IRC.
- NAILS:** 16d common = 0.162" dia. x 3¹/₂" long.



MSTC Repair Strap

CODES: ICC-ESR-2523; City of L.A. RR25713; Florida FL 10852

Model No.	Ga	Dimensions		Fasteners (Total)	Allowable Tension Loads (DF/SP)	Allowable Tension Loads (SPF/HF)
		W	L		(160)	(160)
MSTC52	16	3	52 ¹ / ₄	12-16d sinkers	1150	995
				16-16d sinkers	1535	1330

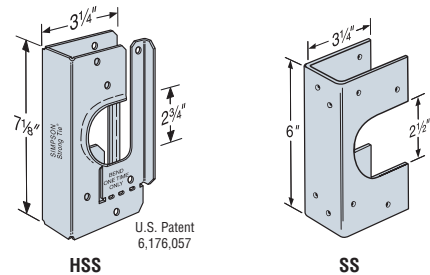


- To meet the prescriptive IRC requirement 16d common or 16d box nails (0.135" dia. x 3¹/₂") may be used. Allowable tension load is 0.88 of table loads when installed with 16d box nails. Install 8 nails at each end of strap.

HSS/SS Stud Shoes

Model No.	Ga	Stud Size	Fasteners	Allowable Loads ¹		
				DF/SP		Tension
				Compression Floor (100)	Roof (125)	
SS1.5	16	2x	12-10dx1 ¹ / ₂	500	500	—
SS2.5	16	3x	12-10dx1 ¹ / ₂	500	500	—
SS3	16	2-2x	12-10d	665	785	—
SS4.5	16	3-2x	14-10d	665	785	—
HSS2-SDS1.5	16	2x	12-SDS 1/4"x1 ¹ / ₂ "	1200	1200	1000
HSS2-2-SDS3	16	2-2x	12-SDS 1/4"x3"	1200	1200	1000
HSS2-3-SDS3	16	3-2x	12-SDS 1/4"x3"	1000	1000	970
HSS4-SDS3	16	4x	12-SDS 1/4"x3"	1200	1200	1000

CODES: ICC-ESR-2608; Florida FL 10864

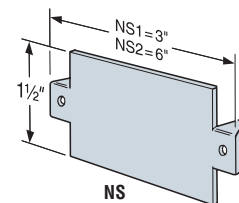


- Roof loads are 125% of floor loads unless limited by other criteria. Floor loads may be adjusted for other load durations according to the code, provided they do not exceed roof loads. Tension loads may not be adjusted.
- NAILS:** 10d = 0.148" dia. x 3" long, 10dx1¹/₂" = 0.148" dia. x 1¹/₂" long.

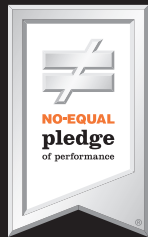
NS Nail Stops

Model No.	Ga	W	L
NS1	16	1 ¹ / ₂	3
NS2	16	1 ¹ / ₂	6

- OPTIONAL NAILS:** 8d = 0.131" dia. x 2¹/₂" long.



Some of the products shown above are available with a ZMAX[®] galvanized coating for extra corrosion protection. ZMAX coating is recommended for applications where hardware is being installed onto preservative-treated wood members such as mudsills. See the current *Wood Construction Connectors* catalog or visit www.strongtie.com/info for more details.



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Wood Construction Connectors

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Developed for designers and engineers as a companion to the *AF&PA Wood Frame Construction Manual*.

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Specifications, loads and fasteners information provided in metric and imperial.

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*This flier is effective until **January 31, 2011**, and reflects information available as of February 1, 2009. This information is updated periodically and should not be relied upon after **January 31, 2011**; contact Simpson Strong-Tie for current information and limited warranty or see www.strongtie.com.*