R-CONTROL SIPS

STRUCTURAL INSULATED PANELS

CONSTRUCTION MANUAL

Note: Information deemed reliable at time of printing.
Please visit www.rcontrolsips.com for the latest information.

CONSTRUCTION MANUAL

When you choose R-Control SIPS, you're collaborating with a team of experts who work with you every step of the way. We're here to answer your questions, solve your problems, and do everything we can to make sure your project proceeds smoothly—and ends successfully.

R-Control SIPS are manufactured by R-Control SIPS, LLC. R-Control SIPS facilities adhere to strict, consistent standards to ensure high-quality custom-made R-Control SIPS.

Our network allows us to offer architects, designers and builders the best of both worlds: the resources of the country's provider of SIP products and systems, and the superior attention and customer service of R-Control SIPS.

Note: Information deemed reliable at time of printing. Please visit www.rcontrolsips.com for the latest information.

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General Recommendations

R-Control SIP Sizes

R-Control SIPS are made in a variety of sizes, most commonly from 4’ x 8’ up to 8’ x 24’. Consult your R-Control SIPS expert for sizes and fabrication services available in your area.

Environmentally Safe

The core material for R-Control SIPS, R-Control SIPS EPS with Perform Guard, contains no CFCs, HCFCs, HFCs or formaldehyde and is recyclable. R-Control SIPS EPS with Perform Guard is inert, non-nutritive and highly stable. Your R-Control SIPS expert encourages you to support recycling and energy conservation.

Warranty

R-Control SIPS provide a 20-year warranty covering structural strength and thermal performance. Contact your R-Control SIPS expert for details regarding the warranty program.

Engineering

R-Control SIPS are engineered structural components. Please refer to the R-Control SIPS Load Design Charts for structural capacities. Each structure designed with R-Control SIPS must be reviewed by a qualified design professional.

Mechanical Ventilation

R-Control SIPS construction effectively eliminates air infiltration and exfiltration in a structure. Energy robbing air changes are greatly reduced. For this reason R-Control SIPS recommends that your structure be analyzed by a qualified HVAC representative to determine proper ventilation design. Refer to R-Control SIPS Technical Bulletins sip no. 2000 and sip no. 2051.

Handling - Storage - Protection

R-Control SIPS should be stored in a fully supported manner and protected from weather. Cover stored SIPs with tarps or similar protective wraps. Exposure 1 OSB facings are used in R-Control SIPS manufacture; however, panels used for roof systems must have temporary roofing applied at the time of installation. Apply finished roofing when immediately practical.

Metal roof systems have inherent properties that may cause R-Control SIPS roofs covered with these materials to become hotter than other roof systems. When installing metal roof systems on R-Control SIPS SIPs, additional design considerations may be necessary to protect the roofing underlayment and the SIP from excessive temperatures. These design precautions may include the use of a ventilated air space above the SIP to minimize temperature exposure. Consult with your R-Control SIPS expert for

local recommendations. Refer to R-Control SIPS Technical Bulletin sip no. 2064.

SIP walls must have code approved weather-proof cladding system (underlayment plus siding/cladding) applied when immediately practical. If wall cladding application is delayed (more than three weeks or an anticipated repeated exposure to precipitation is expected) apply temporary breathable weather-proof underlayment to the exterior wall prior to permanent finish materials. Refer to R-Control SIPS Technical Bulletin sip no. 2050.

EPS contains a flame retardant additive. However, the EPS should be considered combustible and used with code approved thermal barriers and should not be stored near any open flame or source of ignition. Do not install or use EPS with coal-tar pitch or highly solvent extended mastics, adhesives or sealants. Consult your R-Control SIPS expert for suggested adhesives, sealants, and assembly specifications not otherwise detailed in this manual. Refer to R-Control SIPS Technical Bulletin sip no. 2048 and sip no. 2064.

SIP Handling and Placement

R-Control SIPS may be complete roof, wall, or floor sections in the building design. R-Control SIPS may be placed on foundations, conventionally framed structural systems, or they may be the structural systems themselves. They may be erected by hand or with the use of a crane or lift truck. Panel weight and contractor preference will dictate the erection method used. Regardless of the erection method or the framing system used to support R-Control SIPS, place, secure and attach the panels following the details and guidelines shown in this manual.

SIP Splines

All spline connections of R-Control SIPS using Double 2X's and I-Beams must be continuous members.

SIP Fastening

R-Control SIPS are connected by nails and R-Control SIPS Low VOC sealant. R-Control SIPS Low VOC sealant must be used together with all fastening techniques. When R-Control SIPS Wood Screw or Metal Fasteners are used, they require a minimum of 1" penetration into the support.

Low VOC Sealant and SIP Tape

R-Control SIPS Low VOC sealant is a sealant which is safe for expanded polystyrene foam insulation. Apply the R-Control SIPS Low VOC sealant in a continuous 1/2" diameter bead as shown in the R-Control SIPS details. This size bead will result in the optimum coating when plates and splines are installed.

R-Control SIPS Tape is a sealing tape for use on R-Control SIPS. R-Control SIPS Tape is used in conjunction with R-Control SIPS Low VOC sealant. When properly applied, the use of R-Control SIPS Low VOC sealant and SIP Tape will augment the overall tightness of the structure.

Vapor Retarders

R-Control SIPS requires the use of SIP Tape or an equivalent vapor retarder at SIP connections per climate conditions or code requirements to ensure long term durable structures. Refer to R-Control SIPS Technical Bulletin sip no. 2022, sip no. 2048, and sip no. 2057.

Thermal Barriers

All interior surfaces of the R-Control SIPS must be finished with a code approved 15-minute thermal barrier, such as 1/2" gypsum board, Blazeguard or 1X wood paneling. Apply code approved thermal barriers according to the manufacturer's specification. Buildings with automatic sprinklers as part of their designs may not require a thermal barrier. Consult your local building code department for special uses.

Hourly fire rated systems can be achieved using high performance thermal barriers such as type X and C gypsum board, spray applied fire proofing, etc. Refer to R-Control SIPS Technical Bulletin sip no. 2018.

Special Treatments

R-Control SIPS are produced with R-Control SIPS EPS with Perform Guard that protects the core insulation from potential termite damage. Please contact your R-Control SIPS expert to learn about specifications for these special treatments.

Perform Guard®

Disclaimer

Details, illustrations, pictures and guidelines provided herein give basic information and illustrate examples of R-Control SIPS installation. The basic information provide herein is not intended to cover every potential use and application of R-Control SIPS. It is the responsibility of the installer to become familiar with his specific application and determine if R-Control SIPS are suitable. By commencing work, the installer accepts full responsibility for the proper and safe installation of R-Control SIPS at his job site. Adding an insulation component may change the behavior of a wall assembly with regard to air movement, water vapor transmittance, bulk water management and heating, cooling and ventilation systems. It is the responsibility of the owner or the owner's representative to design the insulated wall assembly to perform in a manner ensuring function and durability. Furthermore, it is the sole responsibility of the installer to meet all federal and local regulatory requirements for job site safety for himself, his workers and any others on the job site while in the execution of all phases of R-Control SIPS installation.

R–Control SIPs Do's

1.) Handle SIPs with appropriate care.
2.) Store SIPs fully supported off the ground.
3.) Protect SIPs from weather with breathable covering.
4.) Lift and place SIPs with appropriate equipment.
5.) Provide level and square foundations or supporting floors.
6.) Install SIPs in accordance with approved drawings.
7.) Separate SIP facings and untreated plates from contact with concrete.
8.) Support both SIP facings fully on foundation or floors.
9.) When using cap or sill plates, use equal to full SIP width and offset plates joints from spline joints.
10.) Provide adequate bracing of SIPs during installation.
11.) Use factory provided electrical chases in SIP core.
12.) When using 2X, engineered wood, or I–Beam splines, use only continuous members.
13.) Provide appropriate end bearing for roof SIPs.
14.) Install fasteners flush to SIP facing surface.
15.) Protect SIPs from weather as soon as practical after installation.
16.) Use code approved flashings and exterior wall & roof coverings.
17.) Use code approved thermal barriers on interior.
18.) Have SIP structural requirements reviewed by a qualified design professional.
19.) Have any field modifications to SIPs, such as openings/penetrations reviewed by a qualified design professional.

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
SIP Do's	SIP–100

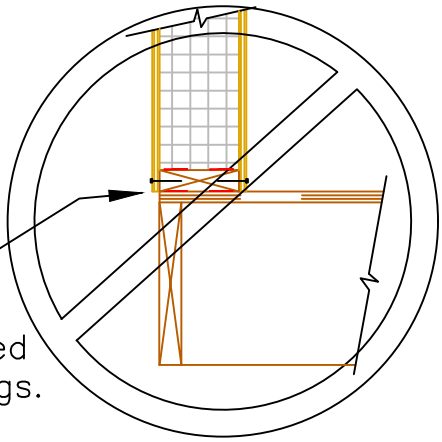
R-Control SIPs Don'ts

1.) Don't drop SIPs on corners.
2.) Don't store SIPs directly on the ground.
3.) Don't leave SIPs exposed to weather for an extended period of time.
4.) Don't lift or place SIPs without appropriate equipment.
5.) Don't overcut OSB facings at openings.
6.) Don't have SIP facings and untreated plates in direct contact with concrete.
7.) Don't have unsupported SIP facings.
8.) Don't have cap or sill plates less than full SIP width or have plate joints aligned with spline joints.
9.) Don't install SIPs without adequate bracing.
10.) Don't cut SIP facings for electrical chases, use factory provided chases in SIP core.
11.) Don't have cuts in 2X or I-Beam splines.
12.) Don't overdrive fasteners into SIP facings.
13.) Don't have unsupported horizontal joints in walls.
14.) Don't install plumbing in SIPs.
15.) Don't install recessed lights in SIPs.
16.) Don't install SIPs without structural review by a qualified design professional.
17.) Don't make any field modifications to SIPs, such as openings/penetrations, without review by a qualified design professional.

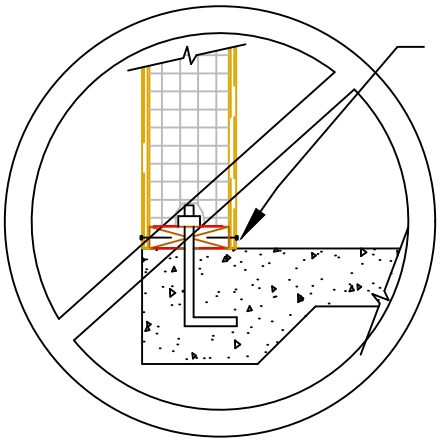
Updated 6-15-20

R-Control® SIP

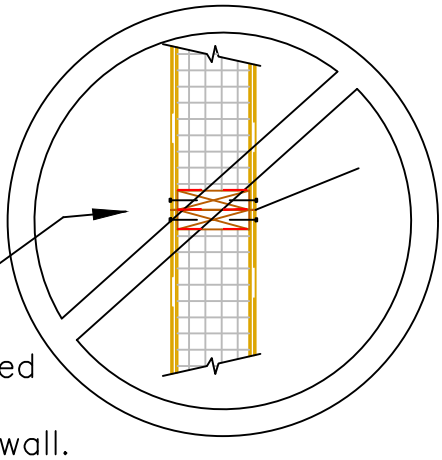
TITLE:	NO.
SIP Don'ts	SIP-100a



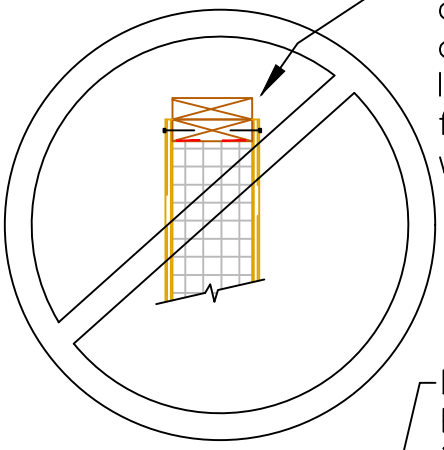
Don't have unsupported OSB facings.



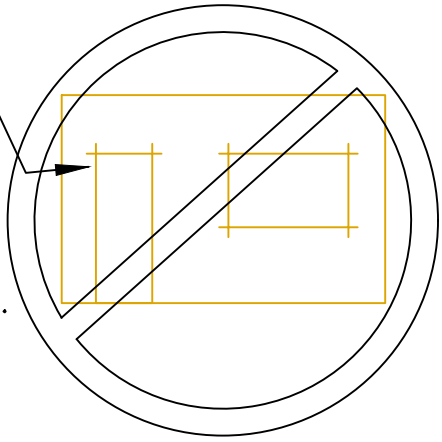
Don't have OSB facings and untreated plates in direct contact with concrete.



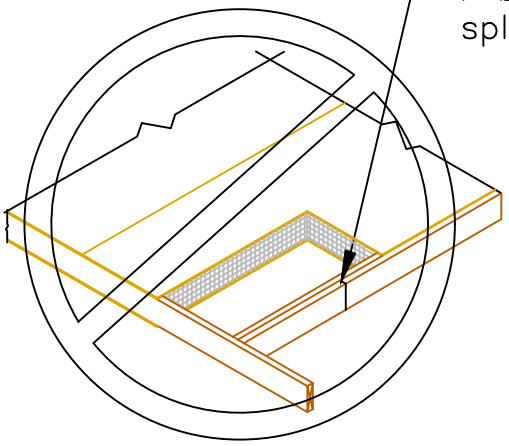
Don't have unsupported horizontal joints in wall.



Don't have additional cap plate less than full panel width.



Don't overcut OSB facings at openings.



Don't have cuts in 2X or I–beam splines.

Note: Please refer to R–Control SIP details for proper installation techniques.

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
SIP Don'ts	SIP–100b

R–Control Do–All–Ply and SIP Tape

1.) Make certain surfaces are clean, dry, and free of dirt and foreign materials prior to placement of R–Control Do–All–Ply or SIP Tape.
2.) Store R–Control Do–All–Ply and SIP Tape in a warm area prior to installation during cold weather.
3.) Place R–Control Do–All–Ply in straight CONTINUOUS 3/8 in. diameter beads as shown in details.
4.) Place R–Control SIP Tape at joints between SIPs as shown in details.
5.) After SIP Tape installation, use a hard roller to apply pressure to the SIP Tape surface to promote adhesion.
6.) Apply SIP Tape or equivalent vapor retarder on interior or exterior of SIP per climate conditions or code requirement.
7.) Refer to R–Control Do–All–Ply and SIP Tape safety data sheets.

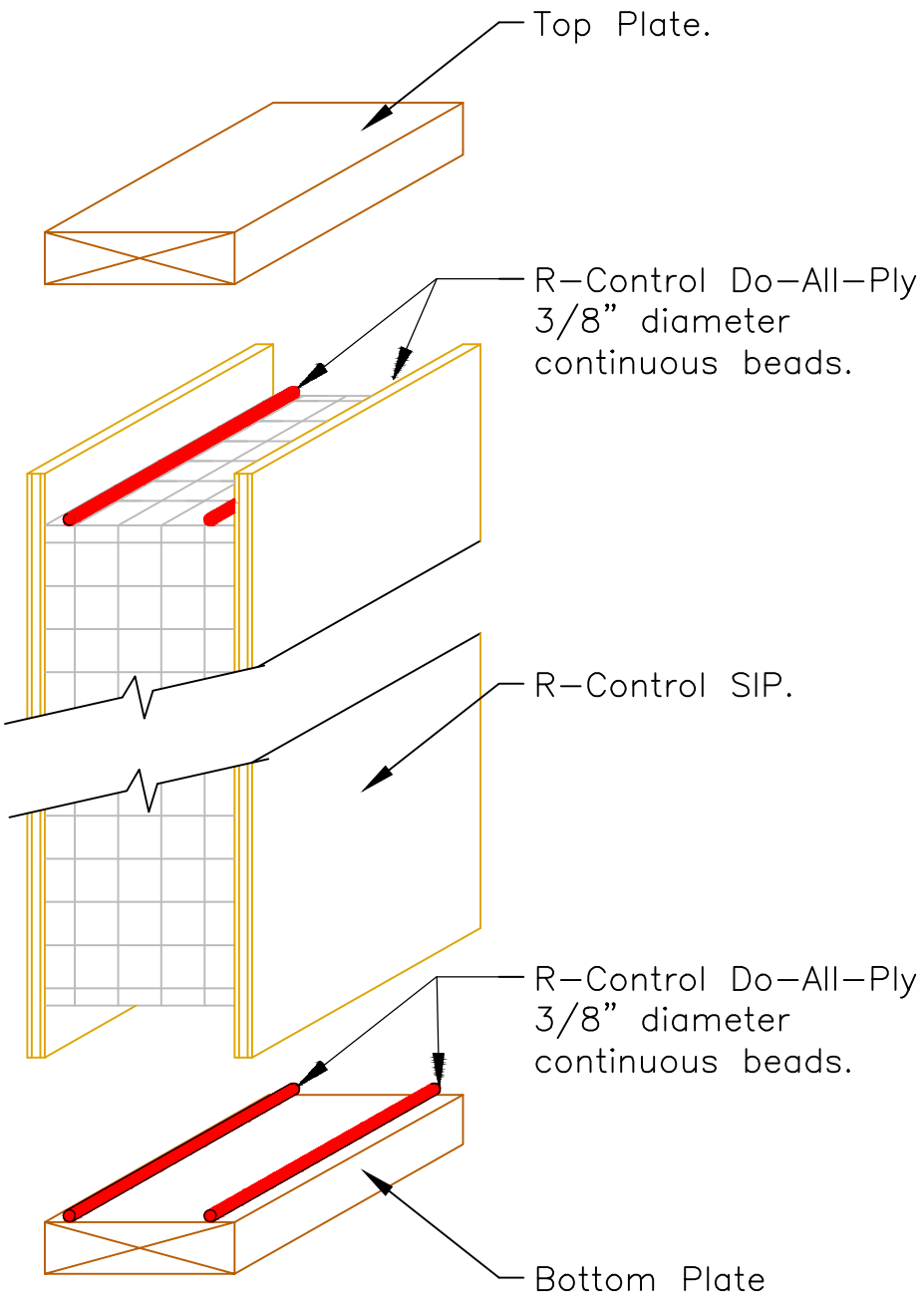
NOTE: It is the responsibility of the installer to apply R–Control Do–All–Ply and R–Control SIP Tape properly.

Failure to install R–Control Do–All–Ply and R–Control SIP Tape in accordance with instructions and as shown in details will reduce the durability of the SIP structure.

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Do–All–Ply and SIP Tape	SIP–101



SECTION

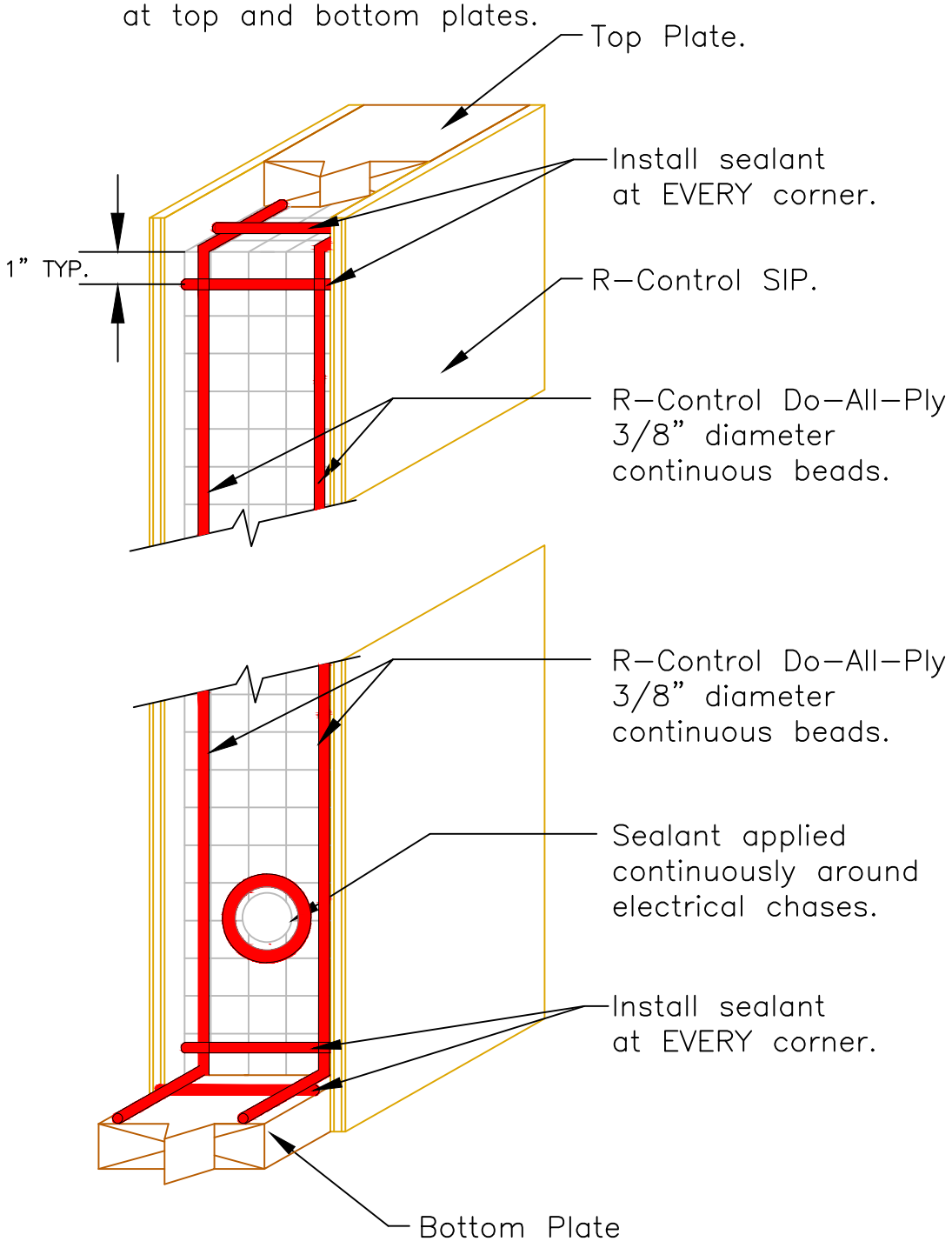
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Do–All–Ply® Application	SIP–101a

See SIP–101a for Do–All–Ply at top and bottom plates.



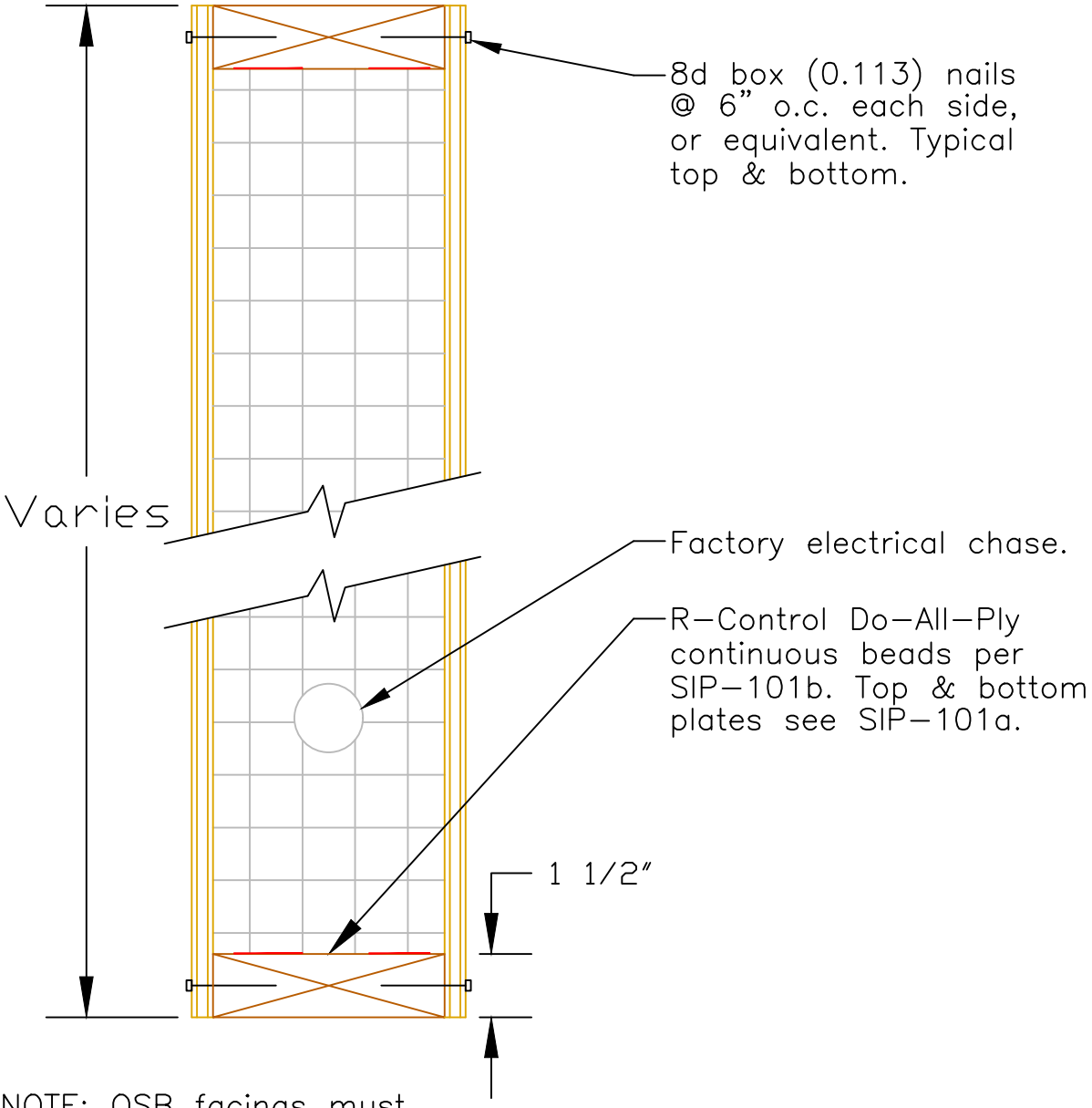
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Do–All–Ply® Application	SIP–101b



NOTE: OSB facings must be fully supported by foundation system.

NOTE: Use minimum grade SPF #2 or engineered equivalent for 2X plating.

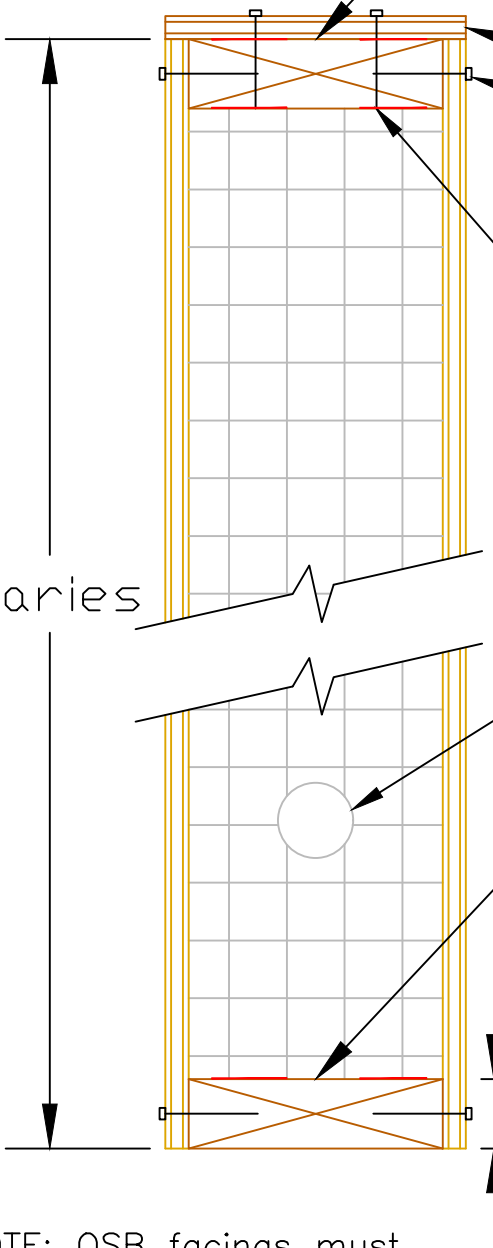
SECTION

Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE:	NO.
Plate Connections	SIP-101c



NOTE: OSB facings must be fully supported by foundation system.

NOTE: Use minimum grade SPF #2 or engineered equivalent for 2X plating.

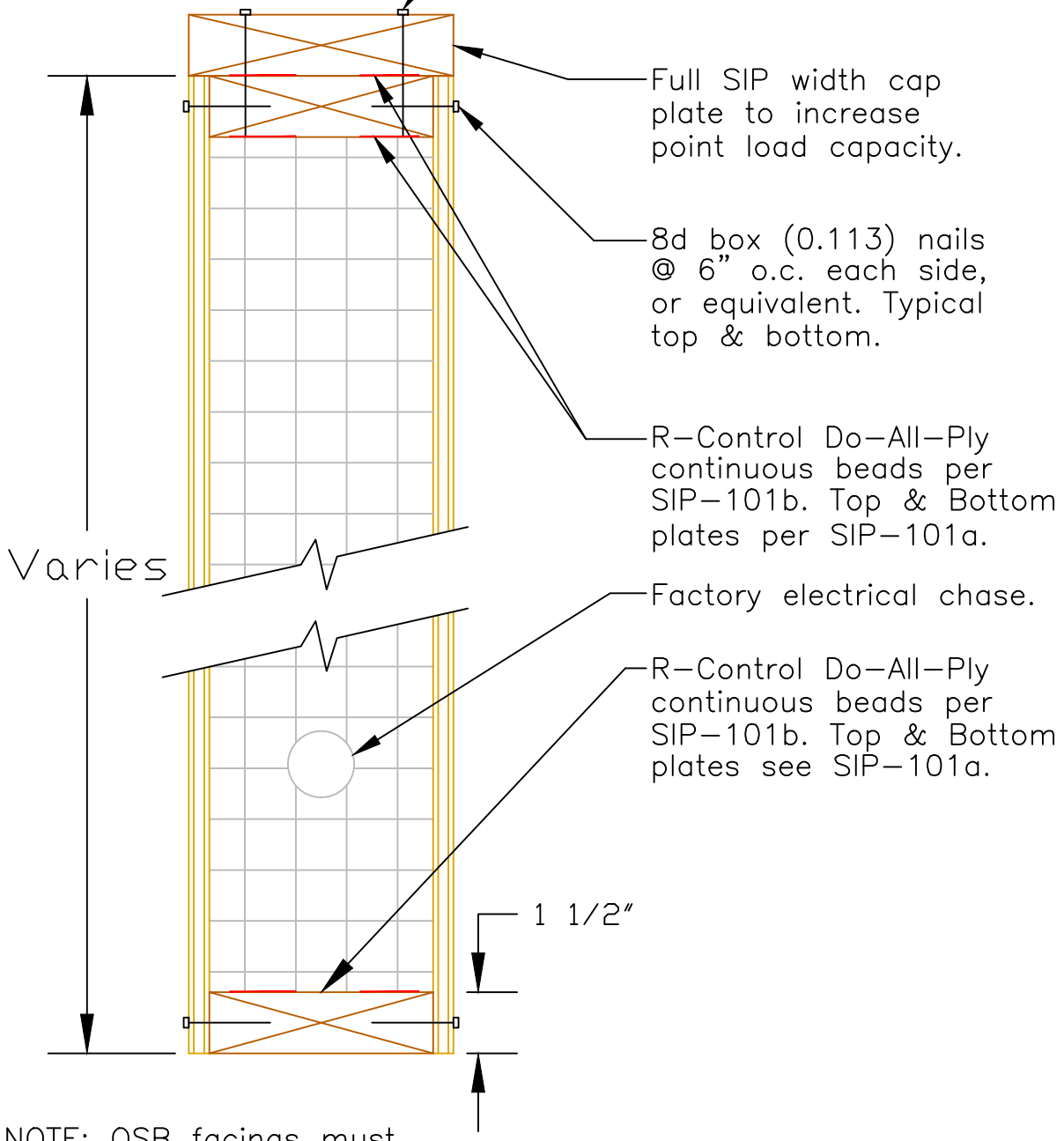
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Plate Connection with Spacer Board	NO. SIP–101d



NOTE: OSB facings must be fully supported by floor/foundation system.

NOTE: Use minimum grade SPF #2 or engineered equivalent for 2X plating.

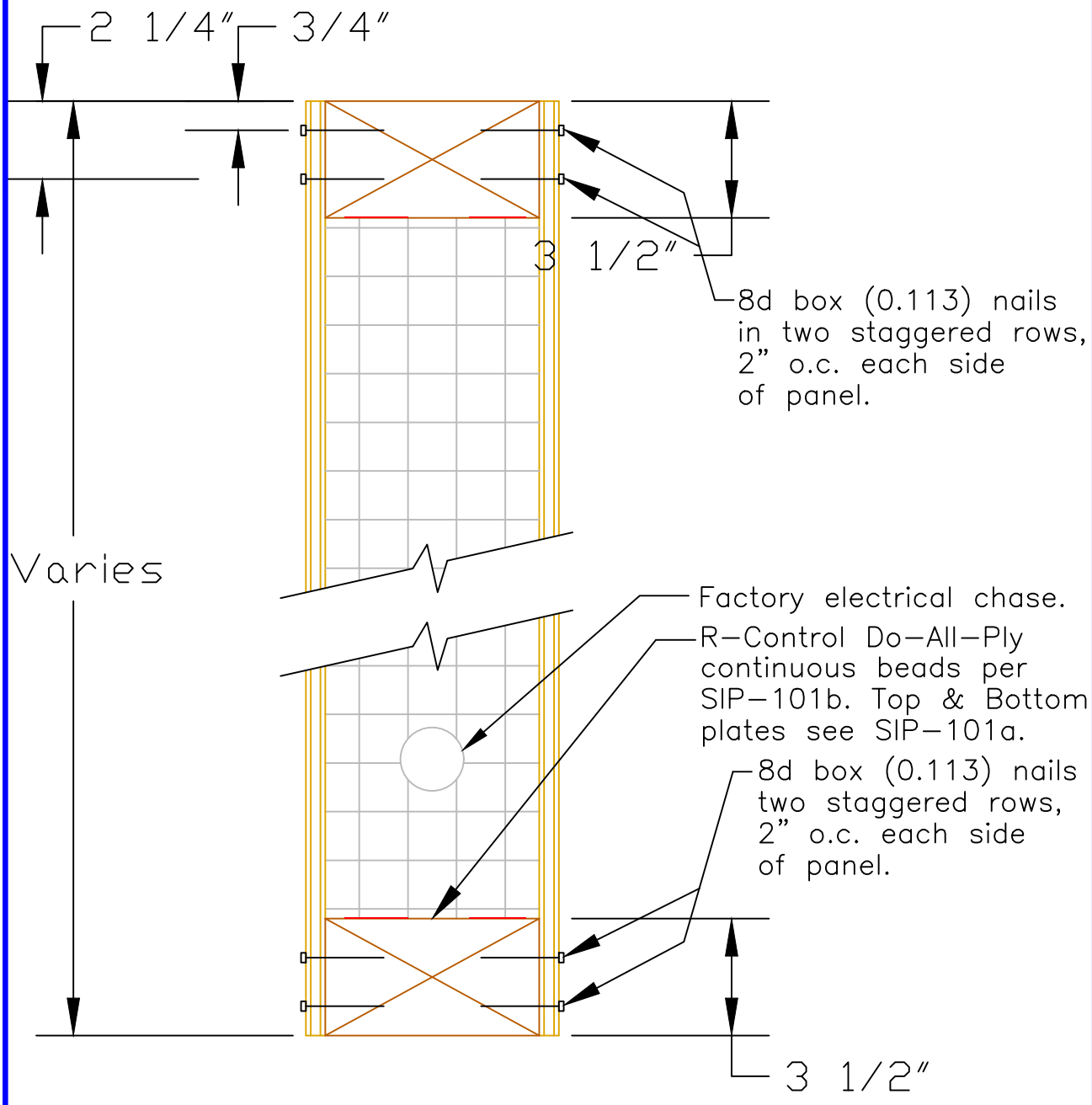
SECTION

Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE: Plate Connection with Cap Plate	NO. SIP-101e



NOTE: OSB facings must be fully supported by foundation system.

NOTE: Use minimum grade Douglas-fir larch #2 or equivalent.

SECTION

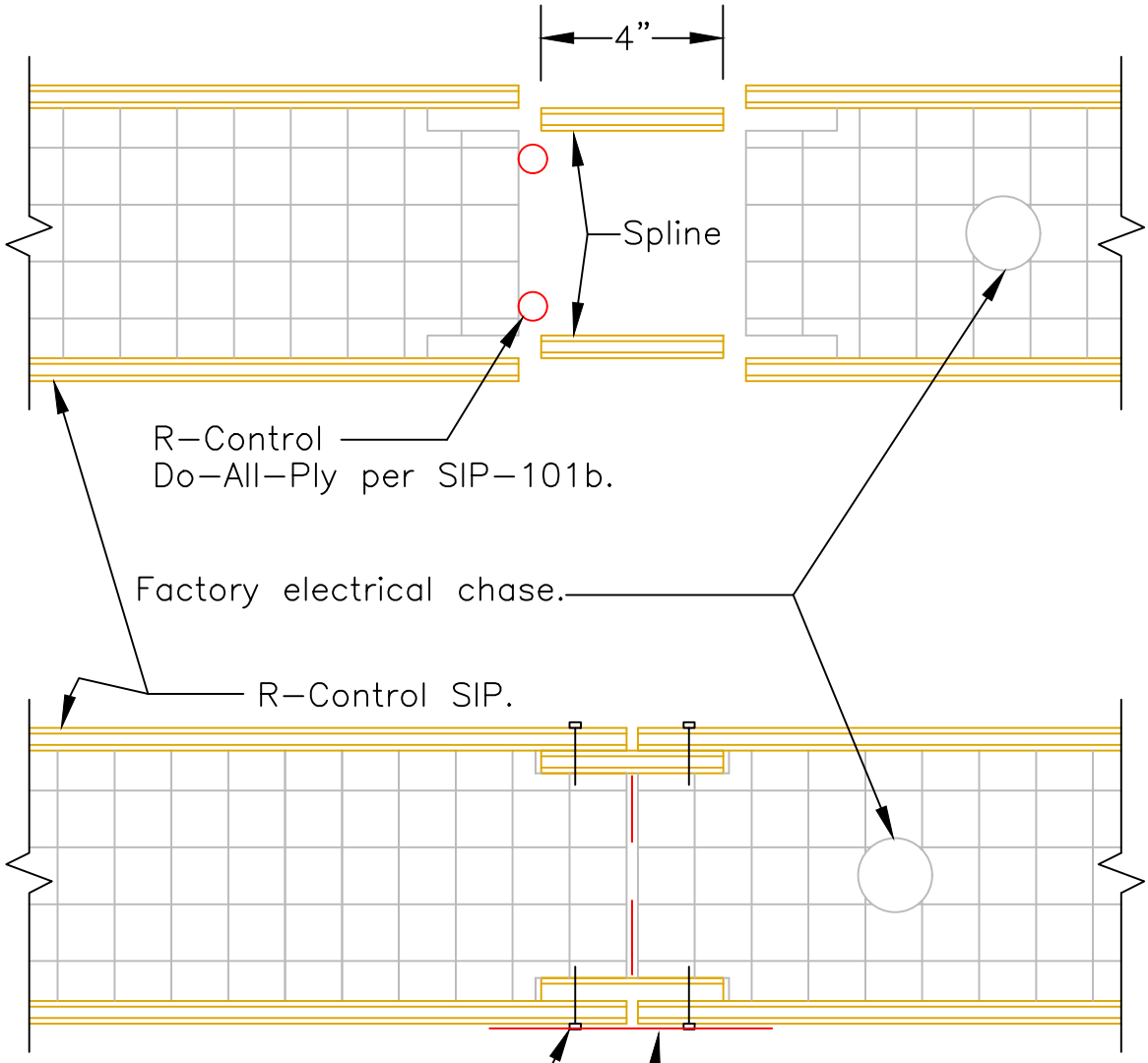
Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE: High Load Shear Wall 4X Plate Connections	NO. SIP-101f

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



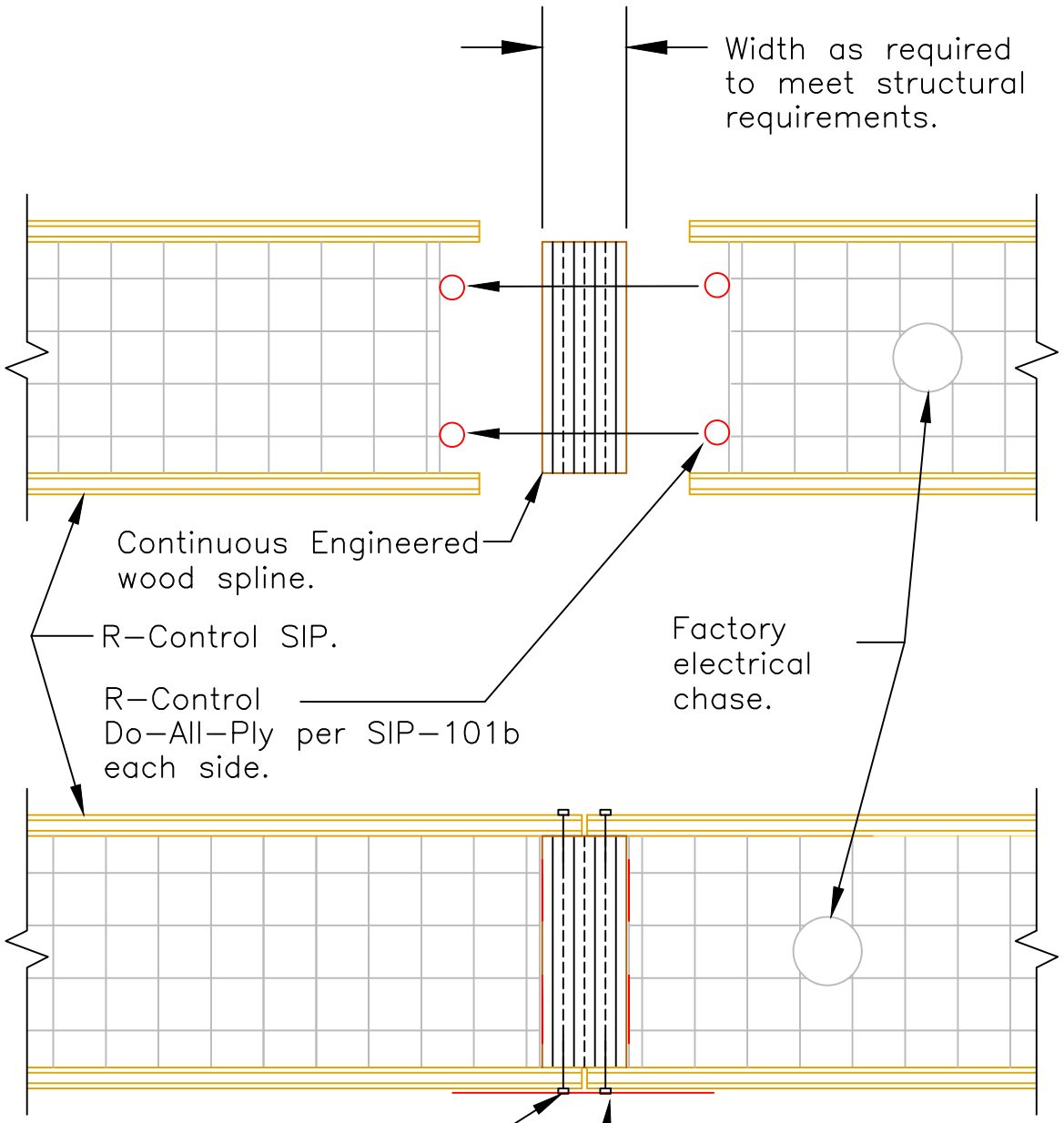
SECTION/PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Spline Connection Surface Spline	SIP–102



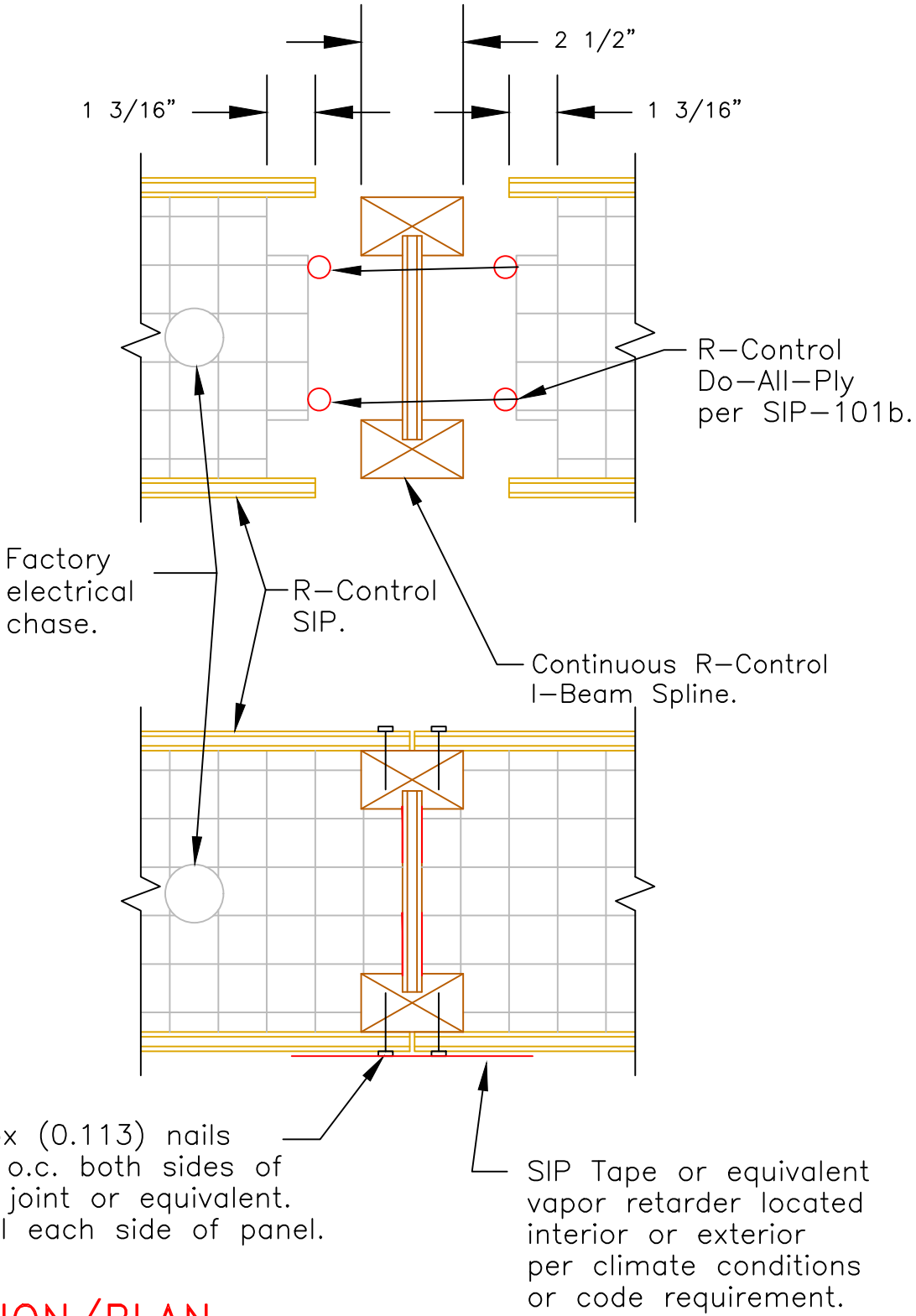
SECTION/PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Spline Connection Engineered Wood	NO. SIP–102a



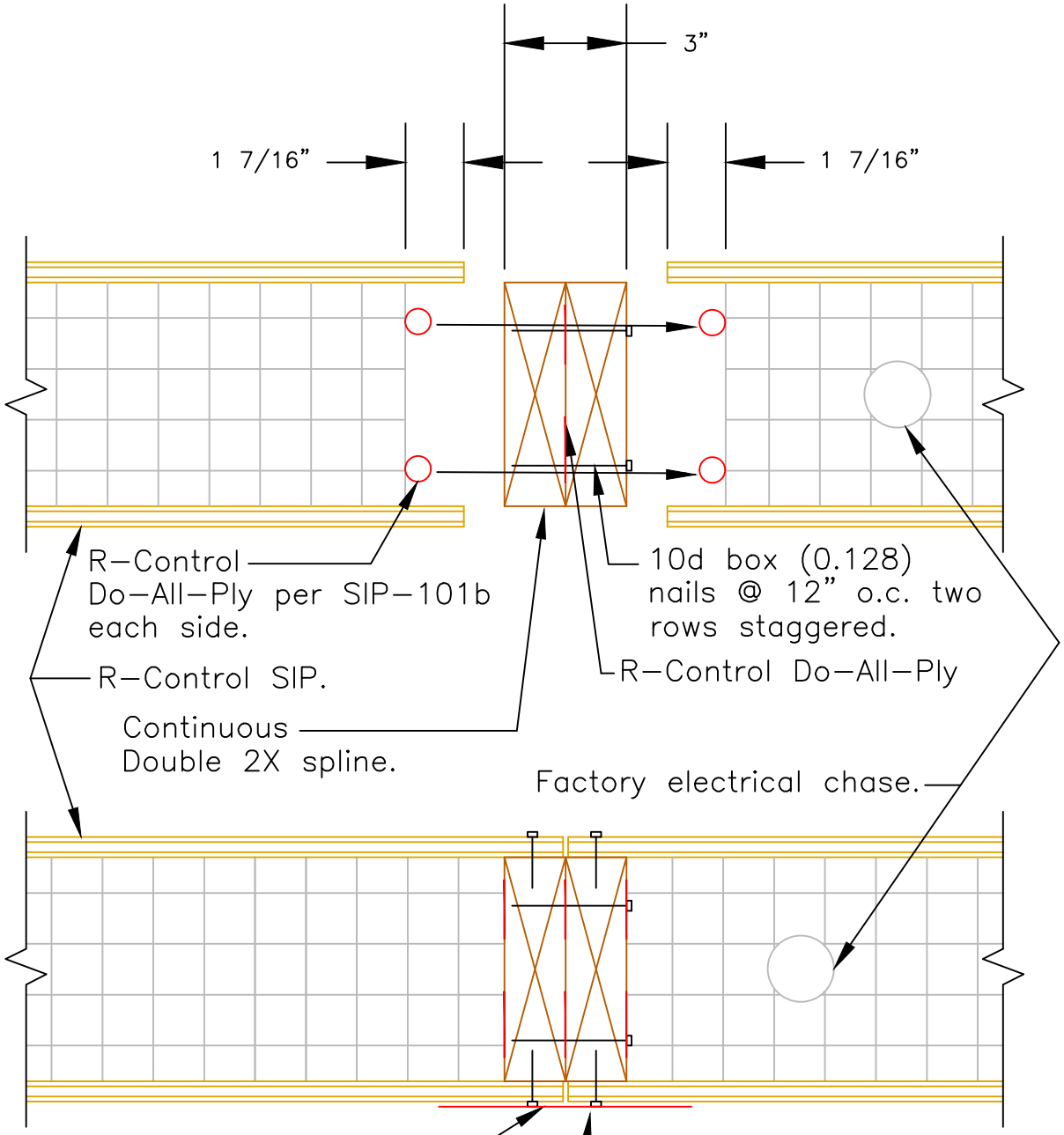
SECTION/PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Spline Connection I–Beam Spline	NO. SIP–102b



SECTION/PLAN

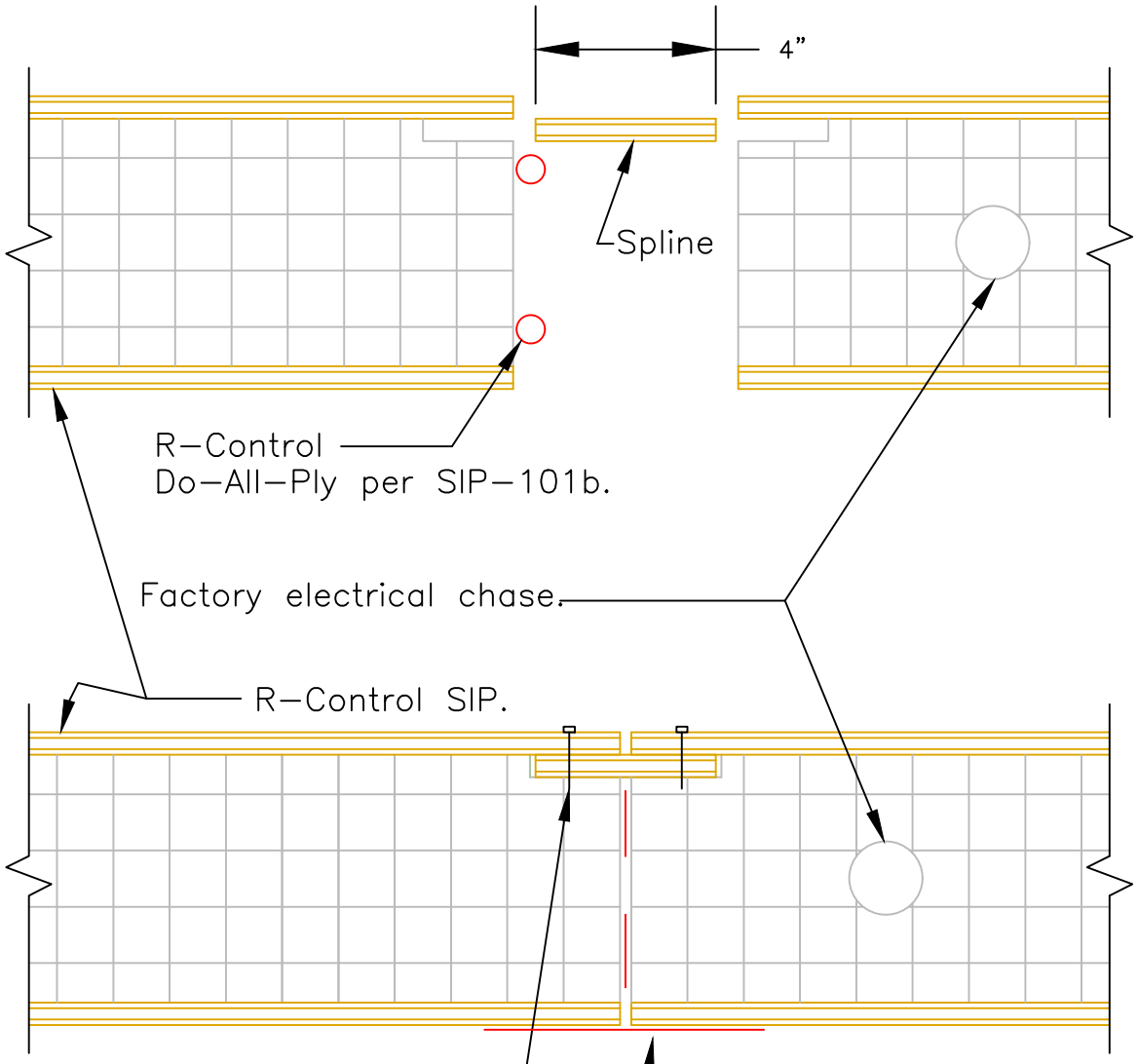
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Spline Connection Double 2X	NO. SIP–102d

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



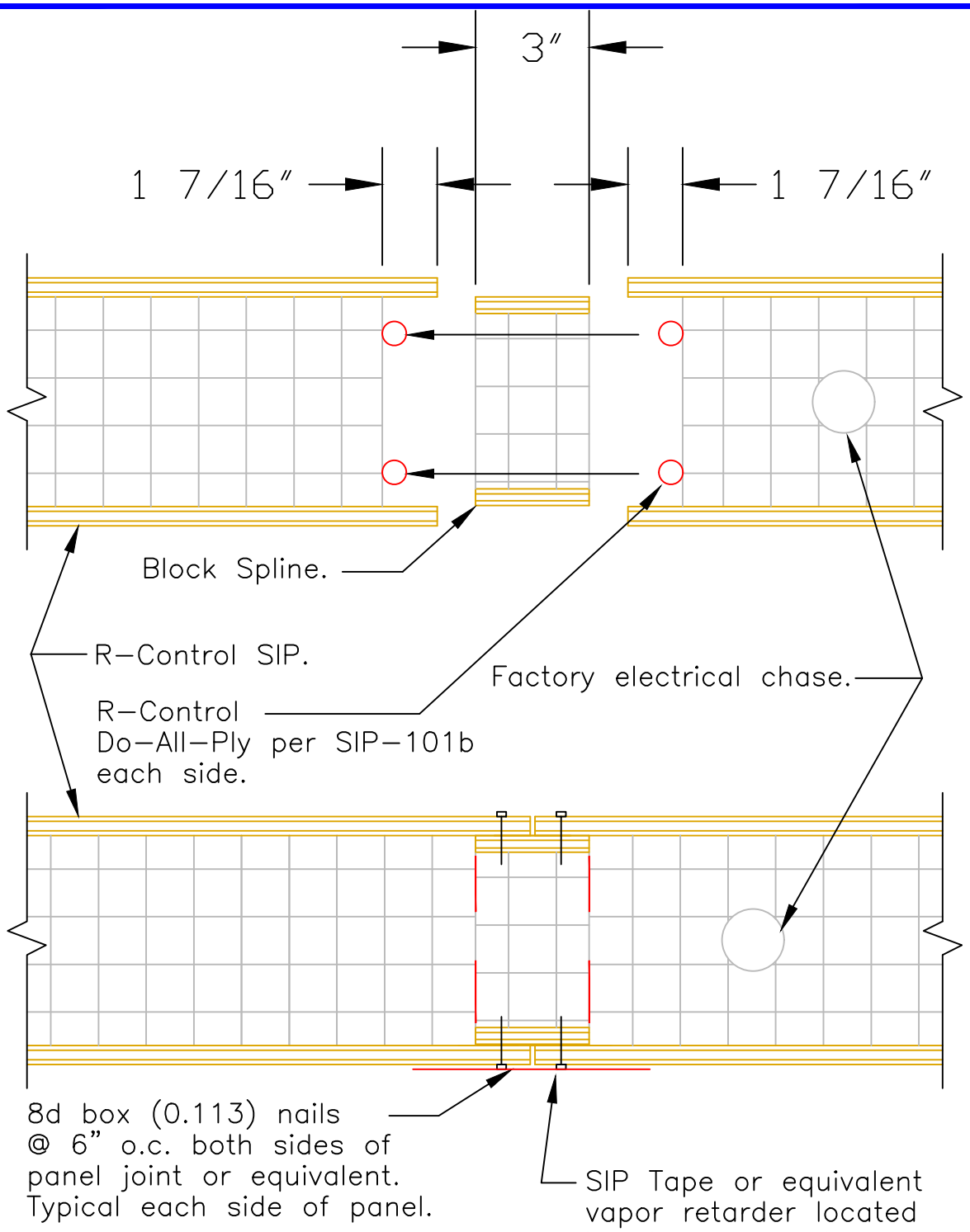
SECTION/PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Spline Connection Surface Spline Top Side Only	NO. SIP–102e



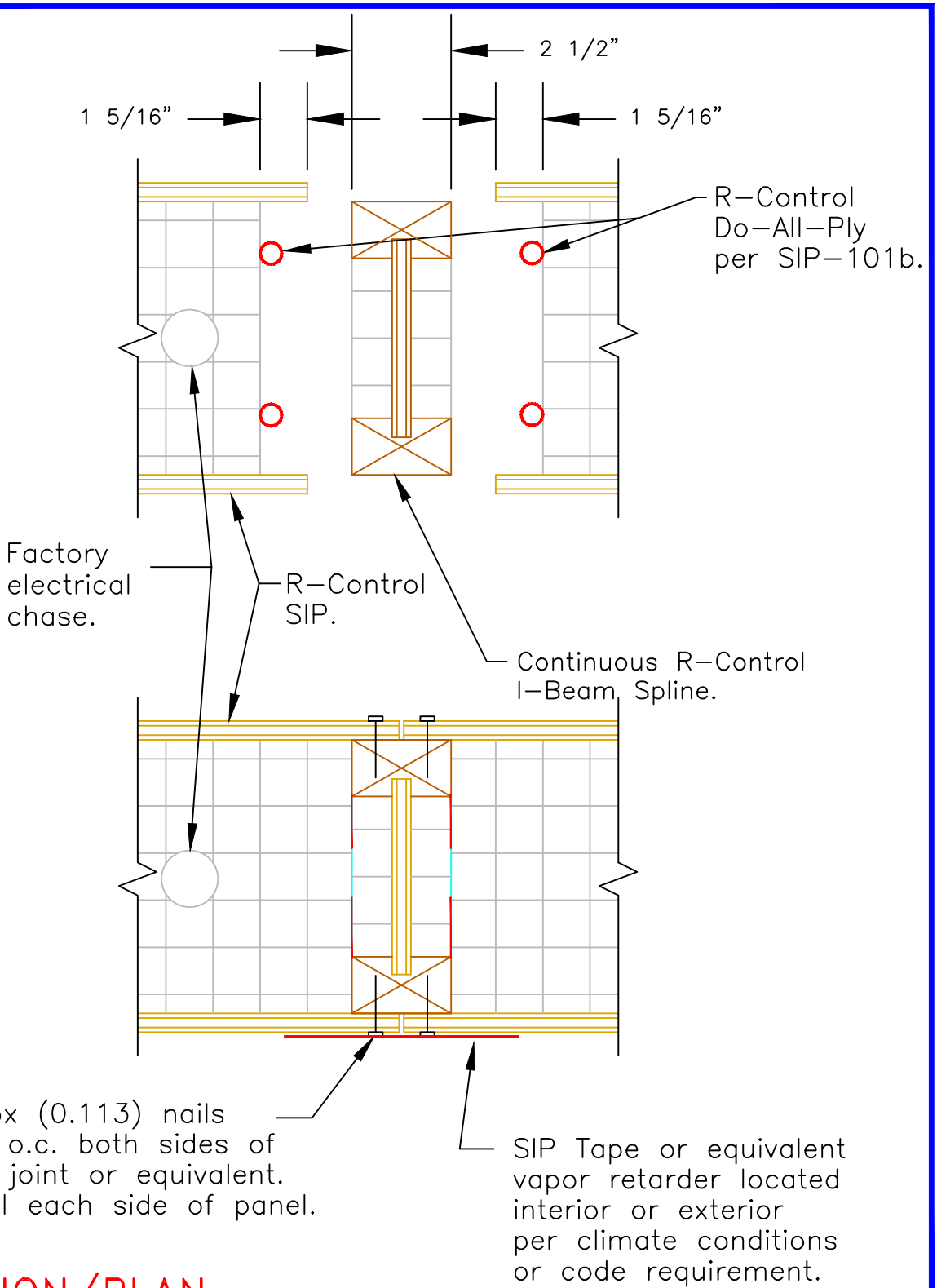
SECTION/PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Spline Connection Block Spline	SIP–102g



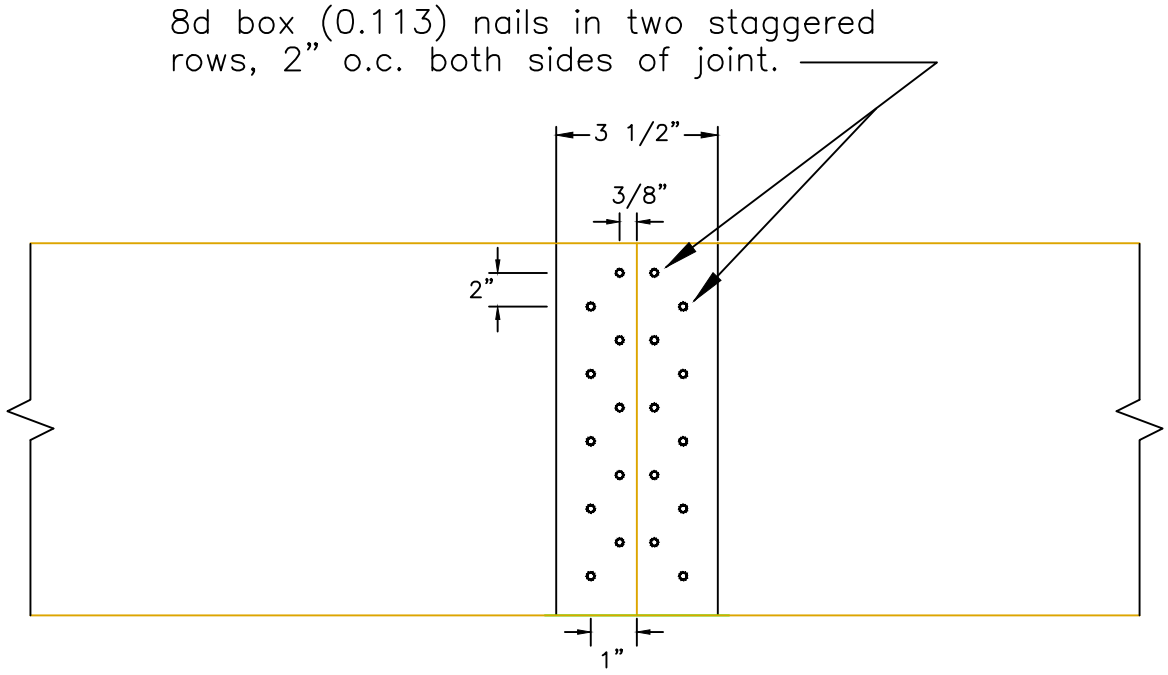
SECTION/PLAN

Scale: NTS

Updated 6–15–20

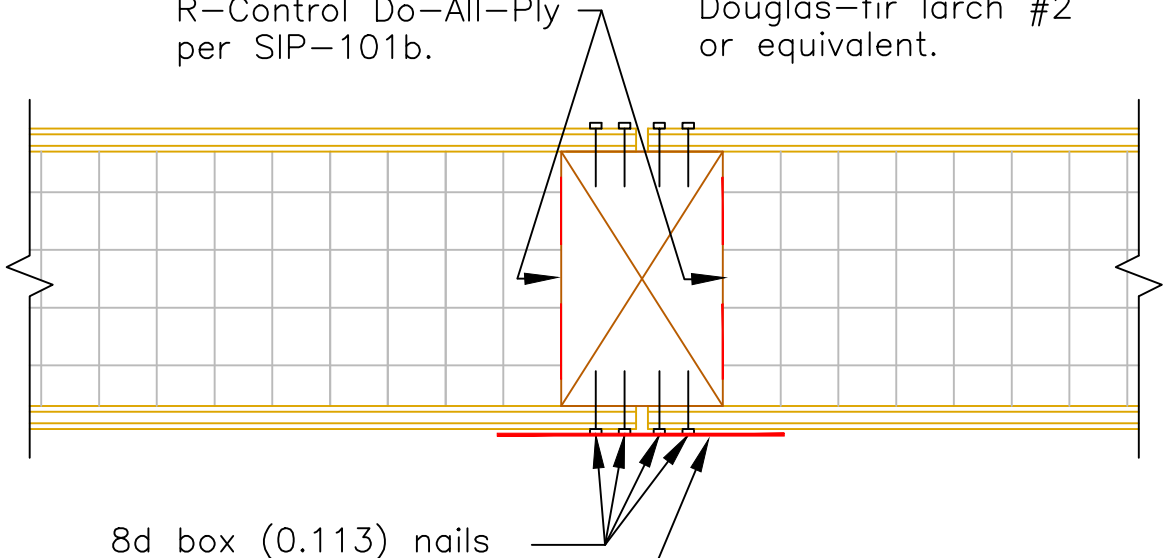
R–Control® SIP

TITLE: Spline Connection I–Beam Spline	NO. SIP–102h



PLAN

Scale: NTS



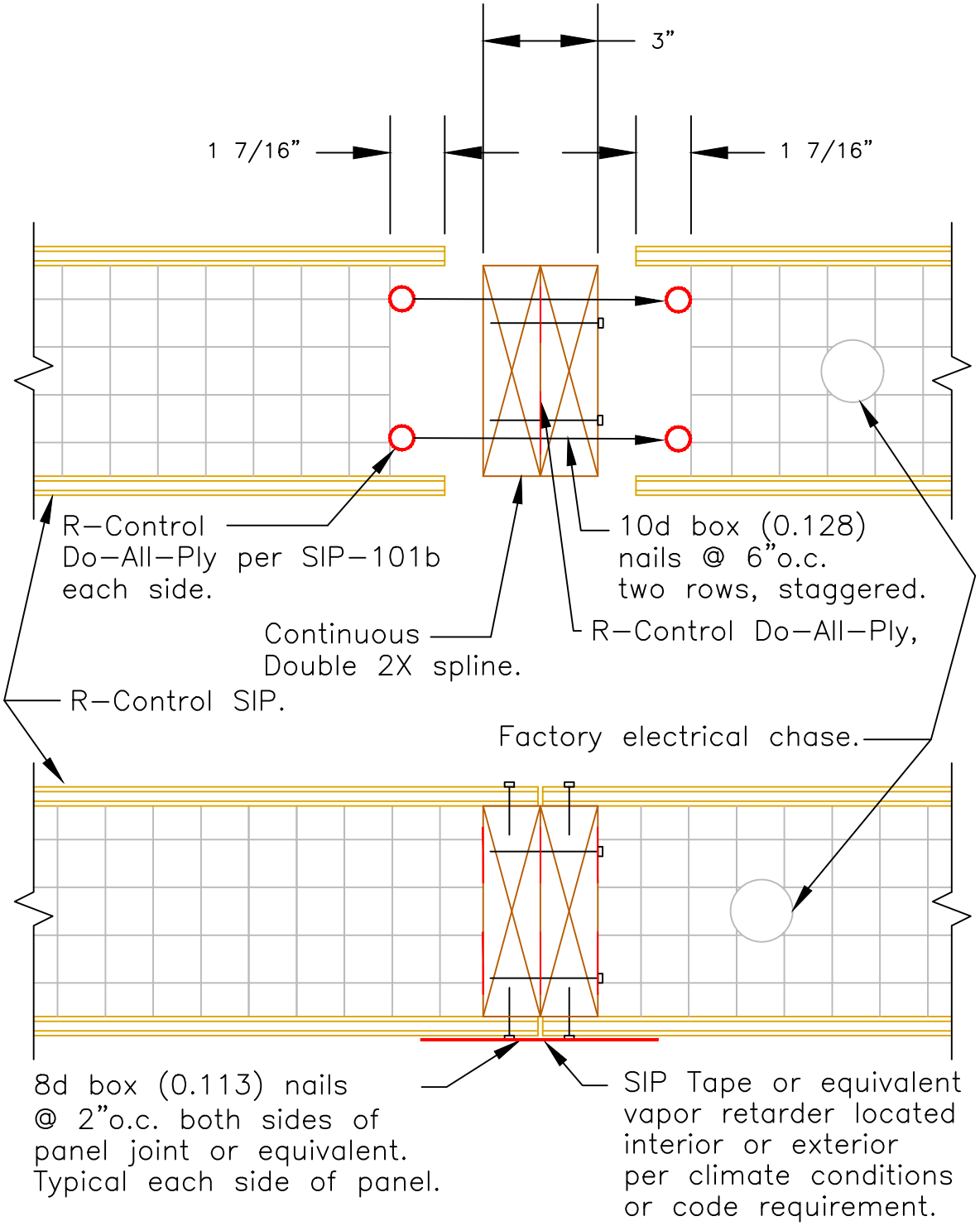
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Spline Connection 4X – 2" o.c.	NO. SIP–102k



NOTE: Use min. grade douglass fir #2 or engineered equivalent for 2X spline.

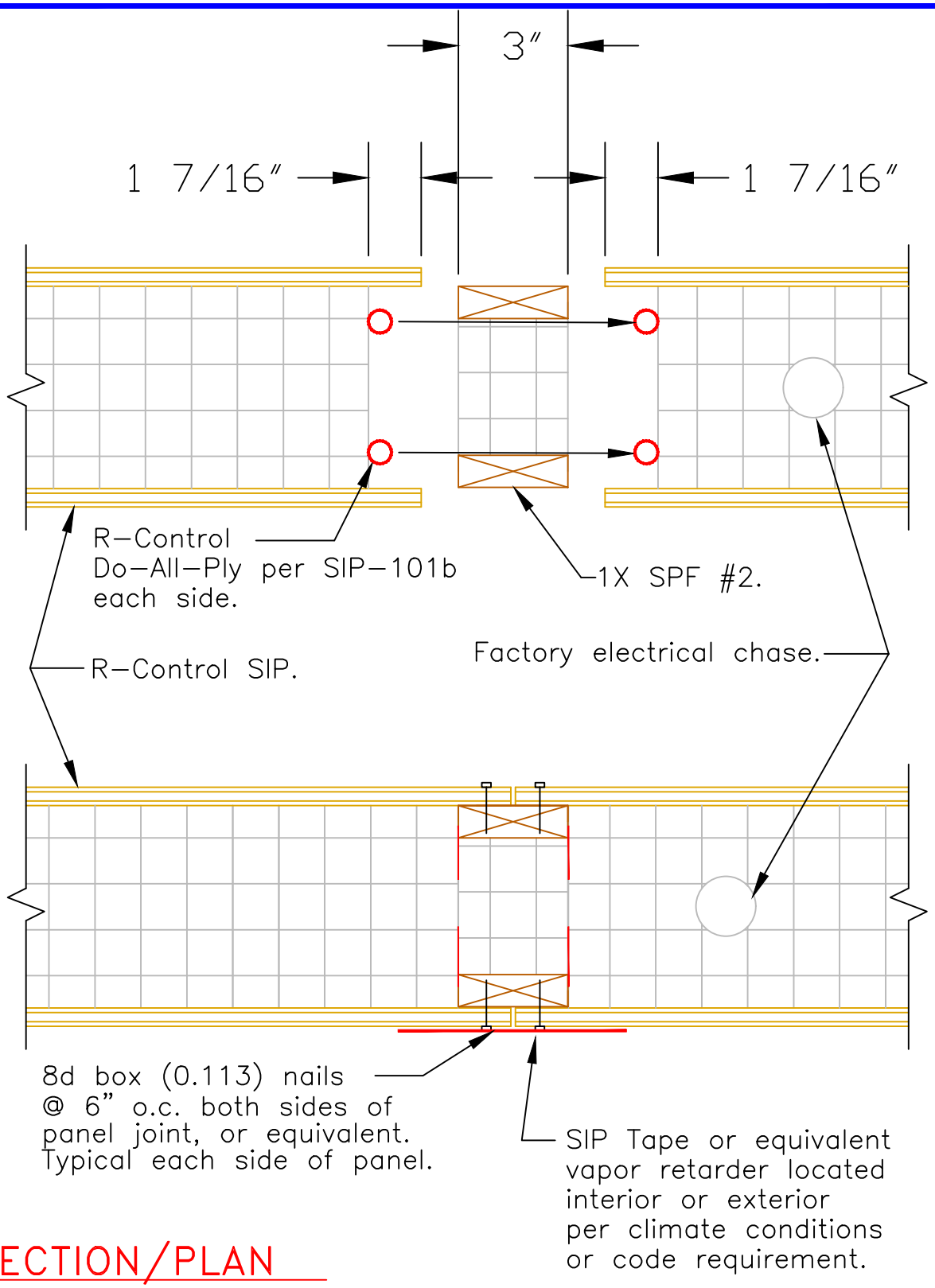
SECTION/PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Spline Connection Double 2X – 2" o.c.	SIP–102I



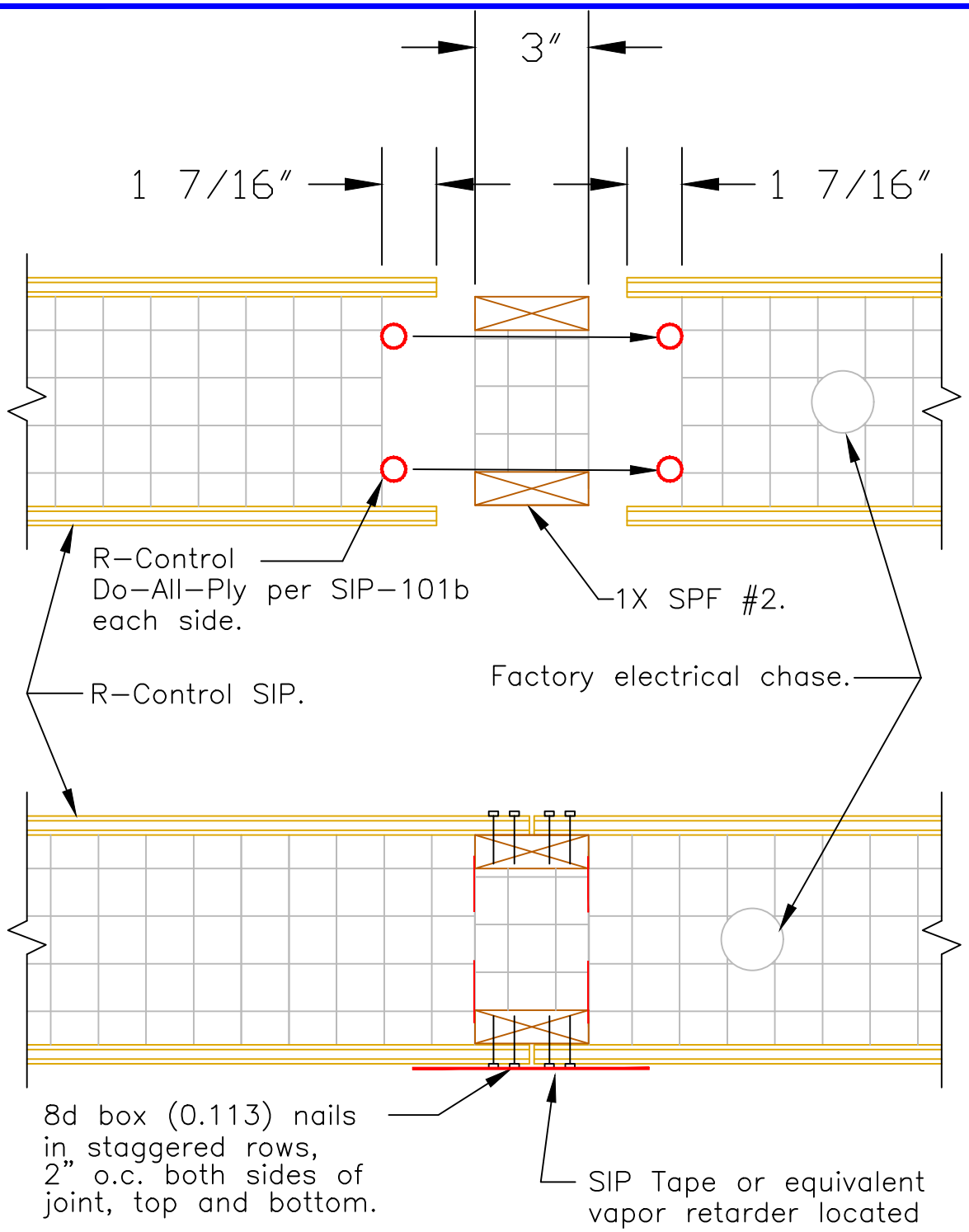
SECTION/PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Spline Connection 1X Lumber Block	NO. SIP–102m



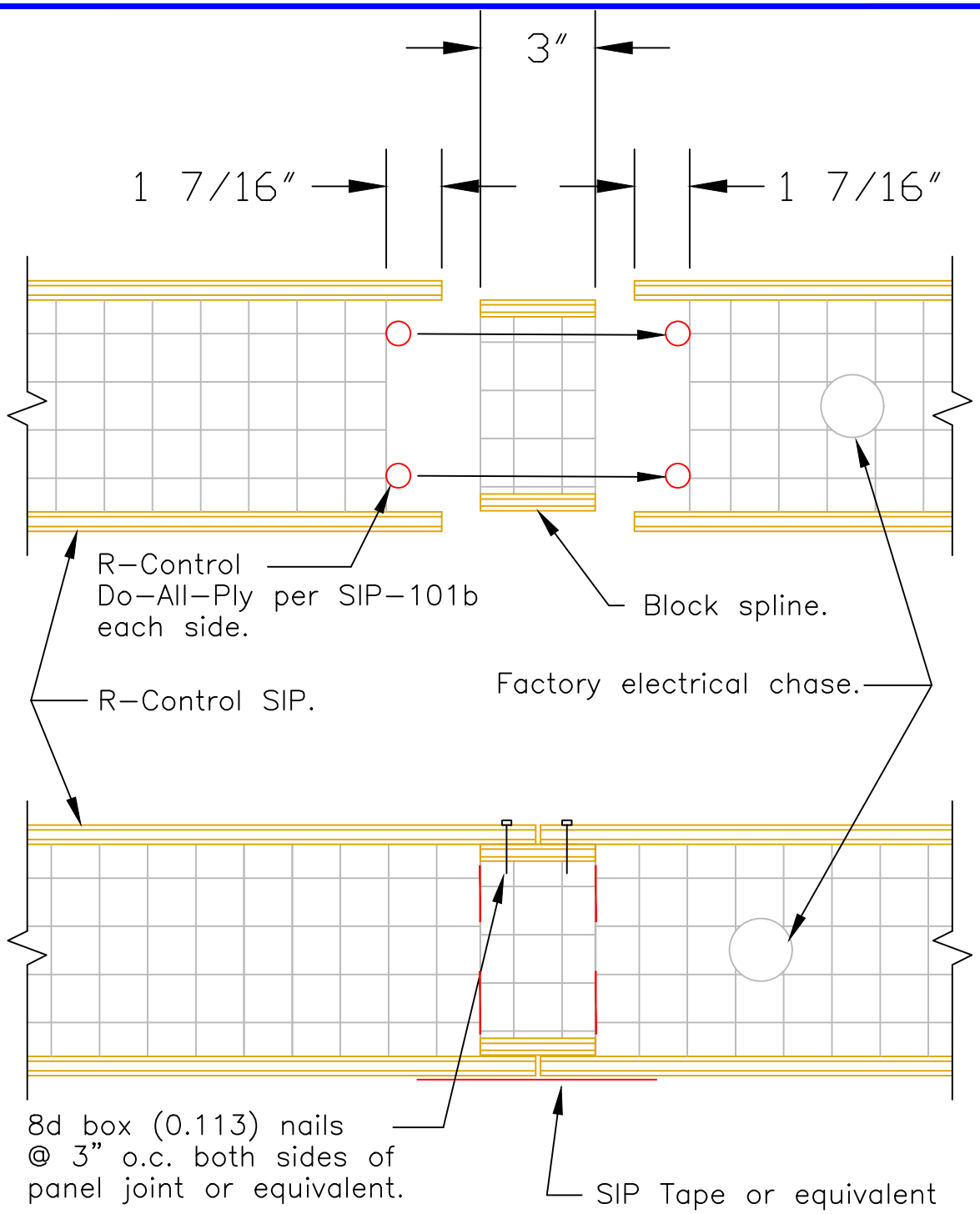
SECTION/PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Spline Connection 1X Lumber Block 2” o.c.	NO. SIP–102n



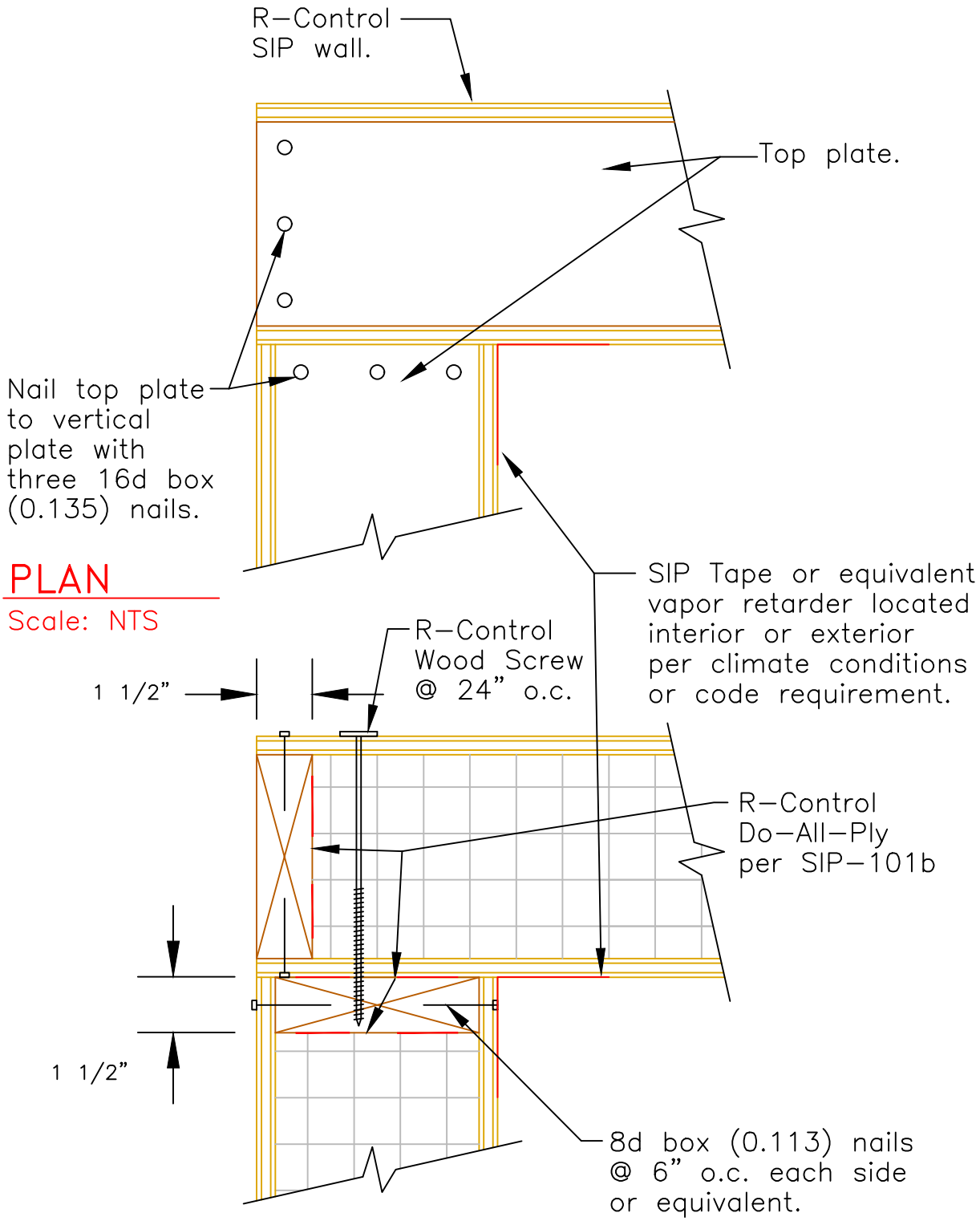
SECTION/PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Spline Connection Block Spline Top Side Only	NO. SIP–102p



PLAN

Scale: NTS

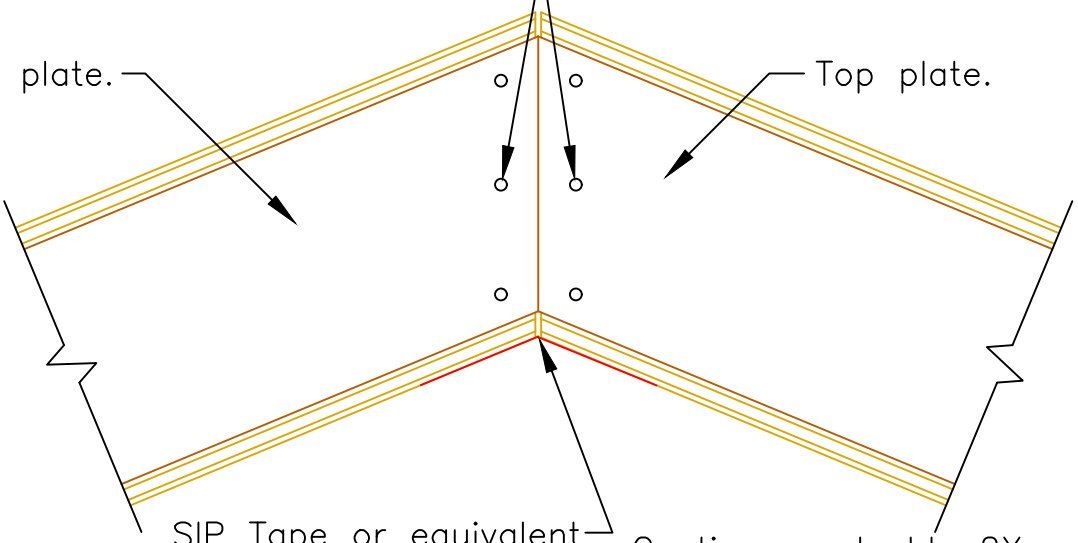
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Corner Connection	SIP–103



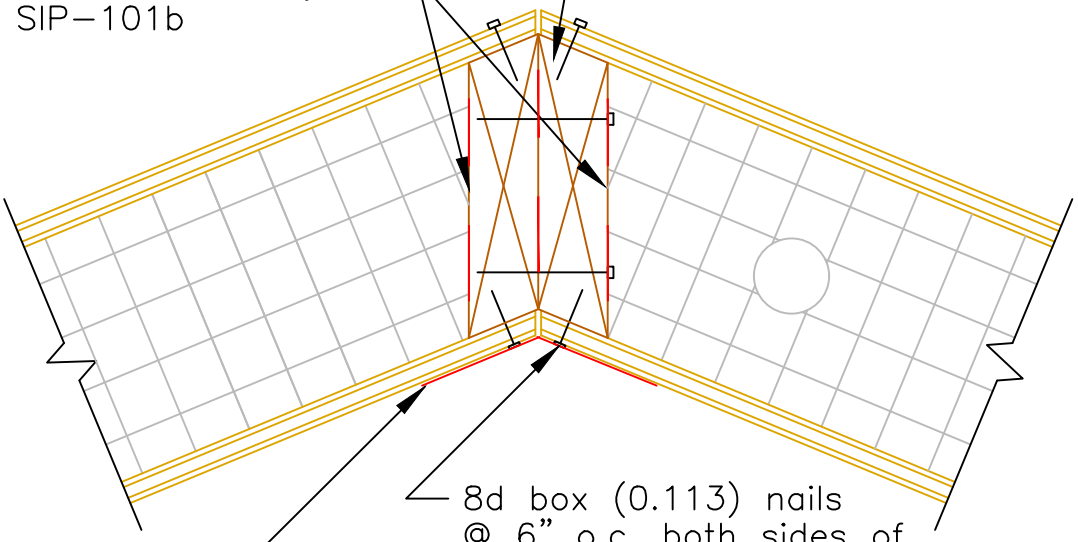
PLAN

Scale: NTS

SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

Continuous double 2X spline, bevel cut, with 10d box (0.128) nails @ 12" o.c. two rows, staggered; & R-Control Do-All-Ply between 2X's.

R-Control Do-All-Ply per SIP-101b



8d box (0.113) nails @ 6" o.c. both sides of panel joint or equivalent. Typical each side of panel.

SIP Tape.

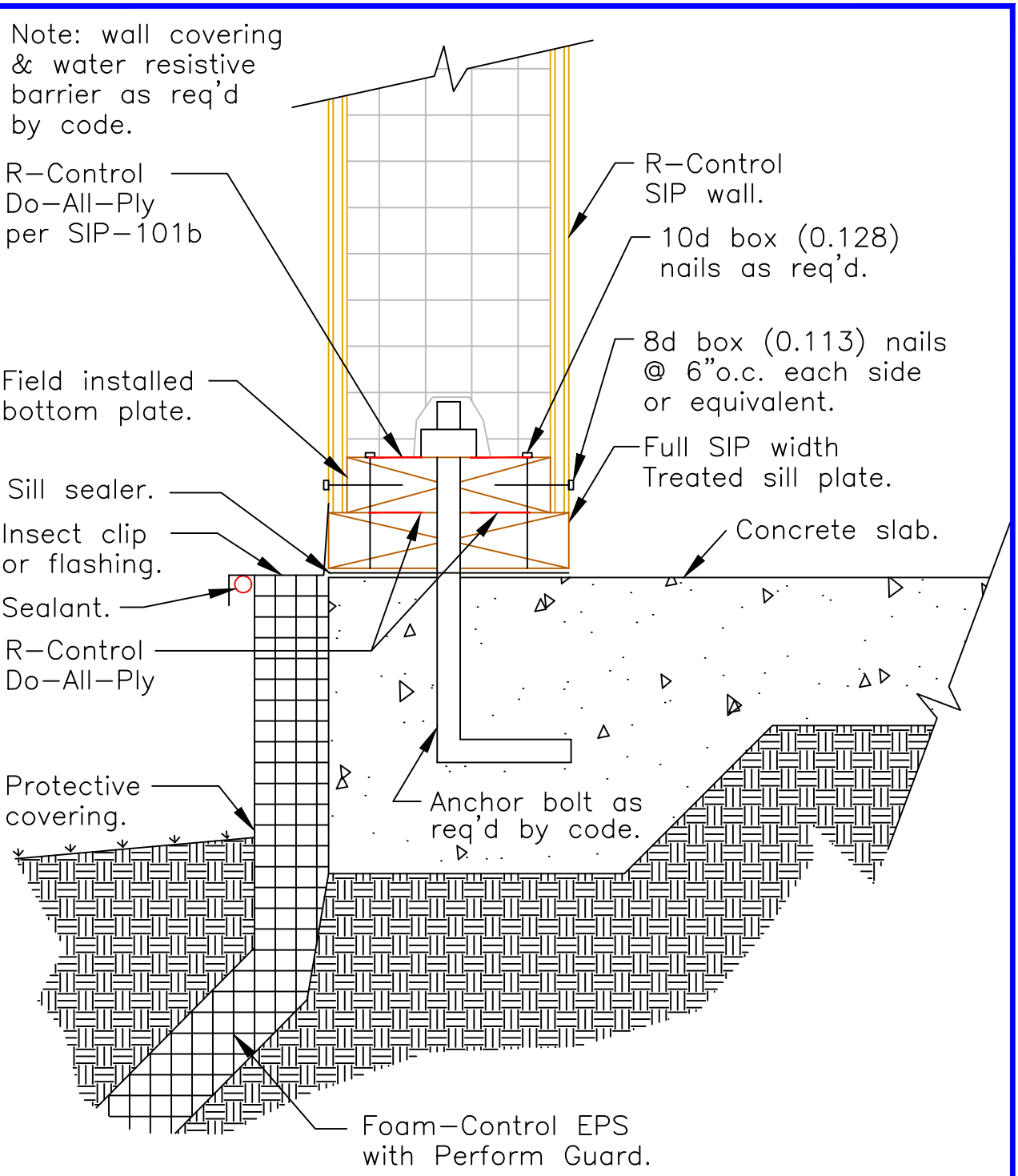
SECTION

Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE:	NO.
Angled Corner Connection	SIP-103b



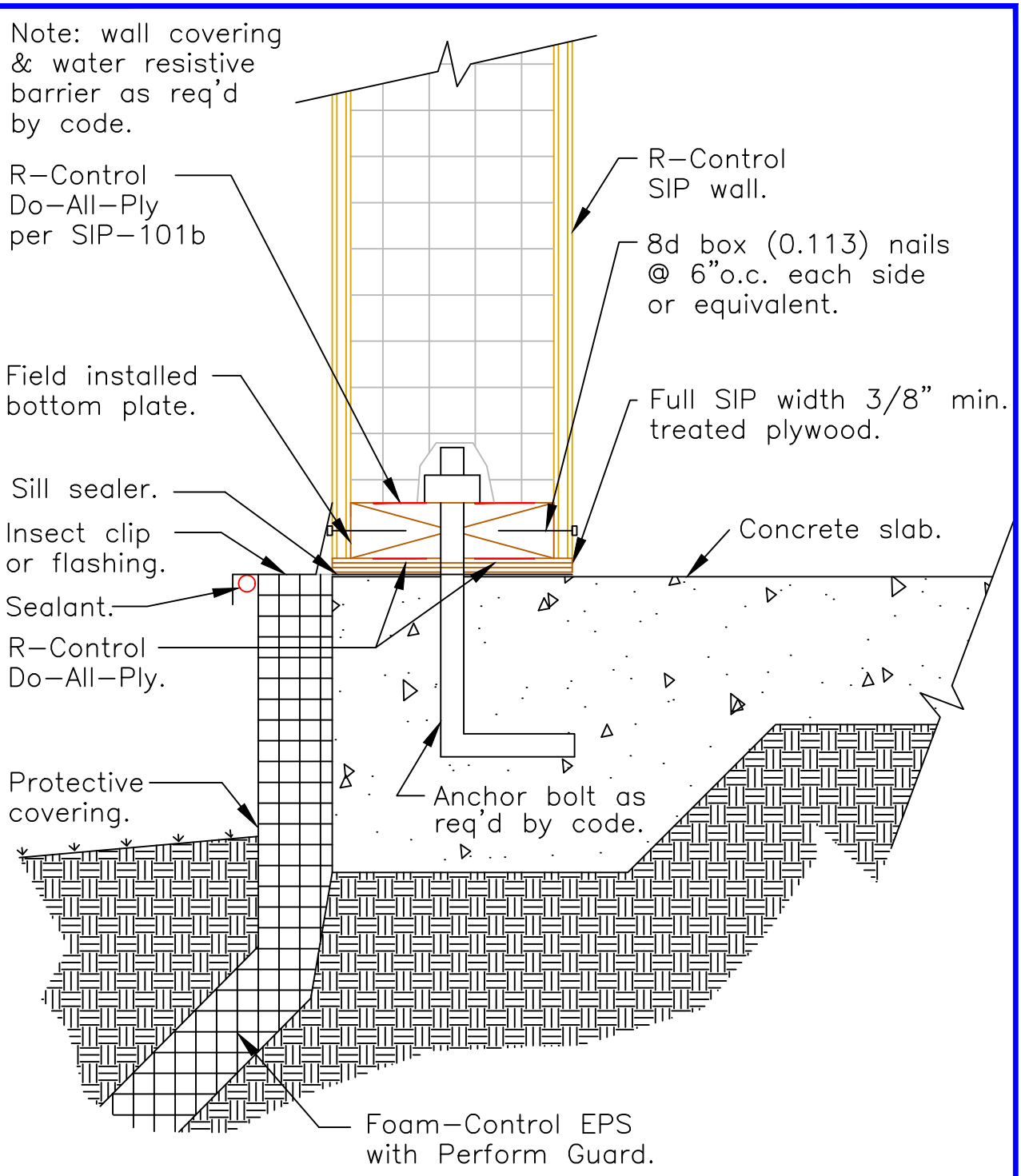
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Slab Foundation Framing	SIP–104



SECTION

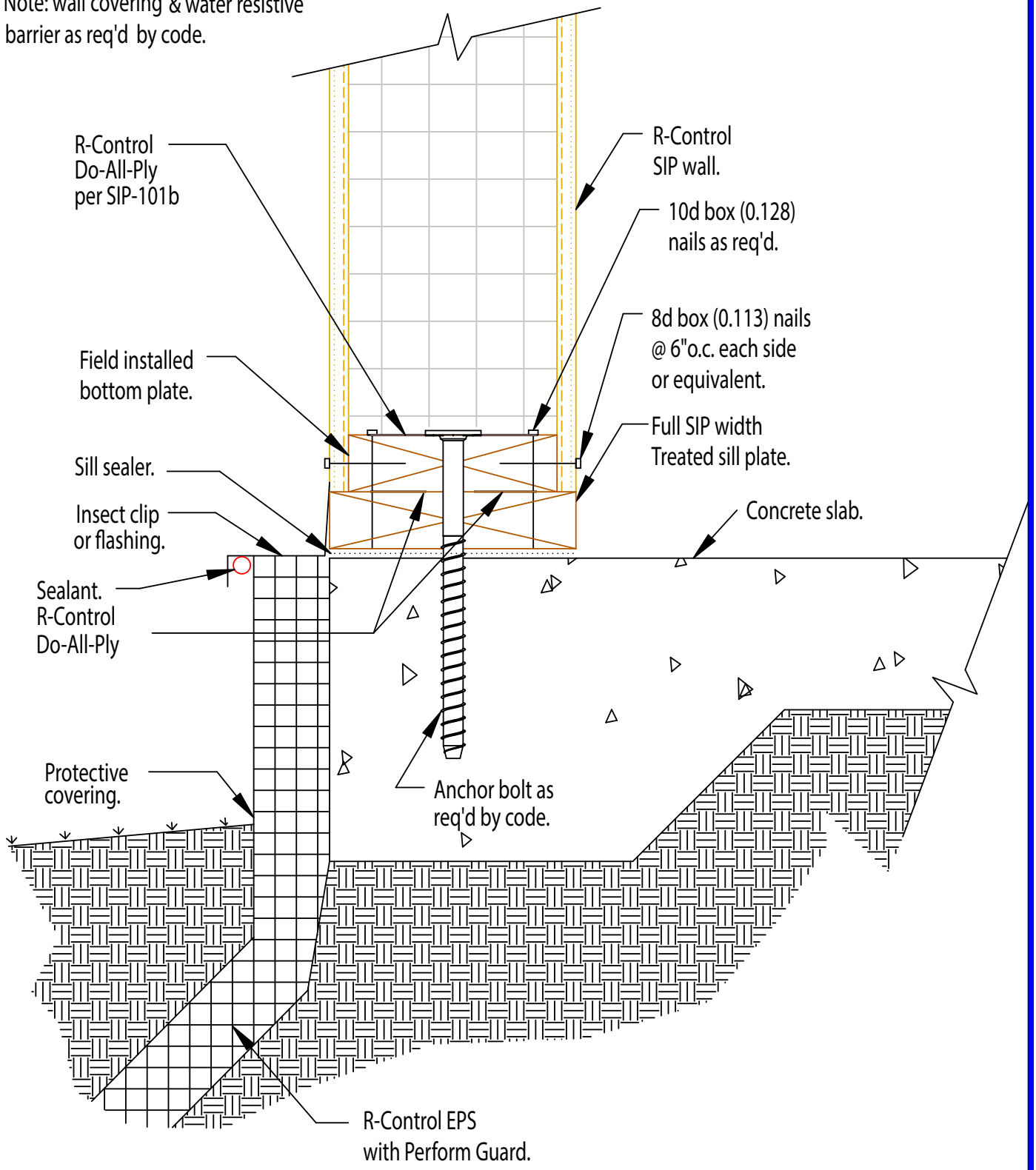
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Slab Foundation Framing	SIP–104a

Note: wall covering & water resistive barrier as req'd by code.



ANCHOR BOLT AS SHOWN:
SIMPSON TITAN HD WASHER HEAD #THD50800WH
SIZE: 1/2" X 8"

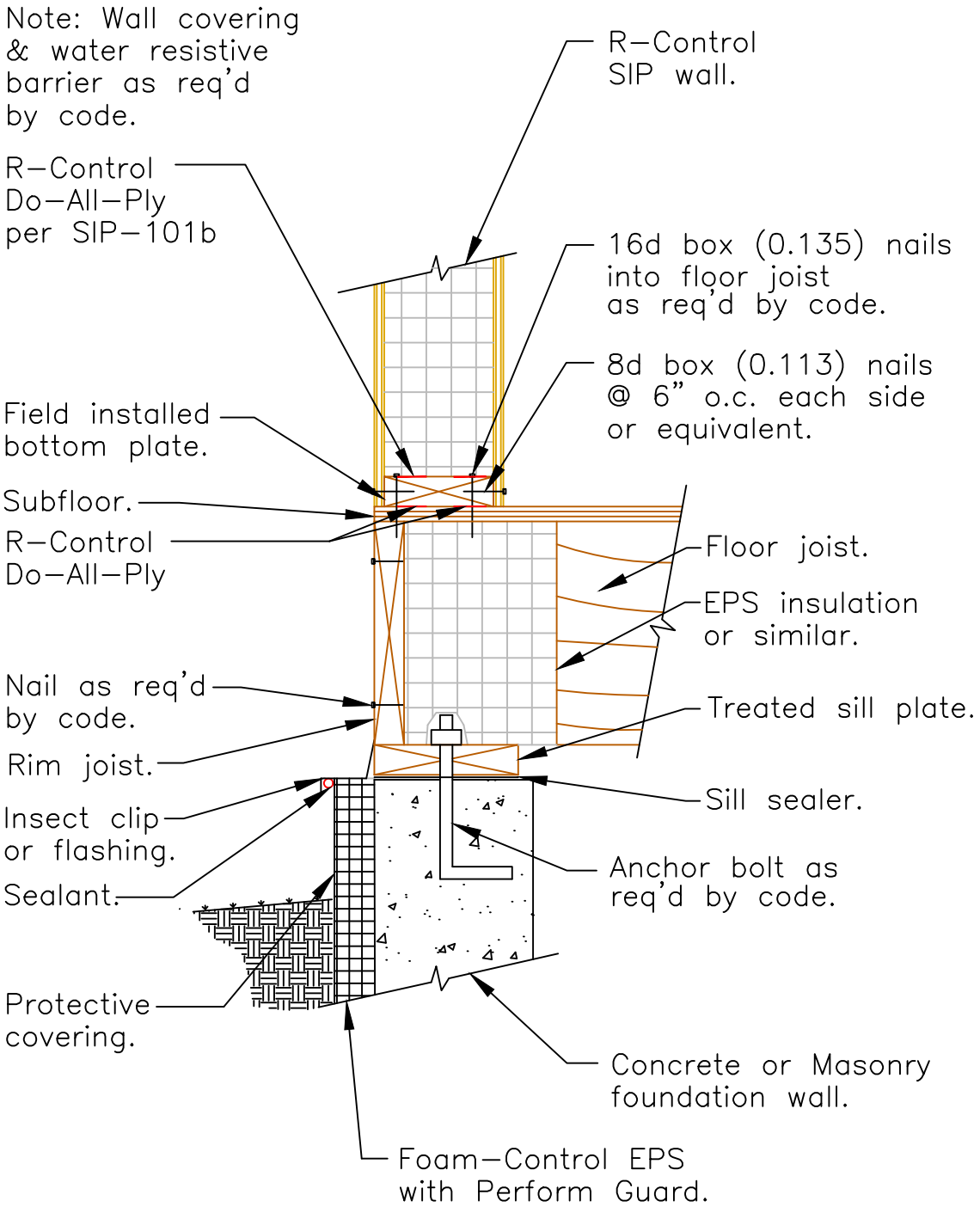
SECTION

Scale: NTS

Updated 9-24-25

R-Control SIP

TITLE:	NO.
Slab Foundation Framing	SIP-104b



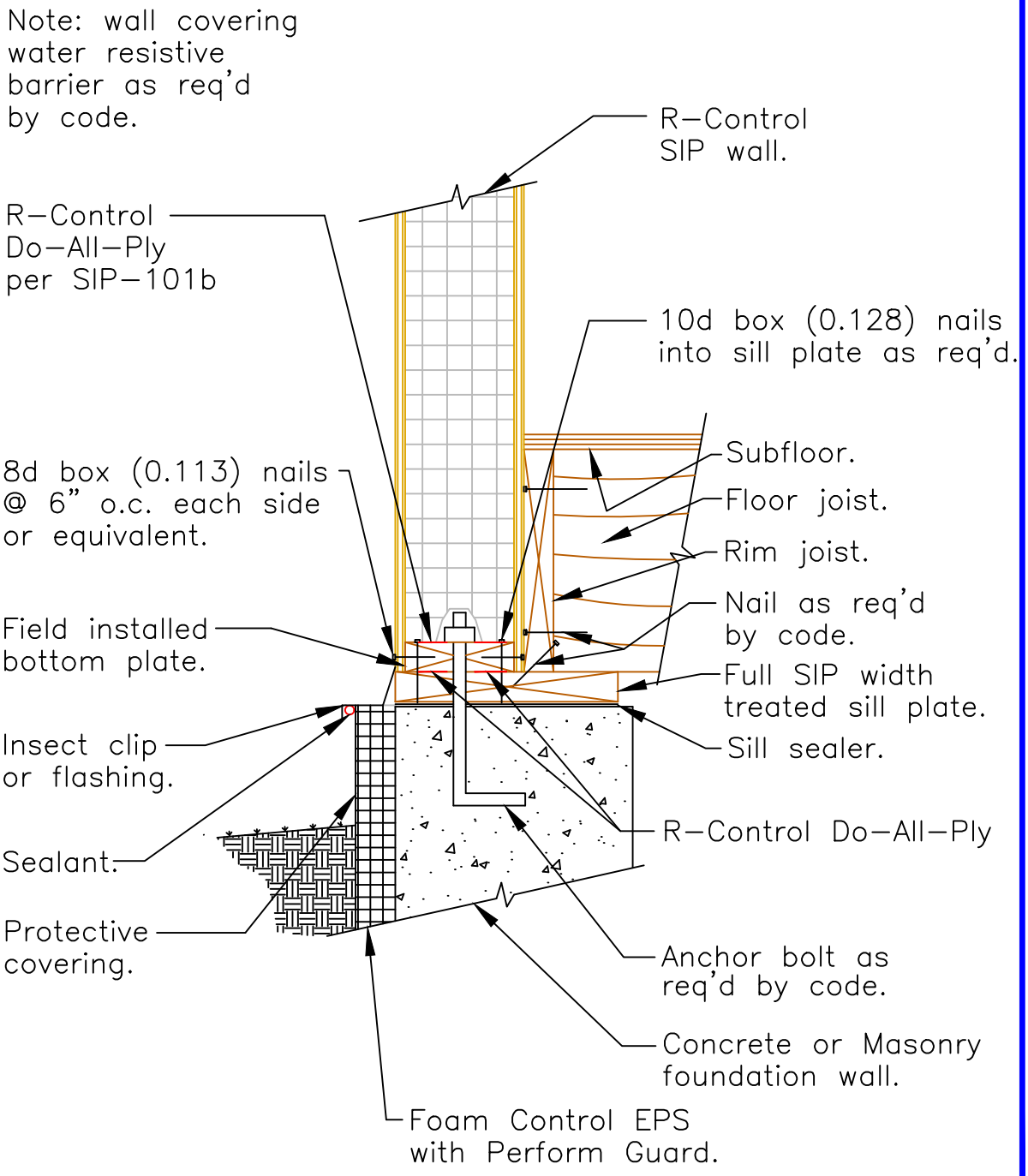
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Foundation Framing – Joist	SIP–105



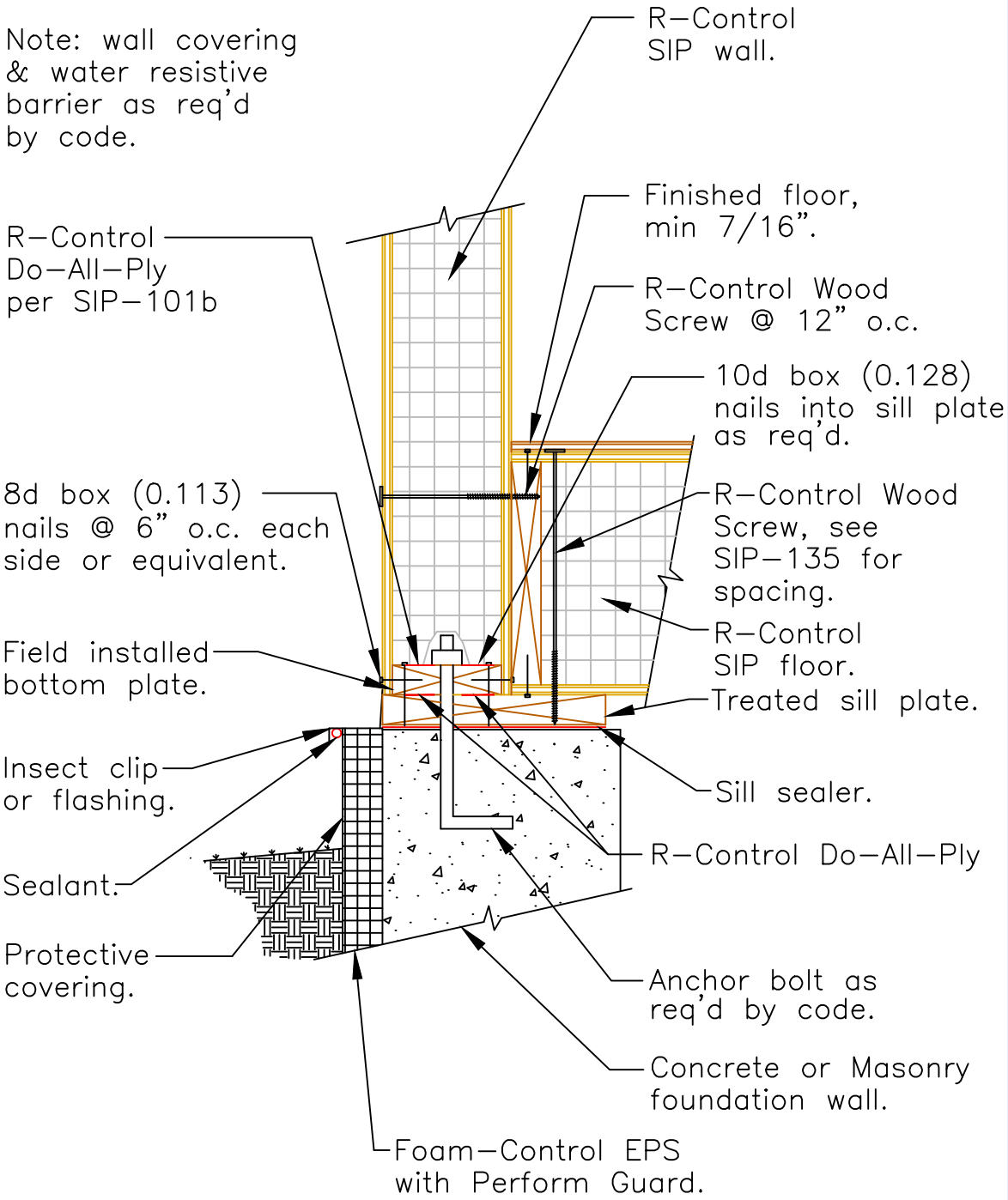
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Foundation Framing – Joist	SIP–105a



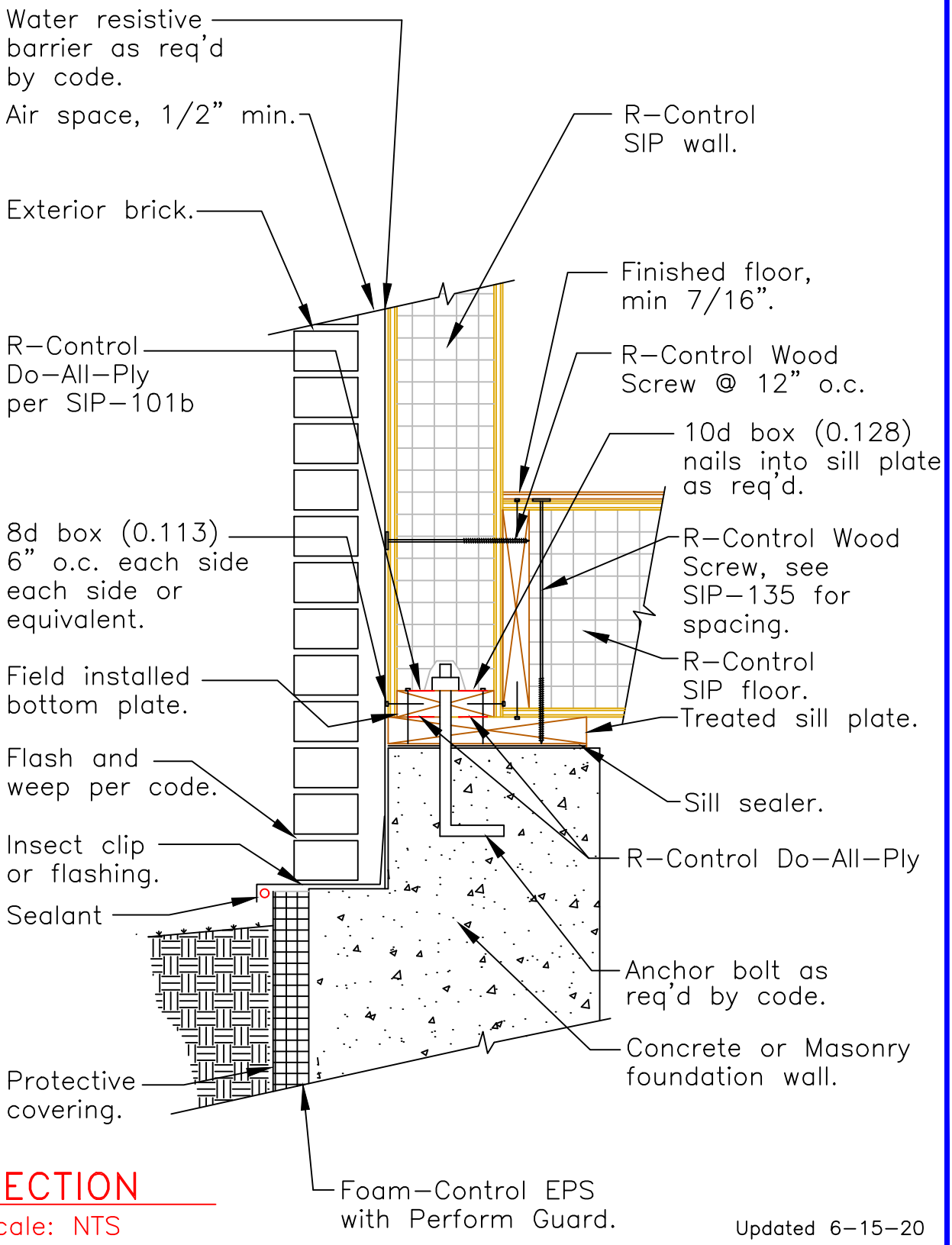
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Foundation Framing – SIP	SIP–105b



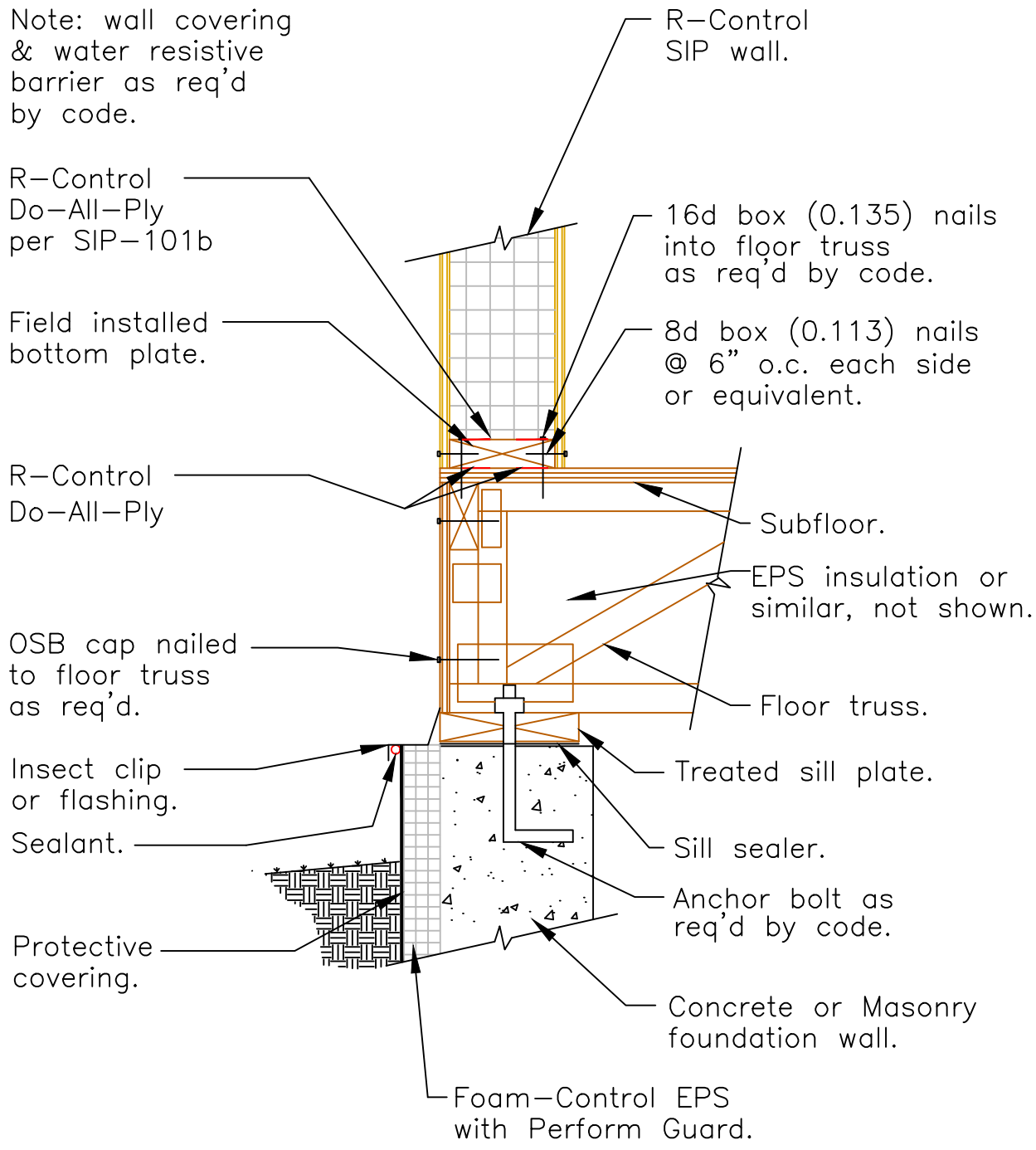
SECTION

Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE: Foundation Framing Brick Ledge	NO. SIP-105c



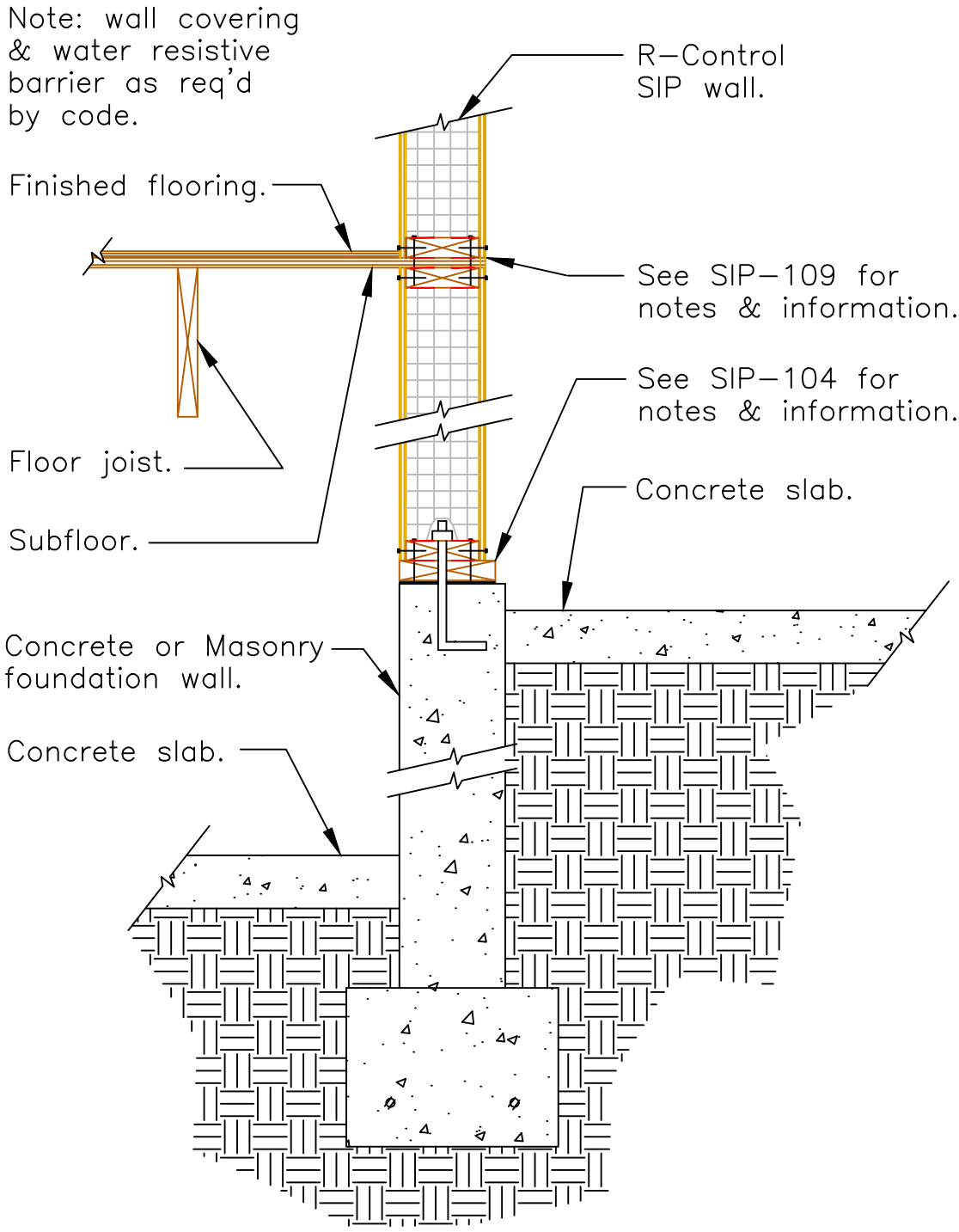
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Foundation Framing – Truss	SIP–106



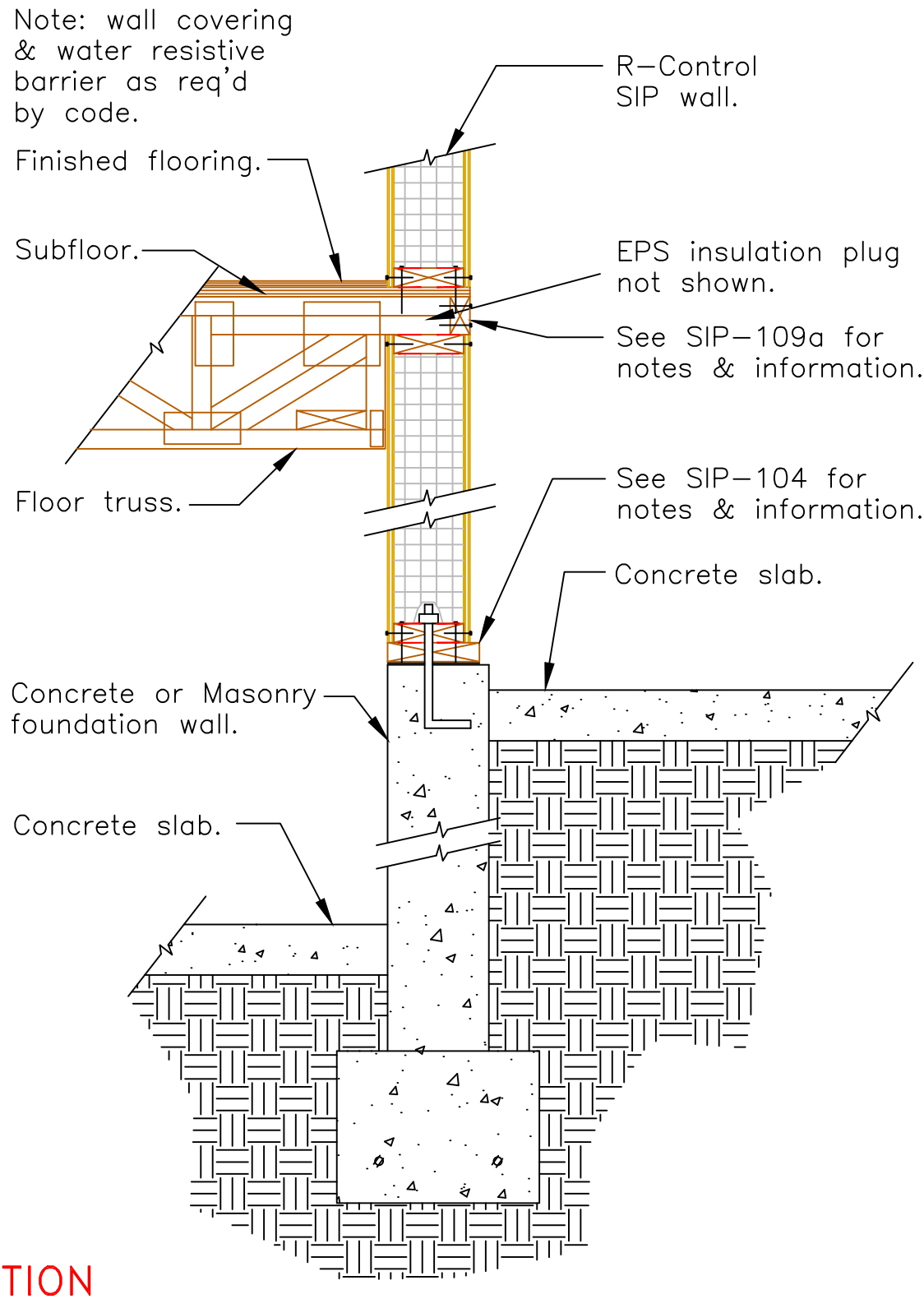
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Knee Wall Framing	SIP–107



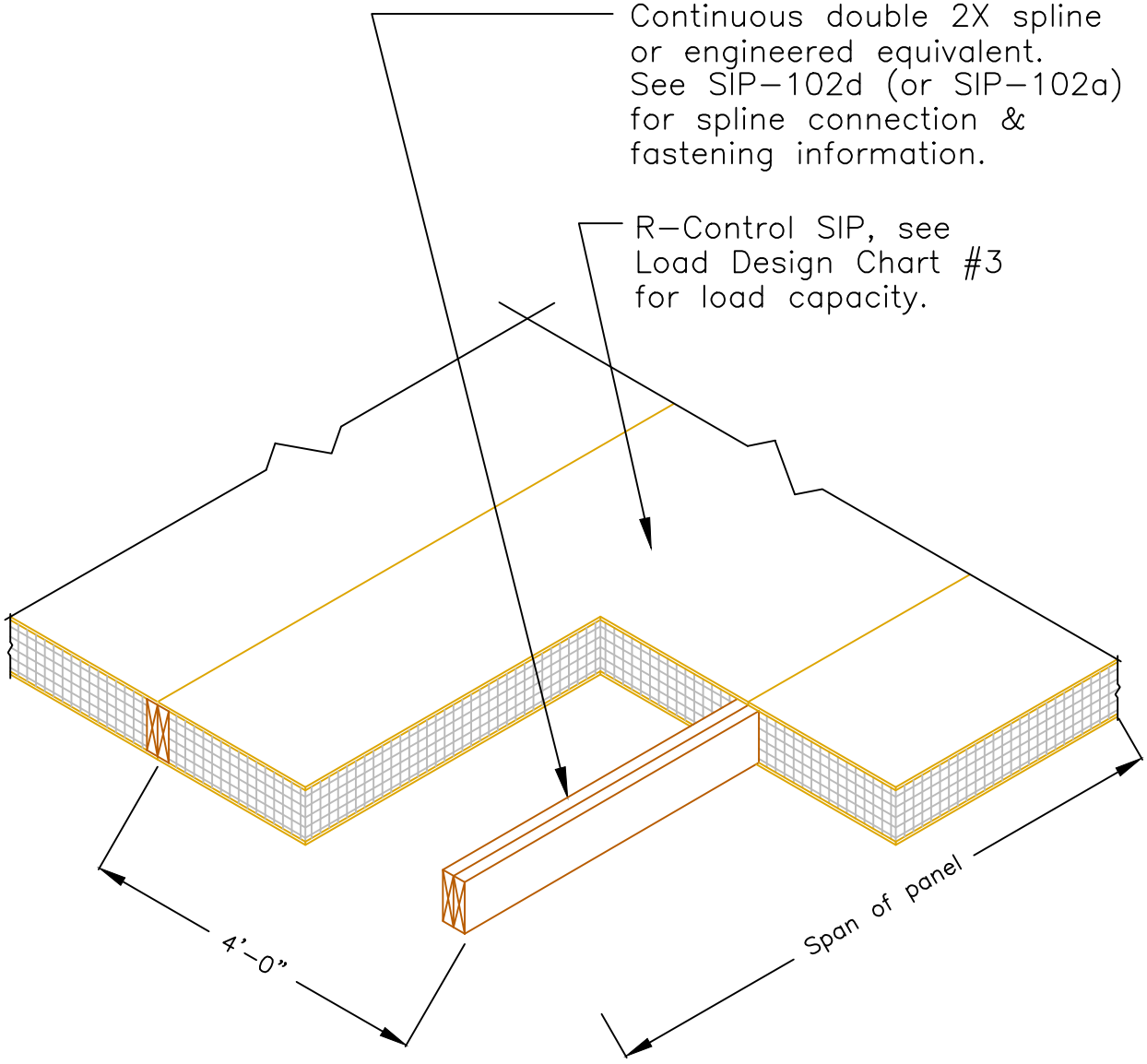
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Knee Wall Framing	SIP–107a



Note:
SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

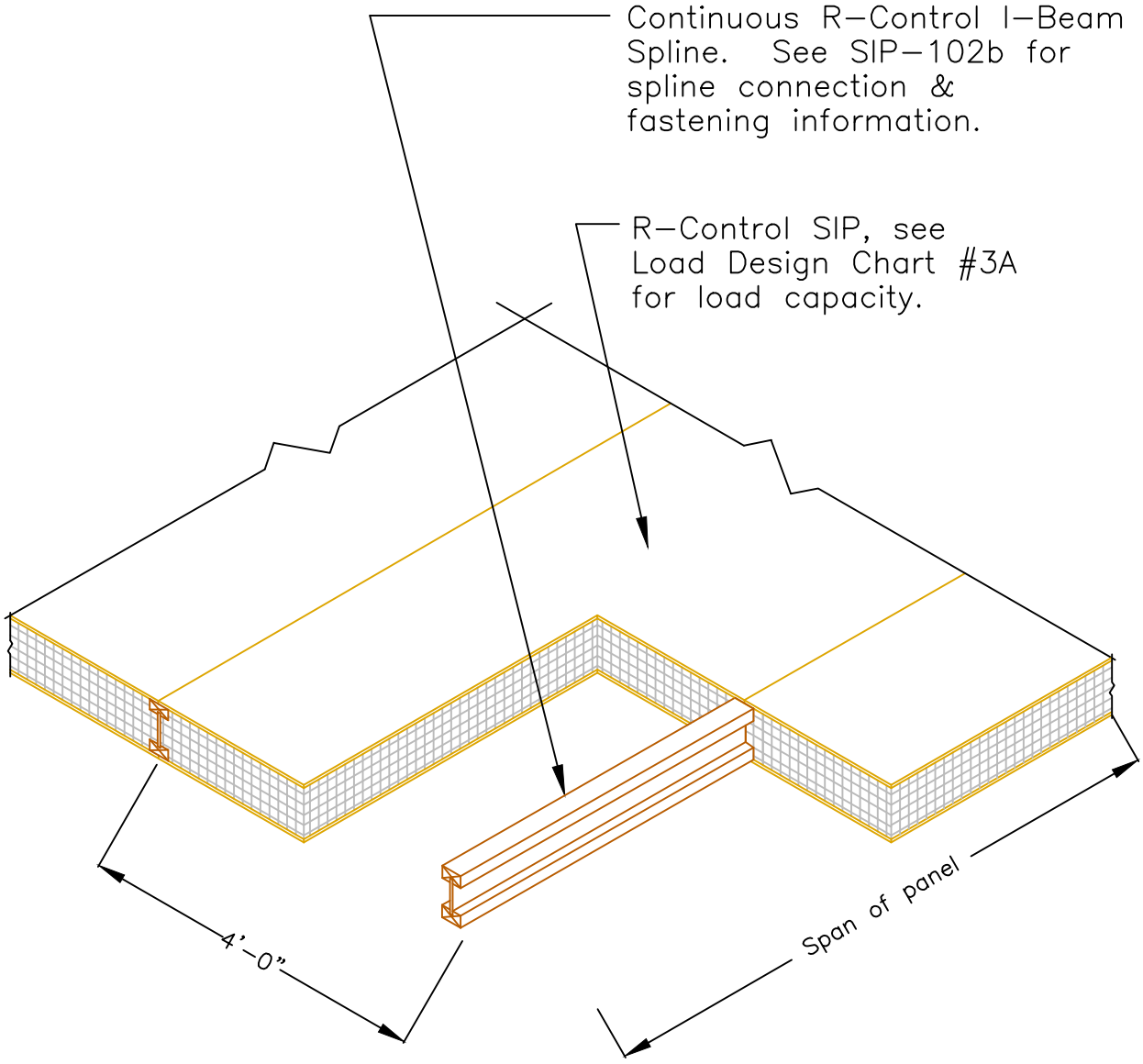
ISOMETRIC PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Floor/Roof SIP 2X Connection	NO. SIP–108



Note:
SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

ISOMETRIC PLAN

Scale: NTS

Updated 6–15–20

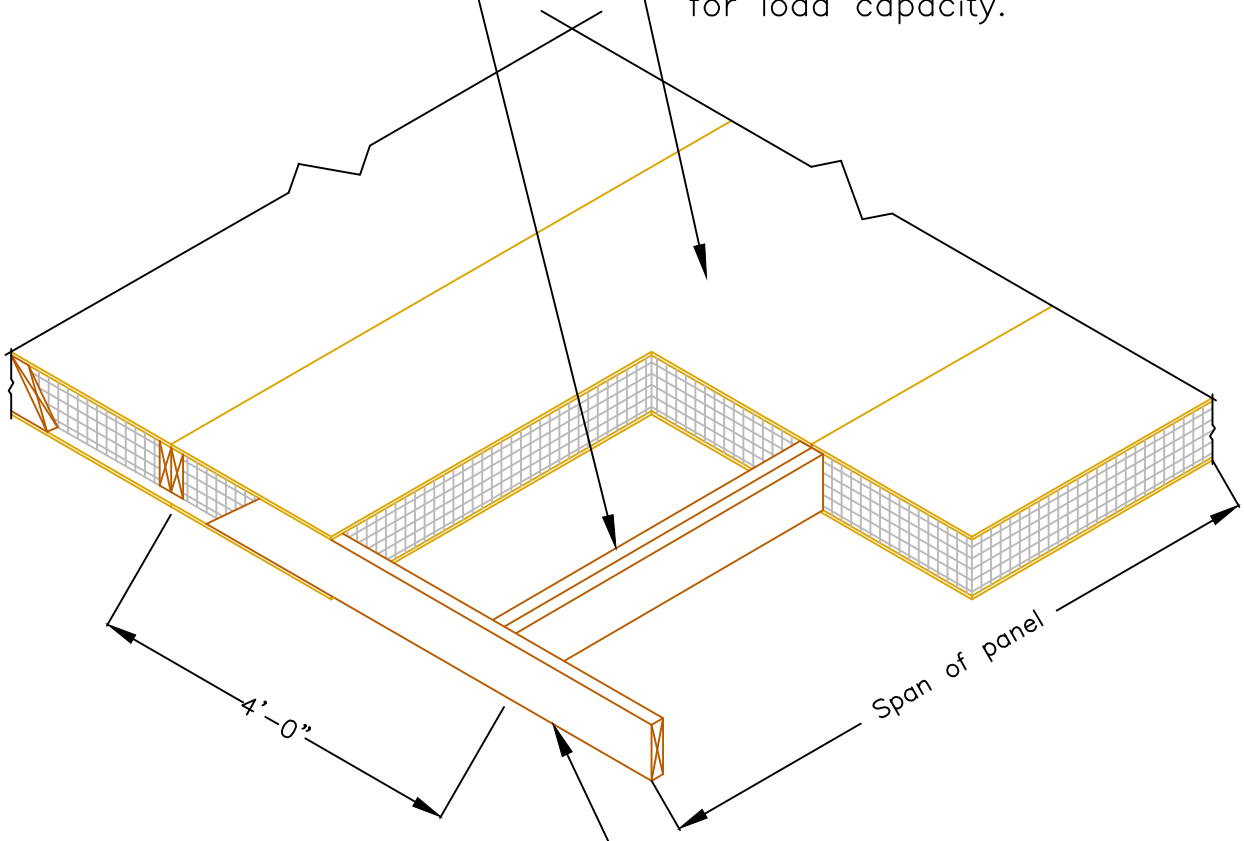
R–Control® SIP

TITLE: Floor/Roof SIP I–Beam Connection	NO. SIP–108a

Note:
Minimum 3" end bearing required on structural supports

Continuous Double 2X spline or engineered equivalent. See SIP–102d (or SIP–102a) for spline connection & fastening information.

R–Control SIP, see Load Design Chart #3 for load capacity.



Note:
SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

Edge plating material, 2X lumber or engineered equivalent.

ISOMETRIC PLAN

Scale: NTS

Updated 6–15–20

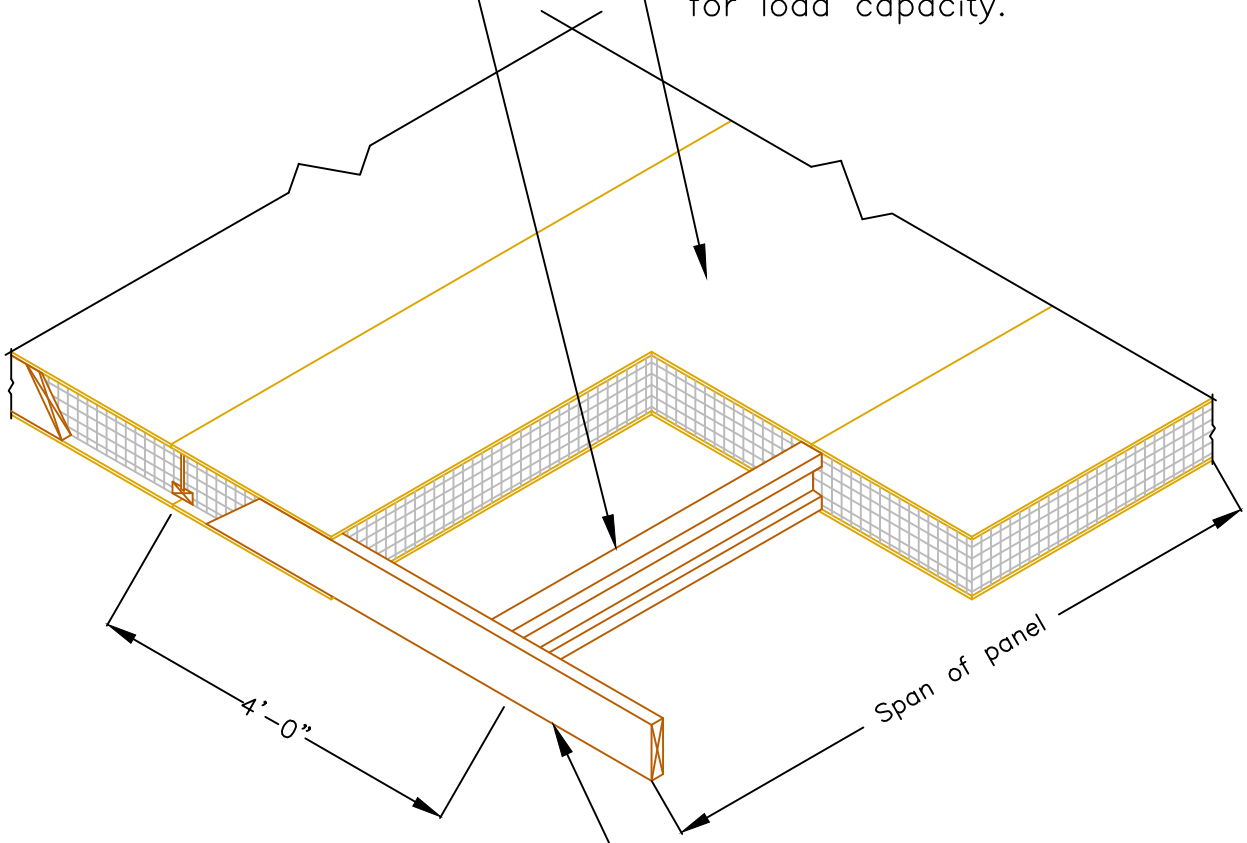
R–Control® SIP

TITLE: Floor/Roof SIP 2X Connection Edge Plating	NO. SIP–108c

Note:
Minimum 3" end bearing required on structural supports

Continuous R-Control I-Beam Spline. See SIP-102b for spline connection & fastening information.

R-Control SIP, see Load Design Chart #3A for load capacity.



Note:
SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

Edge plating material, 2X lumber or engineered equivalent.

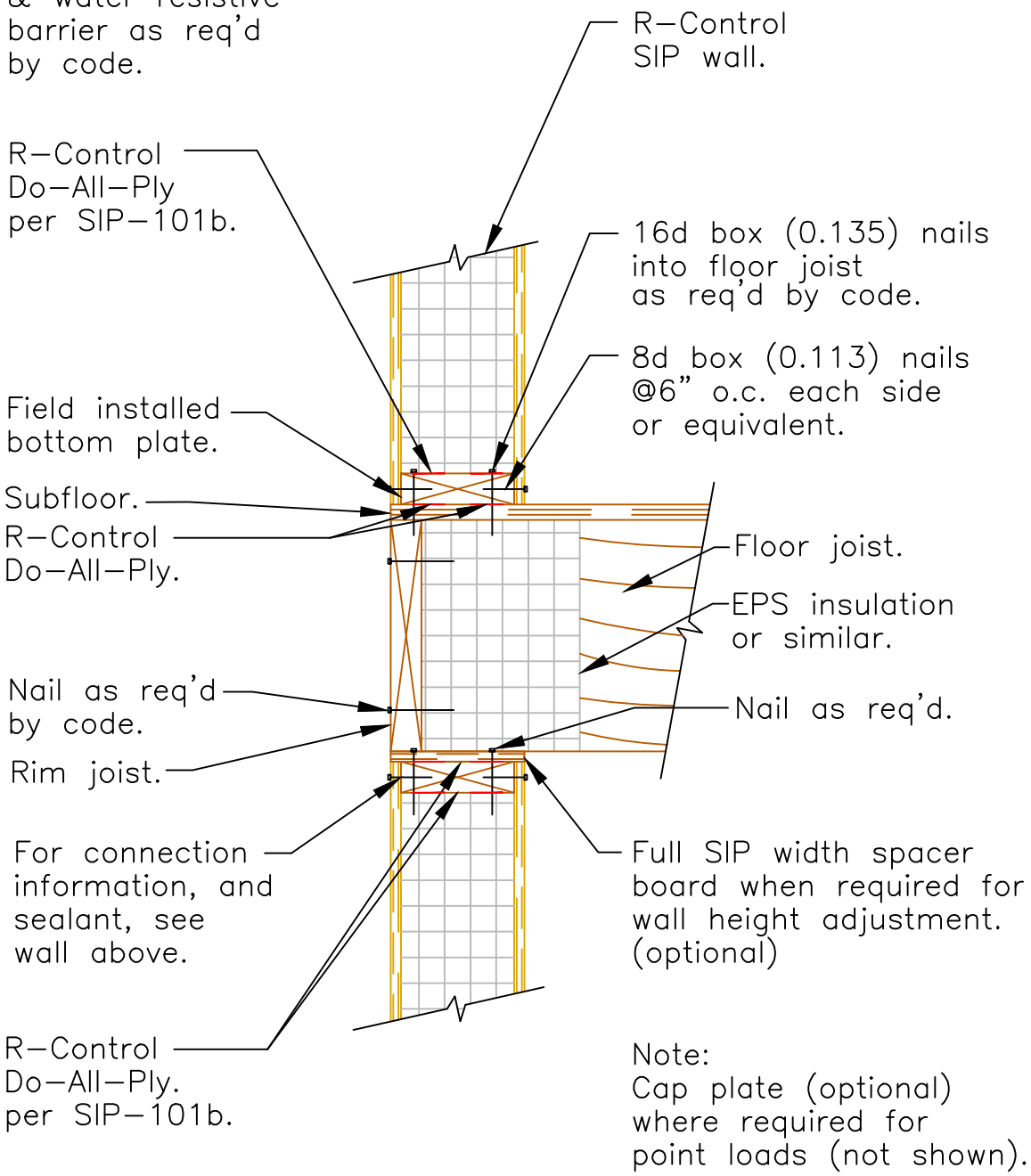
ISOMETRIC PLAN

Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE: Floor/Roof SIP I-Beam Connection Edge Plating	NO. SIP-108d



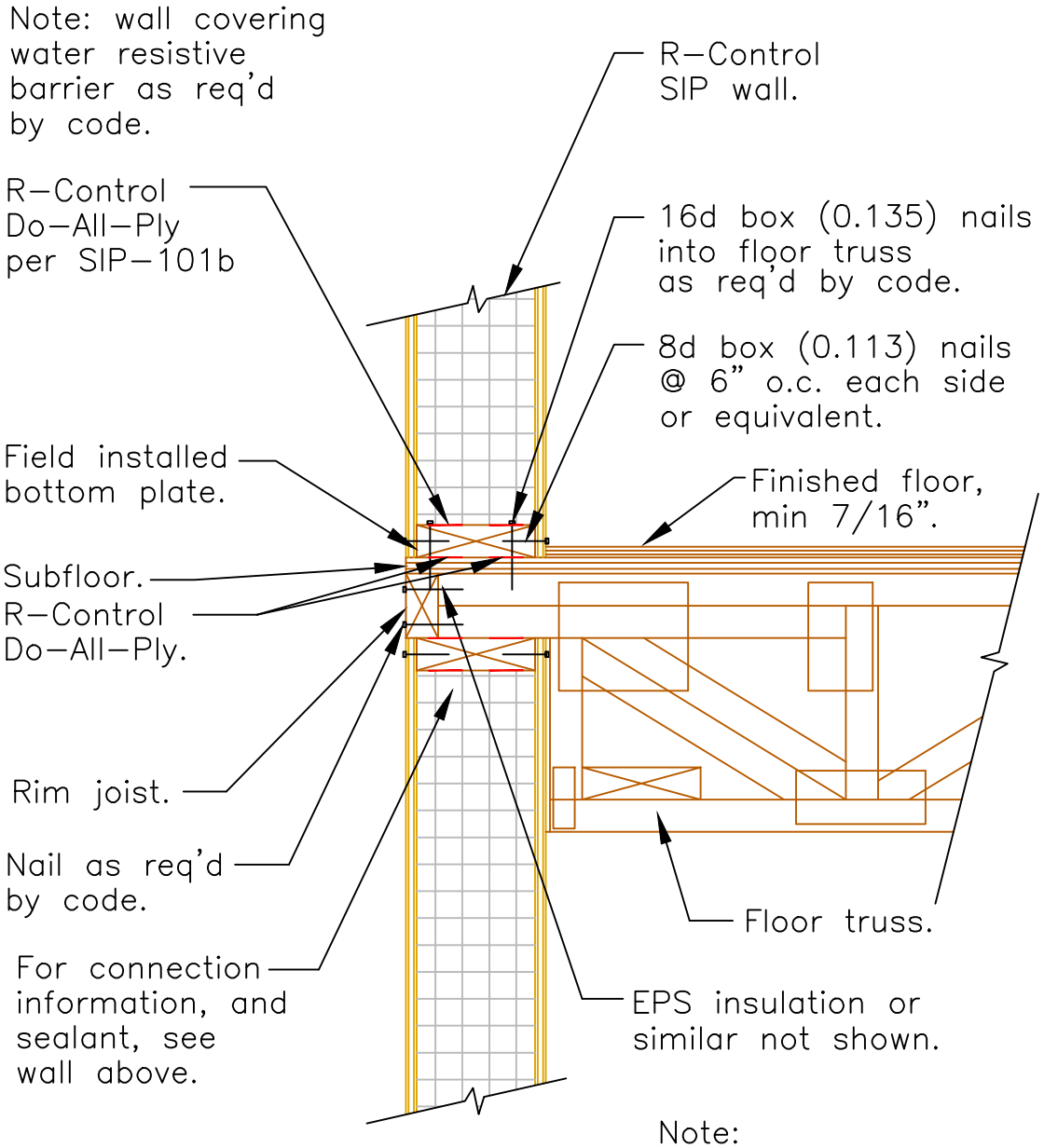
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Floor Joist Bearing on SIP Wall	SIP–109



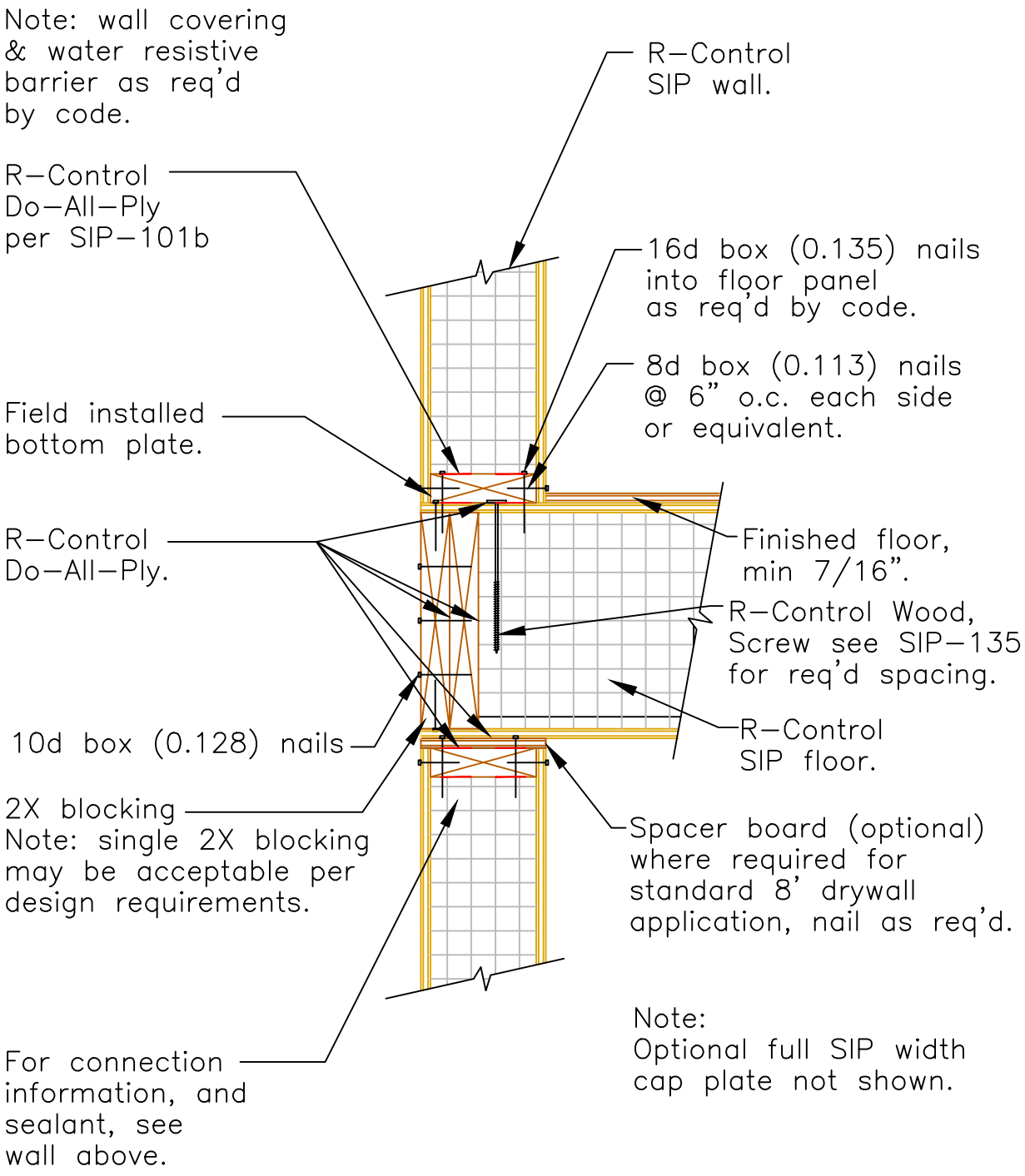
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Floor Truss Bearing on SIP Wall	SIP–109a



SECTION

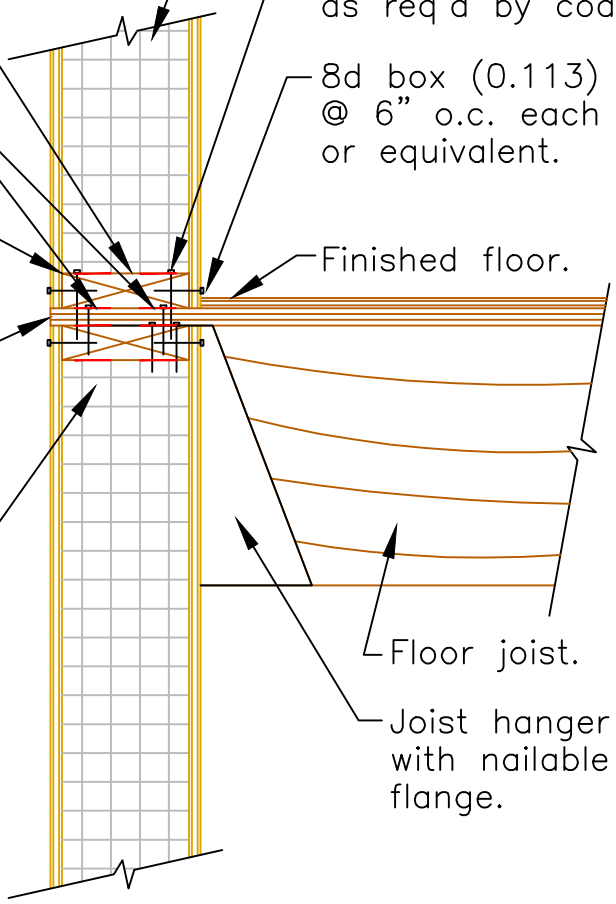
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
SIP Floor on SIP Wall	SIP–109b

Note: wall covering & water resistive barrier as req'd by code.



R–Control Do–All–Ply per SIP–101b

R–Control Do–All–Ply

Field installed bottom plate.

Subfloor extended to outside of wall panel. Nail to top plate with 8d box (0.113) nails at 12"o.c., staggered.

For connection information, and sealant, see wall above.

Note:
Cap plate (optional) where required for point loads (not shown).

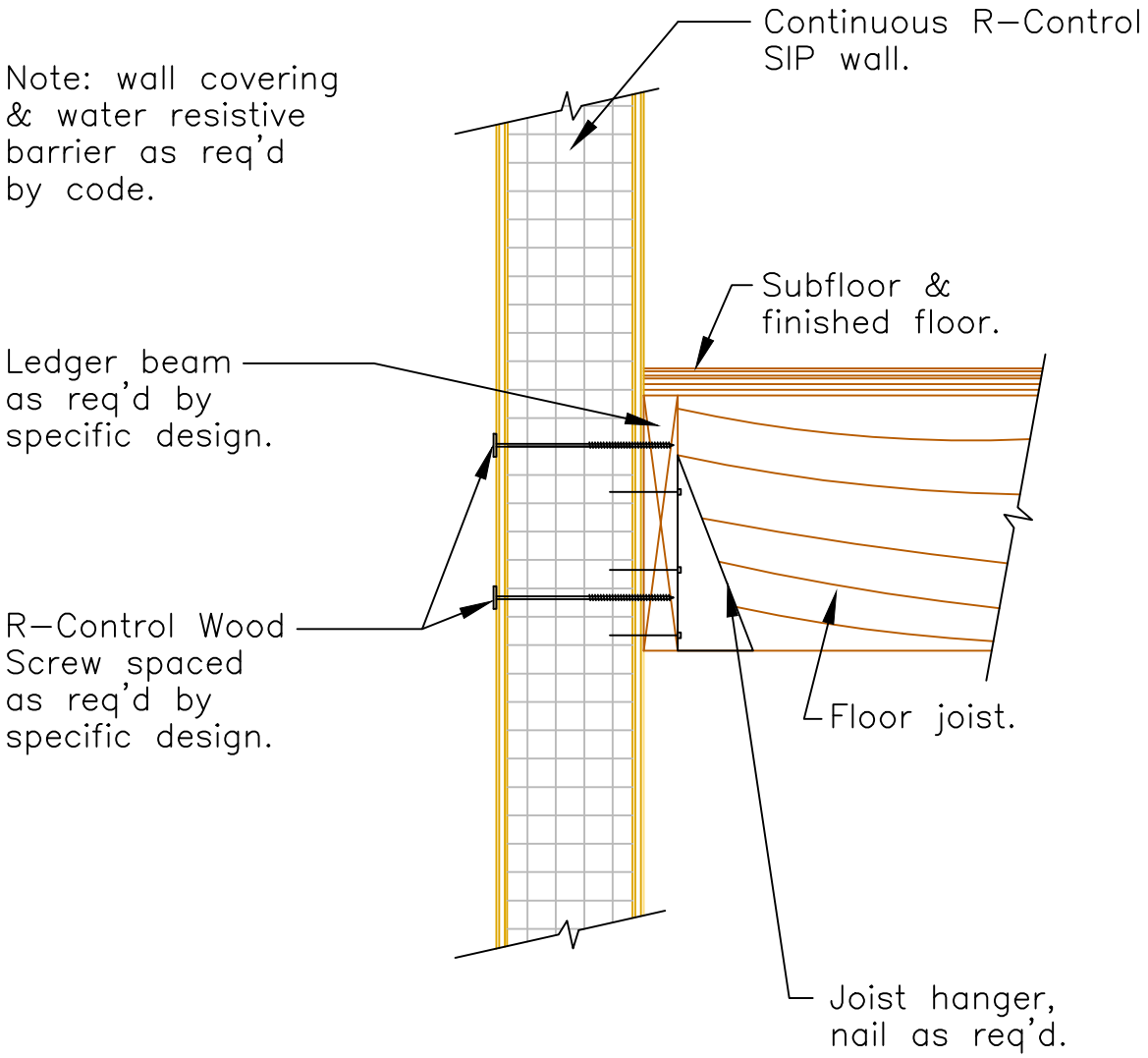
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Floor Joist Hanger and SIP Wall	NO. SIP–109c



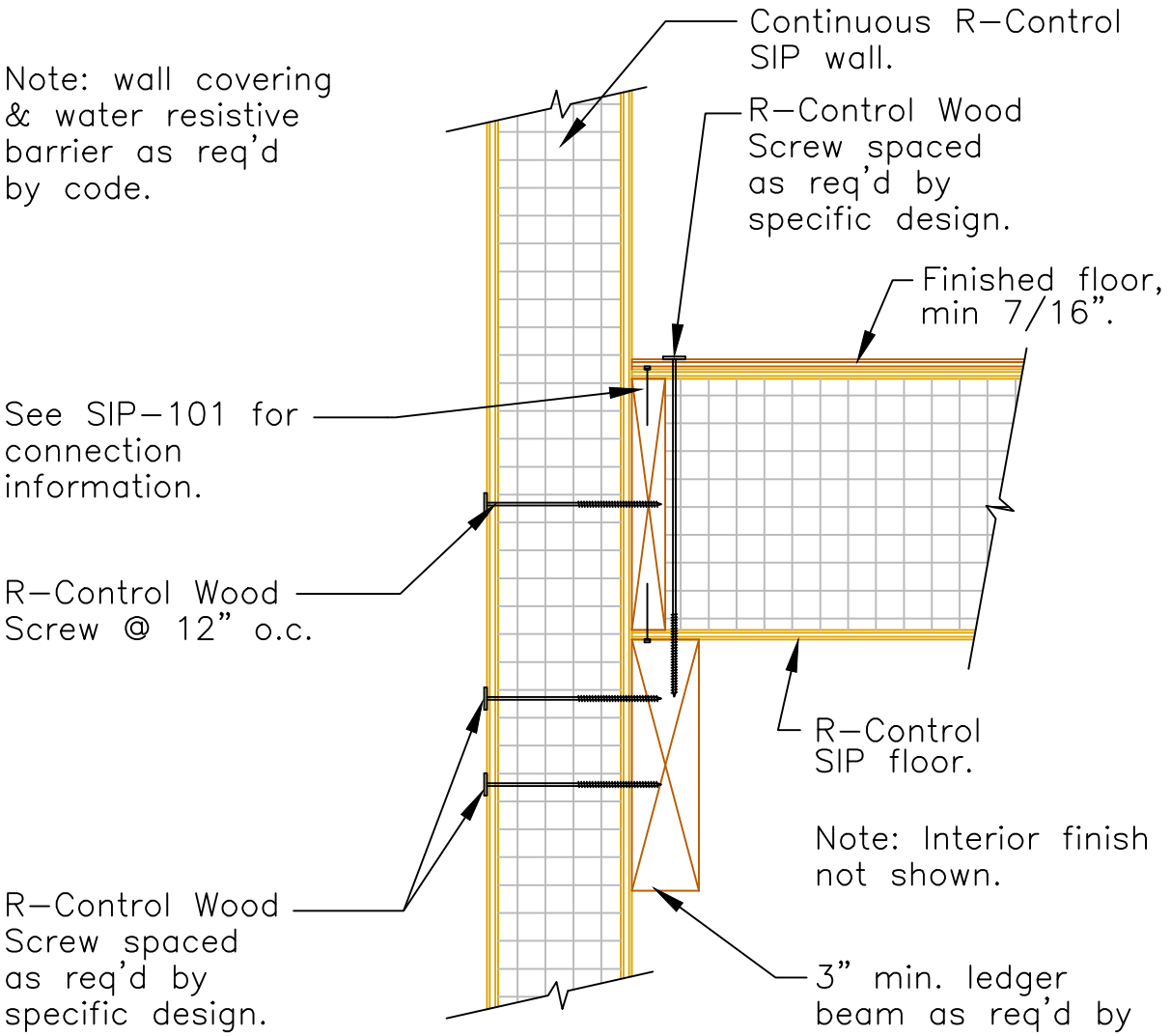
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Floor Joist Hanger and Ledger Beam	NO. SIP–110



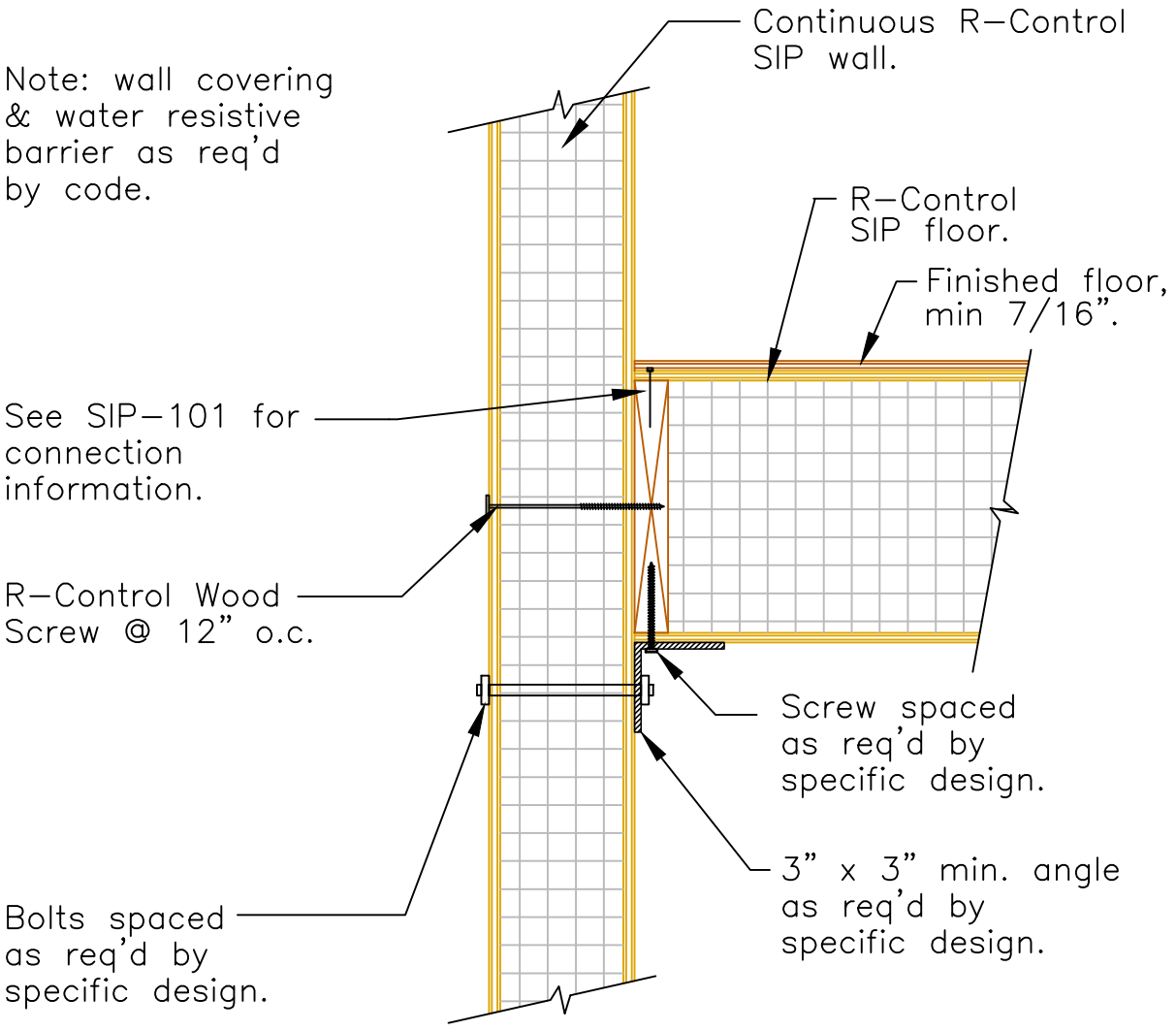
Note: wall covering & water resistive barrier as req'd by code.

SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP	
TITLE: SIP Floor and Ledger Beam	NO. SIP–110a



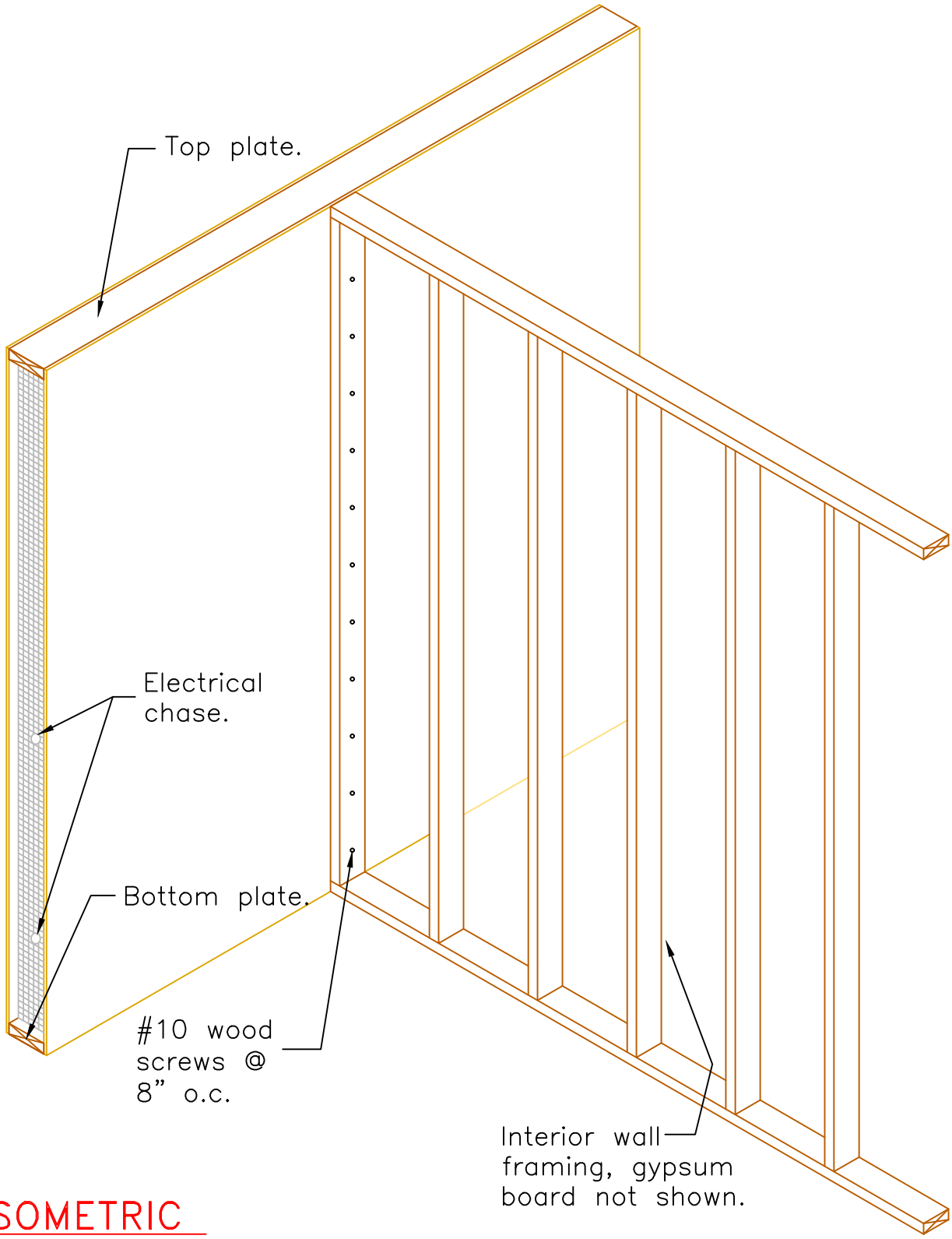
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: SIP Floor and Steel Angle Ledger	NO. SIP–110b



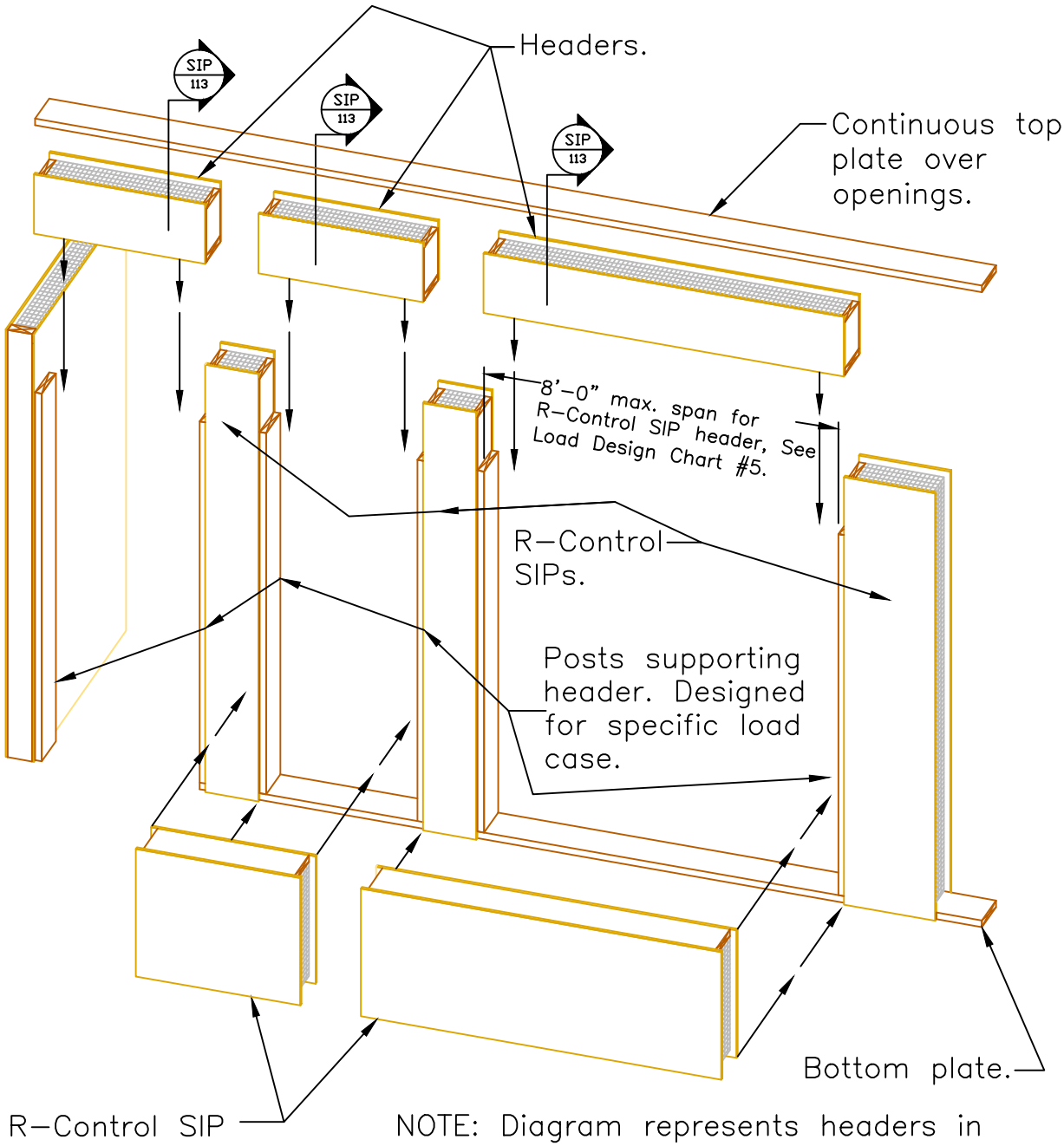
ISOMETRIC

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Interior Wall Connection	SIP–111



NOTE: Diagram represents headers in a wall assembly. Refer to detail SIP-112a. Minimum dimensions are not required between openings, but the posts supporting the header must extend to the floor. The bottom plate of the header must extend to the outside of the post.

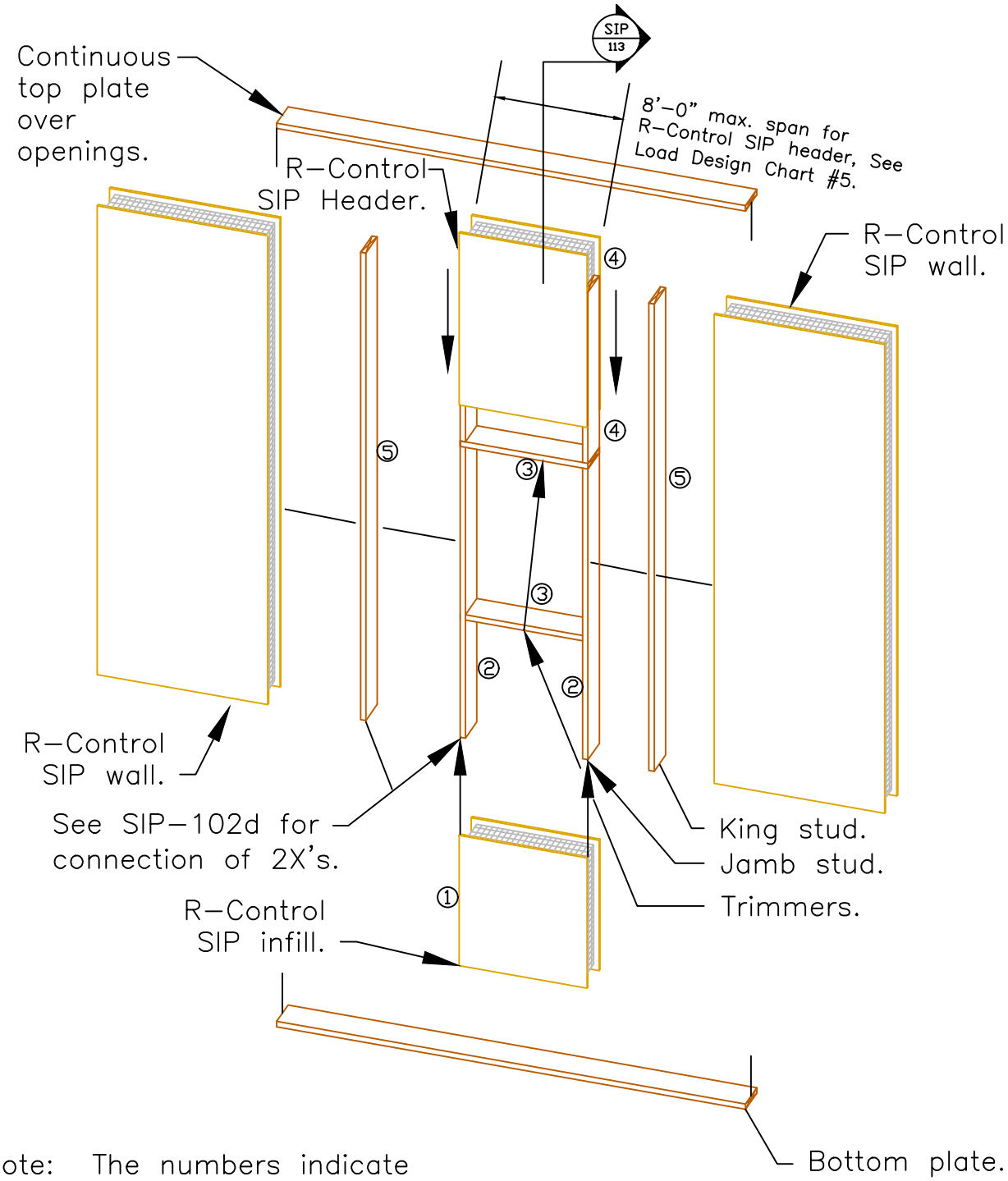
ISOMETRIC

Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE:	NO.
Headers	SIP-112



Note: The numbers indicate sequencing for installation.

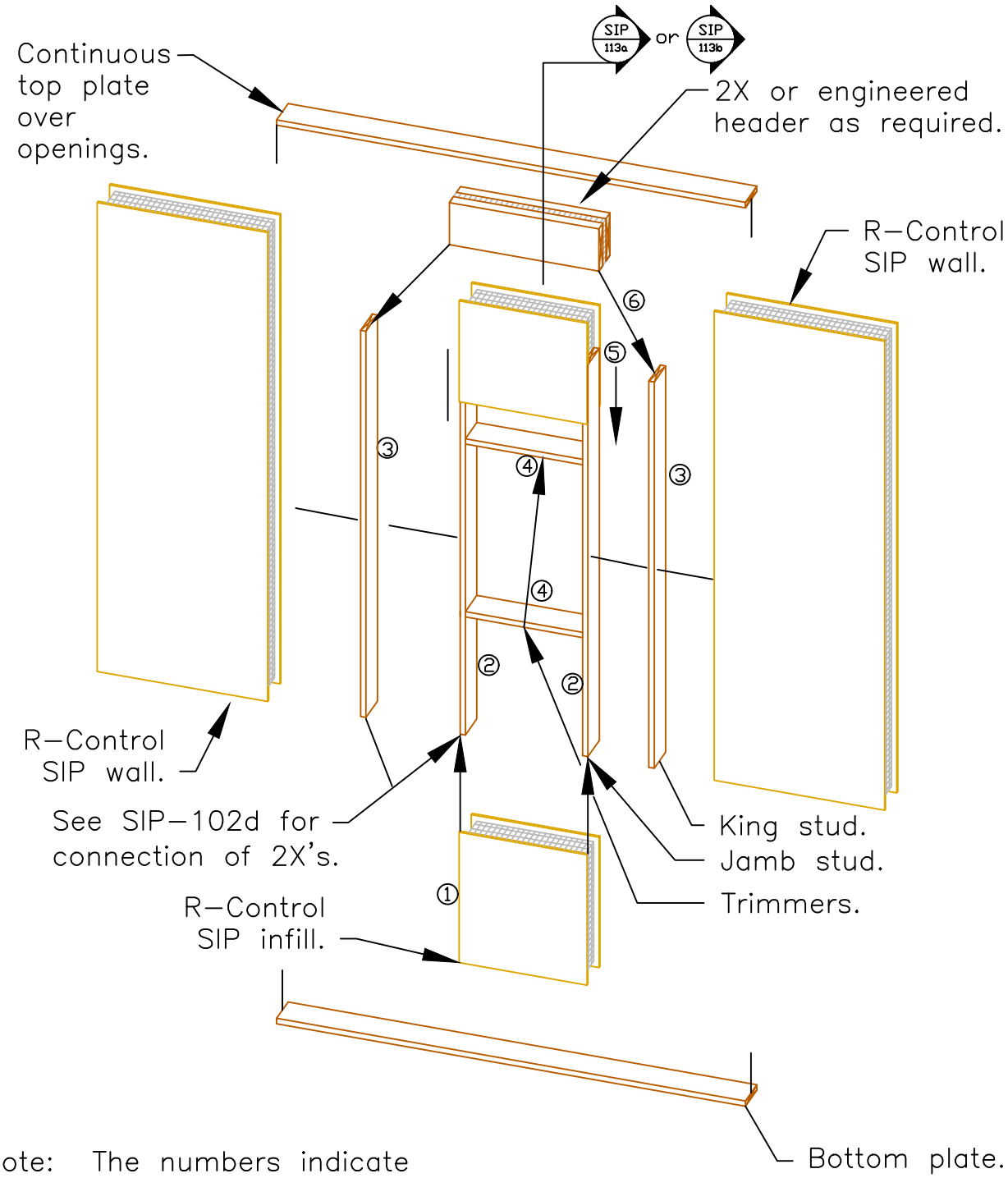
ISOMETRIC

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Headers	SIP–112a



Note: The numbers indicate sequencing for installation.

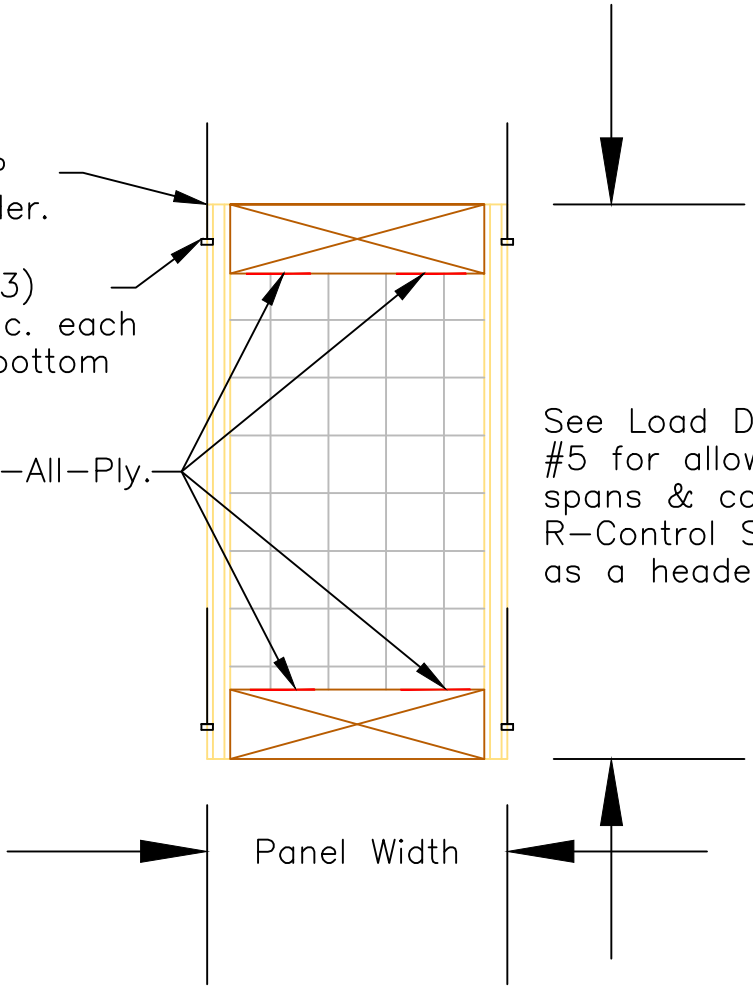
ISOMETRIC

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Headers–Traditional w/ SIP Infill	NO. SIP–112b



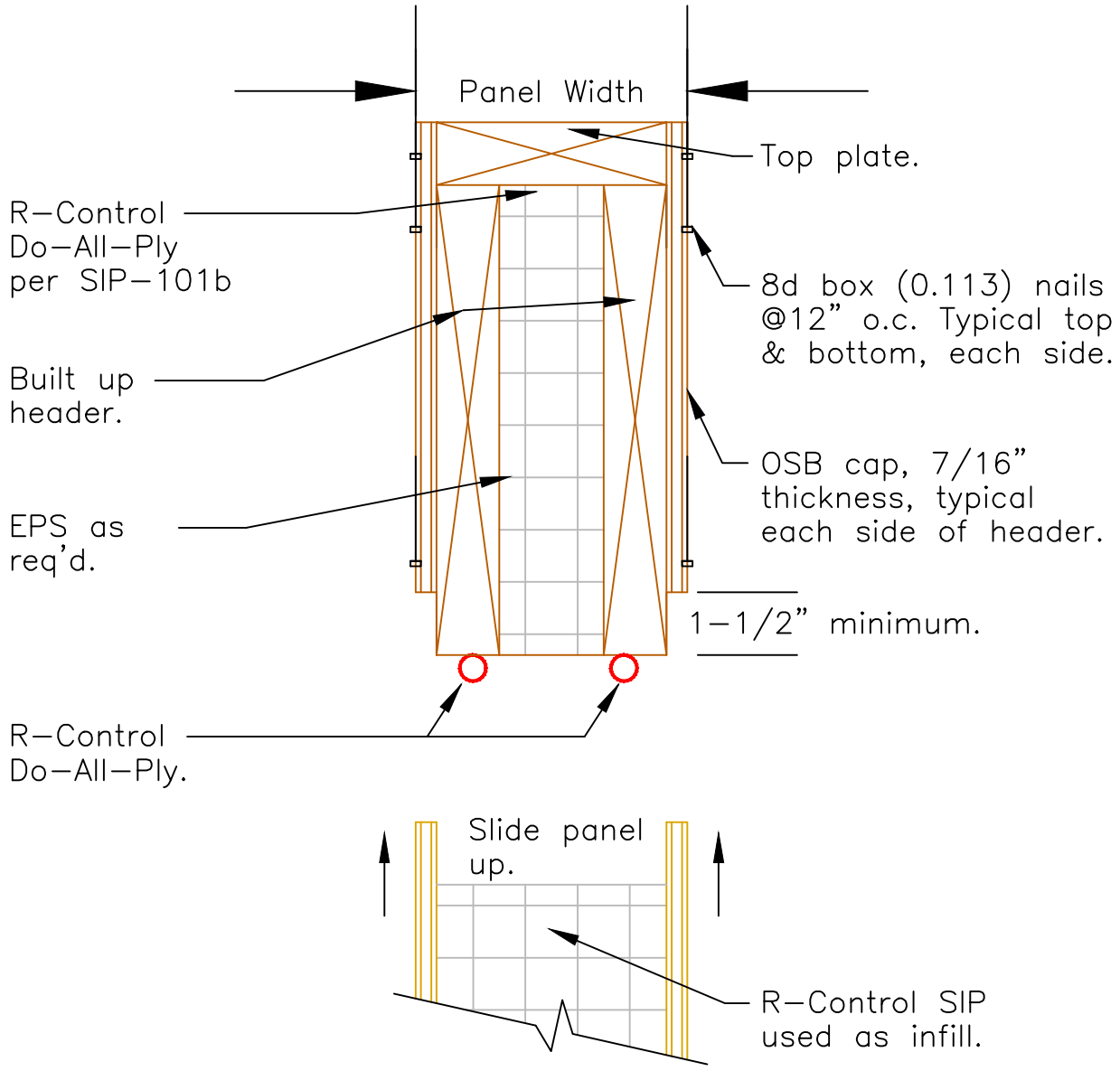
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
SIP Header Plates	SIP–113



NOTE:
See SIP–101 for connection information not shown.

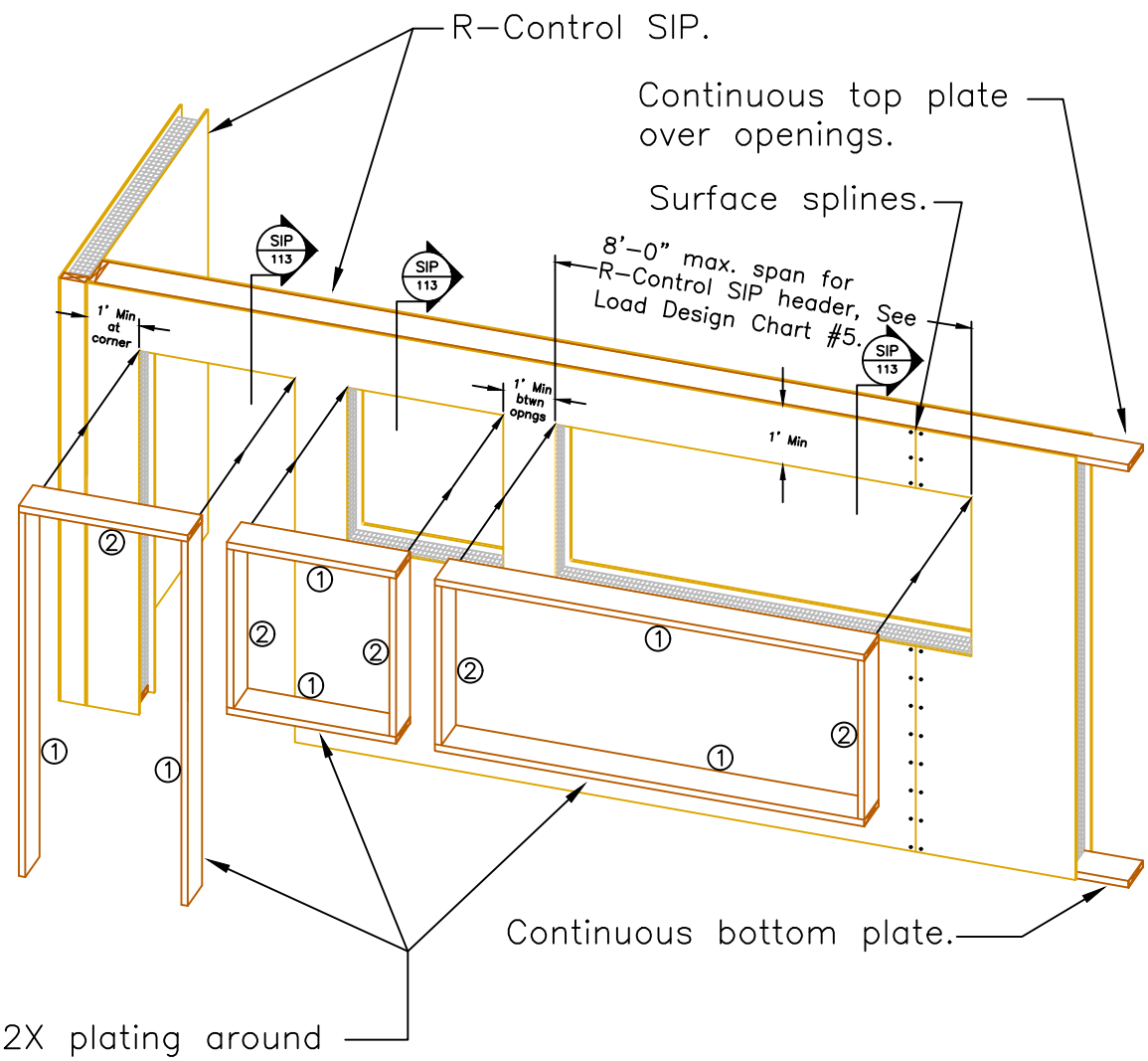
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Header Built Up 2x's	NO. SIP–113b



2X plating around window and door openings. Numbers indicate sequencing for installation. Refer to SIP–115 for connection of 2X's to OSB facings.

NOTE: Diagram represents headers in a monolithic wall assembly. Splines may occur above & below openings. Minimum panel dimension of 12" must be maintained over openings.

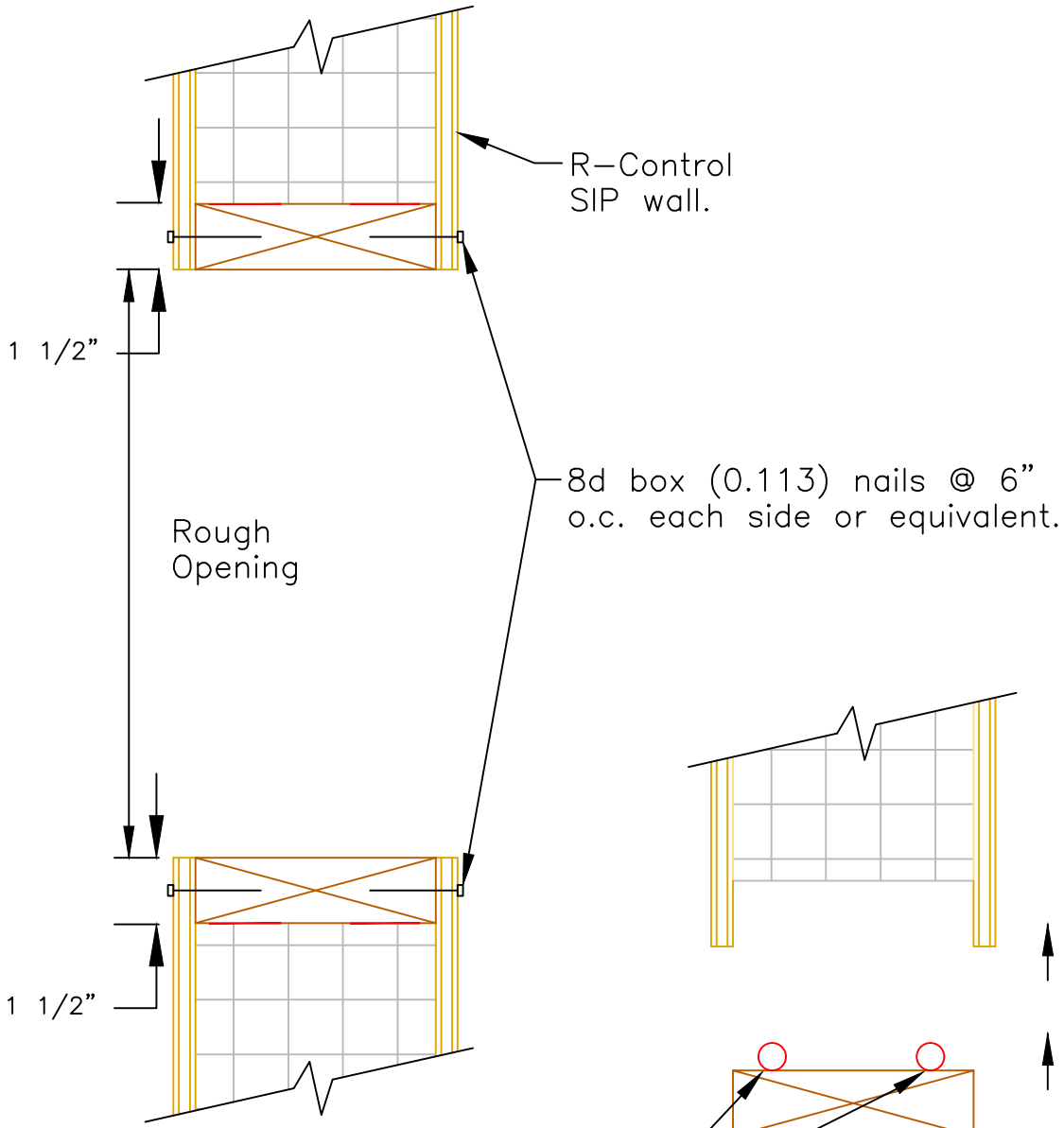
ISOMETRIC

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: SIP Header	NO. SIP–114



Note:
This detail is applicable for horizontal or vertical panels.

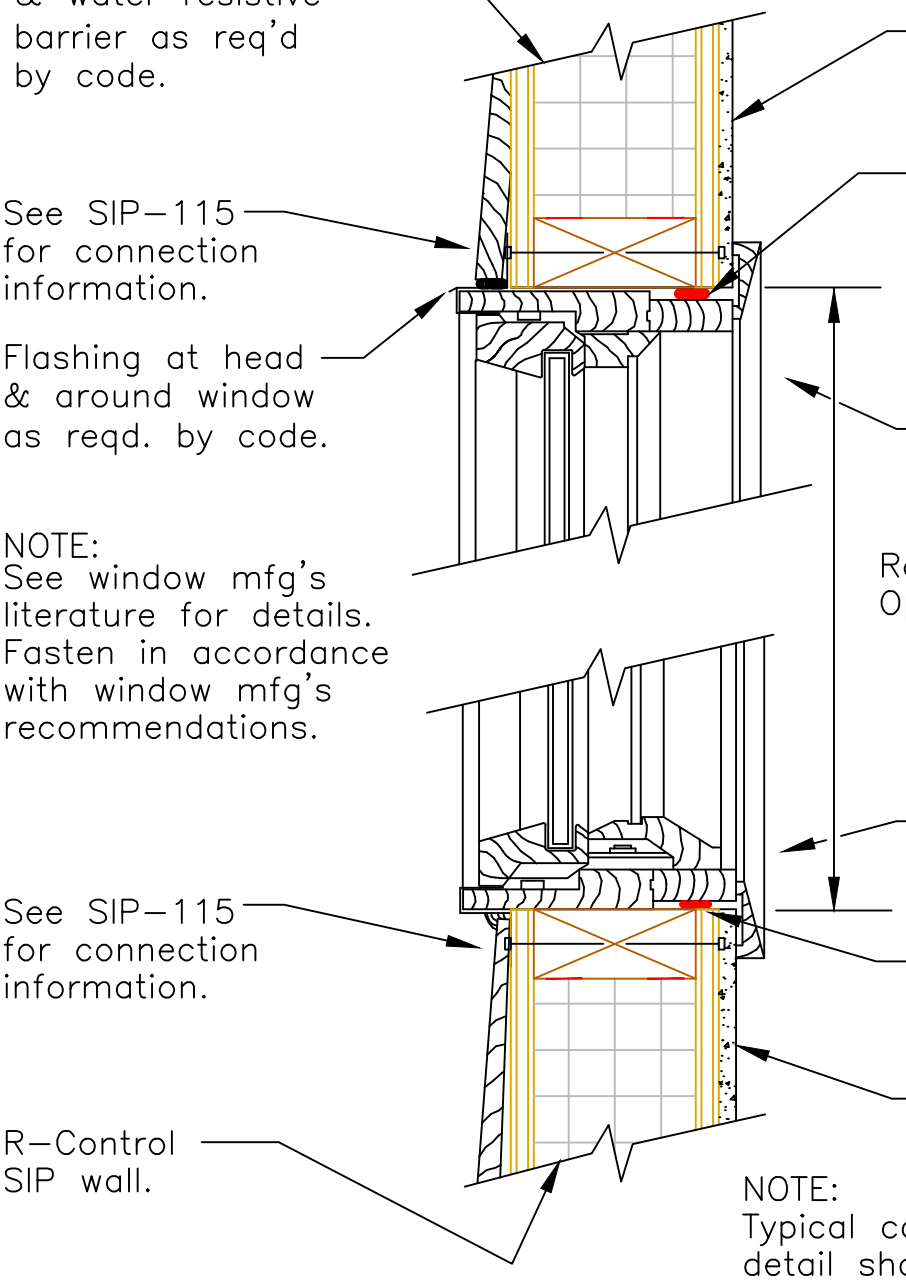
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Openings in SIPs	SIP–115



SECTION

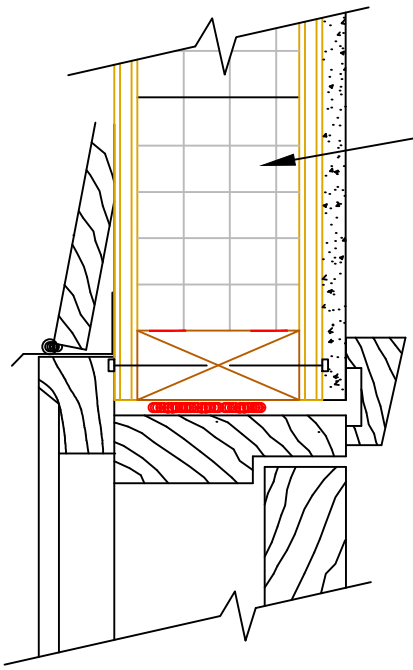
Scale: NTS

Updated 6–15–20

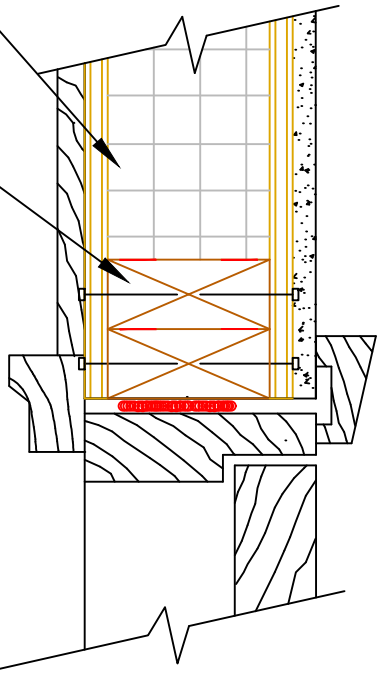
R–Control® SIP

TITLE:	NO.
Windows	SIP–116

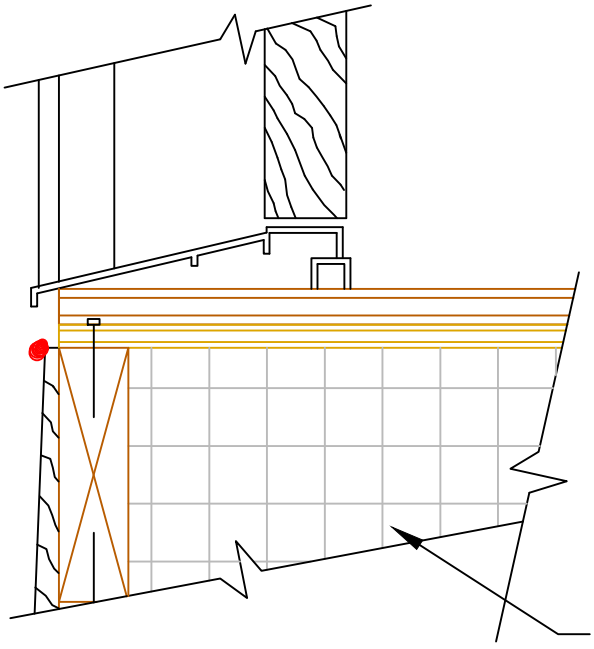
Note: Wall covering & water resistive barrier and flashing as req'd by code.



Typical Head Detail



Typical Jamb Detail (plan)



Typical Exterior Sill Detail

Note: Refer to SIP-116 for notes and detail information.

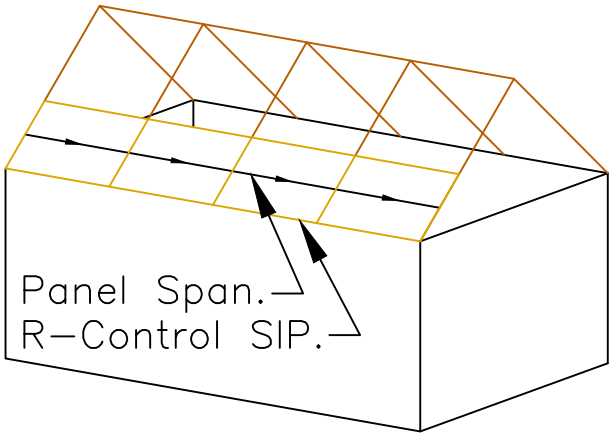
SECTION

Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE:	NO.
Doors	SIP-117

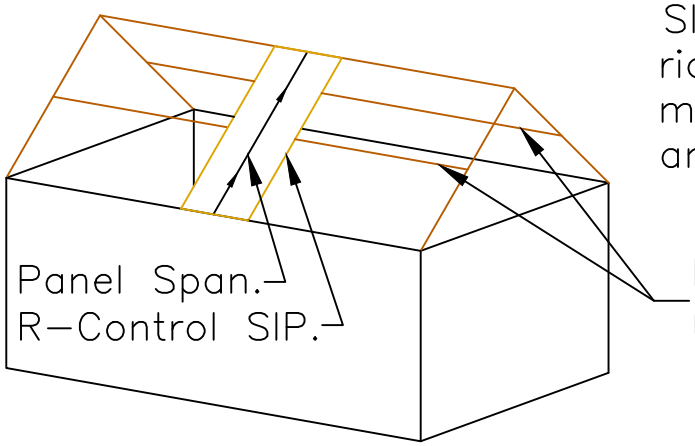


RAFTER SYSTEM

SIPs supported by rafters spanning from ridge beam to eave walls.

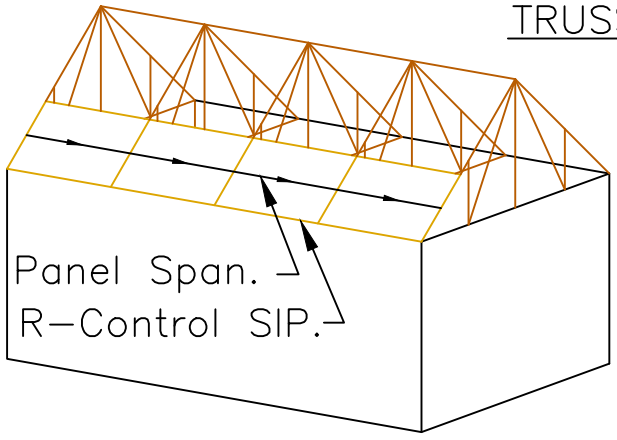
RIDGE BEAM SYSTEM

SIPs supported by ridge beam, mid–span beams and eave walls.



TRUSS SYSTEM

SIPs supported by trusses.



ISOMETRIC

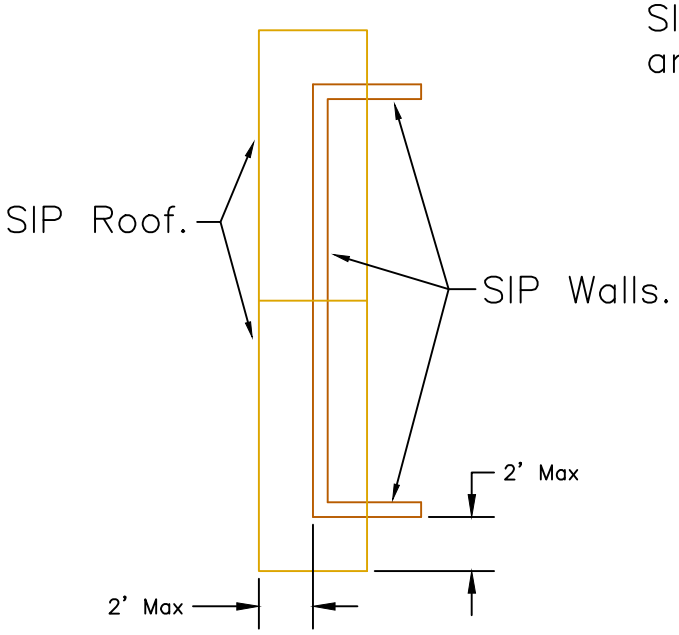
Scale: NTS

Updated 6–15–20

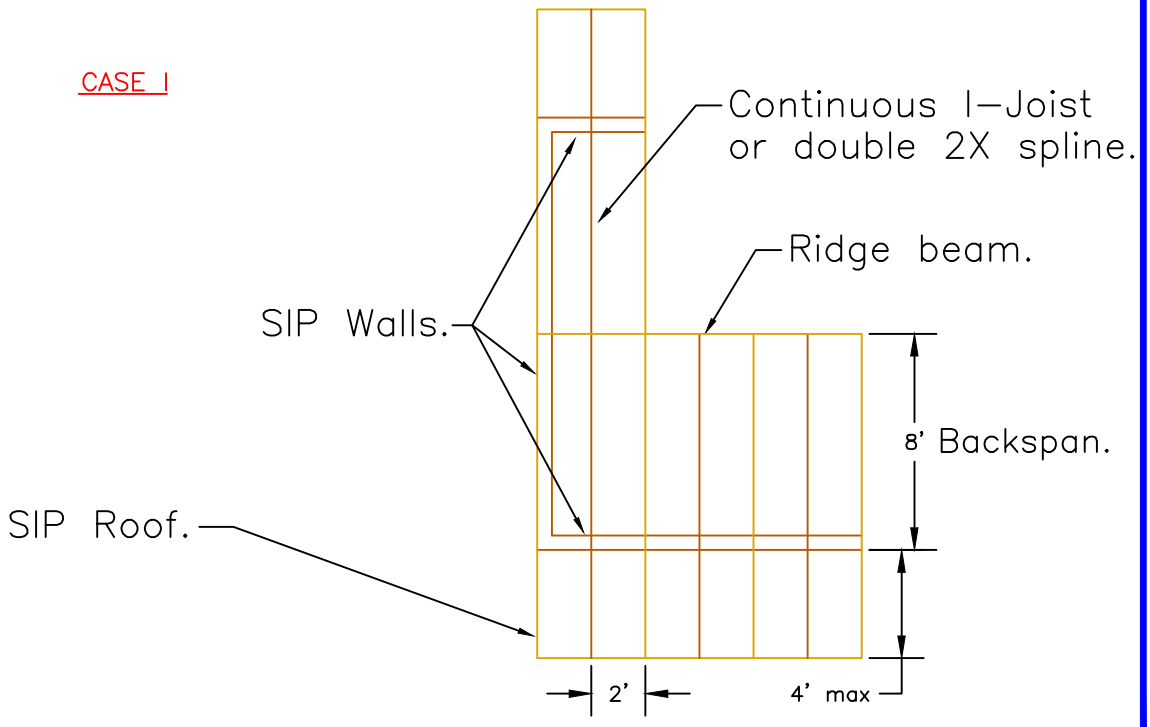
R–Control® SIP

TITLE:	NO.
Roof Framing Options	SIP–118

Note: See Technical Bulletin SIP no. 2029 for capacities and panel limitations.



CASE I



CASE II

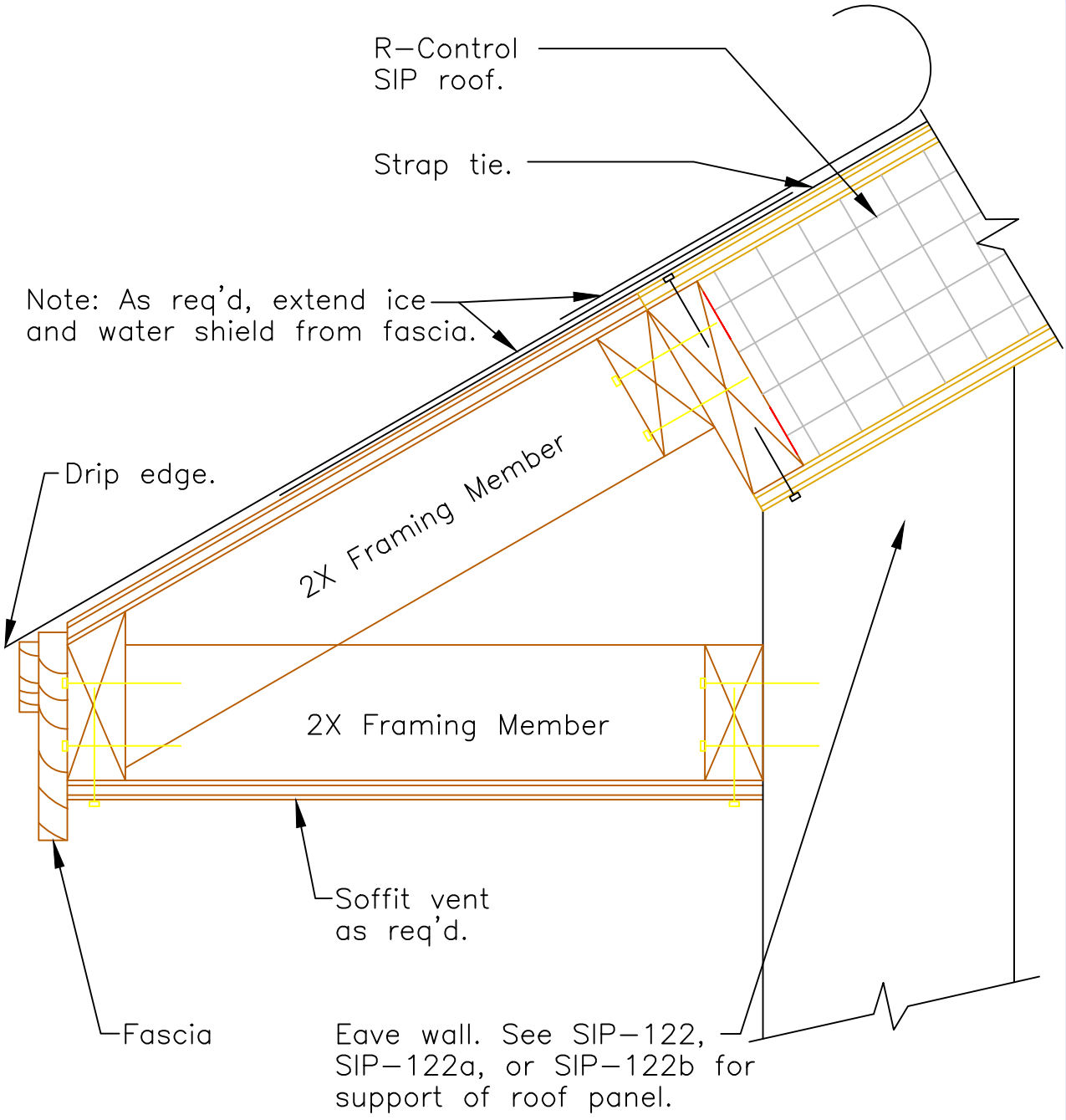
ROOF PLAN

Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE:	NO.
Roof Framing – Cantilever	SIP-118a



Note: Design member sizes and connections as req'd for each condition and/or project.

SECTION

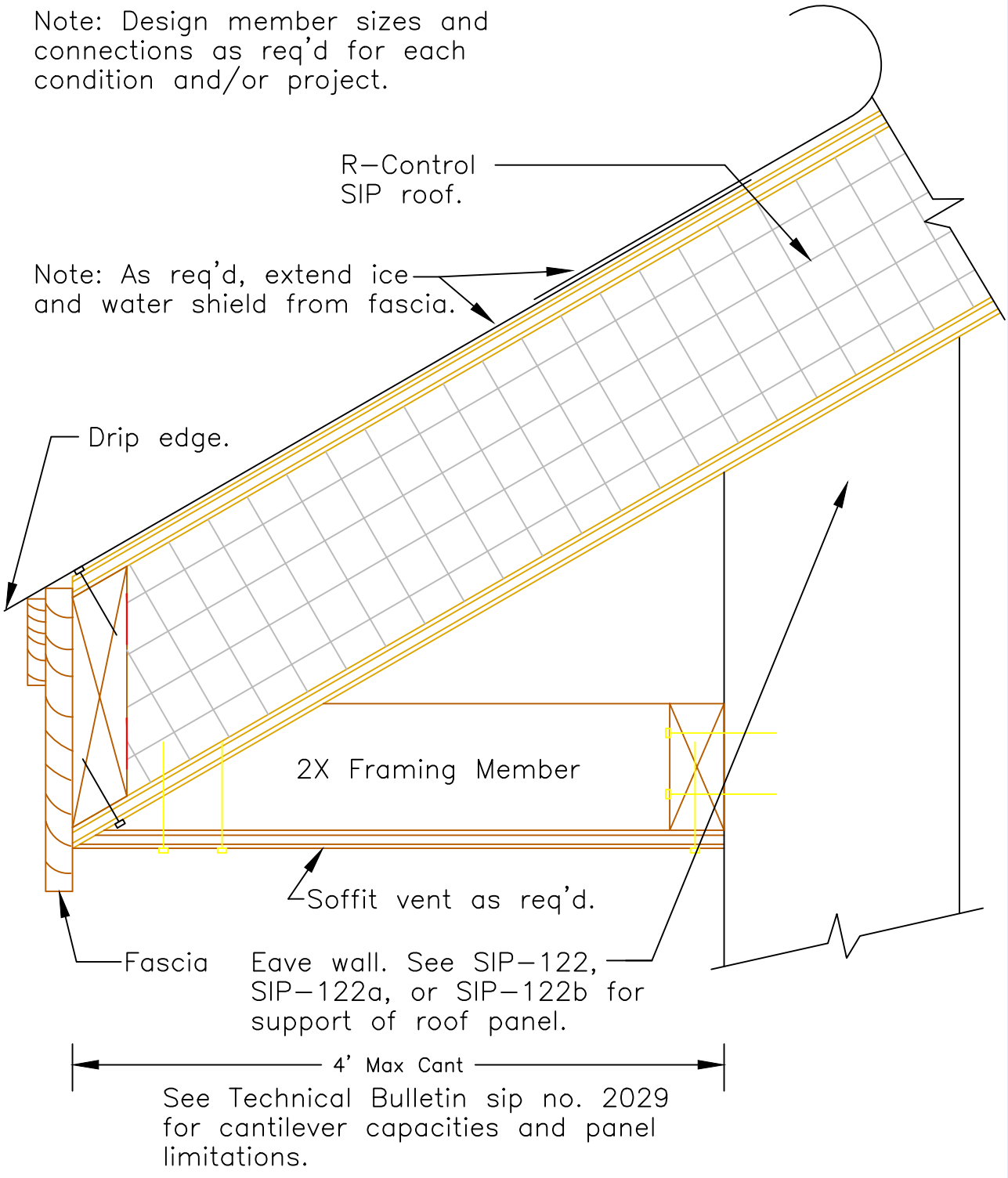
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Roof Eave Built Up – Ladder Framed	NO. SIP–119

Note: Design member sizes and connections as req'd for each condition and/or project.



See Technical Bulletin sip no. 2029 for cantilever capacities and panel limitations.

SECTION

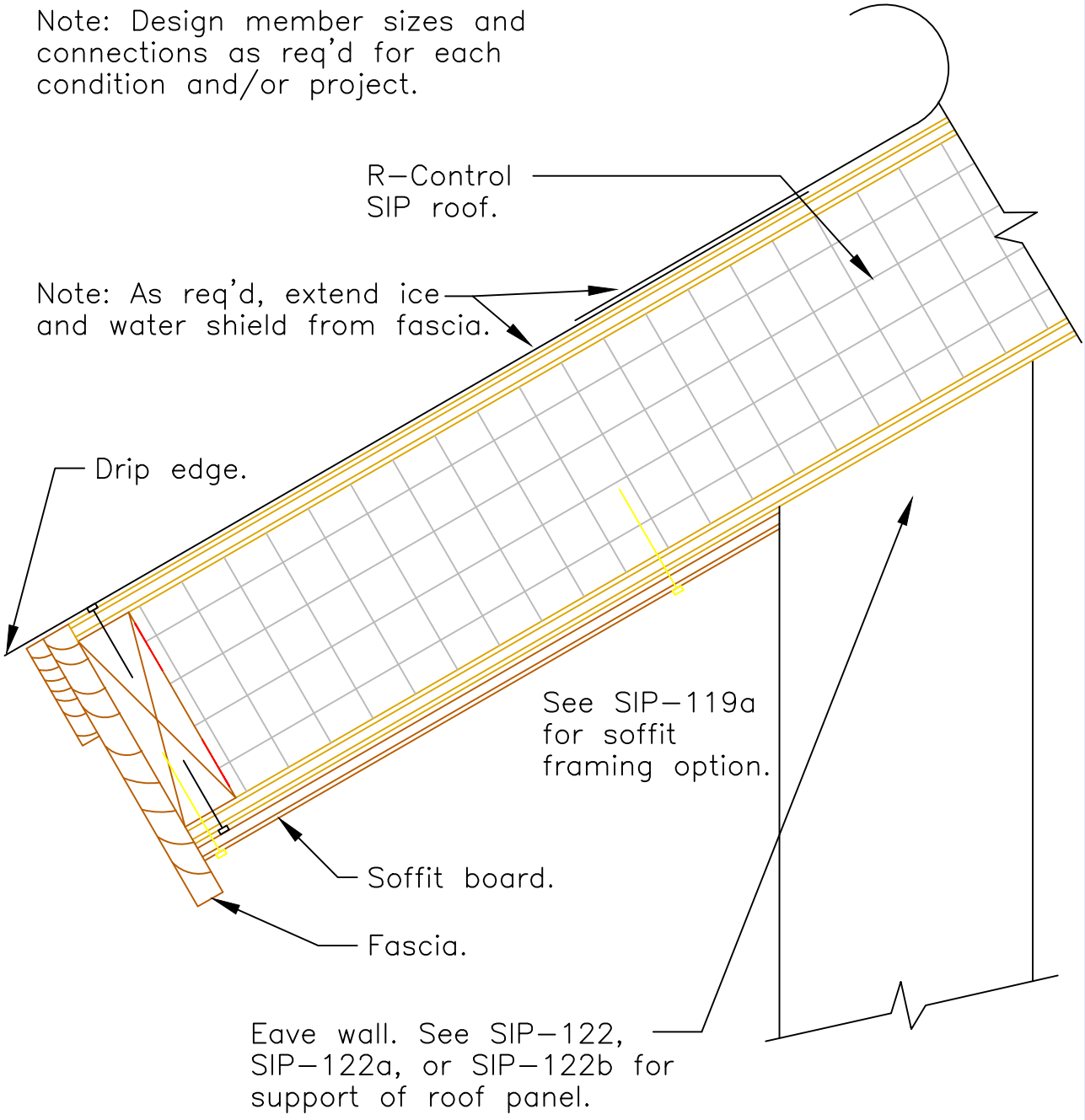
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Roof Eave Plumb Cut – Cant. SIP	NO. SIP–119a

Note: Design member sizes and connections as req'd for each condition and/or project.



See Technical Bulletin sip no. 2029 for cantilever capacities and panel limitations.

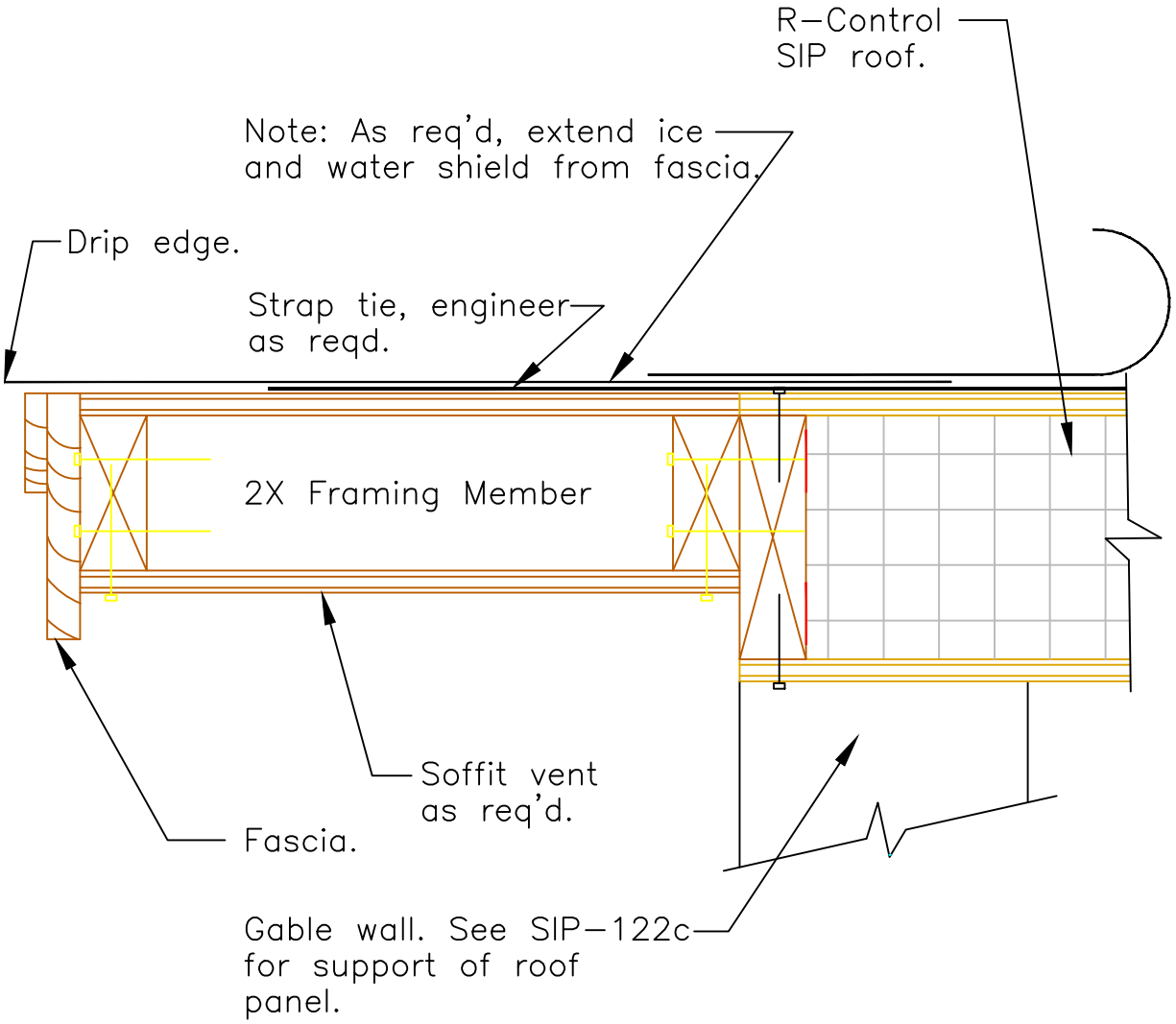
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Roof Eave Square Cut – Cant. SIP	NO. SIP–119b



Note: Design member sizes and connections as req'd for each condition and/or project.

SECTION

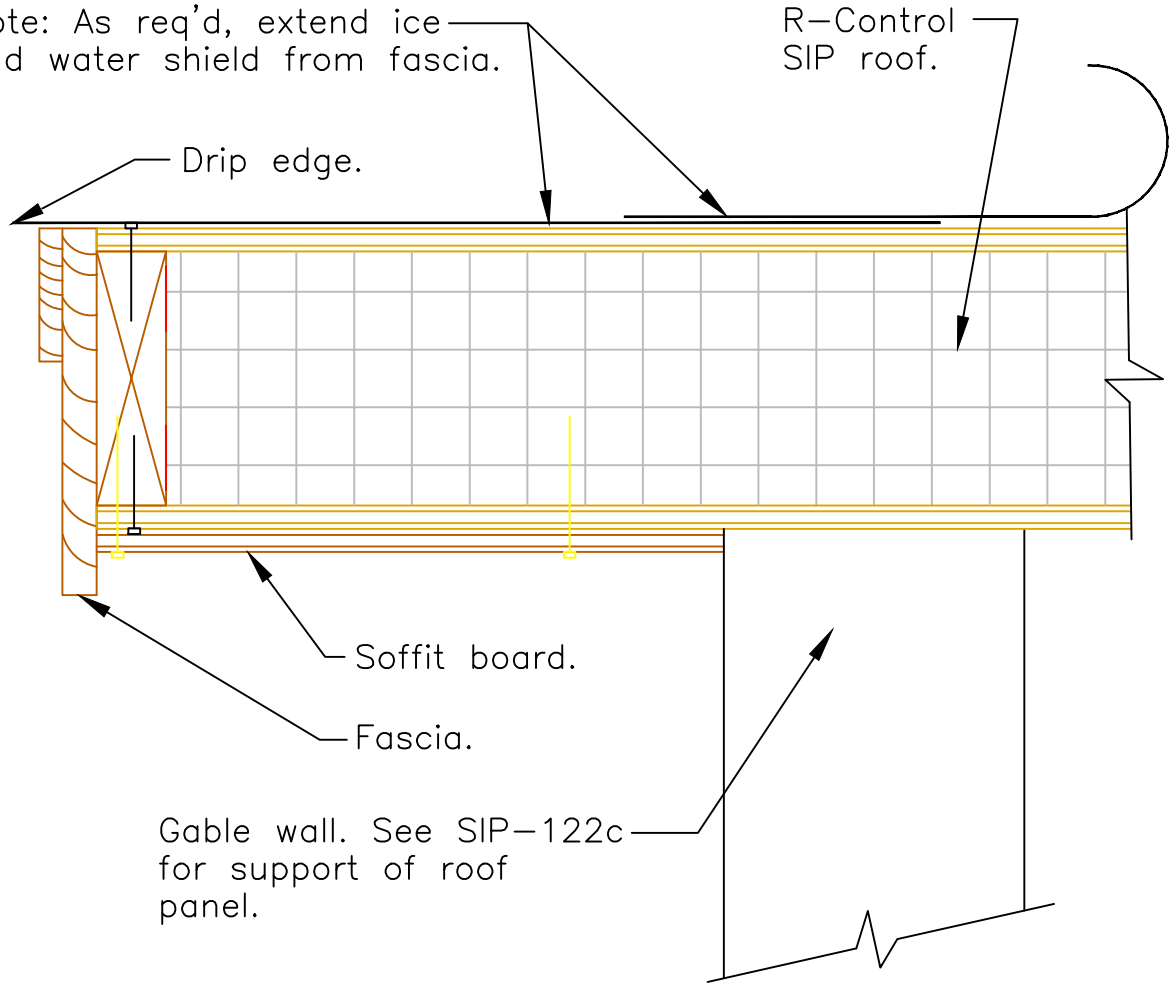
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Roof Gable Built Up – Ladder Framed	NO. SIP–119c

Note: Design member sizes and connections as req'd for each condition and/or project.



See Technical Bulletin SIP no. 2029 for cantilever capacities and panel limitations.

SECTION

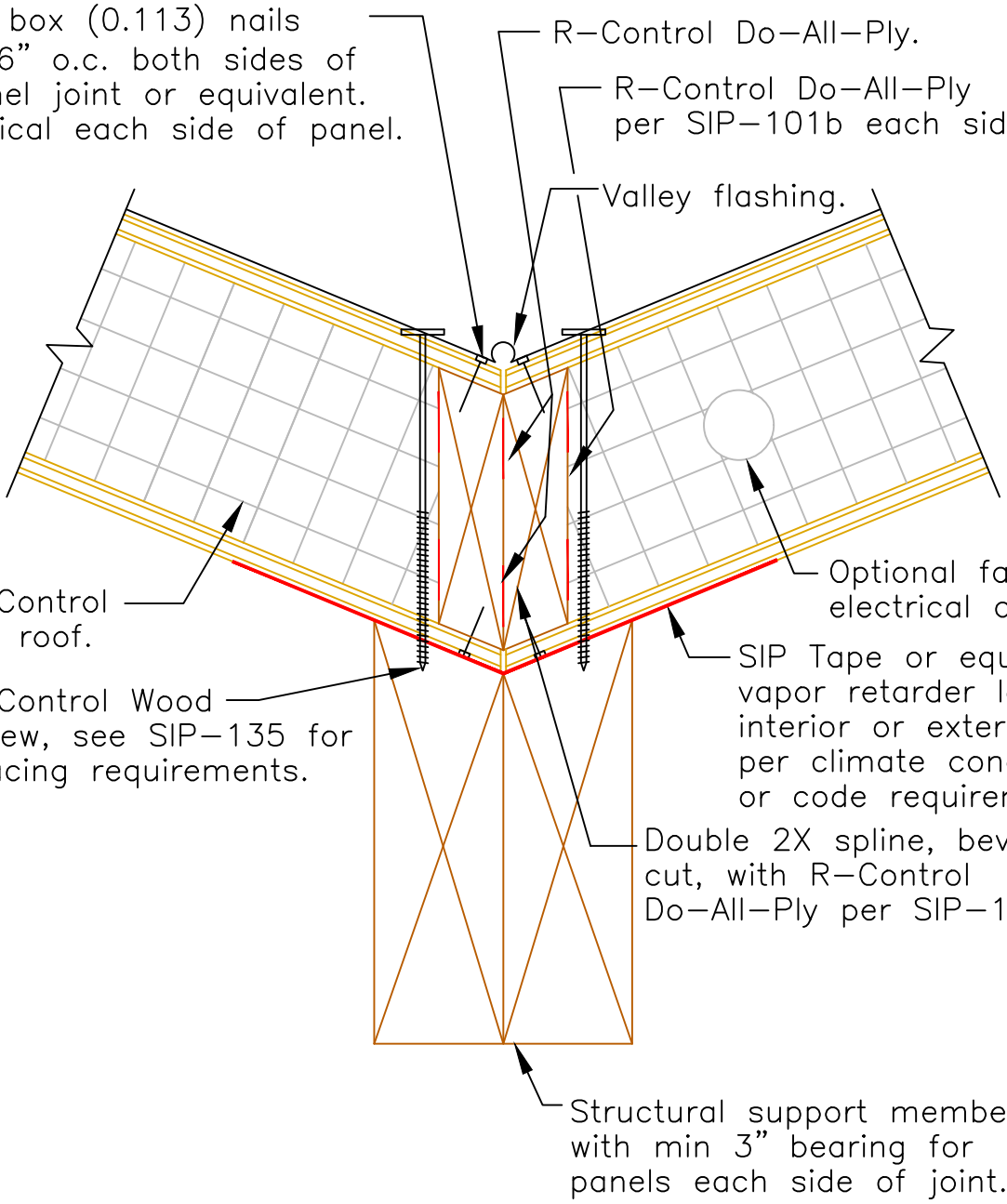
Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE: Roof Gable Square Cut - Cant. SIP	NO. SIP-119d

Note: roof covering & underlayment as req'd by code.



SECTION

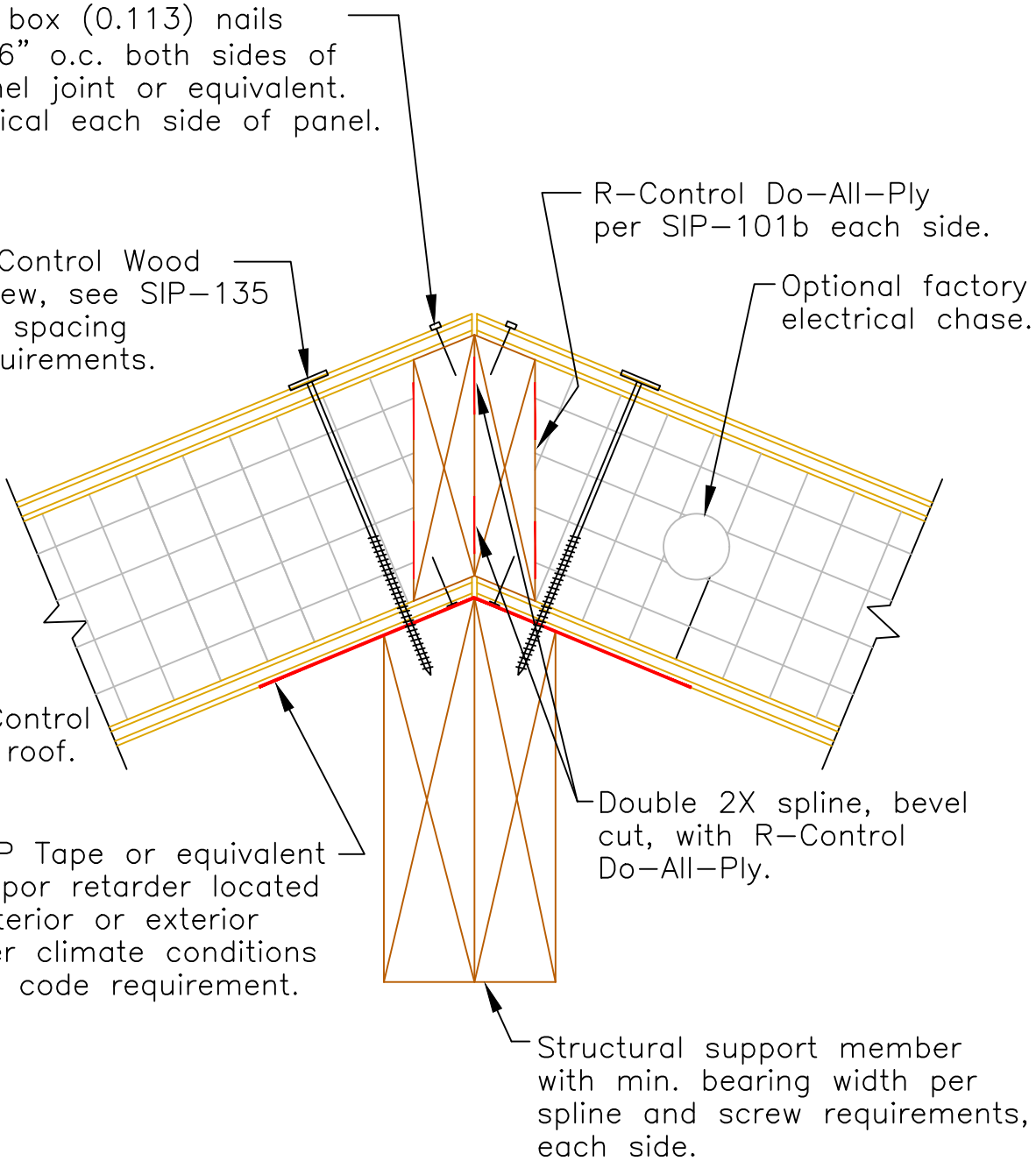
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Roof Valley – Plumb Cut	SIP–120

Note: roof covering & underlayment as req'd by code.



SECTION

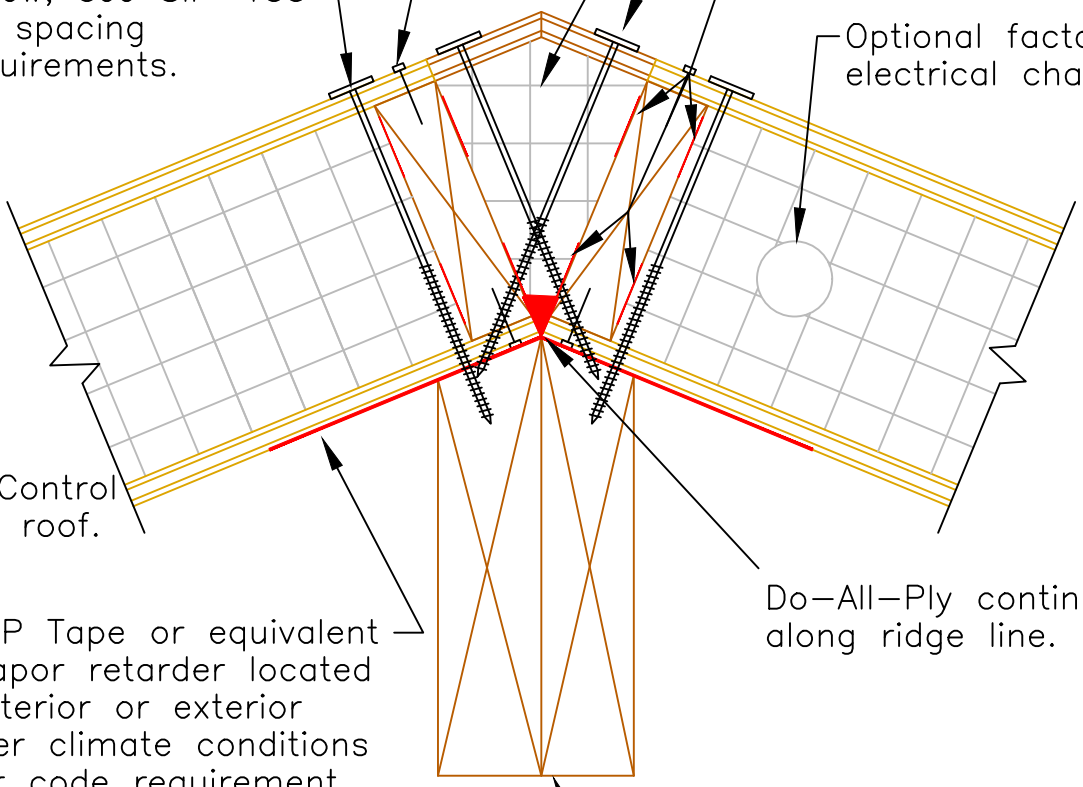
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Roof Ridge – Plumb Cut	SIP–121

Note: roof covering & underlayment as req'd by code.



SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Roof Ridge – Square Cut	SIP–121a

Note: roof covering & underlayment as req'd by code.

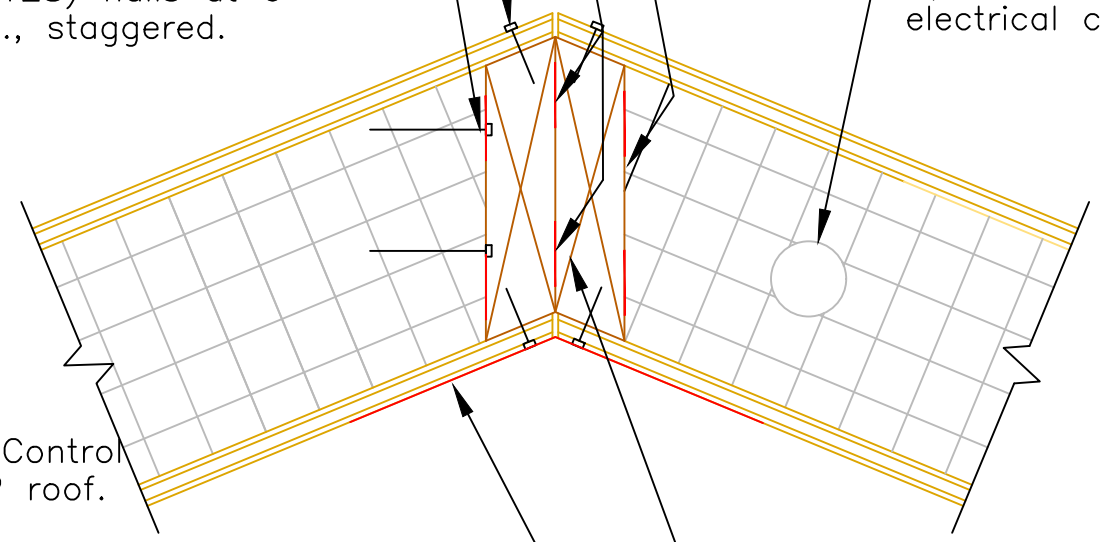
8d box (0.113) nails @ 6" o.c. both sides of panel joint or equivalent. Typical each side of panel.

R–Control Do–All–Ply

R–Control Do–All–Ply per SIP–101b each side.

2 rows of 10b box (0.128) nails at 6" o.c., staggered.

Optional factory electrical chase.



R–Control SIP roof.

SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

Continuous Double 2X spline, bevel cut, with R–Control per SIP–101b.

NOTE: Structural support members max. of 4' from center line of ridge. Support members run parallel to ridge. Panels must have double 2X's or I–Beam Spline @ 4' o.c. See Technical Bulletin sip no. 2029 for cantilever capacities and panel limitations.

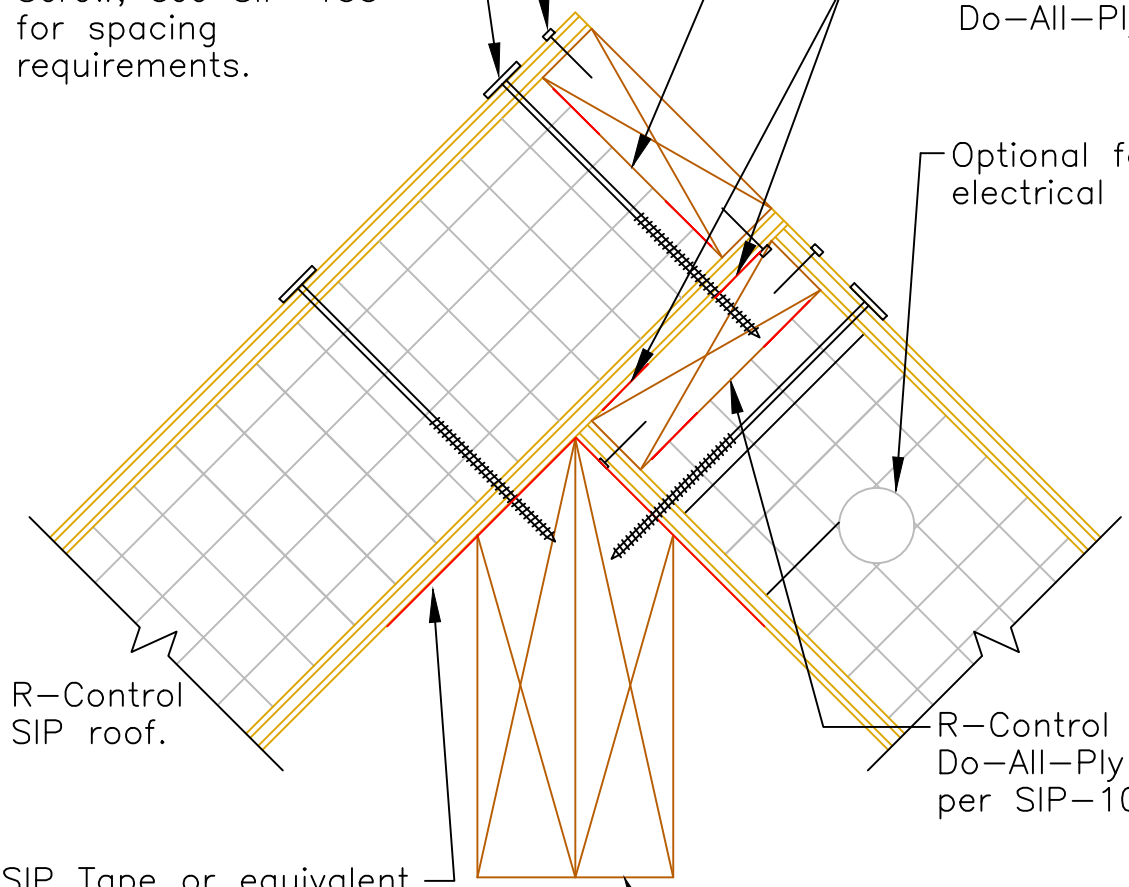
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Roof Ridge Plumb Cut/Cantilever Ridge	NO. SIP–121b



SECTION

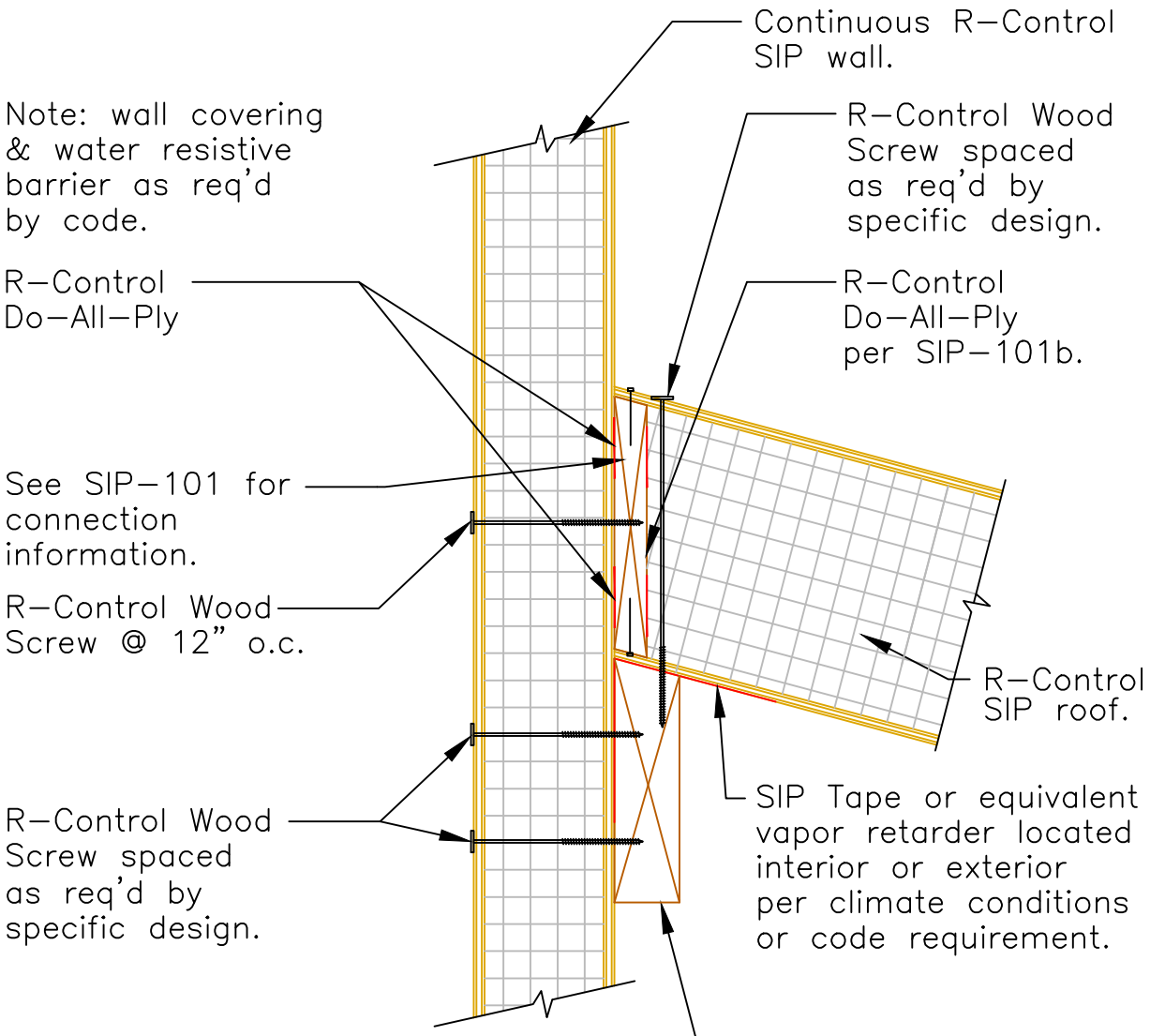
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Roof Ridge – Square Cut	SIP–121c

Note: roof covering & underlayment as req'd by code.



SECTION

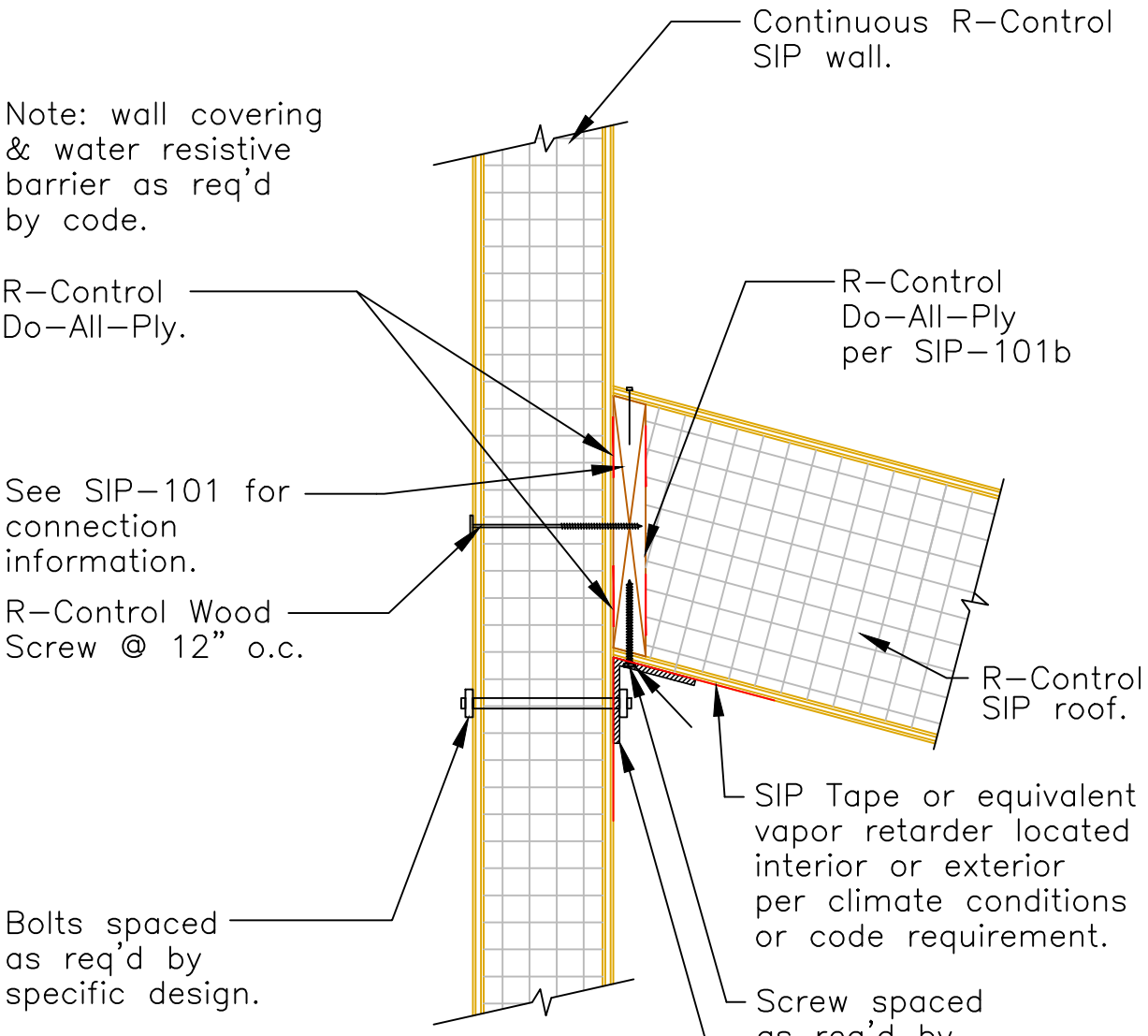
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: SIP Roof and Wood Ledger	NO. SIP–121d

Note: roof covering & underlayment as req'd by code.



SECTION

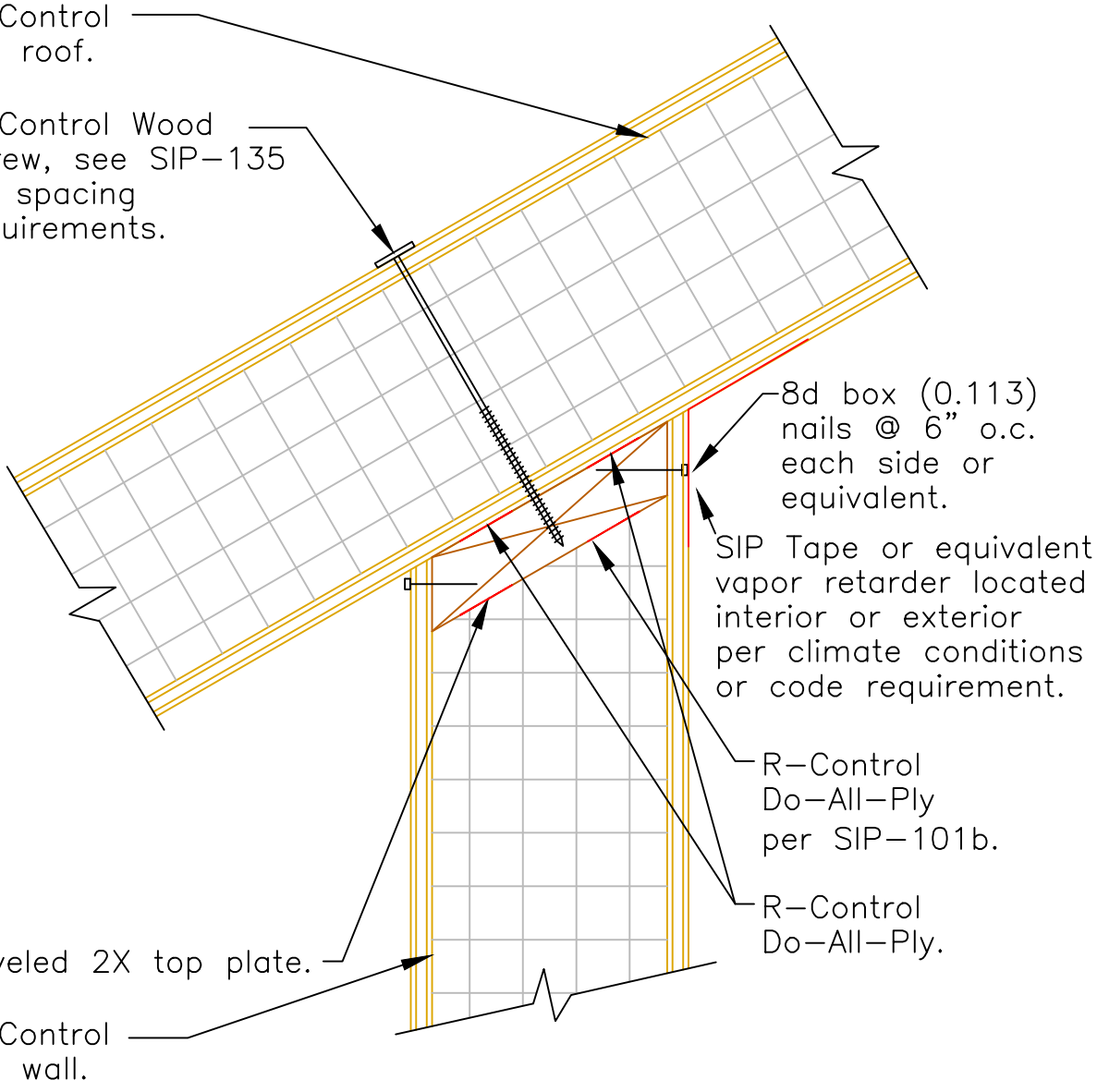
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
SIP Roof and Steel Angle Ledger	SIP–121e

Note: roof covering & underlayment as req'd by code.



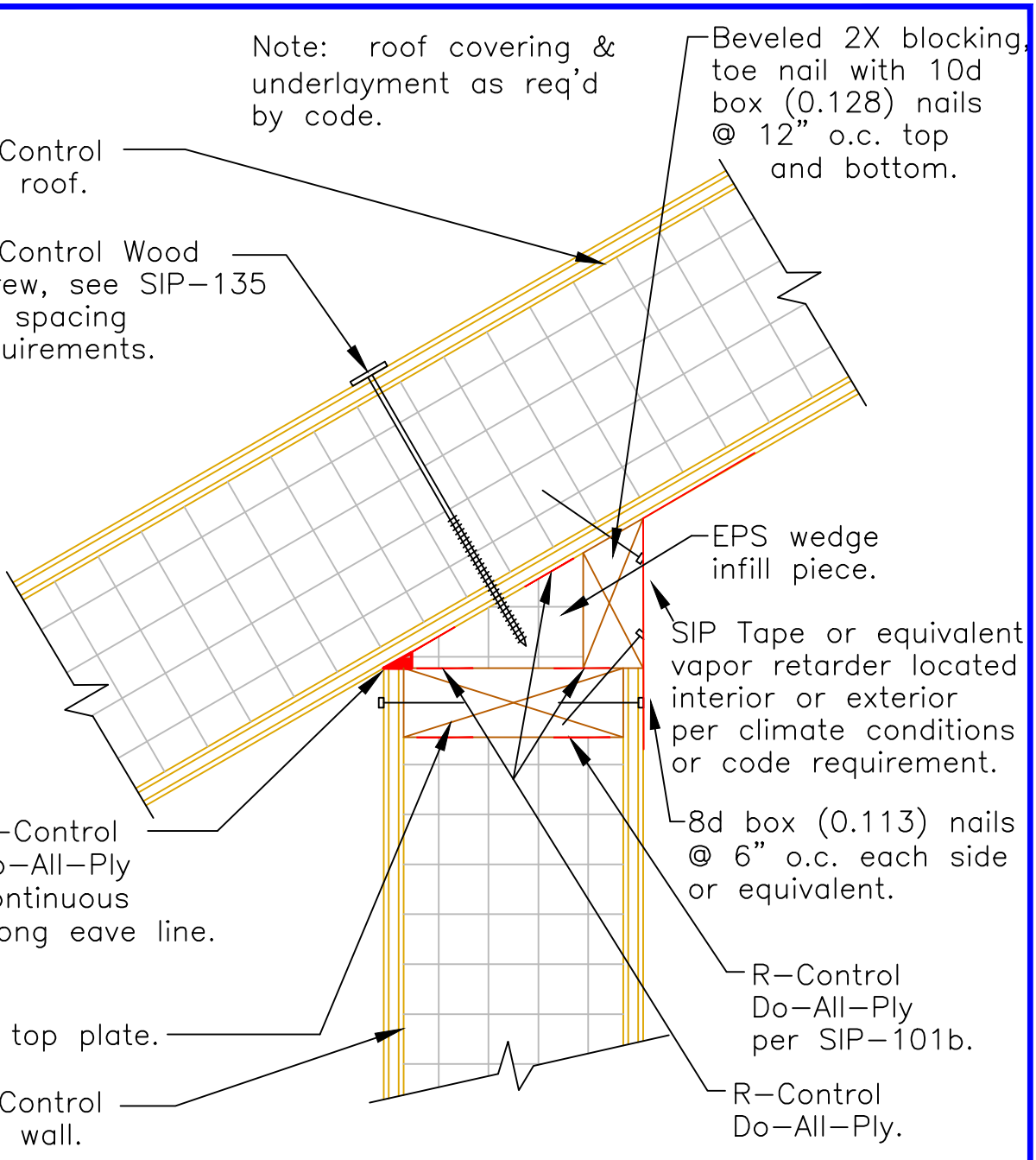
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Beveled SIP Wall	SIP–122



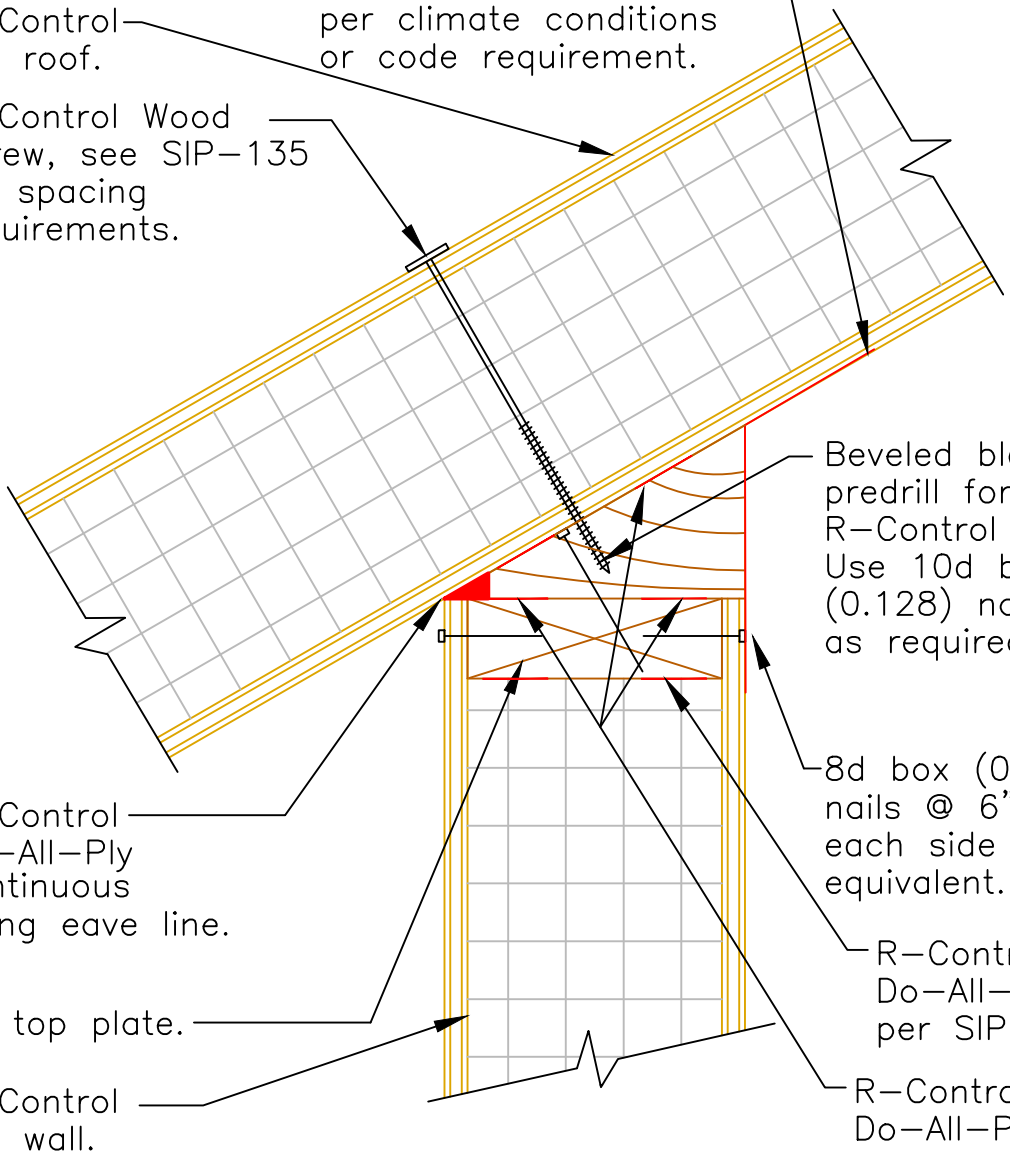
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Beveled 2X Blocking	SIP–122a



SECTION

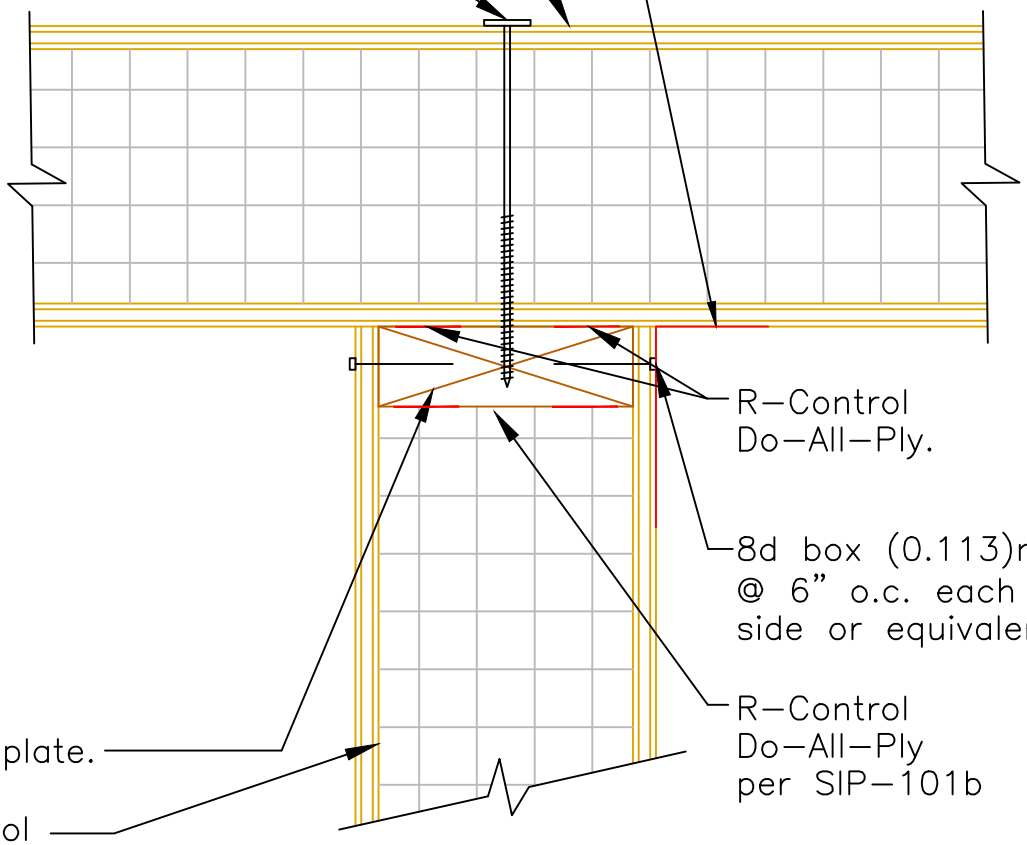
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Beveled Wedge Blocking	SIP–122b

Note: roof covering & underlayment as req'd by code.



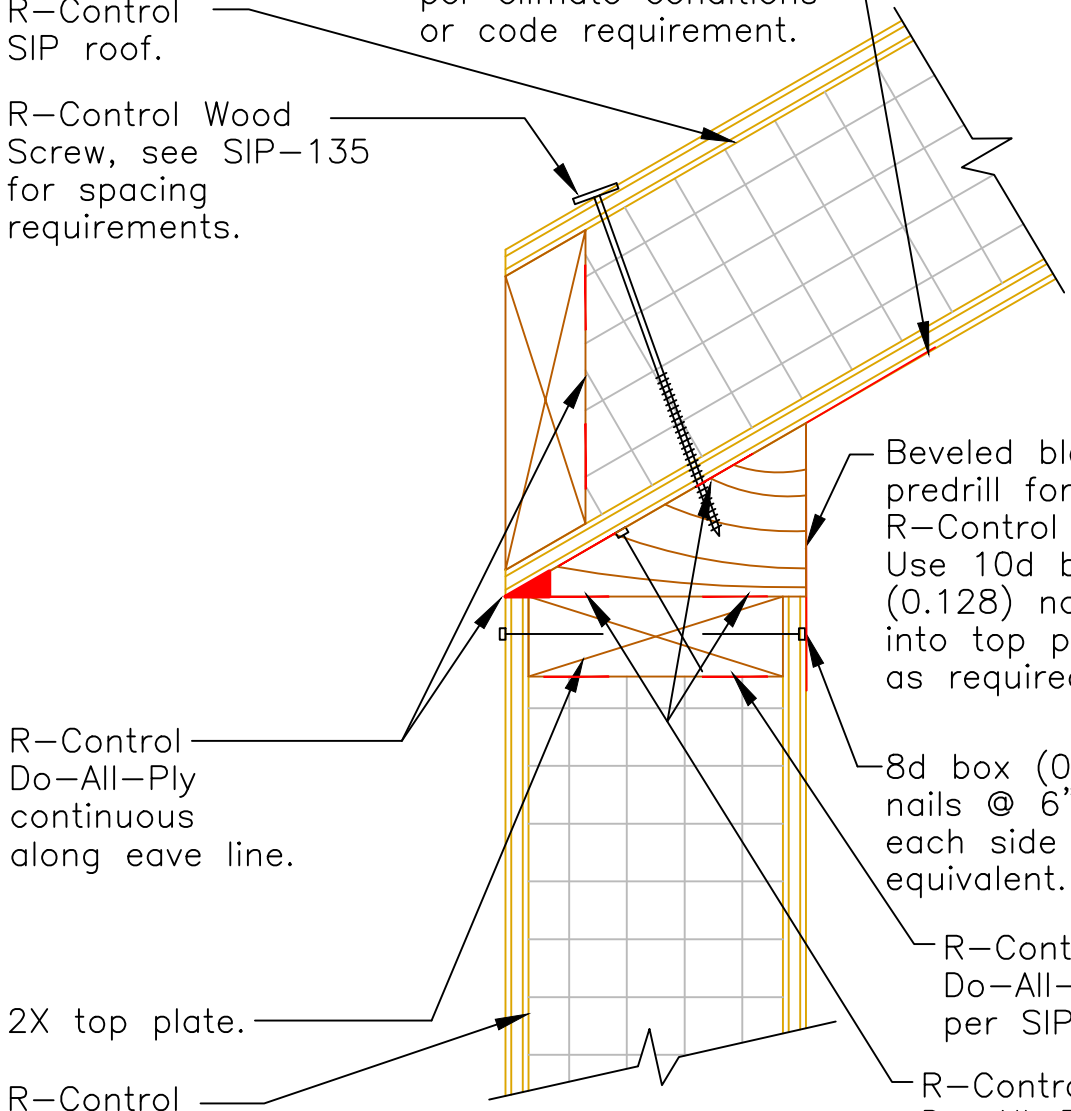
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Gable End	SIP–122c



Note: roof covering & underlayment as req'd by code.

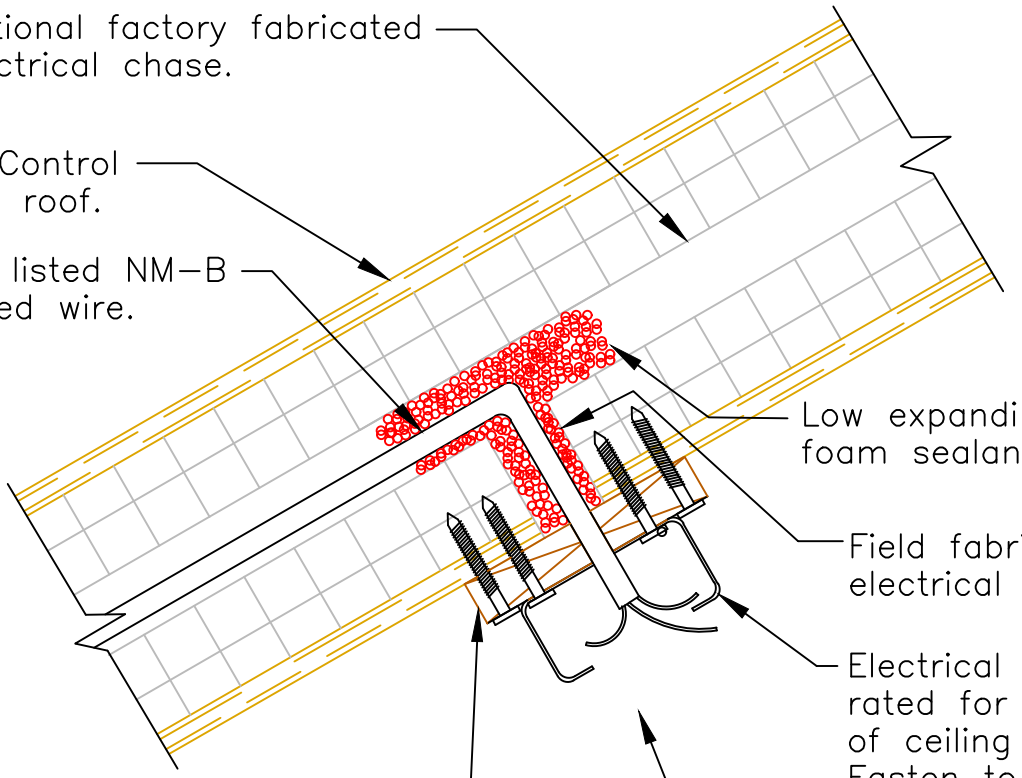
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Plumb Eave Beveled Wedge Blocking	NO. SIP–122d



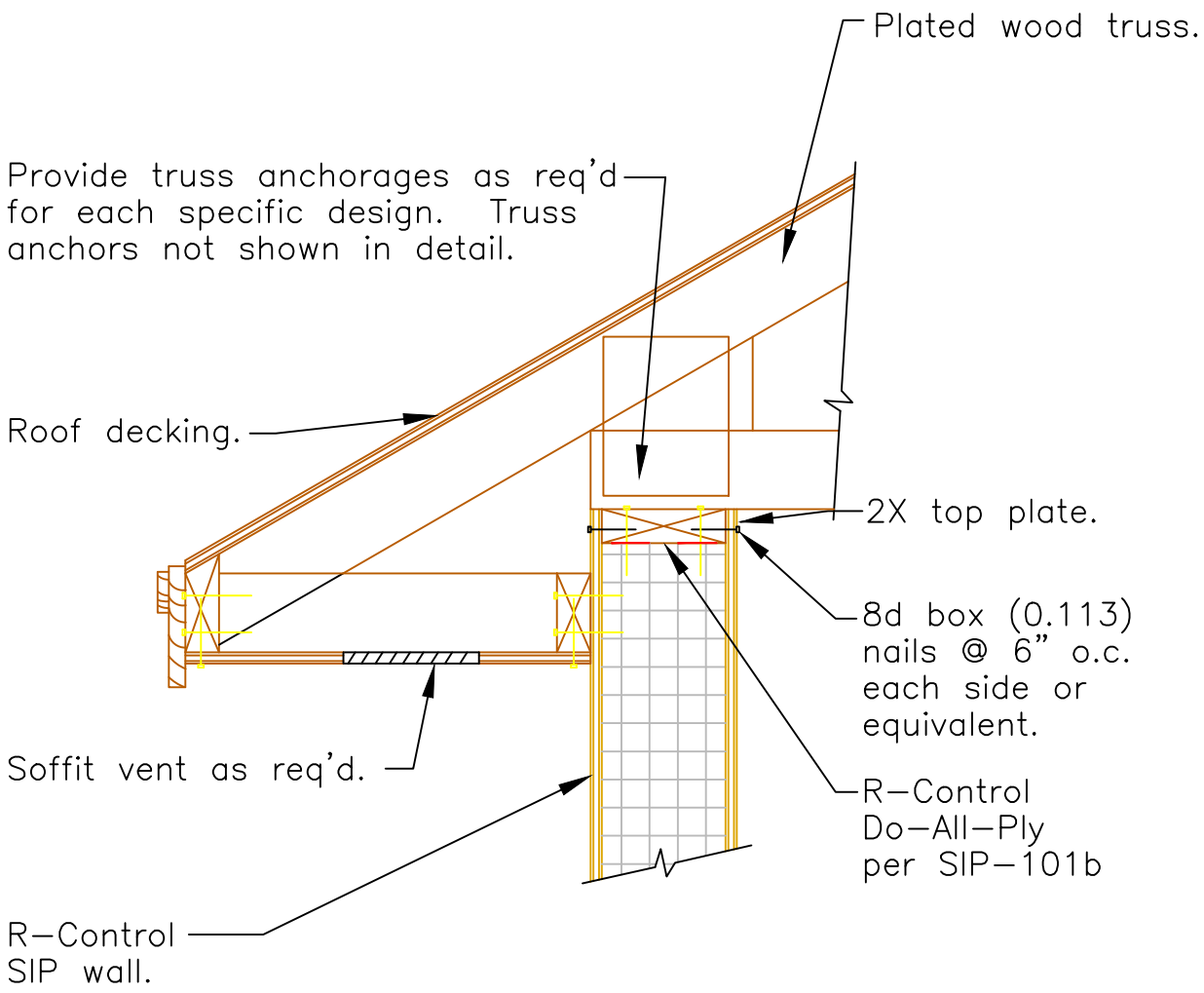
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Ceiling Fan Attachment	SIP–123



Note: Design member sizes and connections as req'd for each condition and/or project.

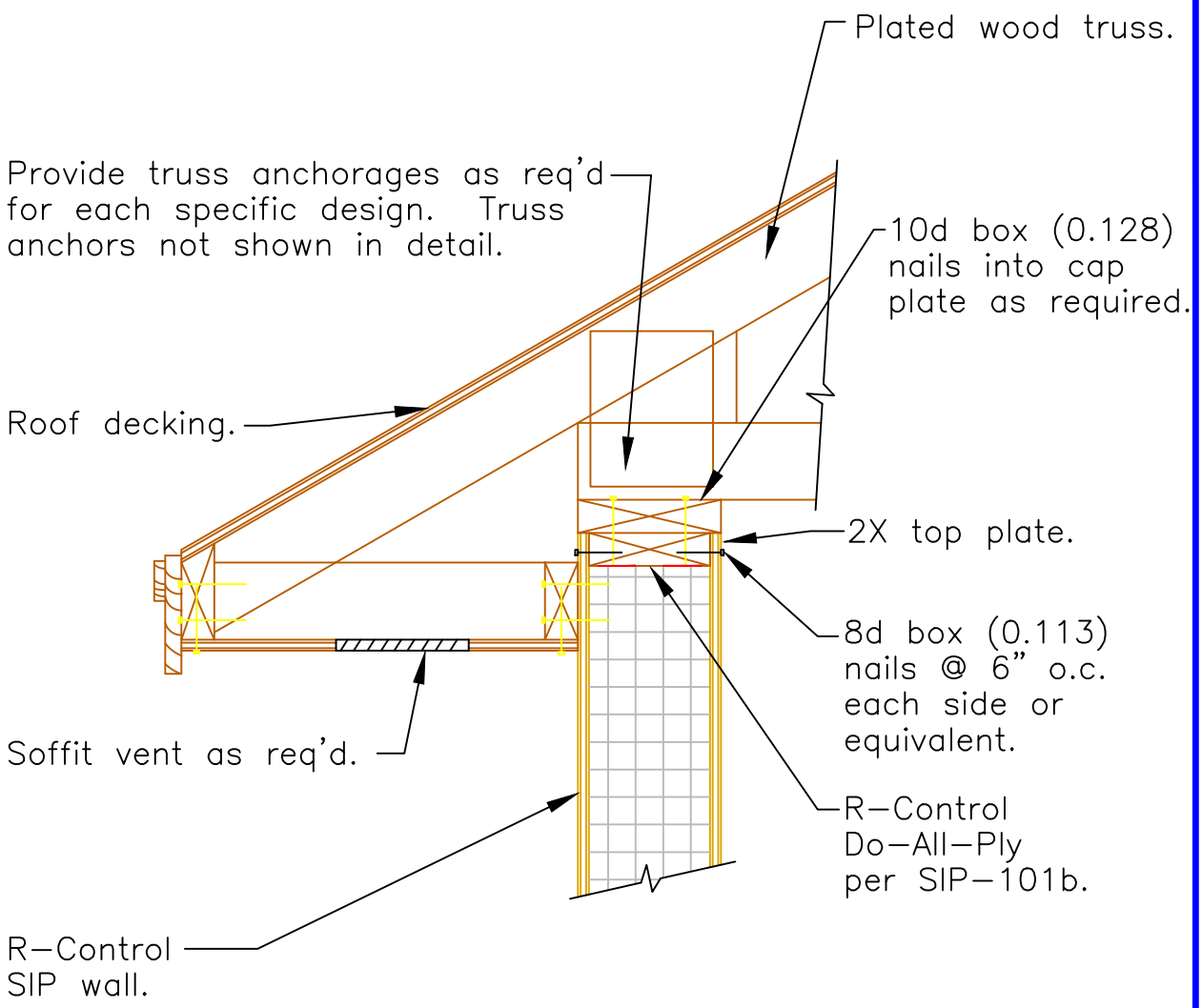
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Truss Bearing on SIP Wall	SIP–124



Note: Design member sizes and connections as req'd for each condition and/or project.

SECTION

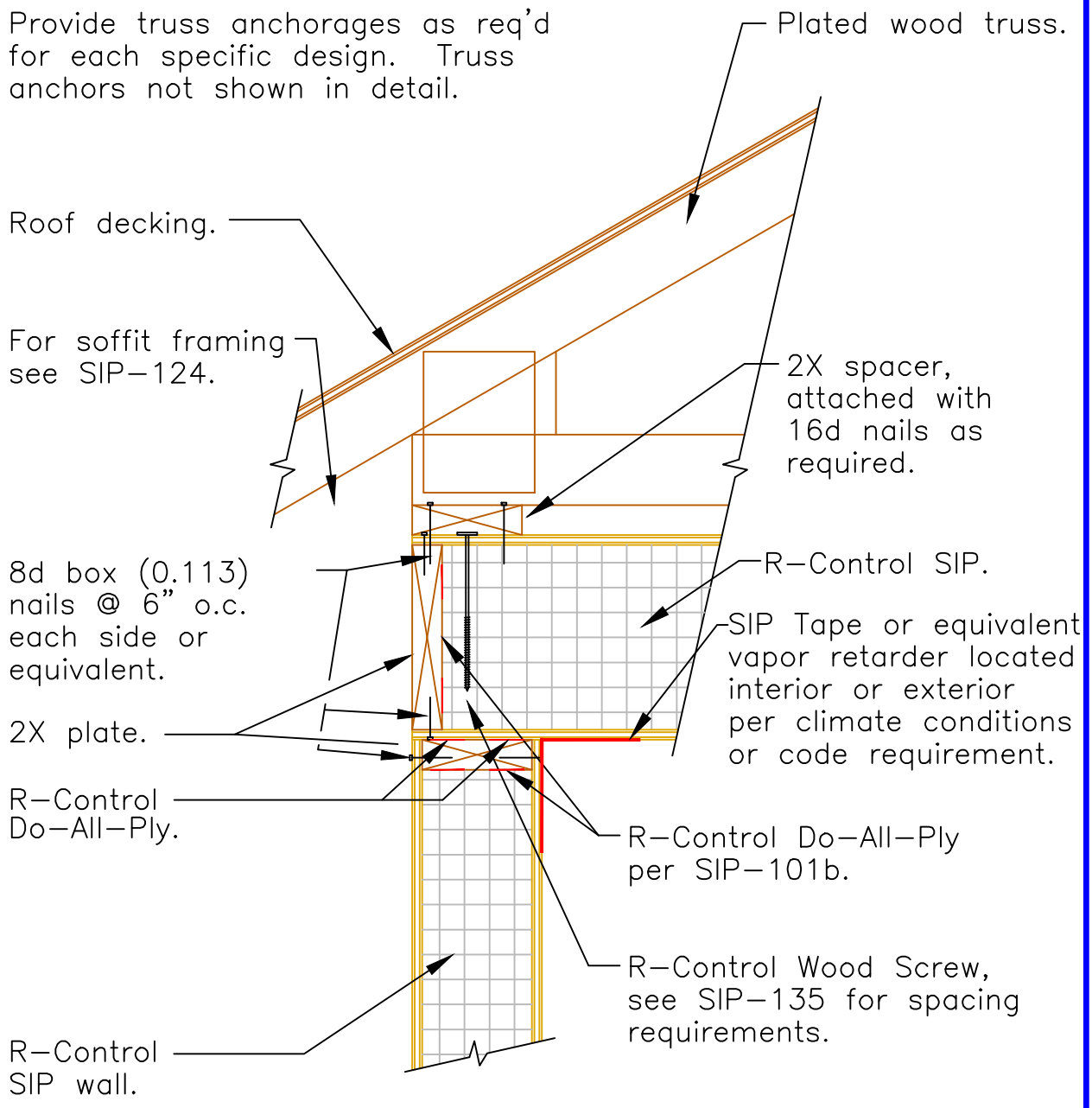
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Truss Bearing on SIP Wall	SIP–124a

Provide truss anchorages as req'd for each specific design. Truss anchors not shown in detail.



Note: Design member sizes and connections as req'd for each condition and/or project.

SECTION

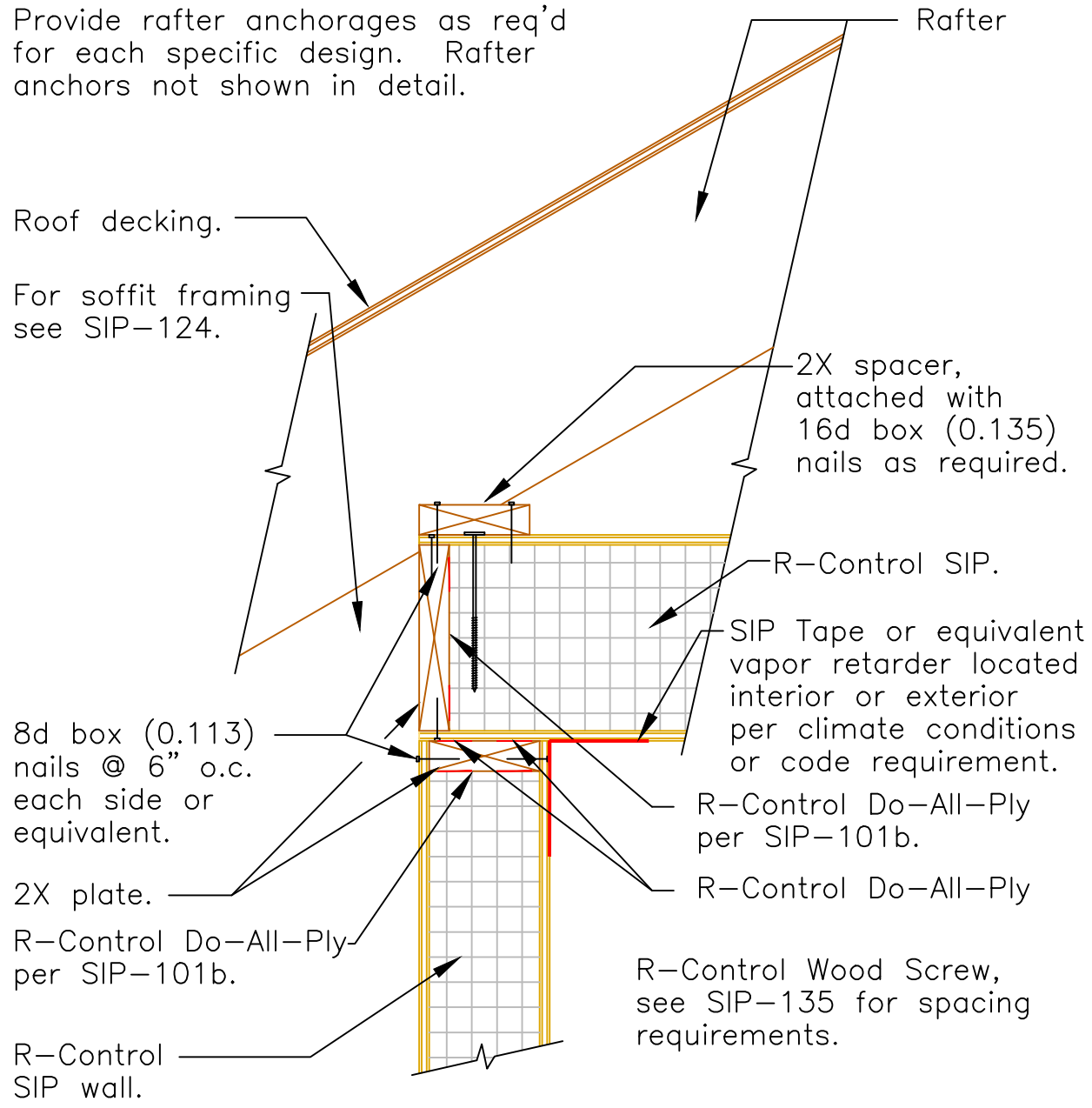
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
SIP Ceiling & Truss	SIP–125

Provide rafter anchorages as req'd for each specific design. Rafter anchors not shown in detail.



Note: Design member sizes and connections as req'd for each condition and/or project.

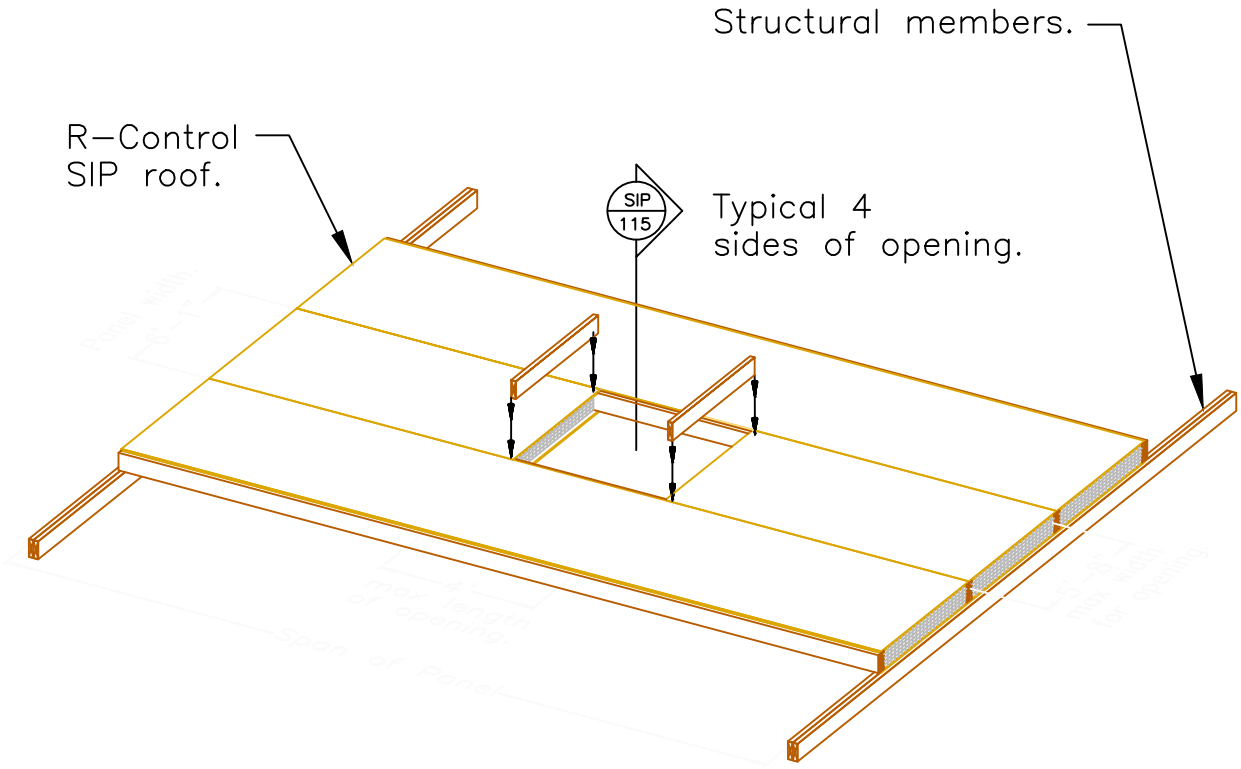
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
SIP Ceiling & Rafter	SIP–125a



Note: For openings bigger in size than shown above or for openings that cut through splines, provide additional framing to support panel edges. This additional framing is to be located under the panels and framed into the main structural members.

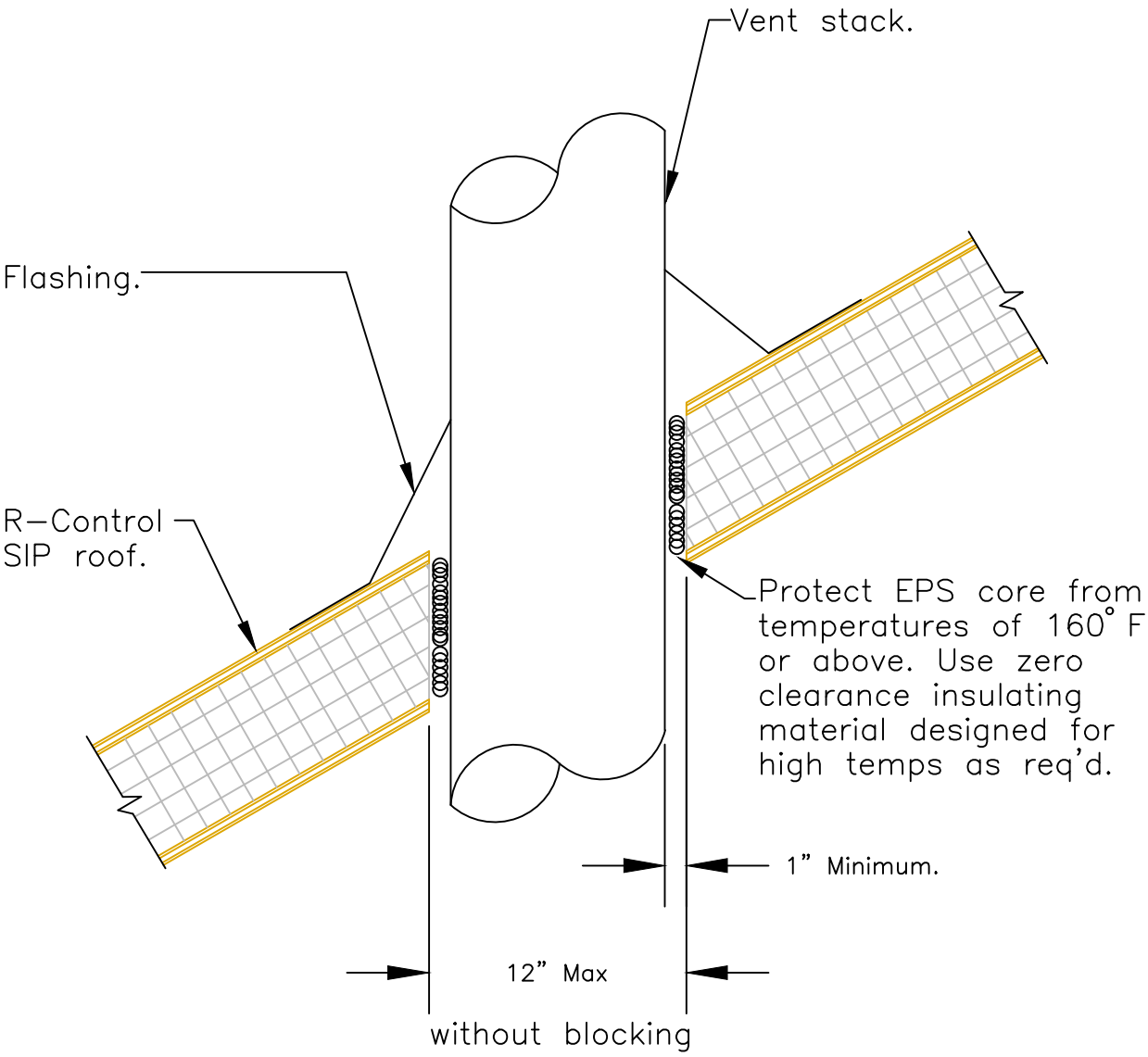
ISOMETRIC

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Roof Openings	SIP–126



Note: review all openings for impact to structural requirements.

Note: Recessed lights are not allowed in R–Control SIPs.

Note: Blocking not req'd for openings less than 12" square. See SIP–115 for openings requiring blocking.

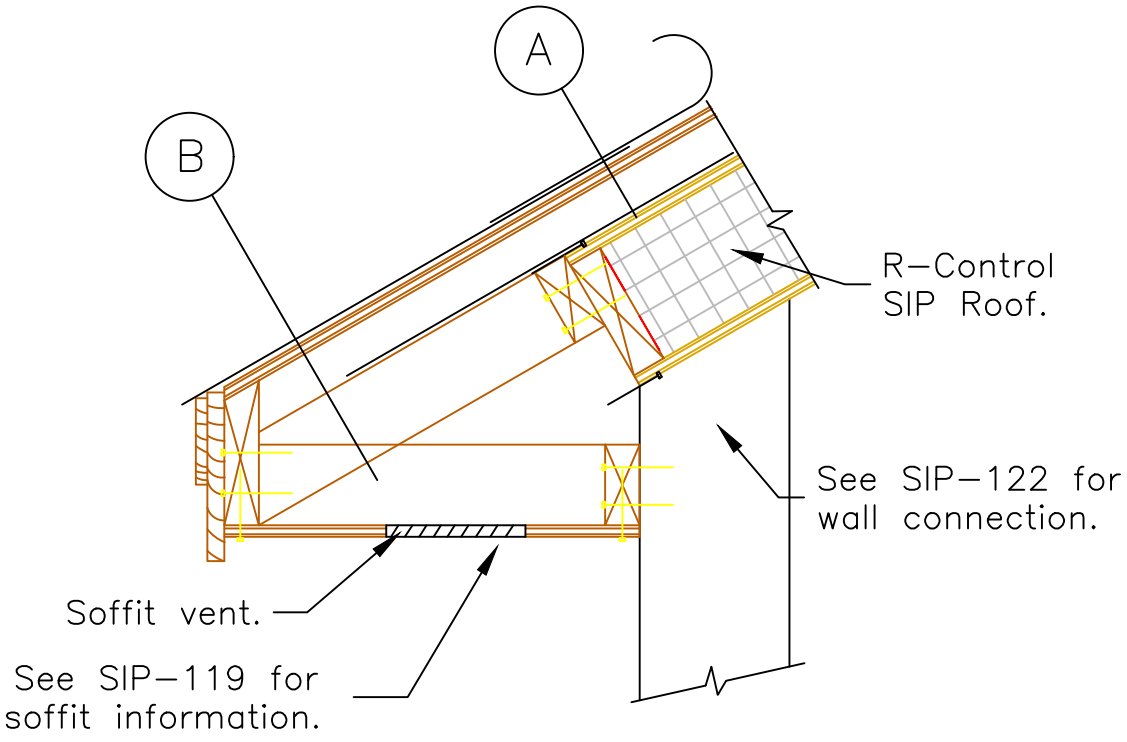
SECTION

Scale: NTS

Updated 6–15–20

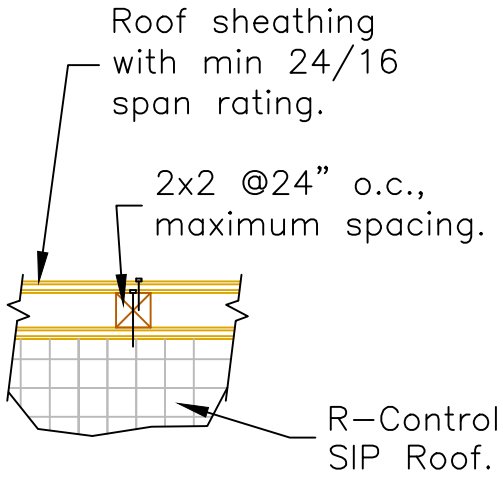
R–Control® SIP

TITLE:	NO.
Roof Penetrations	SIP–126a

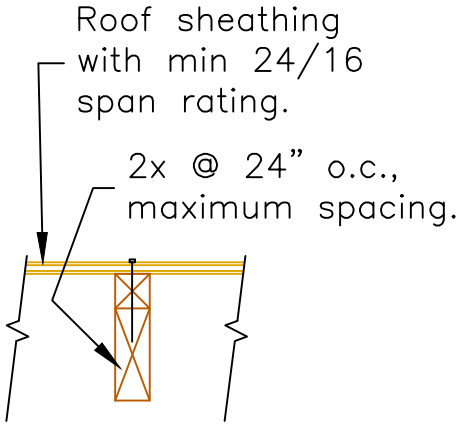


SECTION
Scale: NTS

Note: Design member sizes and connections as req'd for each condition and/or project.



SECTION A
Scale: NTS

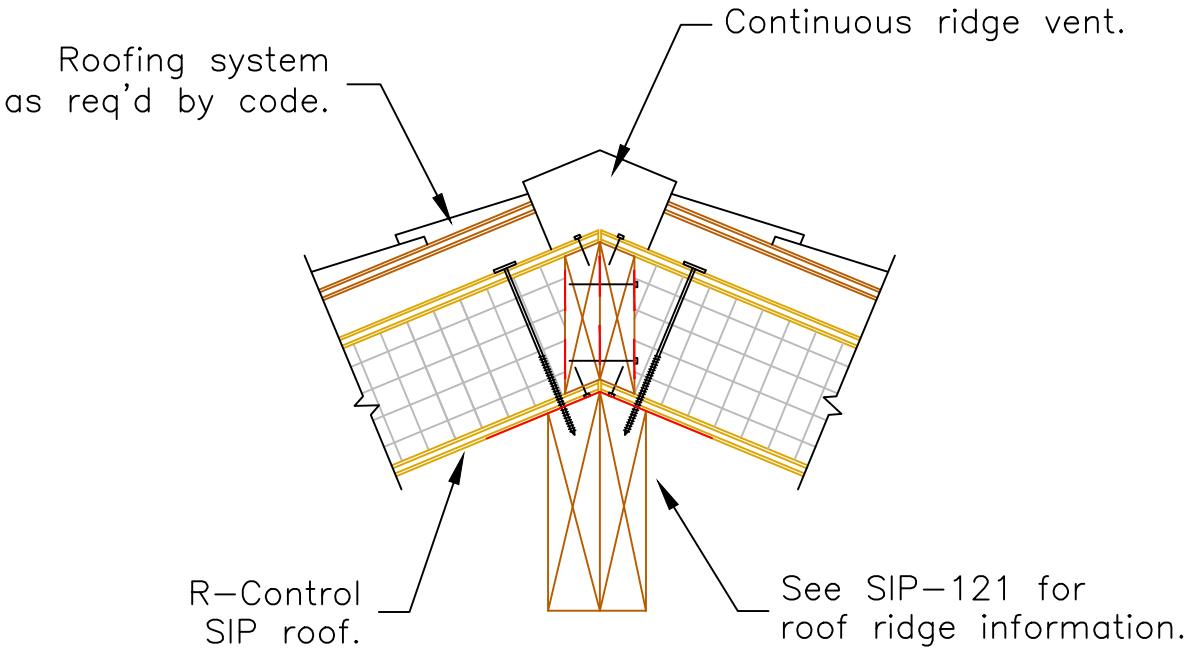


SECTION B
Scale: NTS

Updated 6–15–20

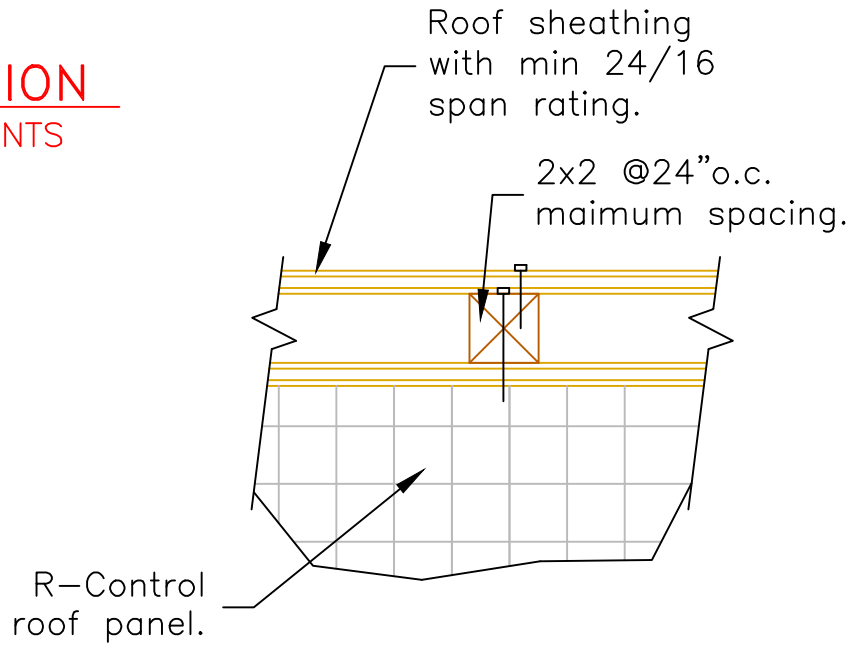
R–Control® SIP

TITLE: Ventilated Roof Eave with 2X Sleepers	NO. SIP–127a



SECTION

Scale: NTS



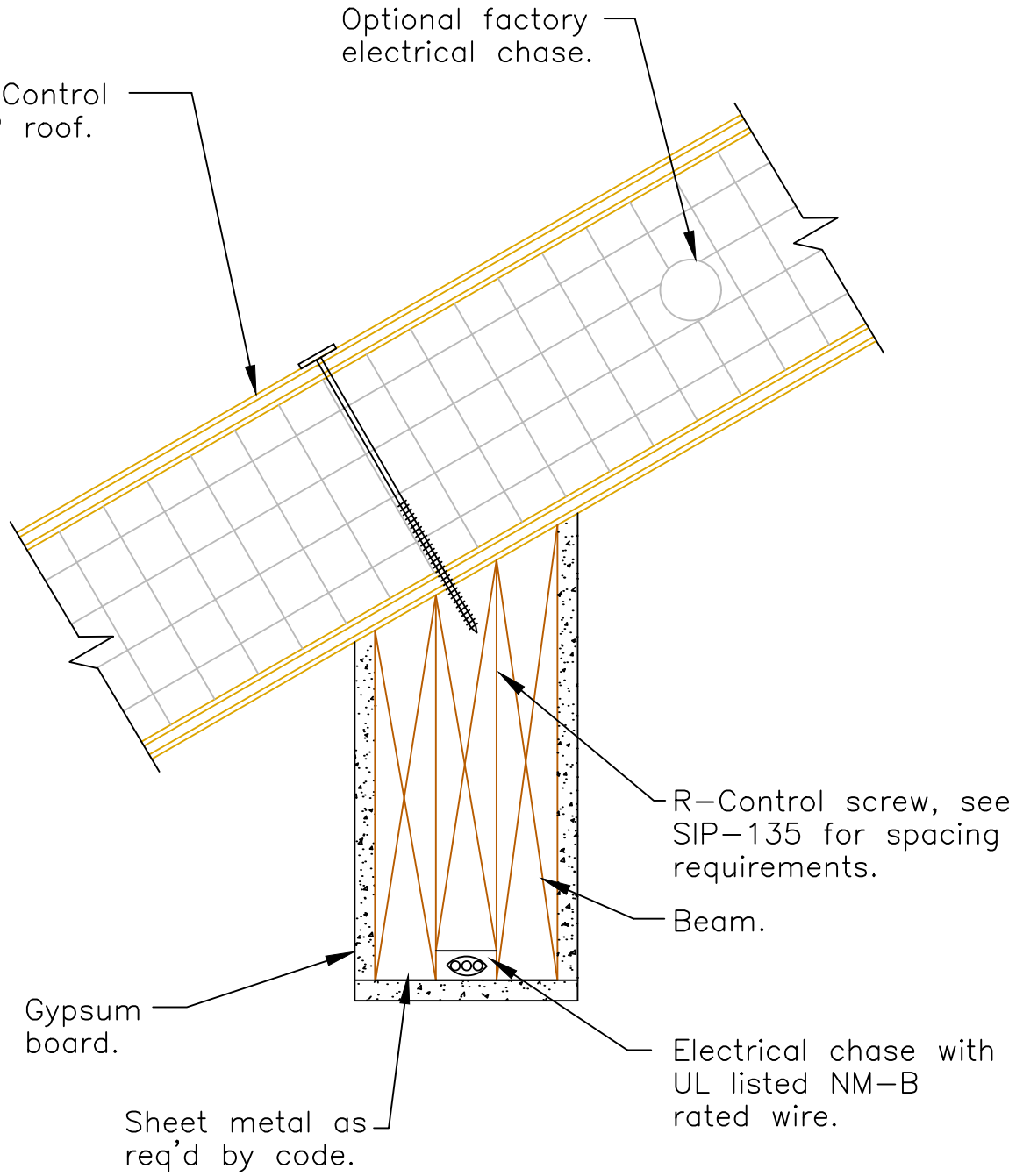
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Ventilated Roof – Ridge	SIP–127b



SECTION

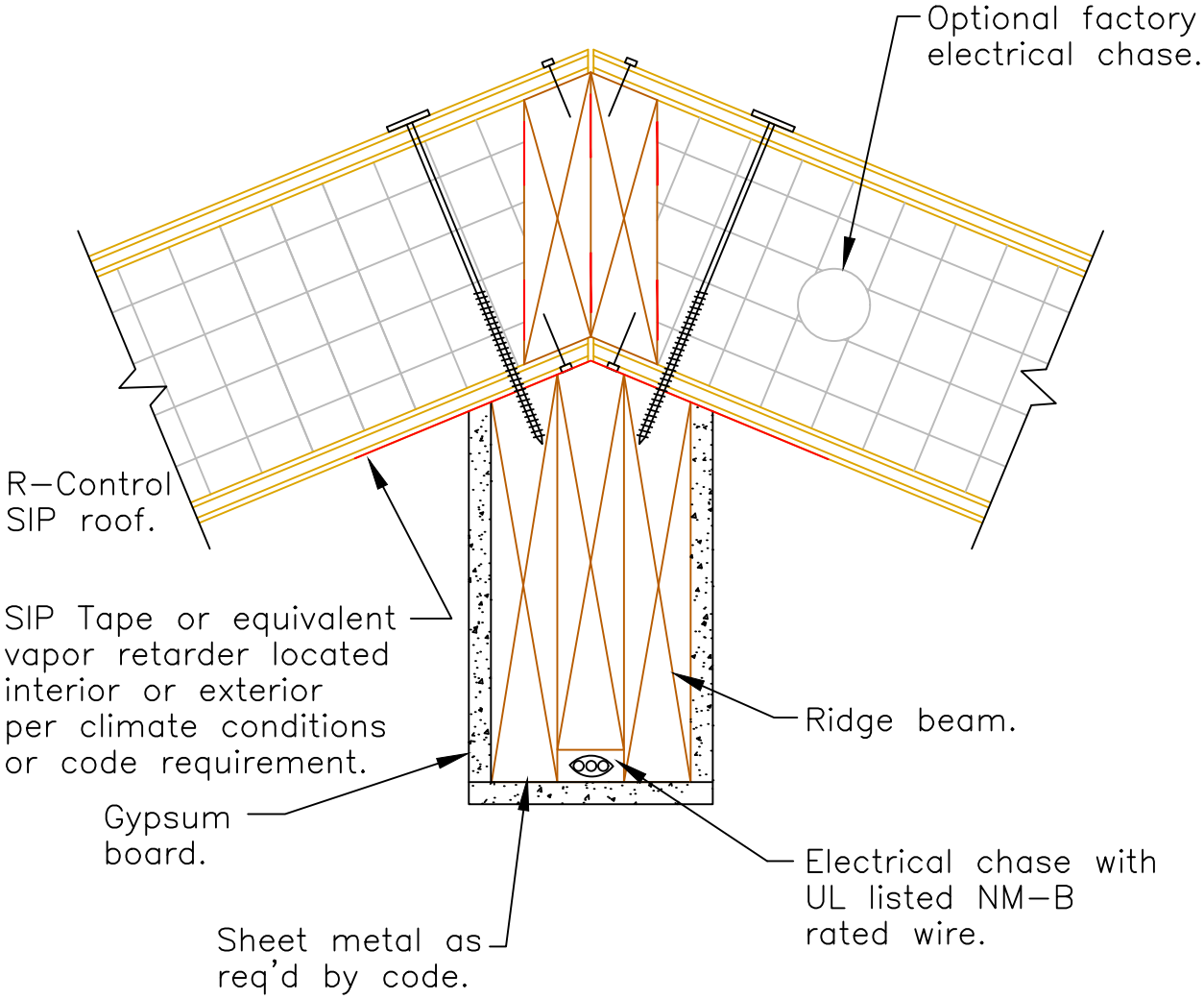
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Chases – Electrical Intermediate Roof Beam	NO. SIP–128

Note: See SIP–121 for connection and Do–All–Ply information.



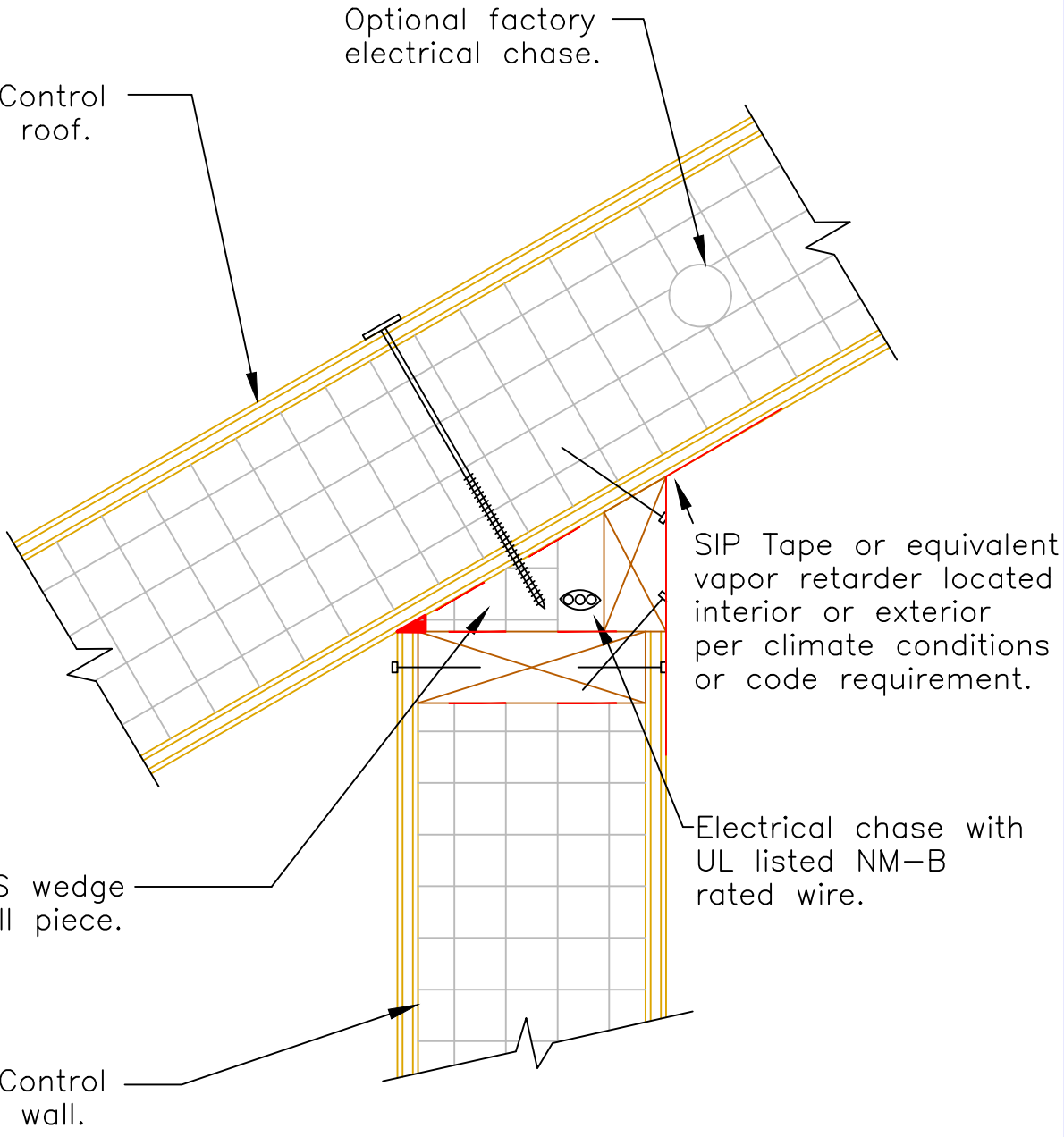
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Chases – Electrical Roof Ridge Beam	SIP–128a



Note: See SIP–122a for connection and Do–All–Ply information.

SECTION

Scale: NTS

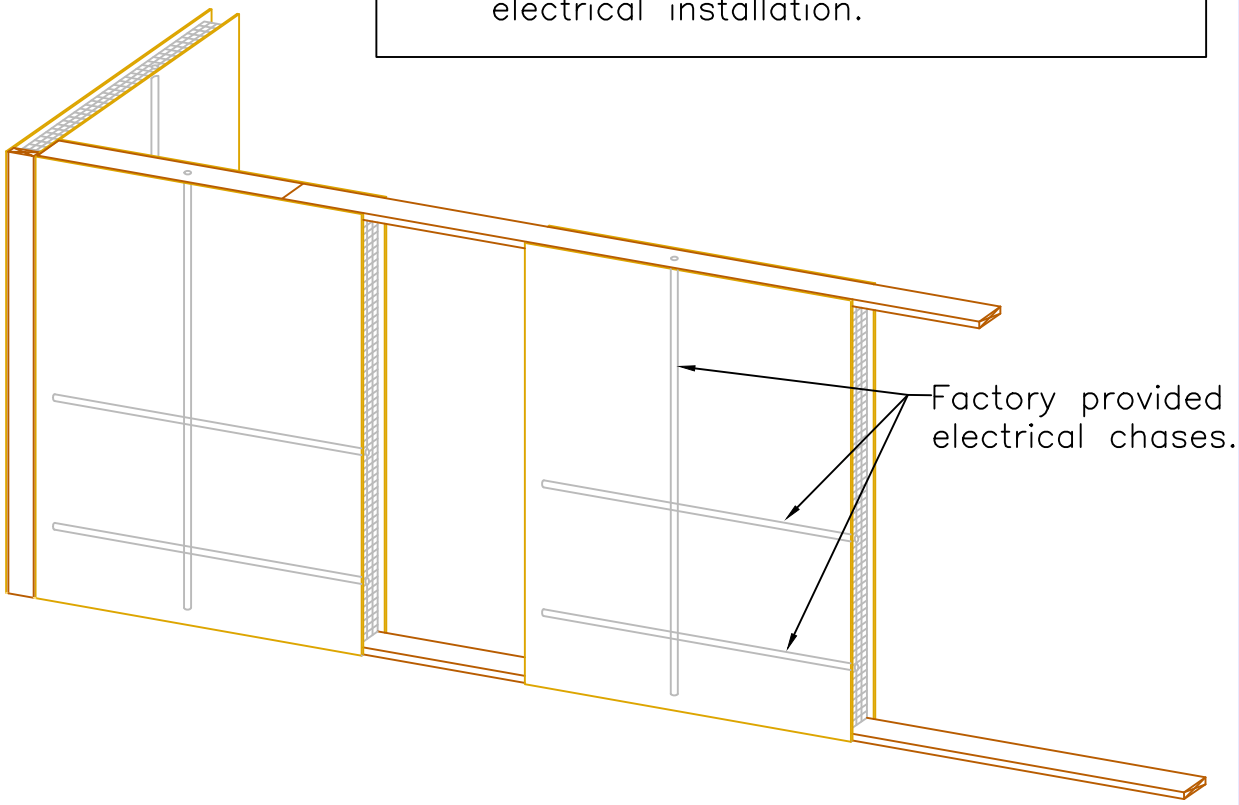
Updated 6–15–20

R–Control® SIP

TITLE: Chases – Electrical Roof / Wall Intersection	NO. SIP–128b

Notes:

1. Factory provided electrical chases must be pre–arranged with the R–Control SIP Manufacturer prior to fabrication of the panels.
2. SIP installer shall provide field drilled holes in top plates, sill/base plates, vertical plates and through floors to access electrical chases.
3. Follow local code requirements for electrical installation.



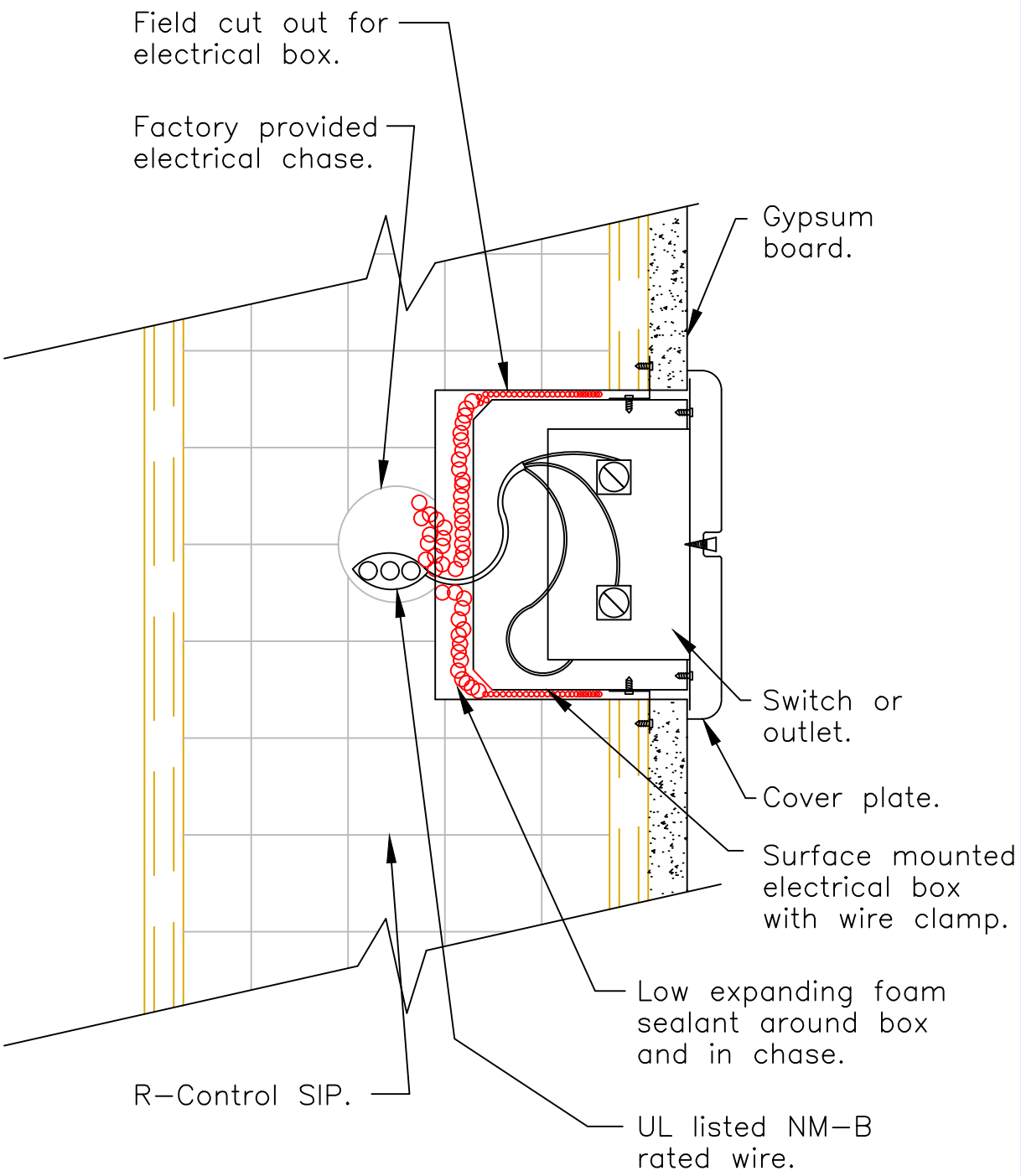
ISOMETRIC

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Chase – Locations In SIP	NO. SIP–129



Note: Follow local code requirements for electrical installation.

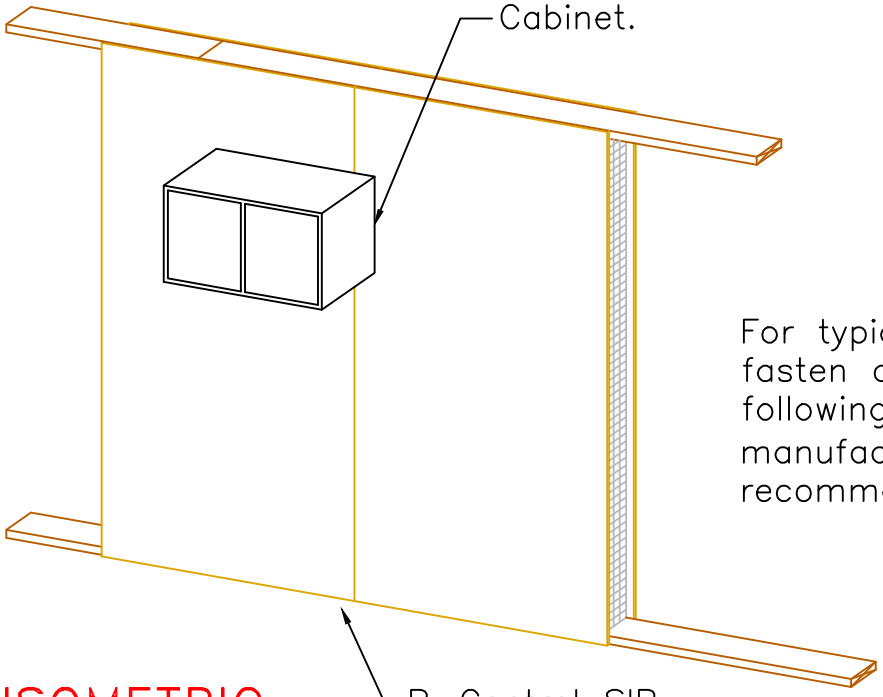
Updated 6–15–20

SECTION

Scale: NTS

R–Control® SIP

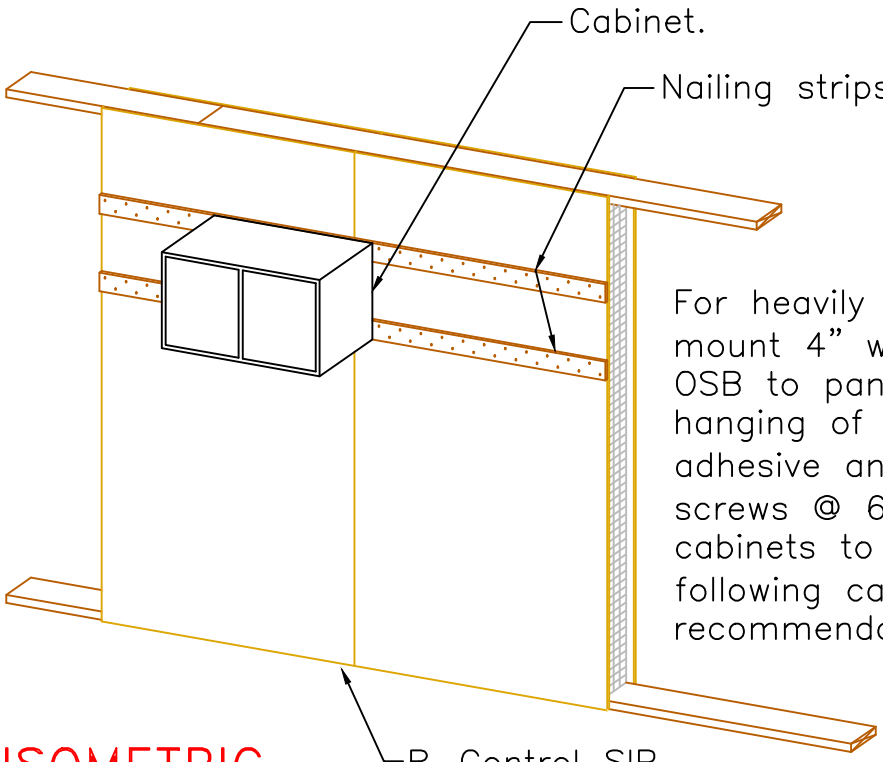
TITLE:	NO.
Box for Switch or Outlet	SIP–129a



For typical cabinet loadings fasten cabinet to panels following cabinet manufacturer's recommendations.

ISOMETRIC

Scale: NTS



For heavily loaded cabinets mount 4" wide strips of OSB to panels prior to hanging of cabinet. Use adhesive and 2 rows of #8 screws @ 6" o.c. Fasten cabinets to nailing strips following cabinet manufacturer's recommendations.

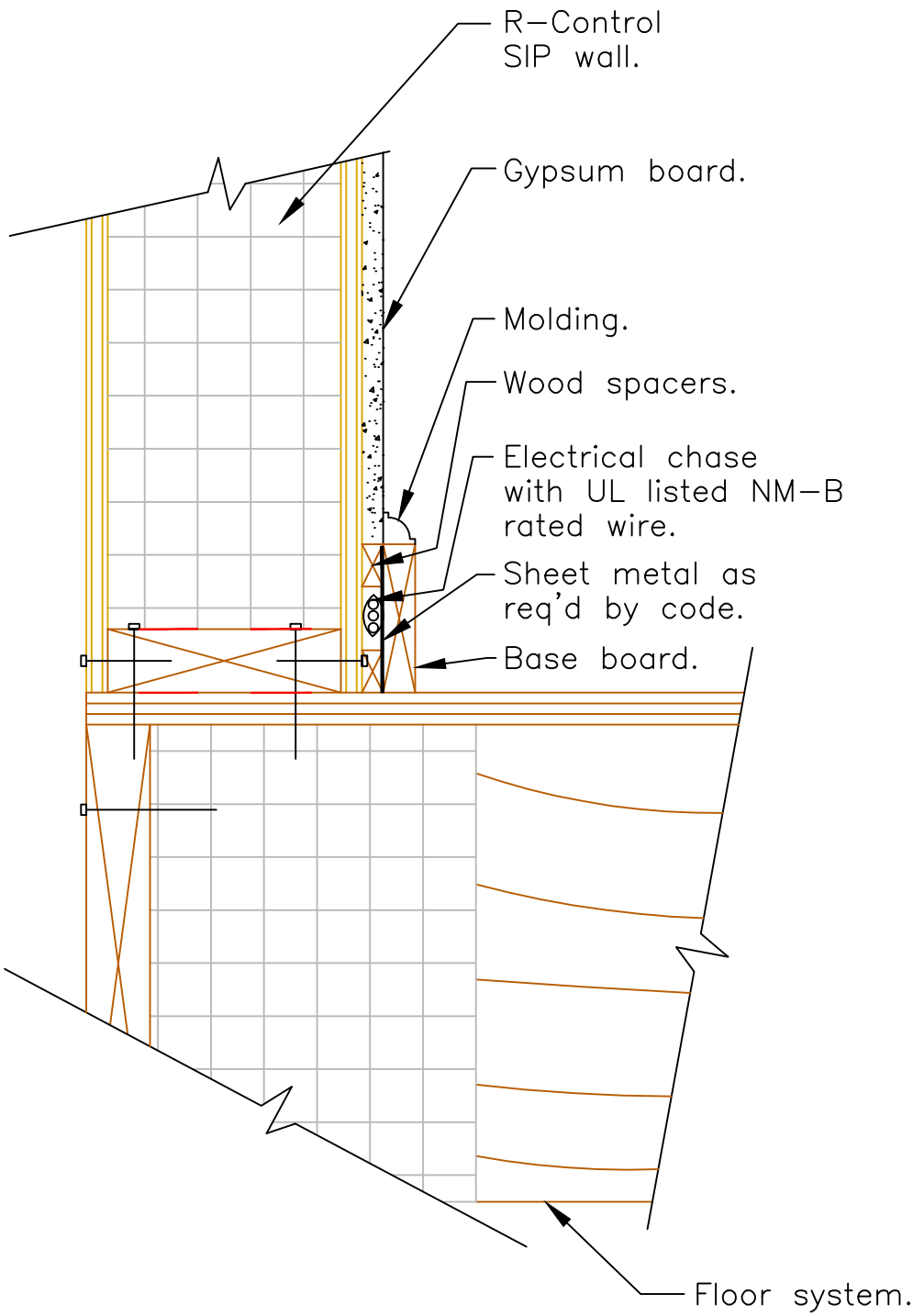
ISOMETRIC

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Cabinet Attachment	SIP–130



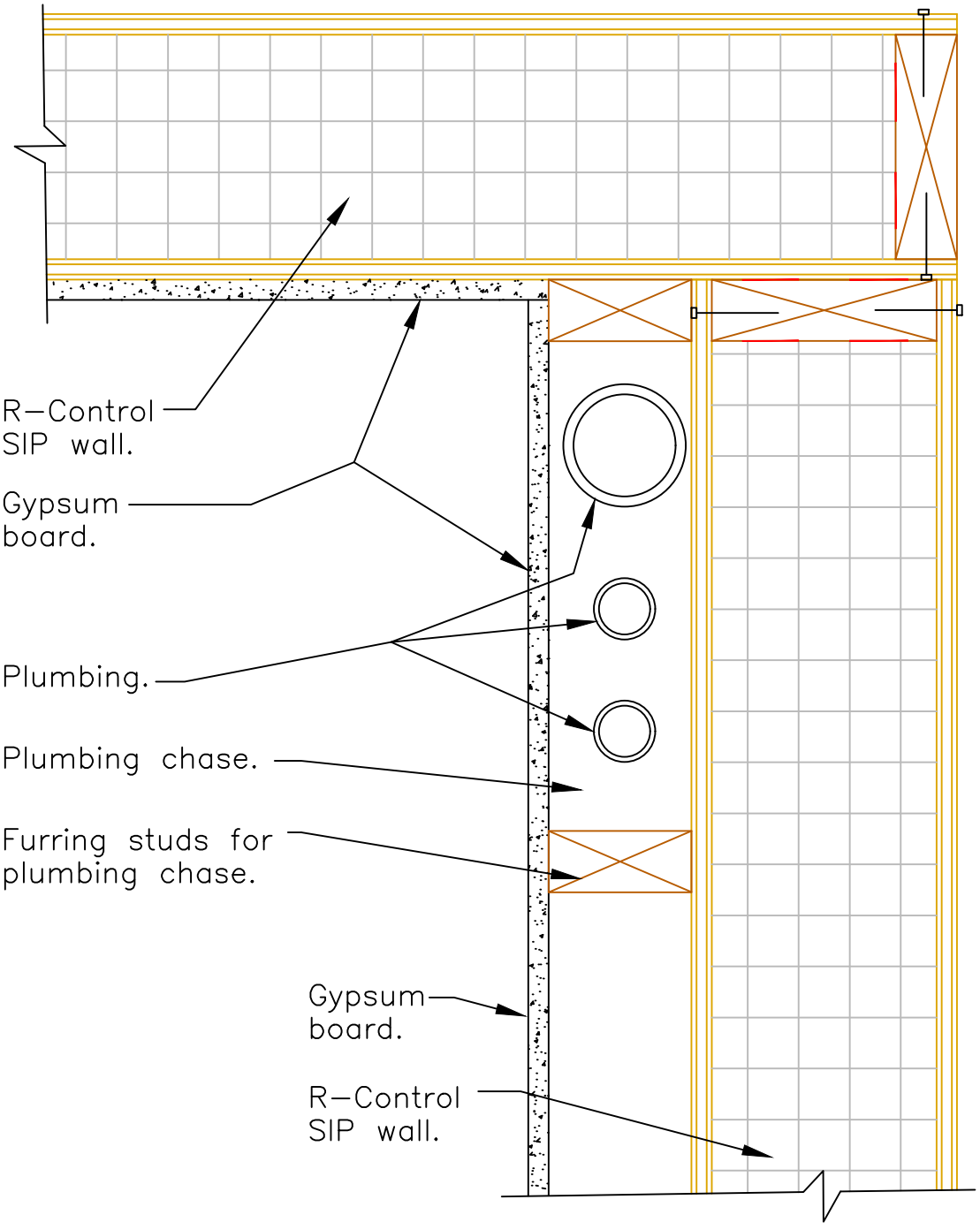
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Base Board Chase	SIP–131



PLAN

Scale: NTS

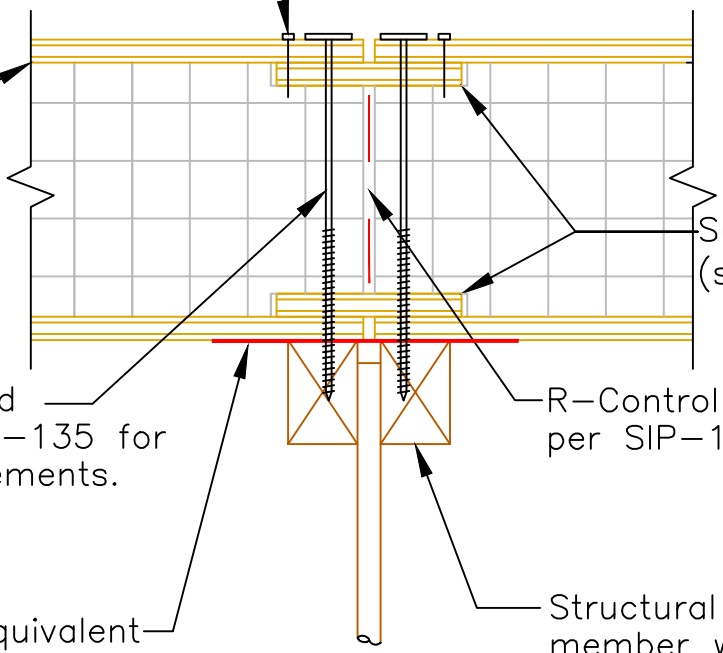
Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Wall Chase	SIP–132

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



SECTION

Scale: NTS

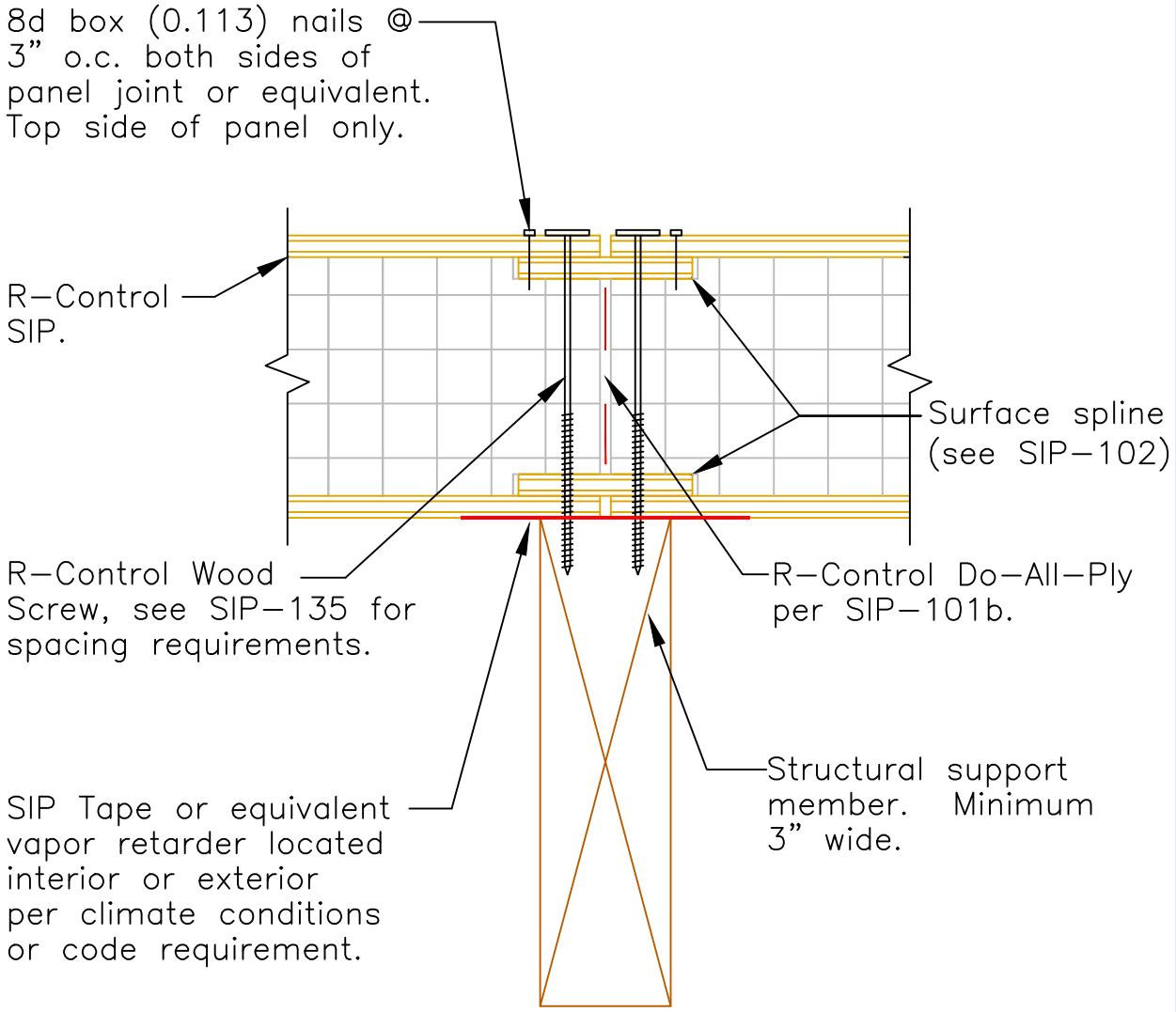
Updated 6-15-20

R-Control® SIP

TITLE:	NO.
Surface Spline @ Truss	SIP-133

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



SECTION

Scale: NTS

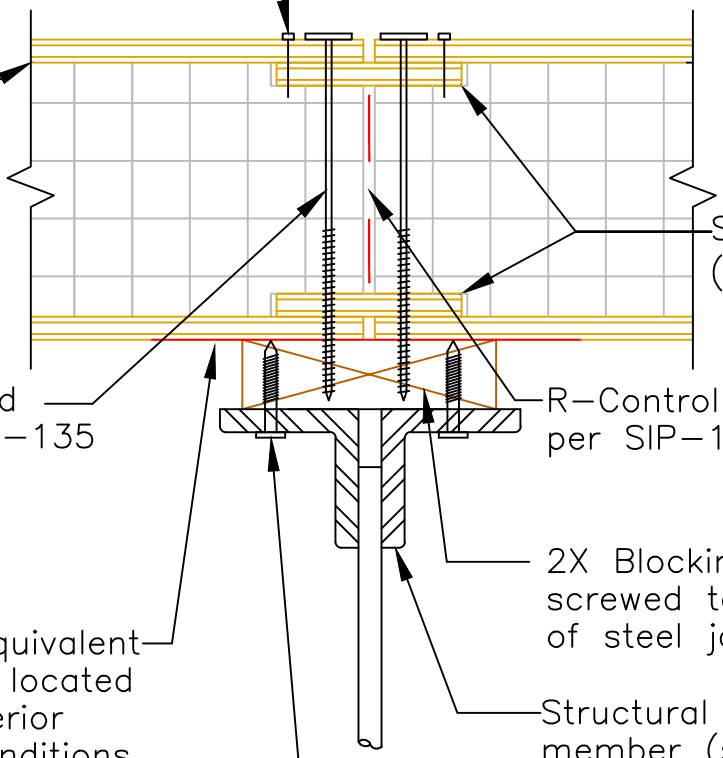
Updated 6-15-20

R-Control® SIP

TITLE: Surface Spline At Dimensional Lumber	NO. SIP-133a

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



8d box (0.113) nails @ 3" o.c. both sides of panel joint or equivalent. Top side of panel only.

R-Control SIP.

Surface spline (see SIP-102)

R-Control Wood Screw, see SIP-135 for spacing requirements.

R-Control Do-All-Ply per SIP-101b.

2X Blocking lag screwed to top chord of steel joist.

SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

Structural support member (steel joist).

Design as req'd by engineer. Predrill flange for screw application.

SECTION

Scale: NTS

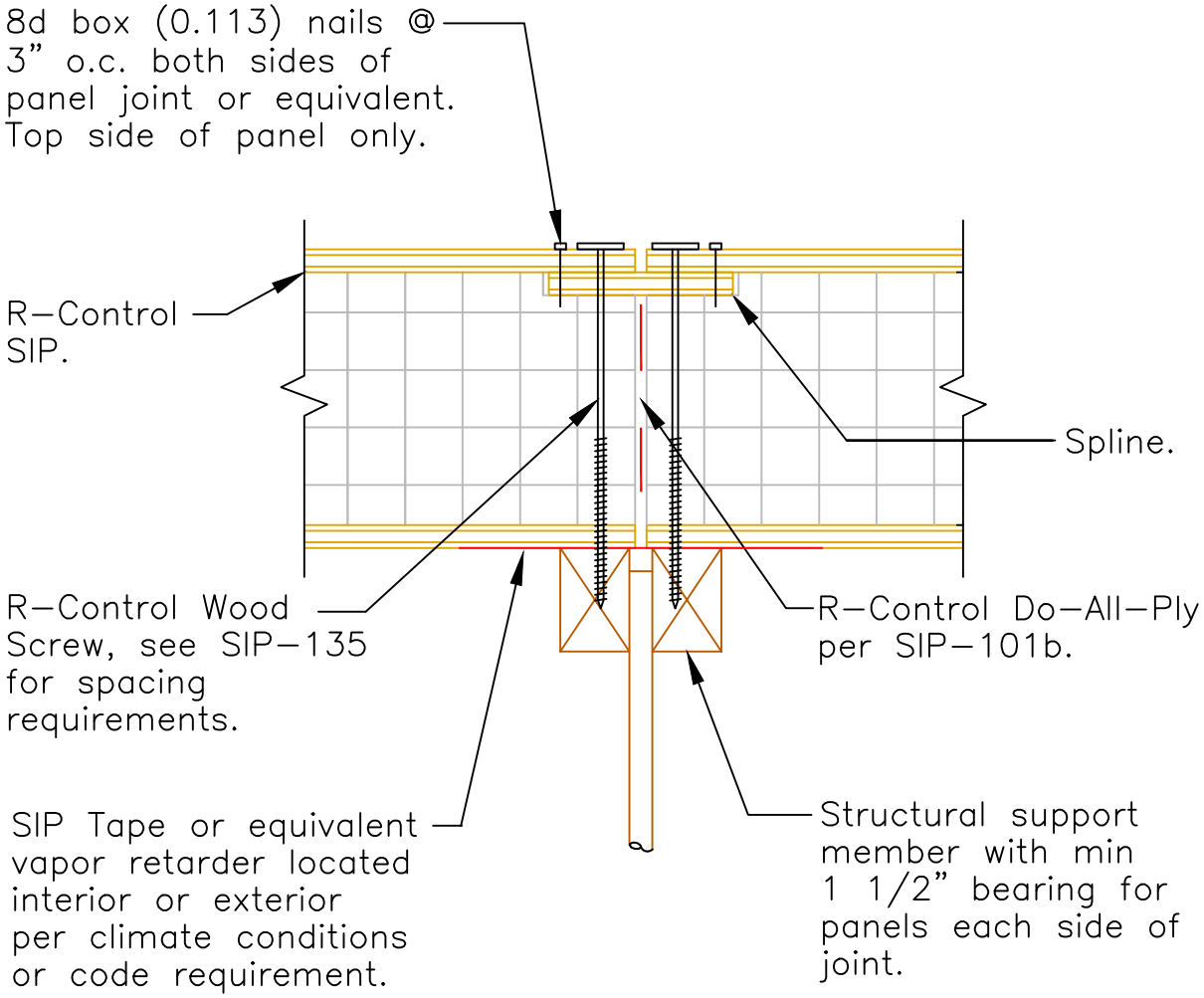
Updated 6-15-20

R-Control® SIP

TITLE: Surface Spline At Steel Joist	NO. SIP-133b

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



SECTION

Scale: NTS

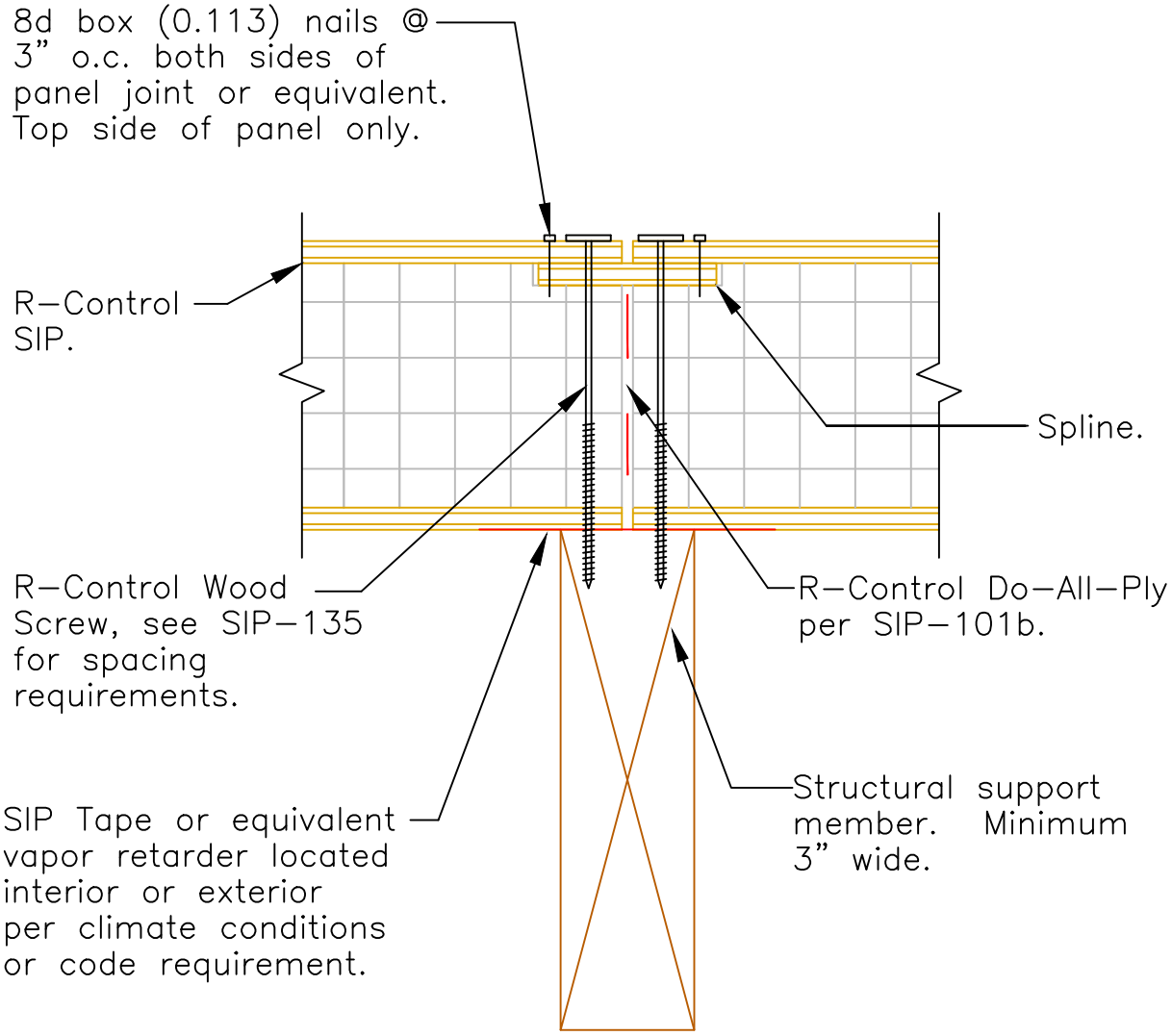
Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Surface Spline (Top) @ Truss	SIP–133c

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



SECTION

Scale: NTS

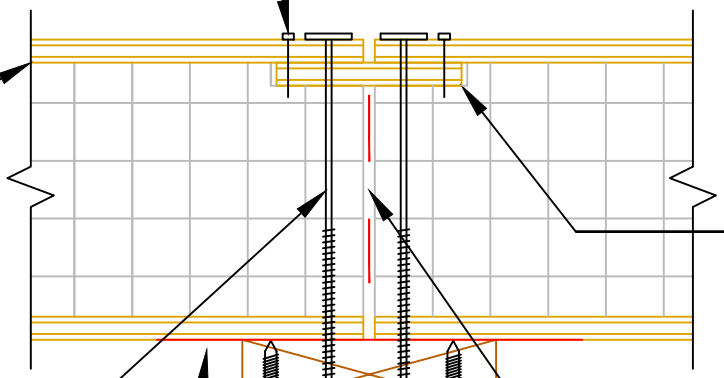
Updated 6-15-20

R-Control® SIP

TITLE: Surface Spline (Top) At Dimensional Lumber	NO. SIP-133d

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



8d box (0.113) nails @ 3" o.c. both sides of panel joint or equivalent. Top side of panel only.

R–Control SIP.

Spline.

R–Control Wood Screw, see SIP–135 for spacing requirements.

R–Control Do–All–Ply per SIP–101b.

SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

2X Blocking lag screwed to top chord of steel joist.

Structural support member (steel joist).

Design as req'd by engineer. Predrill flange for screw application.

SECTION

Scale: NTS

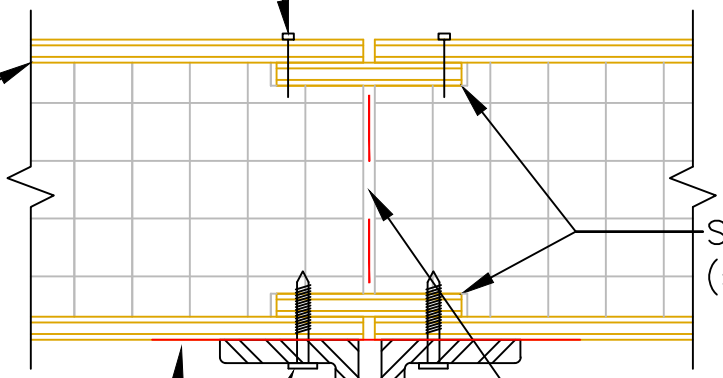
Updated 6–15–20

R–Control® SIP

TITLE: Surface Spline (Top) At Steel Joist	NO. SIP–133e

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



8d box (0.113) nails @ 3" o.c. both sides of panel joint or equivalent. Top side of panel only.

R-Control SIP.

Surface spline (see SIP-102).

R-Control Do-All-Ply per SIP-101b.

SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

Design as req'd by engineer. Predrill flange for screw application.

Structural support member (steel joist).

SECTION

Scale: NTS

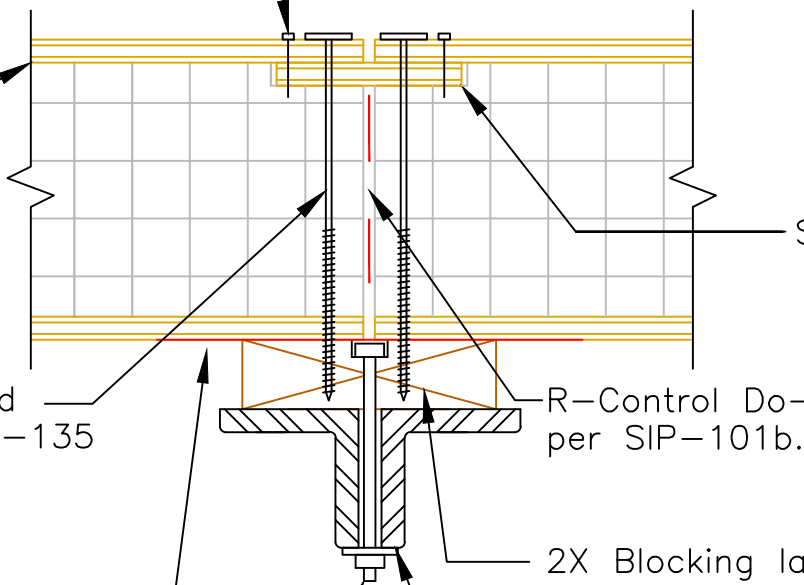
Updated 6-15-20

R-Control® SIP

TITLE: Surface Spline At Steel Joist	NO. SIP-133f

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



8d box (0.113) nails @ 3" o.c. both sides of panel joint or equivalent. Top side of panel only.

R–Control SIP.

Spline.

R–Control Wood Screw, see SIP–135 for spacing requirements.

R–Control Do–All–Ply per SIP–101b.

2X Blocking lag screwed to top chord of steel joist.

SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

Structural support member (steel joist).

Design as req'd by engineer.

SECTION

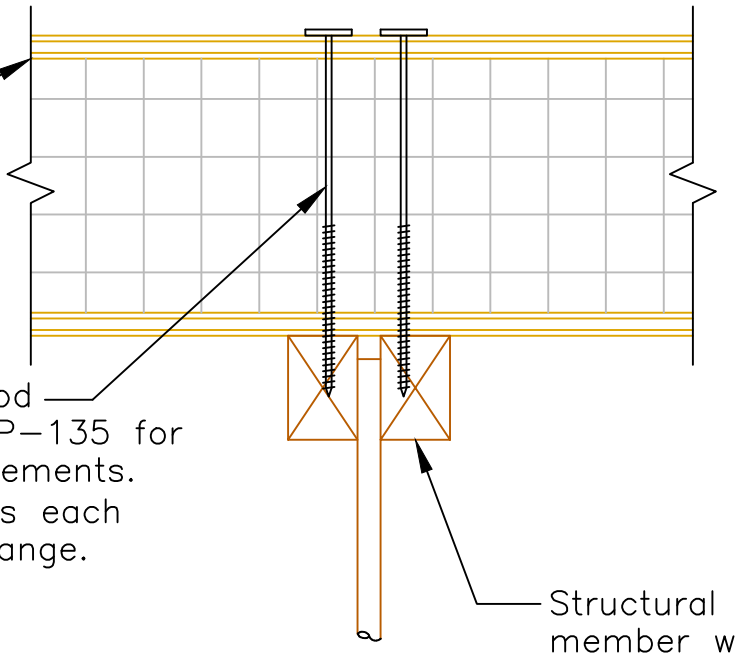
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Surface Spline (Top) At Steel Joist	NO. SIP–133g

Note: roof covering & underlayment as req'd by code.



SECTION

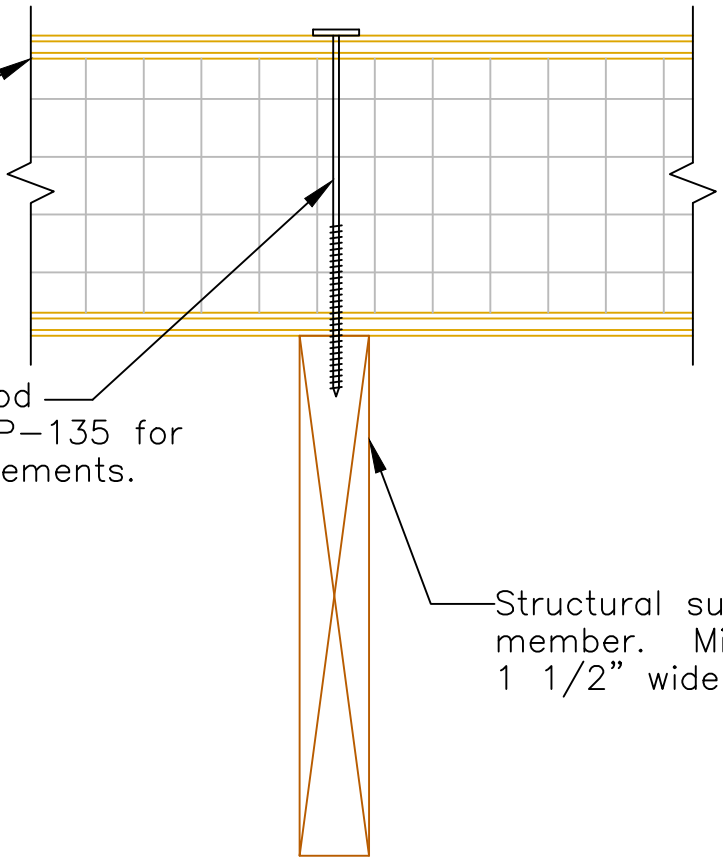
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Continuous SIP @ Truss	SIP–134

Note: roof covering & underlayment as req'd by code.



SECTION

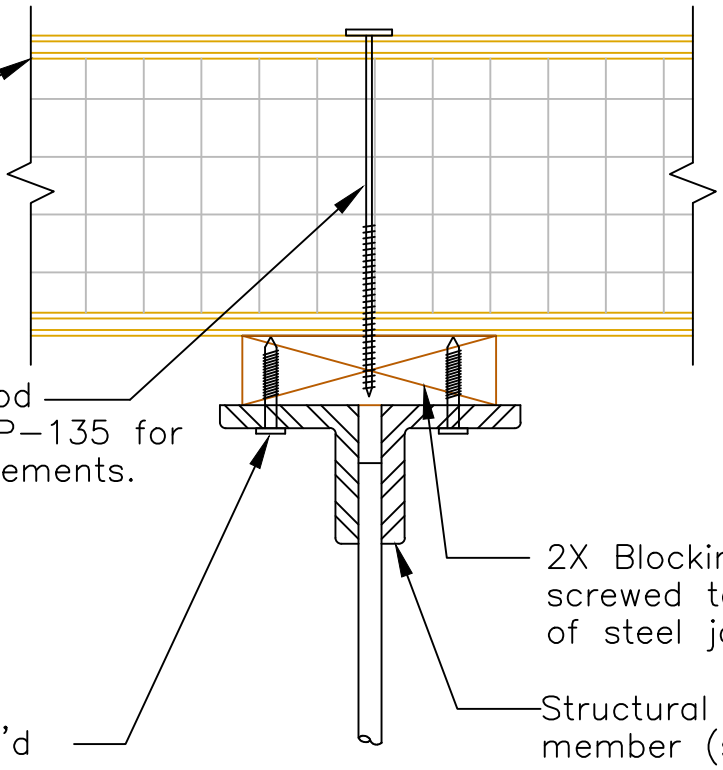
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Continuous SIP at Dimensional Lumber	SIP–134a

Note: roof covering & underlayment as req'd by code.



SECTION

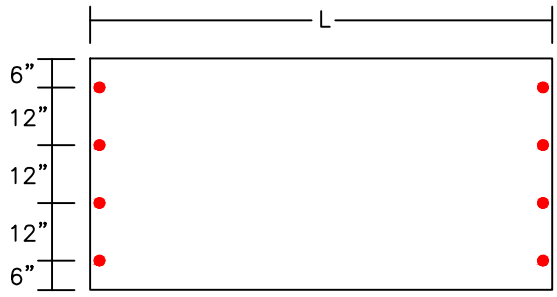
Scale: NTS

Updated 6–15–20

R–Control® SIP

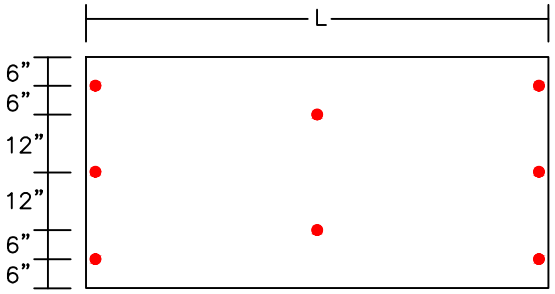
TITLE: Continuous SIP At Steel Joist	NO. SIP–134b

Connection pattern for R–Control Screws 12" on center in accordance with Load Design Chart #8 for single span condition.

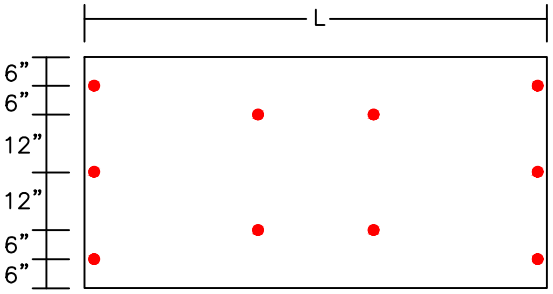


Single span condition.

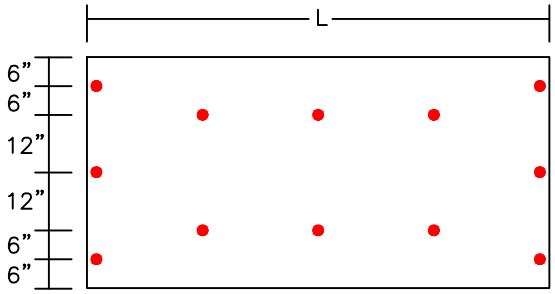
Alternate connection patterns for multispan conditions based on R–Control Screws 12" on center in accordance with Load Design Chart #8 for single span condition.



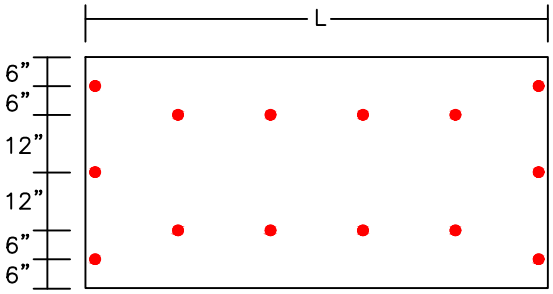
Two span condition.



Three span condition.



Four span condition.



Five span condition.

Notes:

1. Fastening patterns for uplift only. See Load Design Chart #8 for complete information.
2. For diaphragm connection requirements, see to Load Design Chart #7.

PLAN

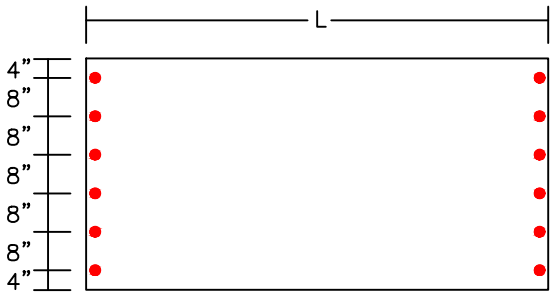
Scale: NTS

Updated 6–15–20

R–Control® SIP

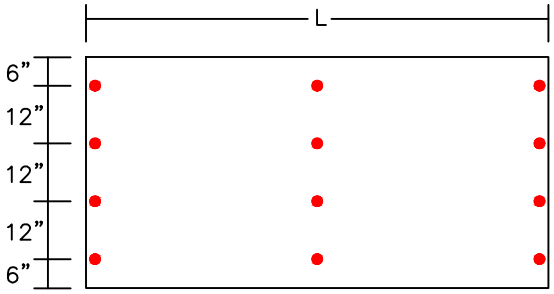
TITLE:	NO.
SIP Roof Fastening Pattern – 12" o.c.	SIP–135

Connection pattern for R–Control Screws 8" on center in accordance with Load Design Chart #8 for single span condition.

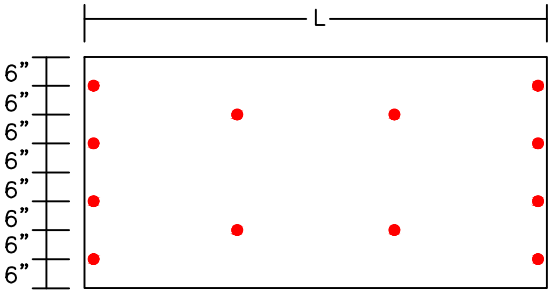


Single span condition.

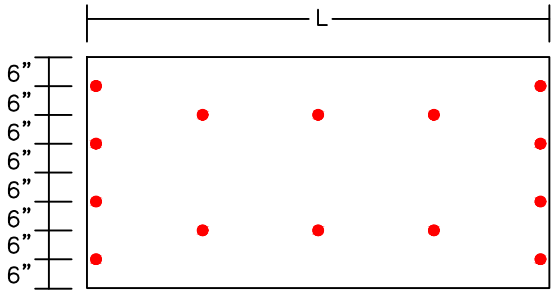
Alternate connection patterns for multispan conditions based on R–Control Screws 8" on center in accordance with Load Design Chart #8 for single span condition.



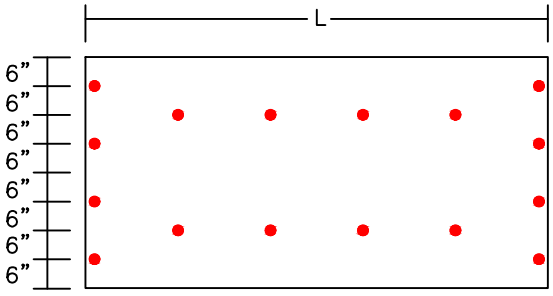
Two span condition.



Three span condition.



Four span condition.



Five span condition.

Notes:

1. Fastening patterns for uplift only. See Load Design Chart #8 for complete information.
2. For diaphragm connection requirements, see to Load Design Chart #7.

PLAN

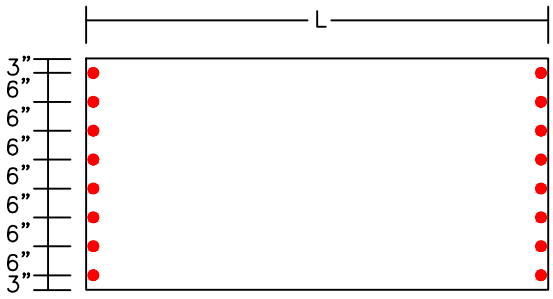
Scale: NTS

Updated 6–15–20

R–Control® SIP

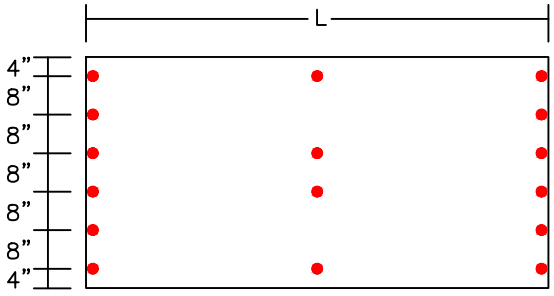
TITLE:	NO.
SIP Roof Fastening Pattern – 8" o.c.	SIP–135a

Connection pattern for R–Control Screws 6" on center in accordance with Load Design Chart #8 for single span condition.

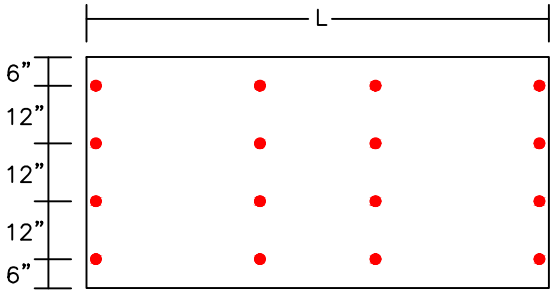


Single span condition.

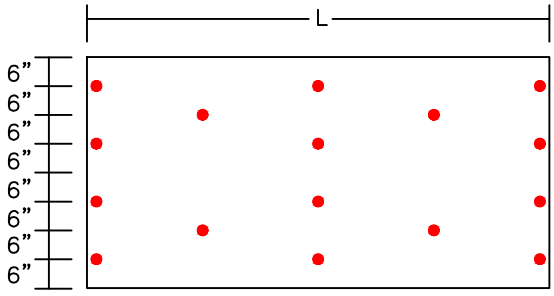
Alternate connection patterns for multispan conditions based on R–Control Screws 6" on center in accordance with Load Design Chart #8 for single span condition.



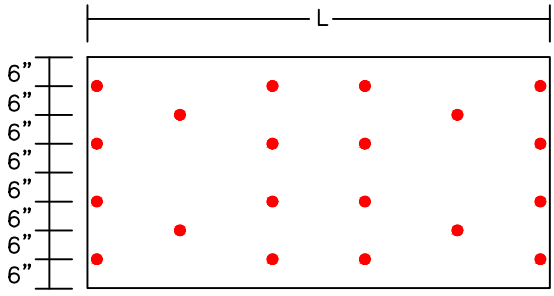
Two span condition.



Three span condition.



Four span condition.



Five span condition.

Notes:

1. Fastening patterns for uplift only. See Load Design Chart #8 for complete information.
2. For diaphragm connection requirements, see to Load Design Chart #7.

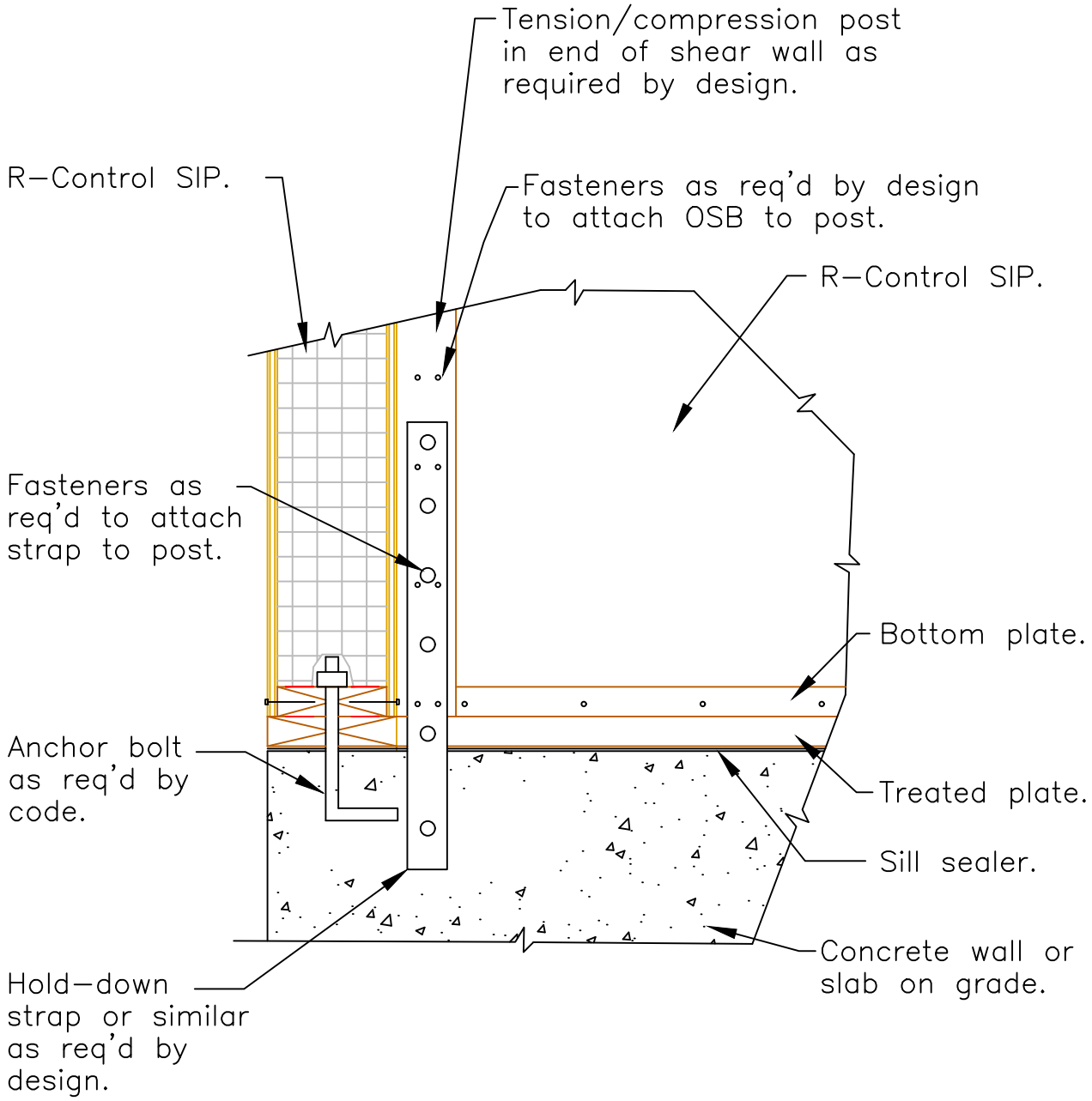
PLAN

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
SIP Roof Fastening Pattern – 6" o.c.	SIP–135b



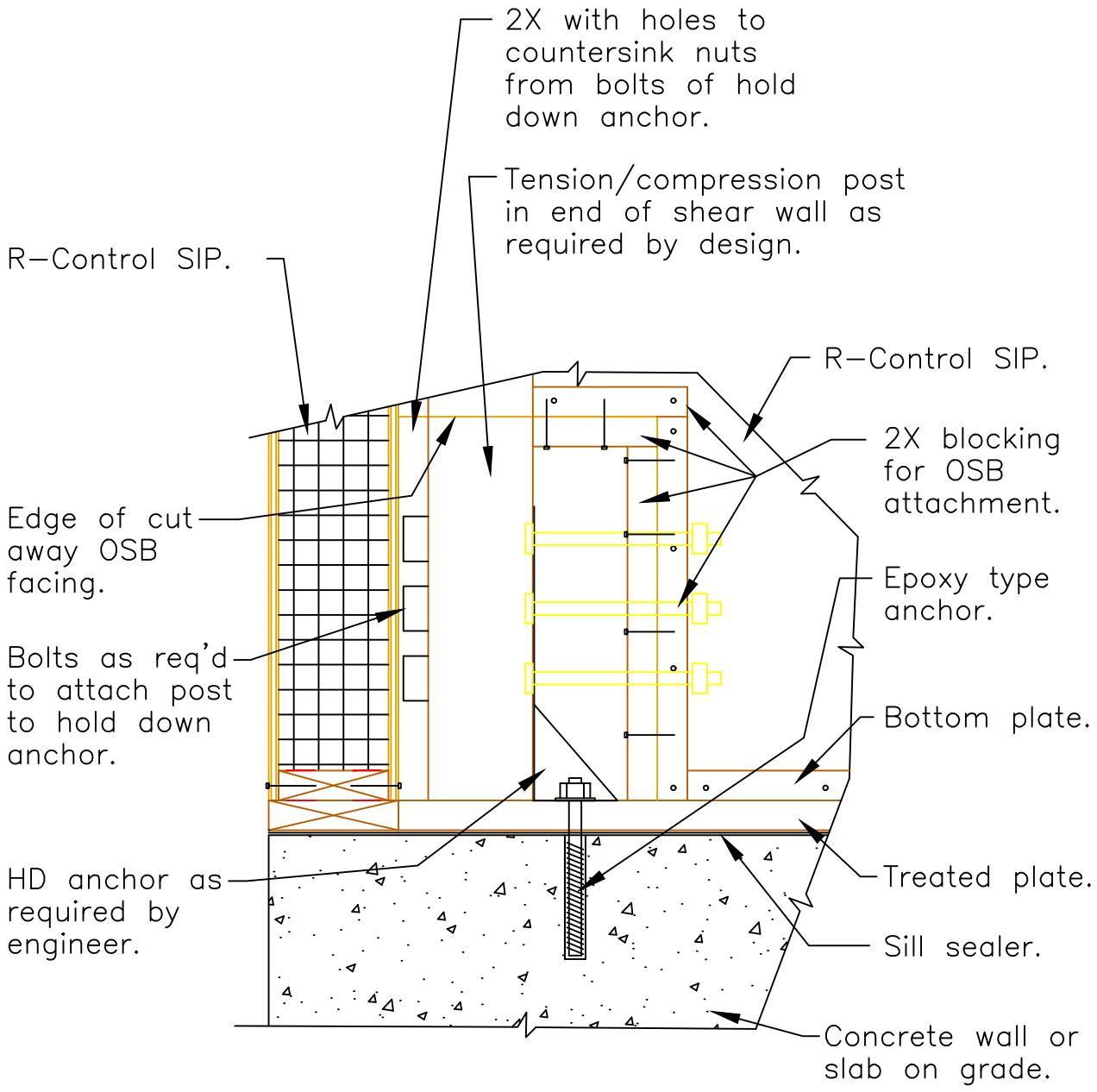
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Post to Concrete Anchorage	SIP–136



Note: Cut panel facings to place HD type anchor, post and 2X plate. Use expanding foam to fill in area around hold down anchor. Insulate cavity with low expanding foam. Replace OSB facing and nail to 2X blocking.

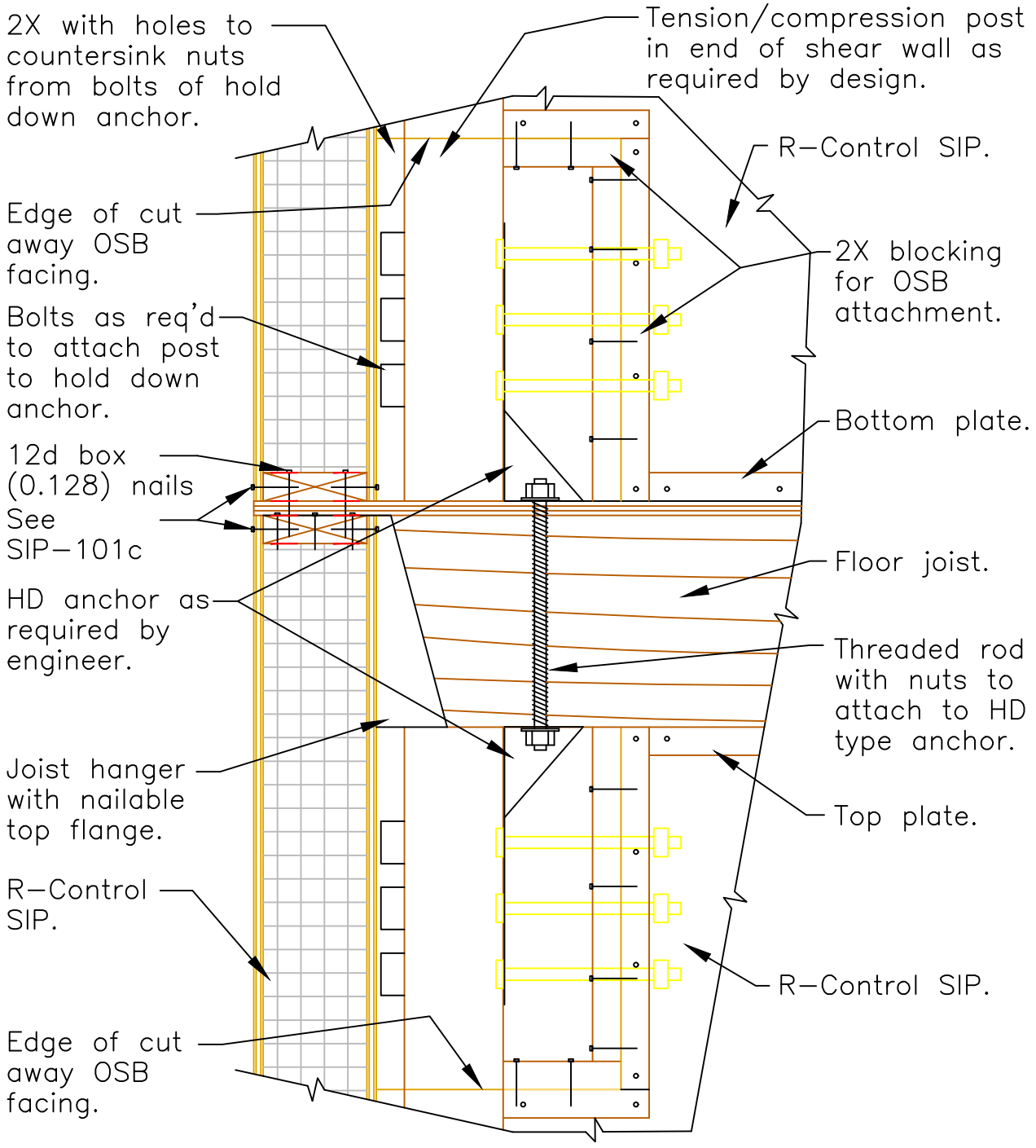
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Post to Concrete Anchorage	SIP–136a



Note: Cut panel facings to place HD type anchor, post and 2X plate. Use expanding foam to fill in area around hold down anchor. Replace OSB facing and nail to 2X blocking.

SECTION

Scale: NTS

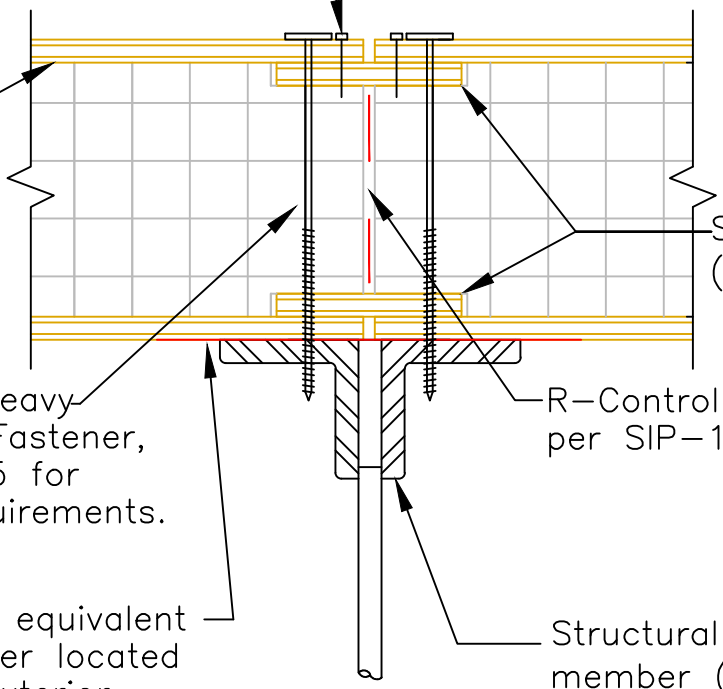
Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Post to Post through Floor	SIP–137

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



SECTION

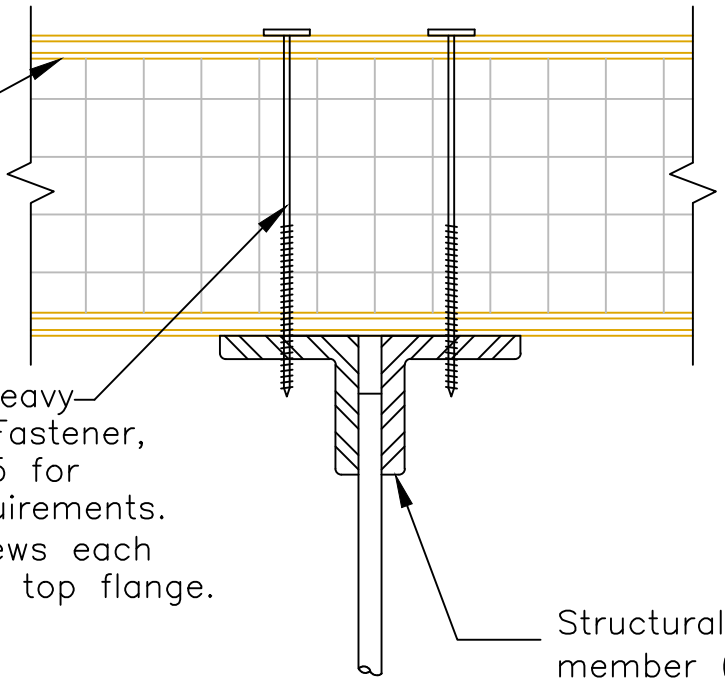
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Surface Spline At Steel Member	NO. SIP–138

Note: roof covering & underlayment as req'd by code.



SECTION

Scale: NTS

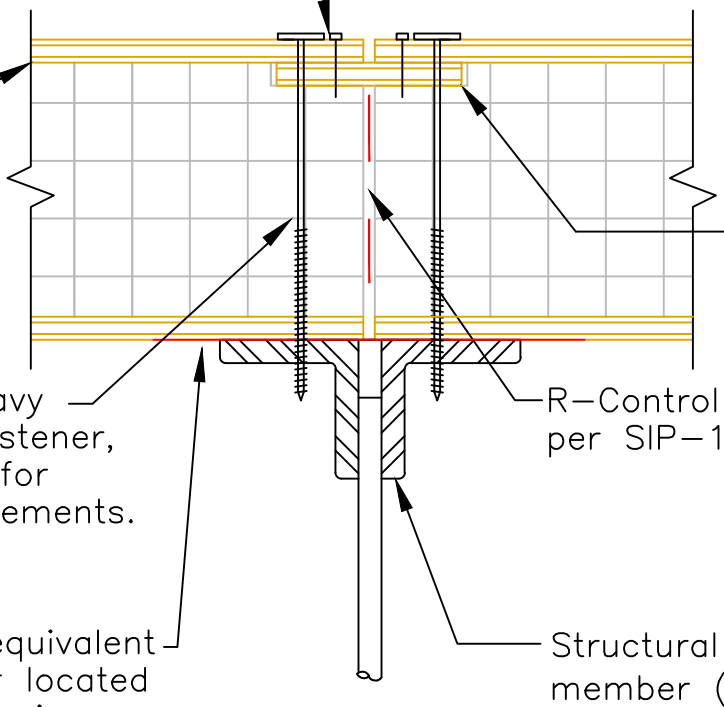
Updated 6–15–20

R–Control® SIP

TITLE: Continuous Panel At Steel Member	NO. SIP–138a

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



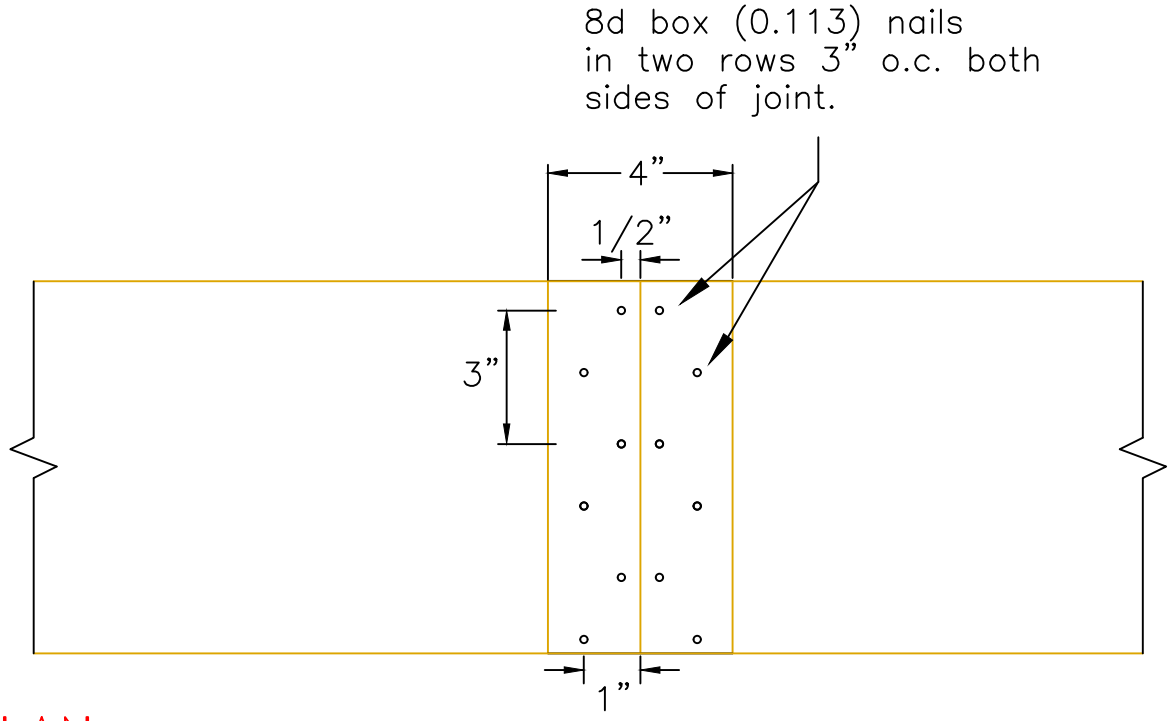
SECTION

Scale: NTS

Updated 6–15–20

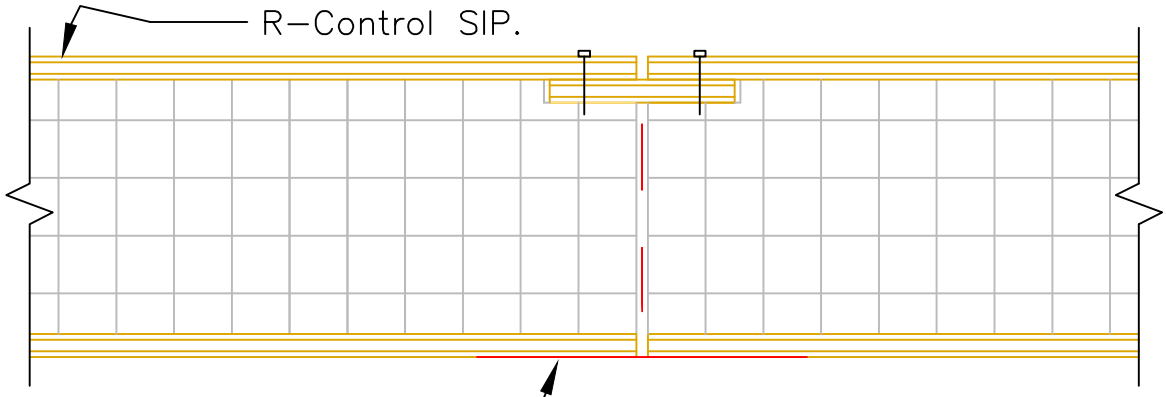
R–Control® SIP

TITLE: Surface Spline (Top) At Steel Member	NO. SIP–138b



PLAN

Scale: NTS



SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".

SECTION

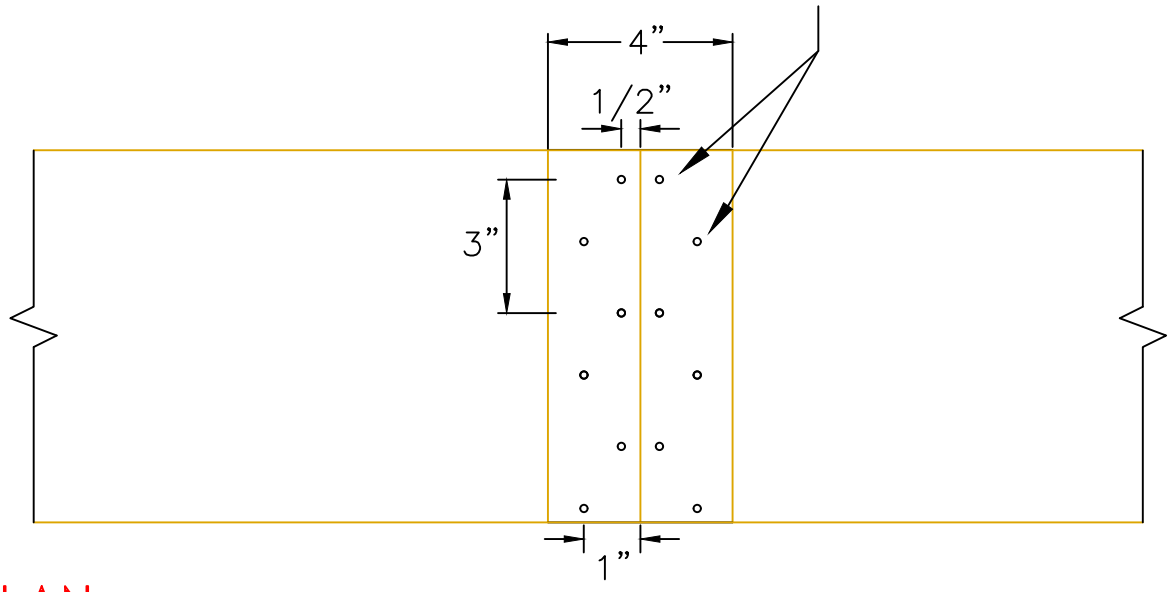
Scale: NTS

Updated 6-15-20

R-Control® SIP

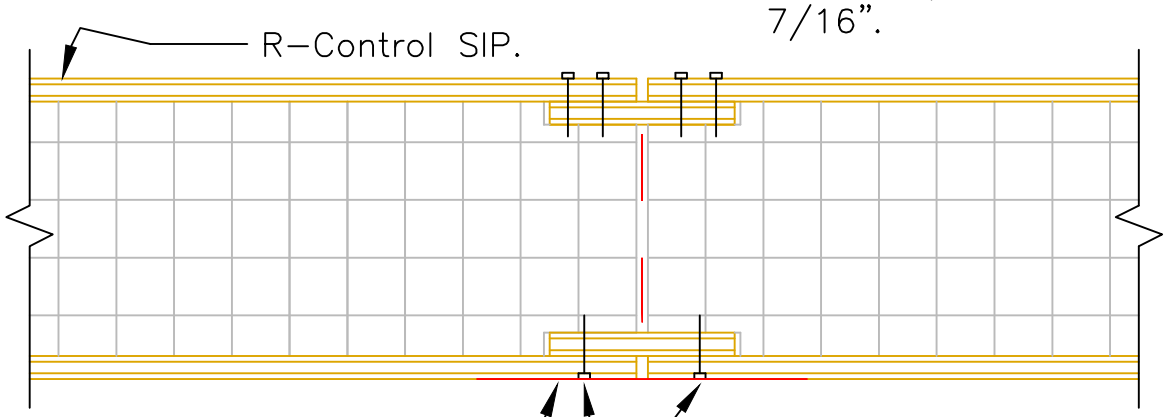
TITLE: Diaphragm Connection – Top Spline Only	NO. SIP-139

Top Spline:
8d box (0.113) in two rows
3" o.c. both sides of joint.



PLAN
Scale: NTS

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



SIP Tape or equivalent vapor retarder located interior or exterior per climate conditions or code requirement.

Bottom Spline:
8d box (0.113) nails 6" o.c. in single row both sides of joint.

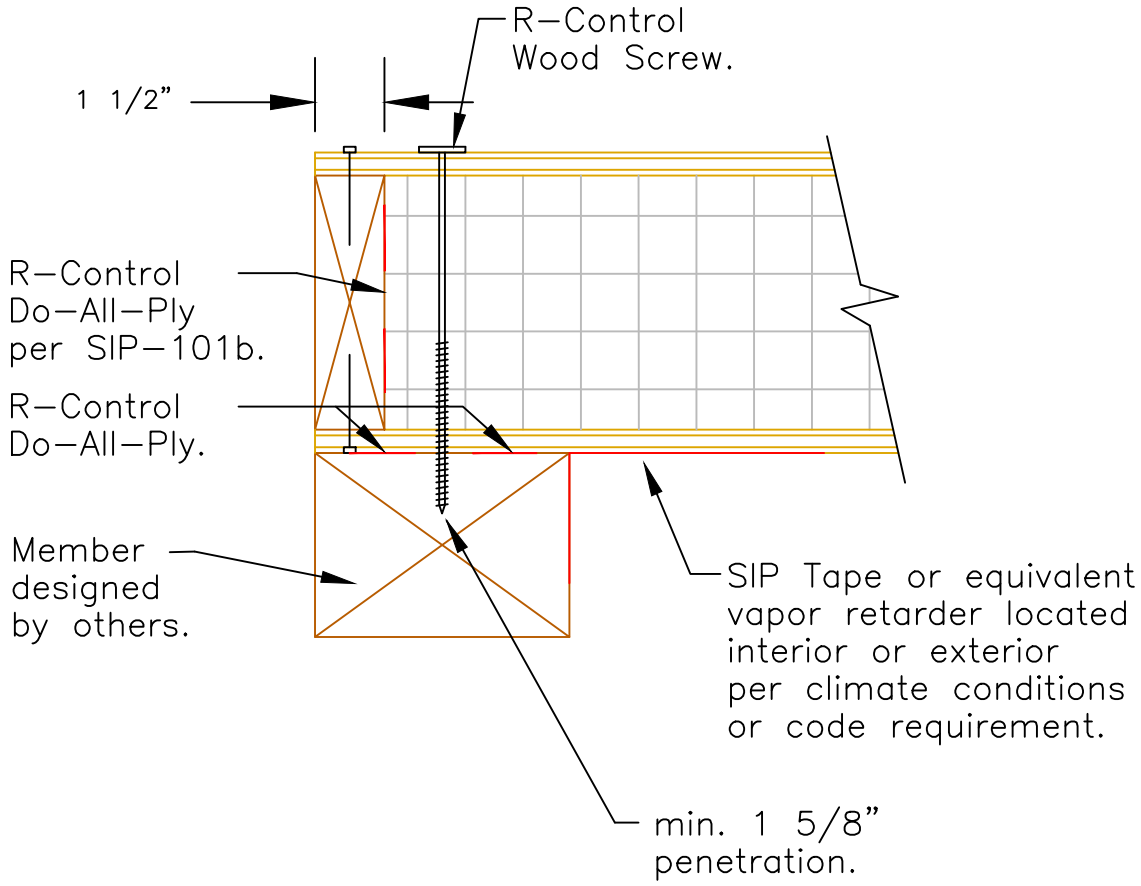
SECTION
Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE: Diaphragm Connection – Splines	NO. SIP-139a

Note: roof covering & underlayment as req'd by code.



SECTION

Scale: NTS

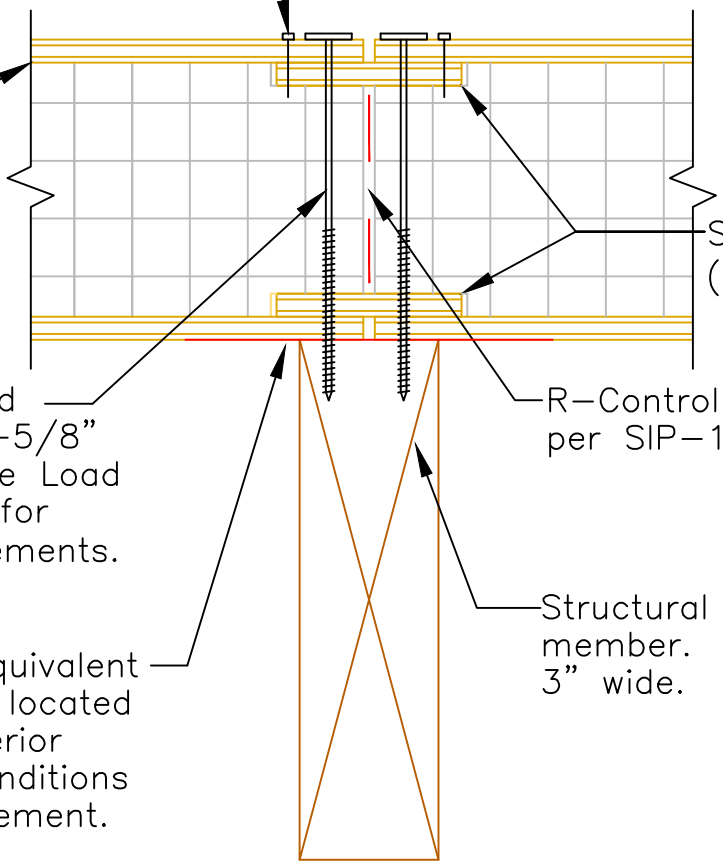
Updated 6–15–20

R–Control® SIP

TITLE: Diaphragm Connection – Support Member	NO. SIP–140

Note: roof covering & underlayment as req'd by code.

Note: Spline to be of material conforming to DOC PS2, min thickness 7/16".



SECTION

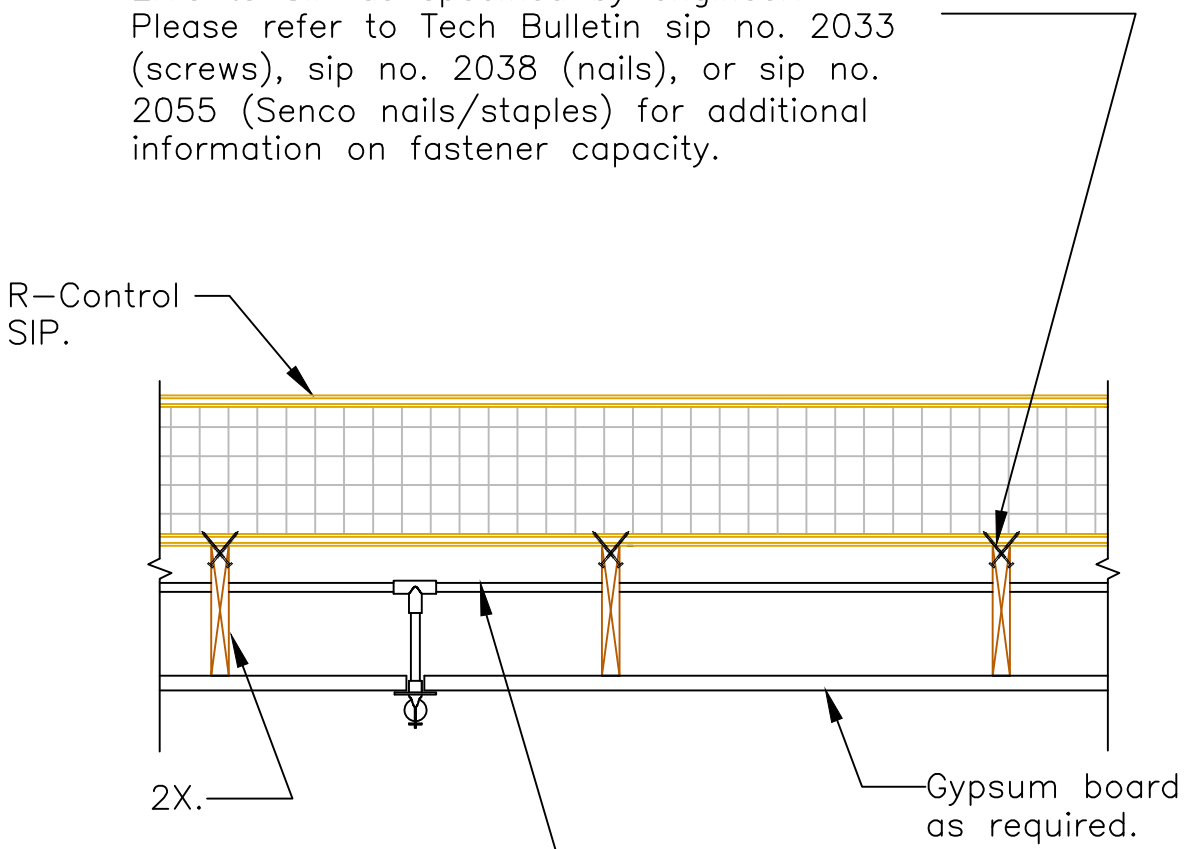
Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE: Diaphragm Connection – Intermediate support	NO. SIP-141

Note: fastener/adhesive attachment of 2X's to SIP as specified by engineer. Please refer to Tech Bulletin sip no. 2033 (screws), sip no. 2038 (nails), or sip no. 2055 (Senco nails/staples) for additional information on fastener capacity.



Note: 2X to be sized as required for cavity depth. 2X may be placed flat against R–Control SIP.

SECTION

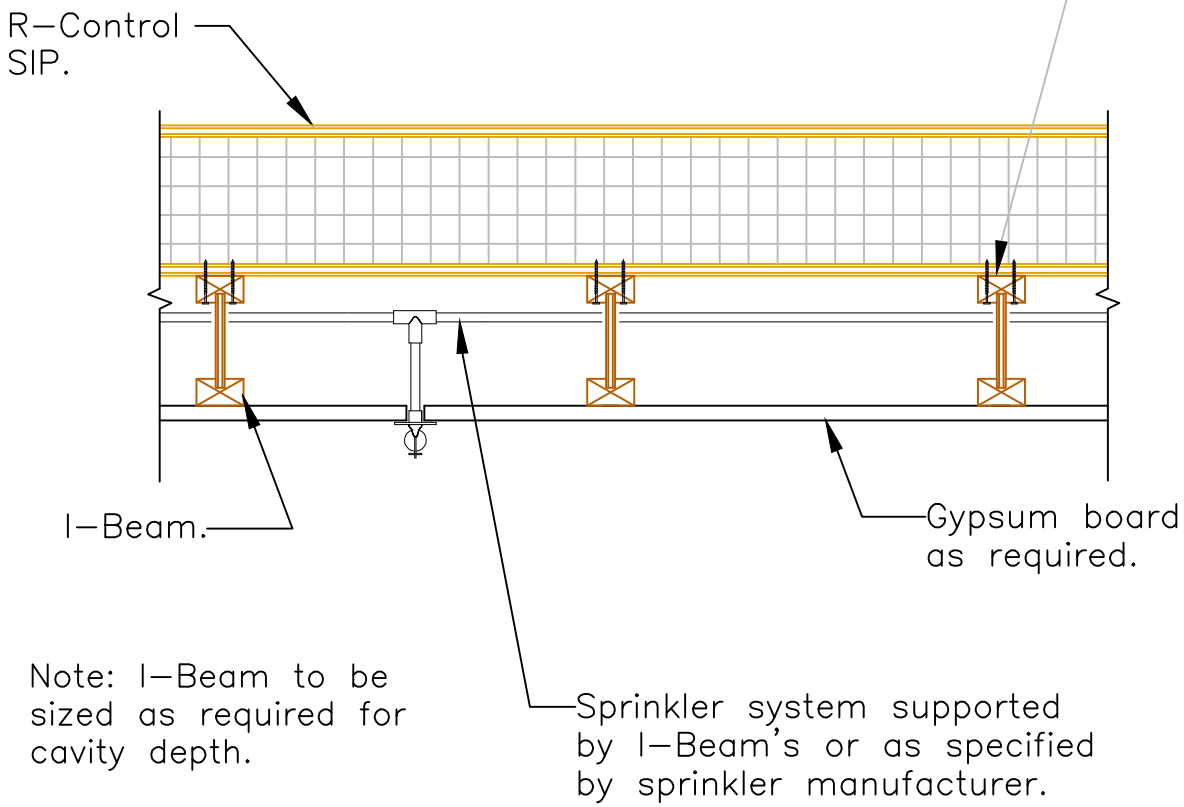
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Soffit Detail– Sprinkler Systems	SIP–142

Note: fastener/adhesive attachment of I–Beam to SIP as specified by engineer. Please refer to Tech Bulletin sip no. 2033 (screws), sip no. 2038 (nails), or sip no. 2055 (Senco nails/staples) for additional information on fastener capacity.



SECTION

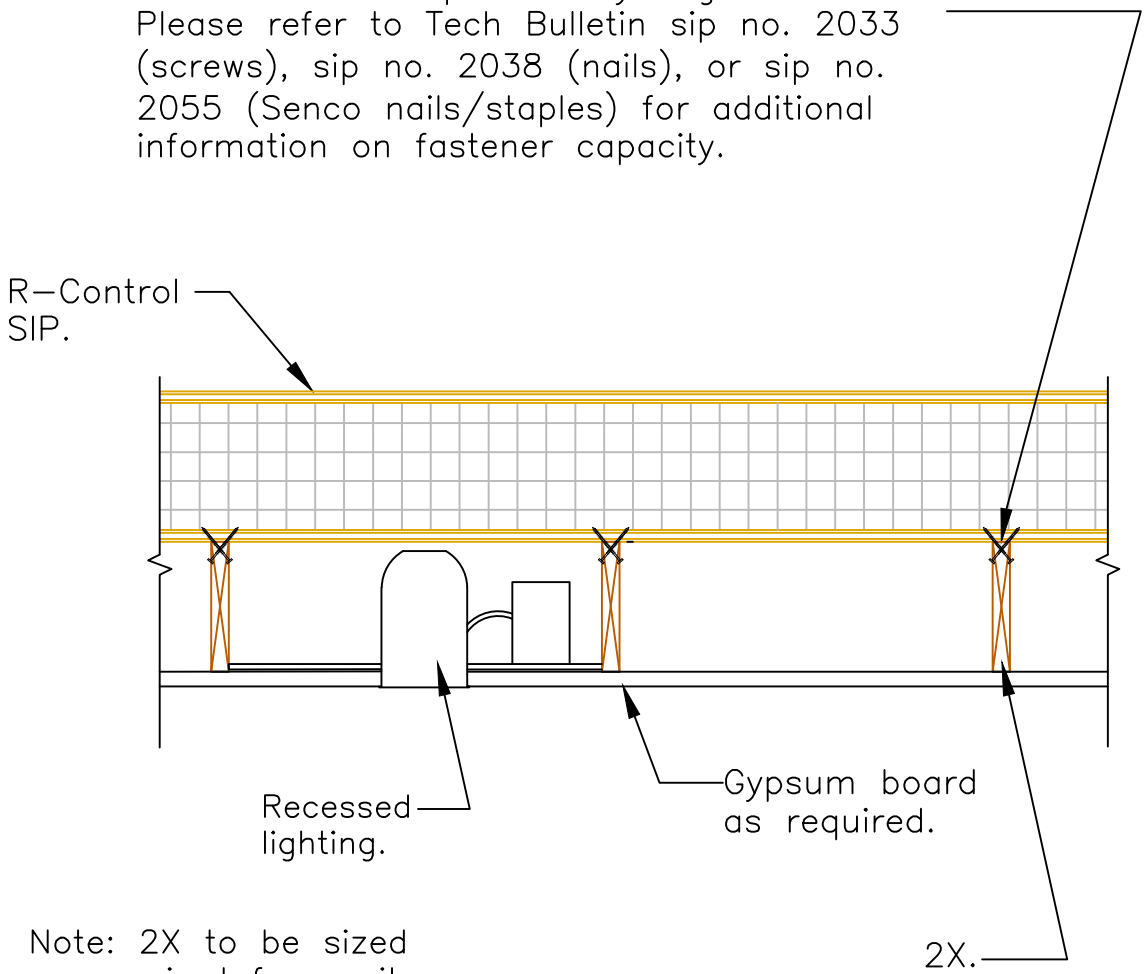
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Soffit Detail– Sprinkler Systems	NO. SIP–142a

Note: fastener/adhesive attachment of 2X's to SIP as specified by engineer. Please refer to Tech Bulletin sip no. 2033 (screws), sip no. 2038 (nails), or sip no. 2055 (Senco nails/staples) for additional information on fastener capacity.



Note: 2X to be sized as required for cavity depth.

SECTION

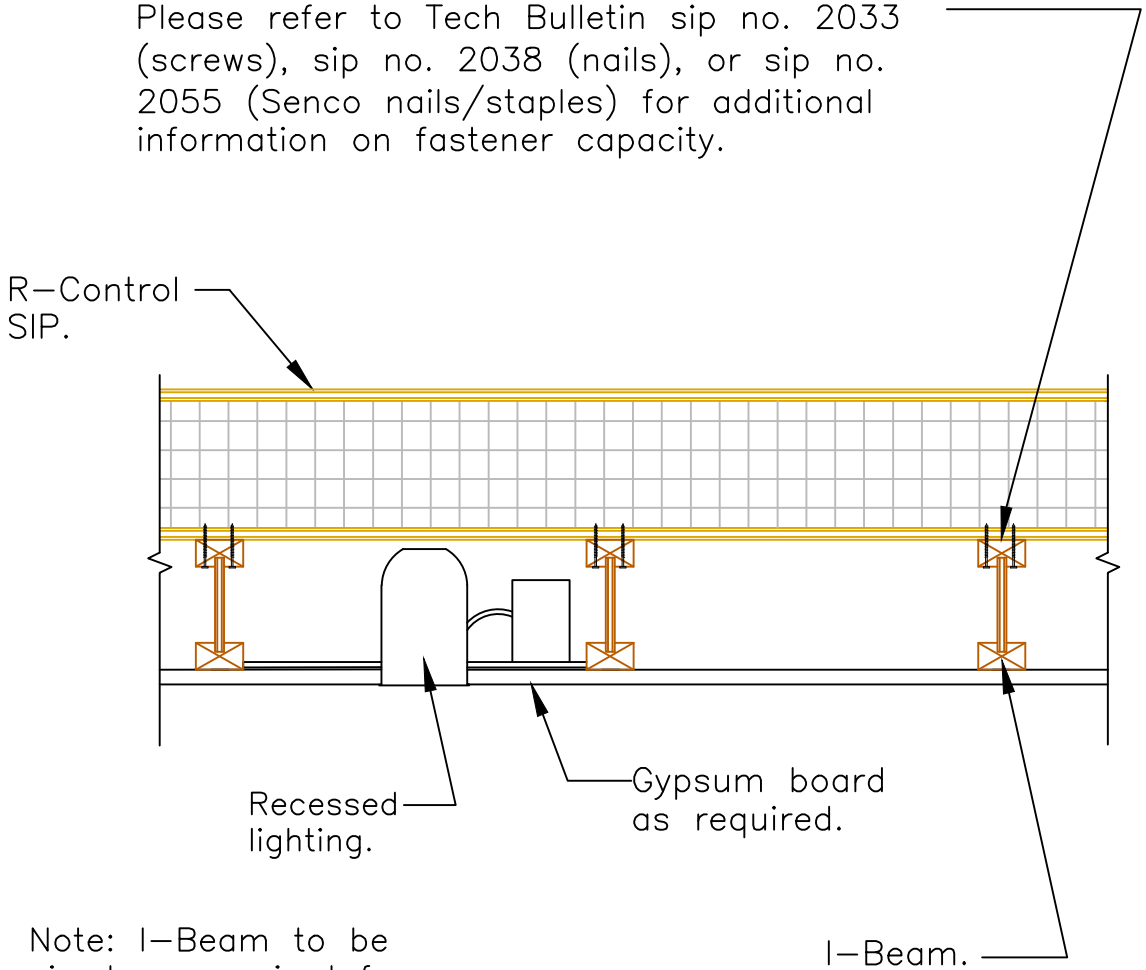
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Soffit Detail– Can Light	SIP–143

Note: fastener/adhesive attachment of I–Beams to SIP as specified by engineer. Please refer to Tech Bulletin sip no. 2033 (screws), sip no. 2038 (nails), or sip no. 2055 (Senco nails/staples) for additional information on fastener capacity.



Note: I–Beam to be sized as required for cavity depth.

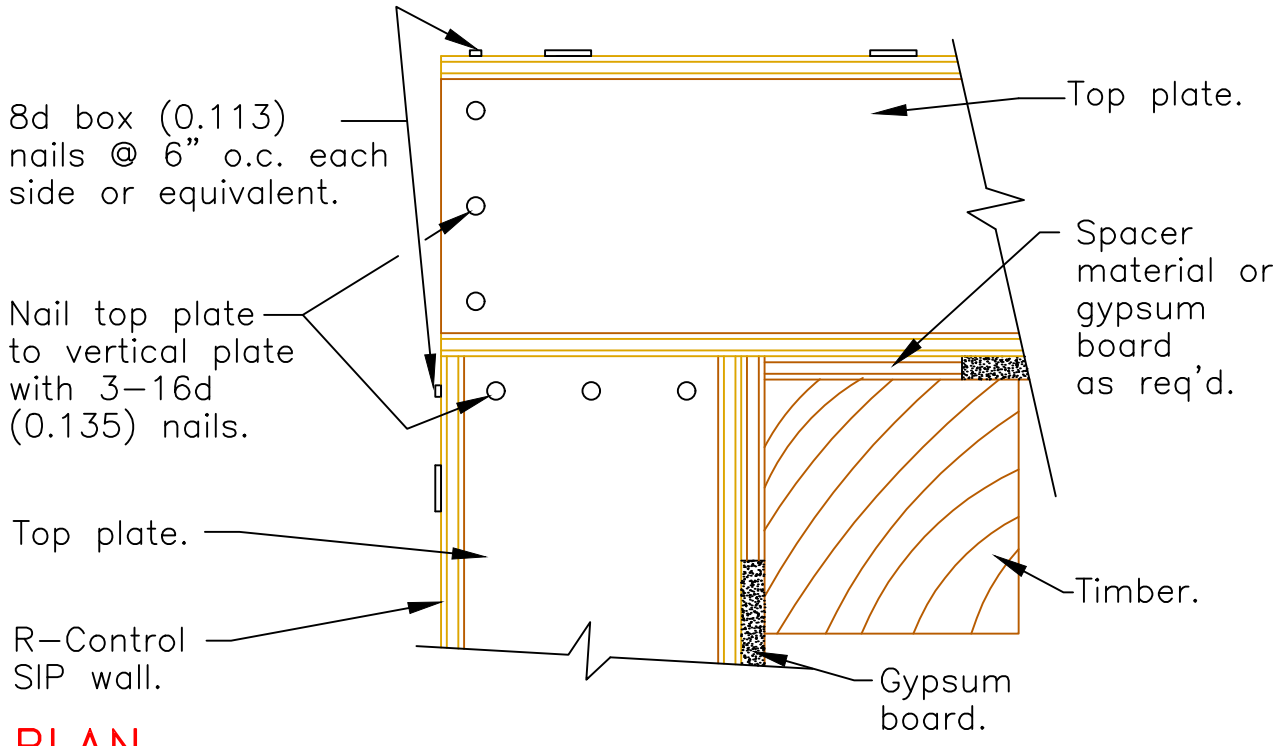
SECTION

Scale: NTS

Updated 6–15–20

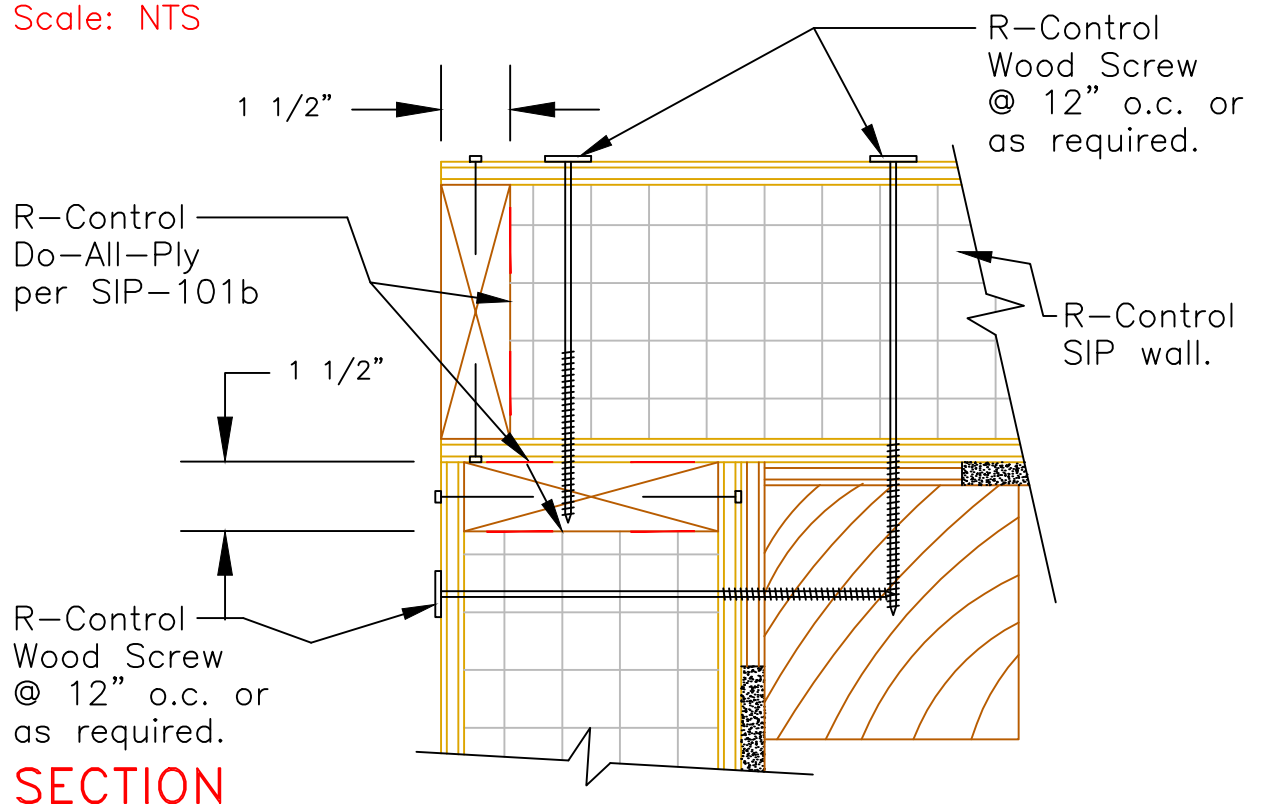
R–Control® SIP

TITLE:	NO.
Soffit Detail– Can Light	SIP–143a



PLAN

Scale: NTS



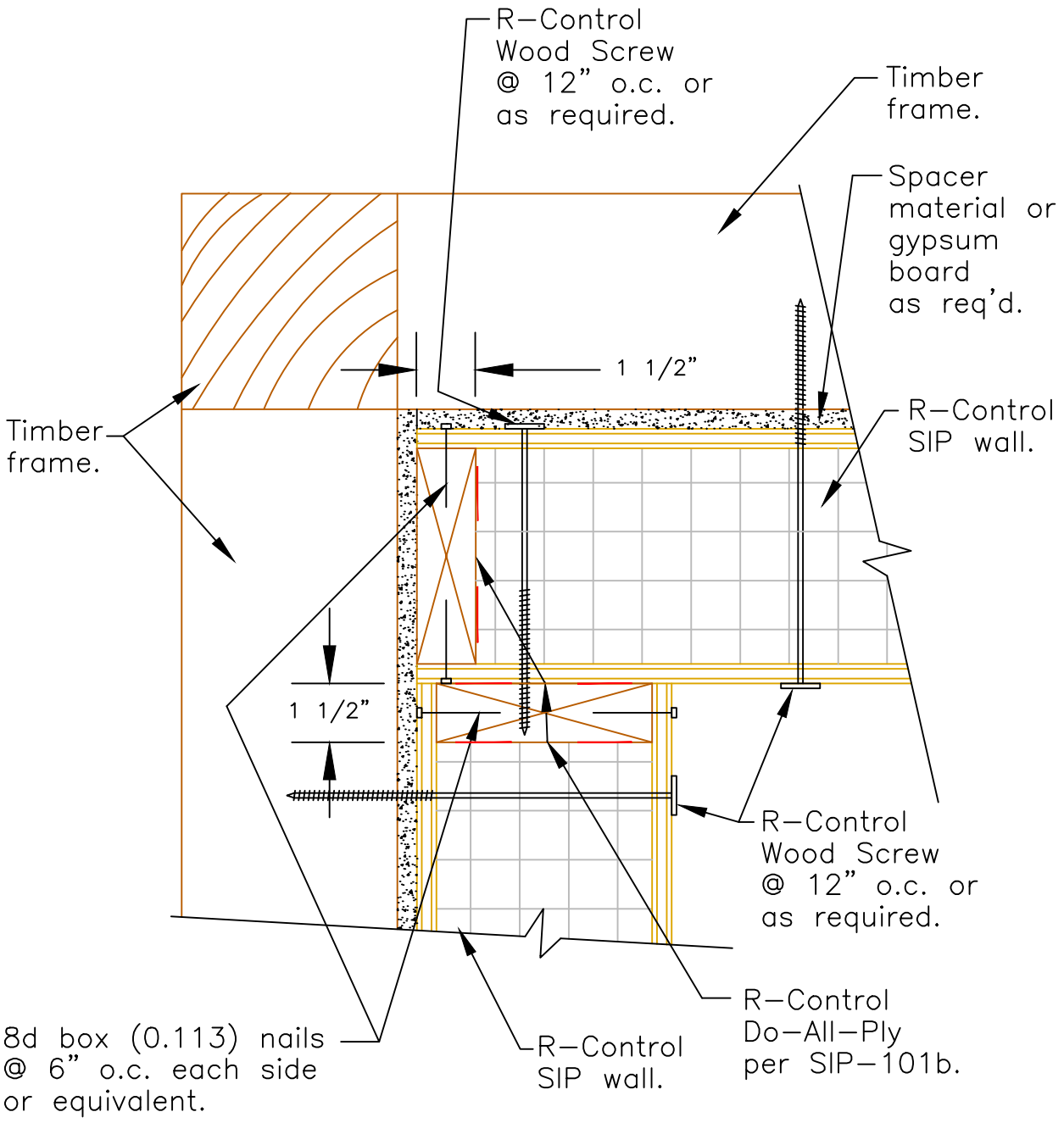
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Corner Connection	SIP–201



SECTION

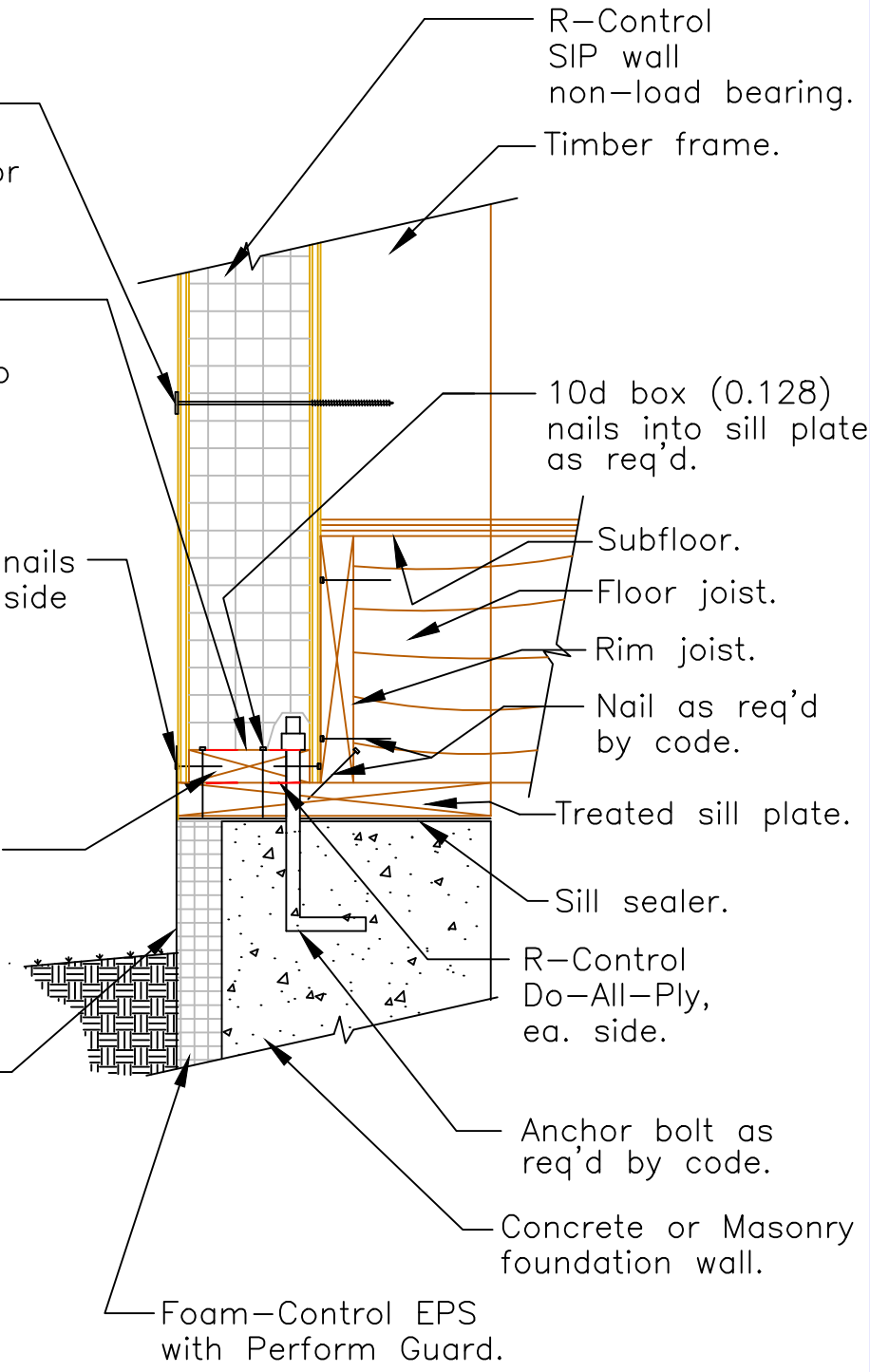
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: Reentrant Corner Connection	NO. SIP–202

Note: wall covering & water resistive barrier as req'd by code.



SECTION

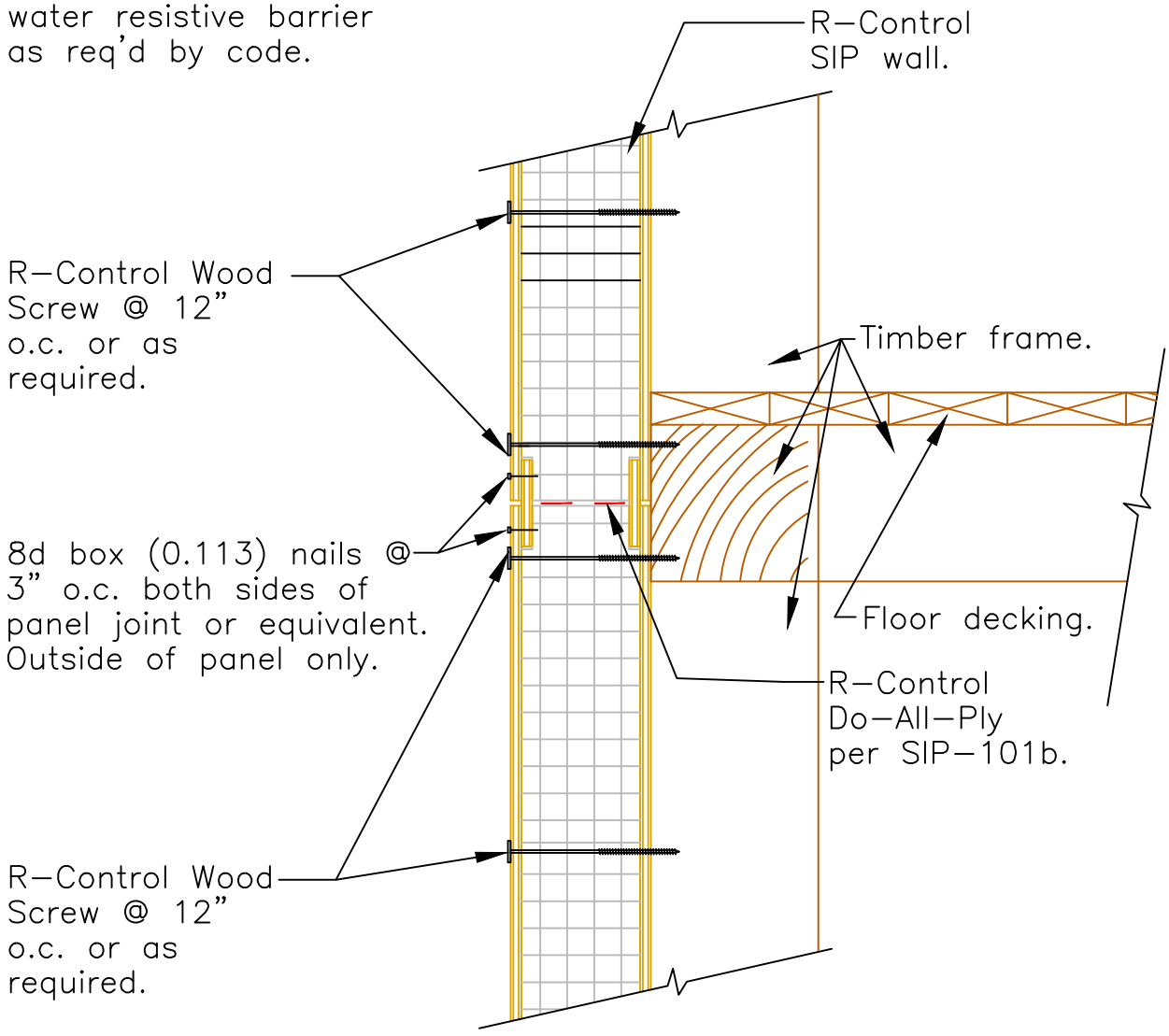
Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE:	NO.
Foundation Framing – Joist	SIP–203

Note: wall covering & water resistive barrier as req'd by code.



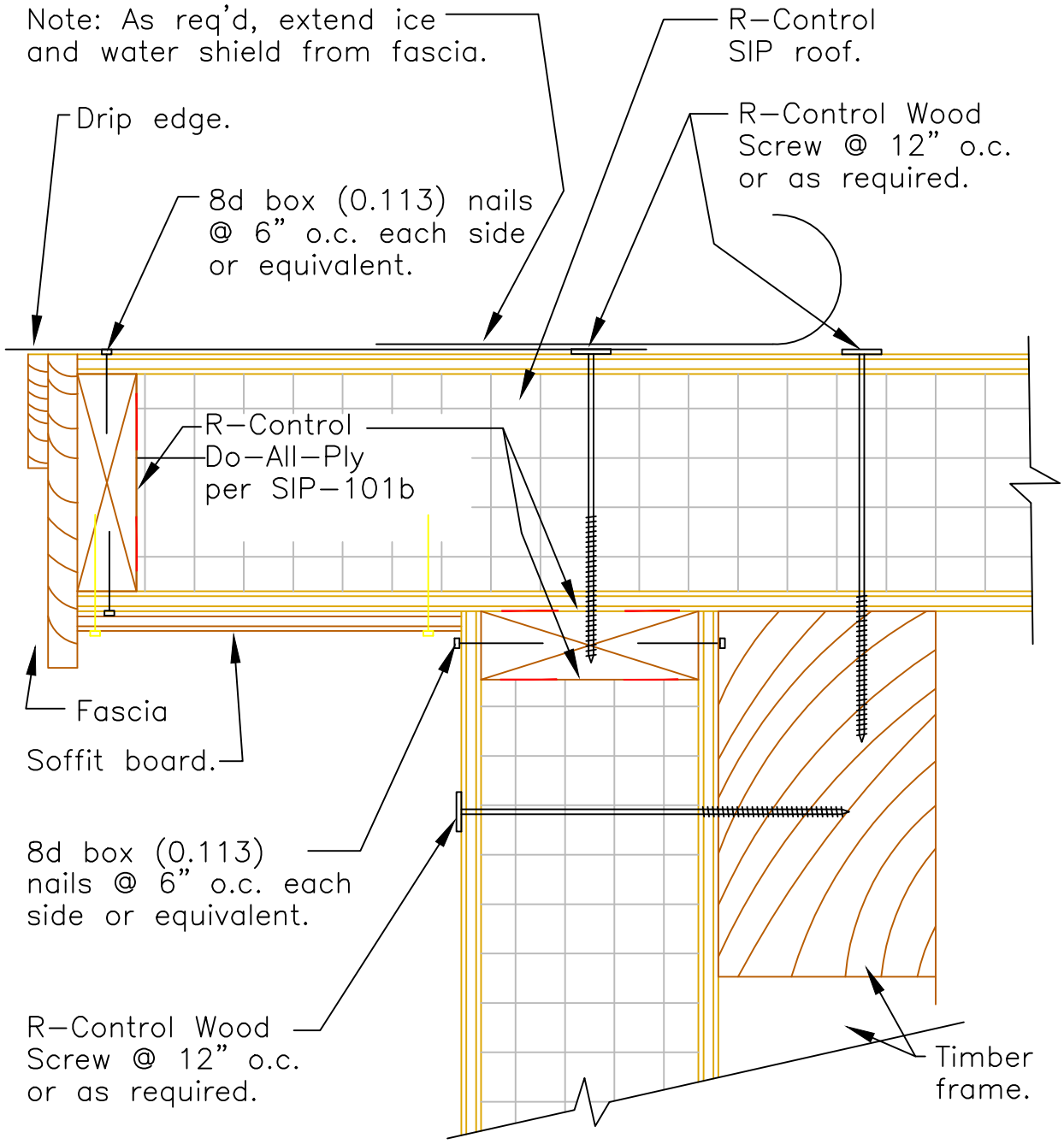
SECTION

Scale: NTS

Updated 6–15–20

R–Control® SIP

TITLE: SIP Wall at Timber Frame Floor	NO. SIP–204



See Technical Bulletin sip no. 2029 for cantilever capacities and panel limitations.

Note: roof covering & underlayment as req'd by code.

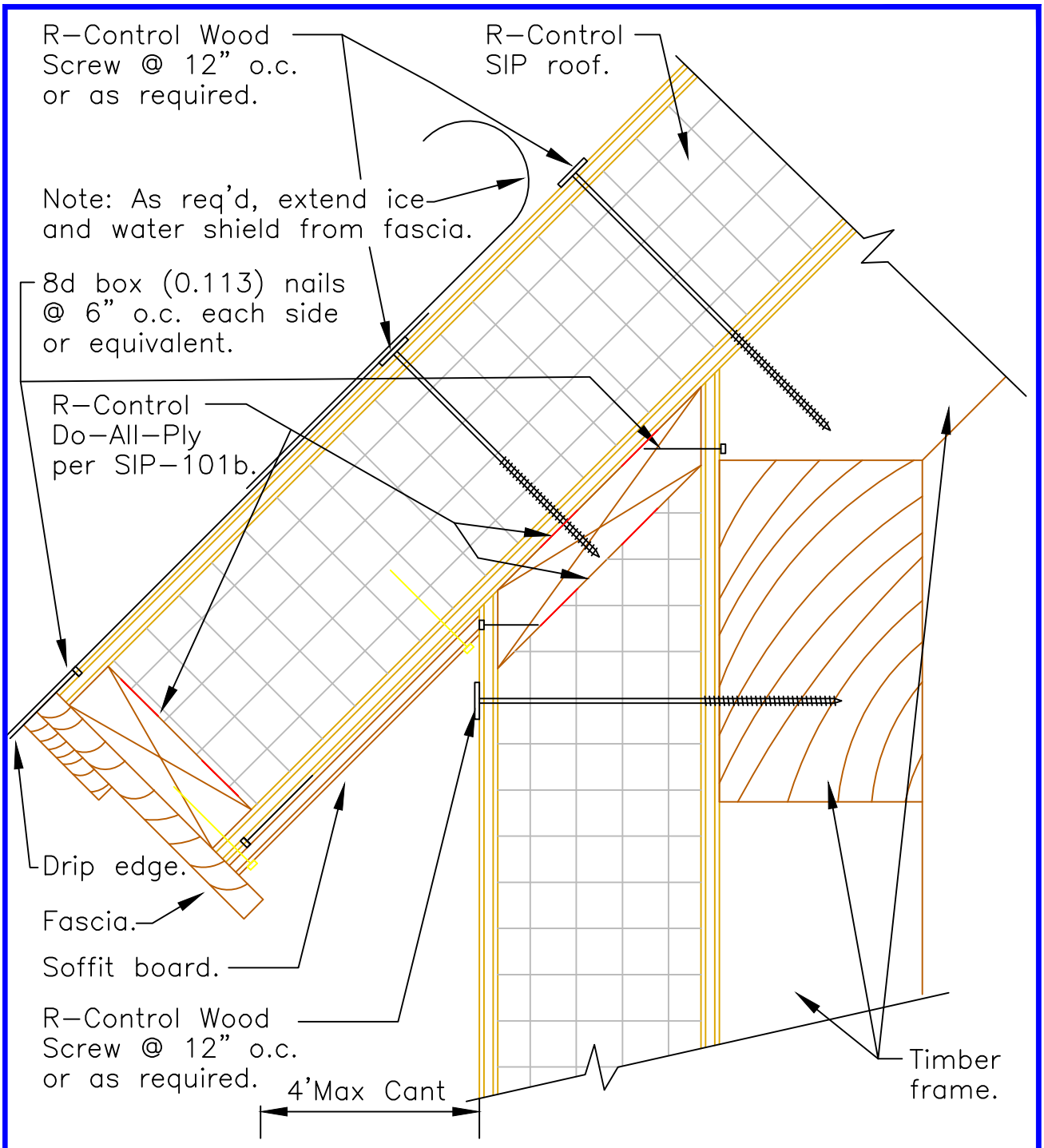
SECTION

Scale: NTS

Updated 6-15-20

R-Control® SIP

TITLE: Roof Gable Square Cut – Cant Panel	NO. SIP-205



See Technical Bulletin sip no. 2029 for cantilever capacities and panel limitations.

SECTION

Scale: NTS

Note: roof covering & underlayment as req'd by code.

Updated 6–15–20

R–Control® SIP

TITLE: Roof Eave Square Cut – Cant Panel	NO. SIP–206

SIP No. 2000

Subject: **Heat Recovery Ventilators**

Date: **November 2007 (Revised January 2015)**

Reducing air leaks in a structure is central to achieving maximum energy performance. Many building strategies such as house wraps, vapor retarders, rigid insulation sheathing, tapes, and sealants are designed to reduce air leakage. R-Control SIPs are one of the best building systems available to provide low air leakage and overall building energy efficiency.

Moisture, fumes from adhesives, smoking, and other gases and particulants can become trapped within the structure. When these pollutants accumulate to high levels they could potentially contribute to an unhealthy living environment.

Heat Recovery Ventilators (HRVs) allow a structure to remain efficient while also providing fresh air at a low operating cost. Indoor air pollutants are continuously being taken away and replaced with fresh air. This provides a healthier living environment while retaining energy savings.

A brief synopsis of how HRVs work to effectively improve indoor air quality follows:

What Is An HRV?

An HRV is a unit that can continually exchange stale inside air for fresh outside air, while also using the heat (or cold) from the exhaust air to raise or lower the temperature of the incoming air. A large percentage of the heat in the exhausted air can be recaptured. This efficiency allows a constant flow of fresh air, but doesn't require a separate heating unit to heat all the fresh incoming air.

What Installation is Required?

HRVs require some planning before construction. The main unit should be placed in a temperature controlled area, basement, mechanical room, etc. Ductwork is typically run from rooms such as bathrooms, laundries, and kitchens to the HRV. These areas are chosen for their typically high levels of odor and humidity. Insulated ductwork is then run from the HRV to the exterior of the building. A separate system of fresh air ductwork is run from the exterior of the building to the unit and continued to the fresh air drop, often a return air of a furnace.

How Do They Work?

Stale air is drawn from the bath, laundry, and kitchen to the HRV, and is ducted through the HRV to the outdoors. Meanwhile, fresh outside air is drawn to the HRV, then ducted to the inside fresh air drop point. As the two separate streams of air pass each other within the HRV, they are separated by a medium that provides a conductor for the heat to be exchanged from the hot air to the cold air. The incoming fresh air is warmed by the transfer of heat from the inside air and is then ducted into the living area or furnace air supply.

Excessive moisture can also be controlled with an HRV. As the air streams pass the medium, condensate will appear on the exhaust side of the medium. The condensate forms because the warm moisture-laden exhaust air cannot hold as much moisture after its heat has been drawn through the medium. The excess moisture is removed and drained away.

How Can They Benefit The Sunbelt?

In areas where warm, humid outside air exists, an HRV will allow fresh air to be introduced to the building while controlling the humidity level. The two airstreams will follow the same routes as before, but as they pass within the unit, heat is drawn from the warm, humid outside air. Its ability to hold moisture decreases as it cools. Condensate is left behind as before, except that the condensate forms on the opposite side of the medium. Thus, the fresh incoming air is cooled and dried before being introduced into the living area. The air exchanger must be equipped with a desiccant system for sunbelt areas.

R-Control Warranty and Ventilation

The R-Control warranty requires that a mechanical ventilat-

ing system be installed in the R-Control structure in order for the R-Control warranty to be valid.

The humidity level in a structure should be controlled to <40% in winter and <60% in summer. Higher levels of moisture could lead to condensation problems.

The information in this bulletin is being provided to assist you in achieving proper design, installation and operation. Please consult a local HVAC engineer and contractor, or reference ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) Standards for design and installation of HRVs as part of a complete HVAC design. Refer to Technical Bulletin sip no. 2051 for additional information on HVAC system design.

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(SIPS)

SIP No. 2001

Subject: **Electrical Wiring**

Date: **November 2007 (Revised January 2015)**

R-Control SIPs can be wired using standard “Romex” type wire that is labeled NM-B, having sufficient wire gauge size required for the anticipated maximum amperage loading designed for the structure.

UL tests and lists non-metallic sheathed cable under test method UL-719.

UL NM-B has a maximum conductor temperature of 90°C (194°F) and is labeled NM-B. The conductor temperatures under normal conditions will not exceed 60°C, due to the restrictions on amperage loading, and is suitable for use in R-Control SIPs.

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(SIPS)

SIP No. 2008

Subject: **Long Duration Structural Loads**

Date: **November 2007**

R-Control SIPs have been tested to determine the effects of long duration loading.

A 4-1/2" thick 4' X 10' R-Control SIP was placed on supports at the 4' ends of the panel, creating a 10' span. The R-Control SIP was uniformly loaded to full design load @ L/180 continuously for 30 days (Refer to R-Control SIP Load Design Chart #1). During the 30 day period, mid-span deflection was monitored daily. After 30 days, the load was removed and the mid-span deflection was measured immediately and again 24 hours later. This determined the R-Control SIPs recovery and permanent set. After the 24 hour recovery period, the R-Control SIP was again loaded to full design load for a 30 day monitoring period, which included recovery at the end of the test.

After reviewing the data from the test report the following conclusions were drawn:

The deflections for both 30 day periods were similar.

The deflection for the second thirty day period showed a maximum deflection of .703 inches, slightly over the L/180 deflection value of .667 inches.

When the R-Control SIP was unloaded after each 30 day loading period, the R-Control SIP recovered to within approximately 1/8" of the original position.

This testing demonstrates the performance of R-Control SIPs under long duration loading.

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(SIPS)

SIP No. 2010

Subject: **OSB Orientation**

Date: **November 2007 (Revised January 2015)**

Oriented Strand Board (OSB) as the name implies is manufactured in a process that results in properties that are dependent upon the orientation of the wood strands. An OSB panel is stronger in the machine direction versus the cross machine direction. The machine direction is easily discernible on OSB, as the majority of the strands visible will be parallel to the machine direction. Manufacturers indicate with markings which direction the machine direction is on a panel.

R-Control SIPs are normally used in the machine direction. For example, a 4' x 10' R-Control SIP is manufactured with the OSB machine direction parallel to the 10' length. This ensures the performance of R-Control SIPs as shown in the R-Control SIP Load Design Charts.

In limited wall applications, R-Control SIPs can be used with the machine direction of the OSB perpendicular to SIP wall height. Please refer to R-Control SIP Load Design Chart #2B and #4.

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SIP No. 2012

Subject: **Impact Test**

Date: **November 2007**

Impact tests have been conducted on R-Control SIPs. The tests consists of supporting a panel on its short ends, and dropping a 60 pound, 10" diameter, lead shot filled leather bag from various heights.

A 4-1/2" thick 4' x 10' R-Control SIP was tested. A 60 pound bag was dropped from 1-1/2 feet which equals a force of 90 foot pounds - no damage occurred. Dropping the 60 pound bag from 4 feet applied an impact force of 240 foot pounds, again causing no damage.

To further demonstrate the strength of R-Control SIPs, the same 60 pound bag was dropped from a height of 10 feet to create a force of 600 foot pounds of impact.

The R-Control SIP showed no signs of damage even after having been subjected to repeated impact testing.

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R SIPS CONTROL

SIP No. 2013

Subject: **Formaldehyde Levels**

Date: **November 2007 (Revised January 2015)**

The Oriented Strand Board (OSB) used as the facings for R-Control SIPs include very low levels of formaldehyde. The formaldehyde is present in very small amounts due to phenol formaldehyde adhesives which form the structural bond between the wood strands.

Note: Formaldehyde related concerns in wood products are associated with some *urea* formaldehyde adhesives but not with *phenol* formaldehyde adhesives. OSB contains no added *urea* formaldehyde resin.

APA, the Engineered Wood Association, has researched the formaldehyde emissions from APA trademarked products thoroughly and has conducted tests using a large-scale test chamber method for measuring formaldehyde emissions. In this test, OSB is placed within a heated chamber and monitored for formaldehyde emission on both newly produced OSB and OSB several months after production. The OSB concentration within the test chamber was significantly greater than that utilized in a typical structure.

The results of testing by the APA and other laboratories are that less than 0.1 parts per million (ppm) are emitted within the large scale chamber. This is for both new and aged OSB. Formaldehyde that is emitted by OSB is below HUD standards for emissions.

Attached, please find a bulletin authored by the APA concerning formaldehyde and engineered wood products.

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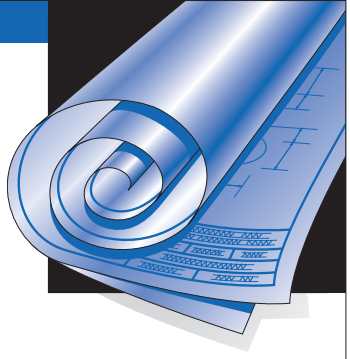


Formaldehyde and Engineered Wood Products

Number J330A
June 2013

Formaldehyde is a naturally occurring organic airborne chemical that can be synthesized for use in certain industrial uses such as adhesives used for wood products and in the manufacture of many other household goods such as medical products, carpets and cosmetics. Because elevated levels of formaldehyde may lead to health concerns, regulations exist to limit exposure. These include limits on formaldehyde emissions from some types of wood products. In addition, some green building specifications create preference for low emitting products. This Technical Note provides facts on formaldehyde and regulations applicable to engineered wood products.

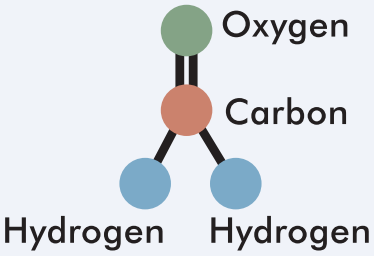
FORMALDEHYDE

At room temperature, formaldehyde is a colorless gas which has a pungent smell at higher concentrations. Small amounts of formaldehyde are naturally produced by humans, animals and plants and may be emitted by fruits, vegetables, trees and raw wood. Formaldehyde is naturally present in outdoor air. Compared to rural air, urban outdoor air concentrations of formaldehyde are typically higher due to human activities such as traffic and other combustion sources. Indoor air may contain formaldehyde from products that emit formaldehyde as well as from combustion sources such as cigarette smoking, cooking or heating fuels. Table 1 shows levels of formaldehyde exposure measured from some typical household activities.

When formaldehyde is emitted into air, it is broken down into carbon dioxide, usually within hours. Formaldehyde is naturally attracted to water, where it is readily absorbed and breaks down. Formaldehyde does not build up in humans or plants. Further information on formaldehyde is cited in the reference section of this publication.

WHAT IS FORMALDEHYDE?

Formaldehyde is a simple chemical made of hydrogen, oxygen, and carbon. It occurs naturally, and is the product of many natural processes. It is made by human bodies and is in the air. Plants and animals also produce formaldehyde. It is in many fruits and vegetables, and is a byproduct of cooking certain vegetables, such as brussel sprouts and cabbage. This chemical breaks down quickly and is metabolized to simple carbon dioxide. Our bodies readily break down the low levels to which people are exposed everyday.



Formaldehyde is also a product from combustion associated with the burning of kerosene and natural gas; automobile emissions; and cigarettes. It is an important industrial chemical used in the manufacture of numerous consumer products, including permanent press fabrics and even toothpaste.

APA

TABLE 1

VARIOUS FORMALDEHYDE EXPOSURE LEVELS

Source/Description	Expected Exposure, parts per billion (ppb)	Footnote (see below)
Painting a 12 ft x 12 ft x 9 ft room	968	(a)
Wallpapering a 12 ft x 12 ft x 9 ft room	2051	(a)
Walk-in closet with 20 permanent press shirts (washed)	231	(b)
Broil fish using a gas or electric range	105	(c)
Gas range in self-clean mode	337	(c)
Electric range in self-clean mode	183	(c)
One cigarette in small room	49	(d)
Human breath	Around 2	(e)
Typical indoor air	10-30	(f)
Urban air	5-100	—
Rural air	0.8-5	—
Raw wood (emission chamber)	20	—

(a) Calculated from data taken from the Batelle report for the California Air Resources Board, *Determination of Formaldehyde & Diisocynate Emission from Residential Indoor Sources,* Contract No. 93-9315, Final Report 1996.

(b) This example is calculated from data for washed permanent press shirts from the Battelle report for the California Air Resources Board, *Determination of Formaldehyde & Diisocynate Emission from Residential Indoor Sources,* Contract No. 93-9315, Final Report 1996.

(c) *Indoor Air Quality Residential Cooking Exposures Final Report,* prepared for the California Air Resources Board, CARB Contract Number 97-330, prepared by Ray Fortmann, Peter Kariher, and Russ Clayton, ARCADIS, Geraghty & Miller, Inc, November 30, 2001.

(d) Reference taken from the *International Programme on Chemical Safety, Environmental Health Criteria 89* published under the joint sponsorship of The United Nations Environment Programme, The International Labour Organization, The World Health Organization, Geneva, 1989.

(e) *Mass Spectrometric Profile of Exhaled Breath* – field study by PTR-MS, Berthold Moser, Florian Bodrogi, Guenther Eibl, Matthias Lechner, Josef Rieder, Philipp Lirk, 2004.

(f) *Interim Findings on Formaldehyde Levels in FEMA-Supplied Travel Trailers, Park Models and Mobile Homes* from the Centers for Disease Control and Prevention, February 29, 2008.

FORMALDEHYDE STANDARDS AND REGULATIONS OF WOOD PRODUCTS

Because some adhesives used to produce composite wood products contain formaldehyde, limits on emissions from pressed wood products have been developed in product standards and state and national regulations. In the U.S., formaldehyde regulations of composite wood products began in the early 1980s for particleboard and decorative plywood panels used in mobile homes (HUD CFR 3280.308). Data indicated that emission levels from moisture resistant phenol formaldehyde adhesives used for structural plywood were very low; therefore the HUD regulations explicitly excluded plywood made with phenol formaldehyde adhesives.

This Technical Note provides information on formaldehyde regulations that apply to U.S. structural engineered wood products. For purposes of this Technical Note, engineered wood products are defined as wood products recognized in U.S. model code for structural applications. Because the vast majority of U.S. construction involves site-built conditions where exposure to weather is expected, the standards for engineered wood products require moisture resistant adhesive systems. The inherent structural and moisture durability of these adhesives systems naturally results in very low formaldehyde emissions. Table 2 provides definitions of the standards, adhesives systems and applications for engineered wood products.

TABLE 2

DESCRIPTION OF U.S. ENGINEERED WOOD PRODUCTS

U.S. Engineered Wood Products

Product	Applicable Standard(s)[a]	Adhesives	Uses
Structural Plywood	*U.S. Voluntary Product Standard PS 1-09 Structural Plywood, U.S. Voluntary Product Standard PS 2-10 Performance Standard for Wood-Based Structural-Use Panels,* CSA O121 *Canadian Douglas-fir Plywood* and CSA O151 *Canadian Softwood Plywood*	Phenol formaldehyde	Sheathing for walls, floors, roof and other industrial and construction uses
Oriented Strand Board (OSB)	*U.S. Voluntary Product Standard PS 2-10 Performance Standard for Wood-Based Structural-Use Panels,* and CSA O325, *Construction Sheathing*	Phenol formaldehyde, pMDI[b]	Sheathing for walls, floors, roof and industrial uses
Structural Glued Laminated Timbers	ANSI A190.1 *Structural Glued Laminated Timber* and CSA O177 *Qualification Code for Manufacturers of Structural Glued Laminated Timber*	Phenol resorcinol formaldehyde (PRF), melamine, polymer isocyanate[c]	Beams, headers, columns, trusses
Prefabricated Wood I-joists	ASTM D5055 *Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists*	Phenol formaldehyde, melamine, polymer isocyanate[d]	Floor joists, roof rafters
Structural Composite Lumber (SCL)[e]	ASTM D5456 *Standard Specification for Evaluation of Structural Composite Lumber Products*	Phenol formaldehyde, pMDI[f]	Beams, headers, studs, flanges of I-joists
Specialty Products – Cross Laminated Timber (CLT), Rim Board, Engineered Wood Siding	ANSI/APA PRG 320-2011 *Standard for Performance-Rated Cross-Laminated Timber,* ANSI/APA PRR-410 *Standard for Performance-Rated Engineered Wood Rim Boards,* ANSI/APA PRP 201 *Standard for Performance-Rated Engineered Wood Siding, and* ICC ES AC 321	Phenol formaldehyde, pMDI	Specialty construction uses

(a) Complete citation of standards is provided in the reference section at the end of this publication

(b) pMDI = Polymeric Methylene Diphenylene Diisocyanate

(c) ANSI A190 adhesives must also meet ANSI 405 and ASTM D2559

(d) Adhesives used to adhere components must meet ASTM D2559

(e) SCL includes laminated veneer lumber (LVL), parallel strand lumber (PSL), oriented strand lumber (OSL) and laminated strand lumber (LSL)

(f) Adhesives must meet ASTM D2559 and D5456

U.S. FORMALDEHYDE REGULATIONS APPLICABLE TO OTHER WOOD PRODUCTS

1. U.S. HUD Manufactured Home Construction and Safety Standard (CFR 3280.308)

This standard specifies a 0.20 ppm emission limit for plywood and a 0.30 ppm limit for particleboard when tested with the ASTM E1333 Large Chamber Method. The intent was to regulate the specific nonstructural panel types. Testing during development of the regulation confirmed PS 1 structural plywood readily meets the plywood emission limit; therefore the regulation explicitly exempts phenolic bonded plywood from ongoing testing and certification. Therefore, **the engineered wood products in Table 2 are either not covered by, or are explicitly exempt from, the HUD regulation.**

2. California Air Resources Board (CARB) Air Toxic Control Measure (ATCM) for Composite Wood Products

This regulation was developed by a division of the California EPA and took effect in 2009. The scope of the standard covers particleboard, MDF and hardwood plywood. The demonstrated low emission levels of the engineered wood products listed in Table 2, led the **CARB regulation to explicitly exempt structural plywood specified to PS 1, structural panels specified to PS 2, OSB specified to PS 2, structural composite lumber specified to ASTM D5456, structural glued-laminated timber specified to ANSI A190.1 and prefabricated wood I-joists specified to ASTM D5055.**

3. U.S. Formaldehyde Standards for Composite Wood Products Act

This Federal Act was signed into law July, 2010 and instructs the EPA to publish implementation rules by January 2013. The act mirrors the standard previously established by the California Air Resources Board and it **explicitly exempts structural plywood specified to PS 1, structural panels specified to PS 2, OSB specified to PS 2, structural composite lumber specified to ASTM D5456, structural glued-laminated timber specified to ANSI A190.1 and prefabricated wood I-joists specified to ASTM D5055.**

INTERNATIONAL REGULATIONS FOR ENGINEERED WOOD PRODUCTS

Wood product standards in other countries often group structural and nonstructural panel types into a common standard, whereby the moisture resistance and formaldehyde emission characteristics are evaluated to specific criteria. Some U.S. Engineered Wood Products have been evaluated to these international formaldehyde emission standards. Following are summary conclusions.

1. Japanese Agricultural Standards (JAS). The JAS standards use the JIS A1460 test method that measures the emissions for wood products when enclosed in a desiccator. The most stringent formaldehyde limit is the F**** designation whereby the product must have average emission level below 0.30 mg/l. U.S. structural plywood (PS 1 or PS 2), OSB (PS 2), structural glued-laminated timber (ANSI A190.1) and Laminated Veneer Lumber (LVL) easily and consistently meet the F**** requirements when evaluated to the respective JAS standard. This formaldehyde regulation is considered one of the most stringent limits in the world.

2. OSB and plywood panels sold into Europe for construction uses must meet the specific product standard for the panel type (such as EN 300 for OSB and EN 636 for plywood) and the general panel standard EN 13986 used for construction applications throughout the European Union. The European standard for formaldehyde emissions is EN 717-1 which uses a one cubic meter chamber to measure emission levels. U.S. structural plywood (PS 1 or PS 2) and OSB (PS 2) easily meet the 0.124 mg/m^3 limit of the E1 class, the most stringent formaldehyde class based on EN 717-1.

3. Laminated Veneer Lumber (LVL), is regulated in Australia by evaluation of formaldehyde emissions using the AS/NZS 4357.4 test method. This method is very similar to the JIS A1460 test method used in the JAS standards. U.S. LVL made to ASTM D5456 has easily and consistently met the 0.5 mg/l limit which qualifies it for the E_0 rating, the most stringent rating in AS/NZS LVL standards.

In summary, when tested to international formaldehyde emission limits, U.S. Engineered Wood Products have consistently met the most stringent emission regulations.

GREEN BUILDING SPECIFICATIONS

Green building rating systems often include criteria to address indoor air quality goals, including mitigation of formaldehyde concentrations or formaldehyde-emitting products. Some of these specifications are relevant to Engineered Wood Products as follows:

1. LEED 2009

This popular rating system uses a point rating system for green buildings. Indoor Environmental Quality Credit 4.4 covers "Low-Emitting Materials – Composite Wood and Agrifiber Products." The section criteria specifies products that "contains no added urea formaldehyde resin". All of the products within Table 2 meet the criteria for this section and thereby are eligible for the point. As with other green building rating systems, final approval is subject to verification by the designer or approved professional that assesses LEED compliance.

2. 2012 National Green Building Standard ICC 700-2012

This national green rating program was developed as a consensus standard and adopted by the International Code Council as a reference standard for adoption by member code groups for residential construction. The criteria for formaldehyde emissions from composite wood products are similar to the LEED 2009 and CARB. **The Engineered Wood Products listed in Table 2 are eligible for the points in Section 901.4(5) which require that a minimum of 85 percent of material within the product group is manufactured from composite wood products that contain no added urea-formaldehyde or are in accordance with the CARB regulations.**

3. CALGreen

This standard has been adopted into California State building law as a method to verify structures meeting state environmental goals for buildings. The third edition of CALGreen (effective July 1, 2012) requires all new buildings (residential and nonresidential) as well as all remodels and additions to existing nonresidential buildings exceeding 2,000 square feet or $500,000 must meet the mandatory requirements of CALGreen. CALGreen specifies that composite wood products used in the interior or the exterior of a building meet the CARB regulations. Similar to the CARB regulation, all structural engineered wood products are explicitly exempt from the requirement. **The engineered wood products in Table 2 are not within the scope of the CALGreen formaldehyde limits and are therefore permitted – (see also the above section on CARB).**

REFERENCES

Engineered Wood Product Standards

U.S. Voluntary Product Standard PS 1-09 Structural Plywood, Form L870

U.S. Voluntary Product Standard PS 2-10 Performance Standard for Wood-Based Structural-Use Panels, Form S350

ANSI A190.1 *Structural Glued Laminated Timber*

ANSI 405 *Standard for Adhesives for Use in Structural Glued Laminated Timbers*

ANSI/APA PRG 320-2011: *Standard for Performance-Rated Cross-Laminated Timber,* Form PRG-320

ANSI/APA PRR-410: *Standard for Performance-Rated Engineered Wood Rim Boards,* Form PRR-410

ASTM D2559 *Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions*

ASTM D5456 *Standard Specification for Evaluation of Structural Composite Lumber Products*

CSA O121 *Canadian Douglas-fir Plywood*

CSA O151 *Canadian Softwood Plywood*

CSA O177 *Qualification Code for Manufacturers of Structural Glued Laminated Timber*

CSA O325 *Construction Sheathing*

*ASTM publications are available at www.astm.org

Formaldehyde Regulations

HUD: standard is available at www.gpo.gov/fdsys/pkg/CFR-2010-title24-vol1/content-detail.html (search for cfr 3280, Manufactured Housing Construction Safety Standard)

CARB: www.arb.ca.gov/toxics/compwood/compwood.htm

EPA Federal Act: www.epa.gov/oppt/chemtest/formaldehyde/

CALGreen: www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf

Formaldehyde Guidance

EPA Integrated Risk Information System: www.epa.gov/iris/subst/0419.htm

U.S. EPA: www.epa.gov/iaq/formaldehyde.html

U.S. Consumer Product Safety Commission: www.cpsc.gov/CPSCPUB/PUBS/725.html

ACC website: www.formaldehydefacts.org

Formaldehyde and Engineered Wood Products

We have field representatives in many major U.S. cities and in Canada
who can help answer questions involving APA trademarked products.
For additional assistance in specifying engineered wood products, contact us:

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Form No. J330A/Revised June 2013

APA

REPRESENTING THE ENGINEERED WOOD INDUSTRY

SIP No. 2015

Subject: **Asphalt Shingles**

Date: **February 2009 (Revised January 2015)**

GAF, a leader in the manufacture of shingles, has examined the use of their asphalt shingles with R-Control SIPs and have authored the attached Technical Advisory Bulletin. GAF has served notice that their products applied directly over R-Control SIP substrates are acceptable and that no restrictions will be placed on their warranty.

GAF shingles are recommended as the preferred asphalt shingle product for use with R-Control SIPs.

When using shingles other than GAF, please contact your asphalt shingle manufacturer to clarify their warranty coverage when applied over R-Control SIP substrates.

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TECHNICAL ADVISORY BULLETIN

To: GAF Residential Sales, GAF Contractors, GAF Field Services

From: Technical Services Department

Date: 07/31/2014

No: TAB-R 2011-101-**R1**

Subject: Acceptable Substrate For GAF Asphalt Shingle Applications

Why Is The Substrate So Important?

A shingle roof substrate is the "foundation" for your roofing system. The substrate provides the smooth structural base on which asphalt shingles are installed. If the substrate is inferior, the integrity of the roofing system may be compromised.

What's Considered A "Standard Deck" For Shingles?

Standard decks include:

- **Plywood or OSB…** 3/8" minimum thickness, exterior grade as recommended by APA – The Engineered Wood Association
- **Wood planking…** Nominal 1" thick (min.) x 6" wide (max.) wood planking, with a maximum 1/8" spacing at the ends and sides

Note: For existing older installations, if spacing is > 1/8" ≤ 1/4", install a double layer of underlayment. If the spacing is greater than 1/4" install a layer of 3/8" minimum thickness APA labeled exterior grade plywood or OSB over the wood planking.

Can The Other Substrates Be Used Without Prior Approval?

When properly installed using the fasteners and construction design recommended by the deck manufacturer, the following substrates may be used:

- GAF Cornell ThermaCal® 1 Ventilating Roof Insulation Panels
- GAF Cornell ThermaCal® 2 Ventilating Roof Insulation Panels
- Loadmaster Shingle Deck
- Tech Shield or equivalent Radiant Barrier Decking systems with vapor permeable, perforated foil backing
- Ainsworth's Thermastrand Radiant Barrier
- 2" Minimum Homasote or Thermasote (Homasote Co.)
- 2" Minimum Span Rock Gypsum Plank (USG) – fasteners must have a minimum 40 lbs. of pullout
- Vented-R (Atlas)
- Vented Nail-Line (Apache)
- Hunter Vented Nail Base
- Foam-Control Nail Base (AFM Corp. Licensed Mfr.)
- Tectum III, Tectum E and Tectum NS (Tectum, Inc.)
- Huber Zip Deck System – A waterproof underlayment such as StormGuard® leak barrier must be used at eaves as required by code or for certain warranty considerations and additional underlayment may be needed on slopes less than 4:12 or on re-roofing projects.

Note: GAF shingles are **not** approved for applications directly over any insulation or fiberboard.

What About Structural Insulated Panels (SIP)?

SIP may be use when:

- Approved/rated by UL for use as a shingle roof deck
- With the minimum thickness of plywood or OSB as recommended above installed in accordance with the SIP panel manufacturers recommendations for use as a shingle roof deck

What About Codes?

Roof decks must meet local codes… and approval from the local building department should be obtained to confirm the deck construction and ventilation meets local code requirements.

Is The Substrate Or Workmanship Covered Under GAF Warranties?

Only GAF Cornell ThermaCal® 1 & 2 Ventilating Roof Insulation Panels are covered by GAF under the GAF Cornell ThermaCal® Nail Base Roof Insulation Limited Warranty. See this limited warranty for complete coverage and restrictions.

All substrates must be installed in accordance with the deck manufacturer's specifications. Roof deck installation instructions, including the need for a vapor retarder, for specific deck types must be obtained from the respective manufacturer. GAF does not warrant the installation method, the performance of the decking or problems with the shingles caused by the deck or substrate, including but not limited to: physical movement, thermal bridging and/or moisture migration at the joints.

Where Can I Get More Information?

GAF Technical Services can assist you… with these and other questions you may have regarding your new roof installation. GAF Technical Services can be contacted **at 800-ROOF-411** (800-766-3411). Also, the GAF website is a great resource for just about any question you may have or for additional information you may require. Please visit: www.gaf.com.

Residential

SIP No. 2016

Subject: **Shear Walls**

Date: **November 2007 (Revised January 2015)**

Racking shear tests have been conducted on R-Control SIPs to demonstrate the capabilities of R-Control SIPs as shear walls.

8' x 8' walls were constructed with R-Control SIPs connected with a surface spline joint. The wall assembly was subjected to racking shear loads as specified by ASTM E 72. The 8' long R-Control SIP wall assembly resisted an average ultimate load of 8357 pounds. This equals a loading of 1045 plf.

A design shear of 335 plf is recommended based upon the average ultimate divided by a factor of safety of three. In addition, the 335 plf result is less than 1/8" deflection as required by the ICC ES acceptance criteria for sandwich panels.

The design value of 335 plf is for standard applications following standard recommended R-Control SIP details.

Design shear values up to 920 plf can be obtained using additional fasteners. Please refer to R-Control SIP Load Design Chart #6 for additional information.

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R-SIPS CONTROL

SIP No. 2017

Subject: **Windspeed vs Pressure**

Date: **November 2007**

R-Control SIP structures can be designed to resist most wind loading conditions. The chart contained in this bulletin can be used as an estimate for wind loading, based upon wind speed.

The formula for approximating pressure is $p=0.00256w^2$ or the constant of 0.00256 times the windspeed squared. The graph presents this formula. It should be noted that the graph is based upon atmospheric pressure of 14.7 psi, a temperature of 60^0F and air which is at 0.0764 lbs/ft^3. Project values will vary with building design, elevation, atmospheric conditions and geographic location.

EXAMPLE:

Windspeed of 135 mph.

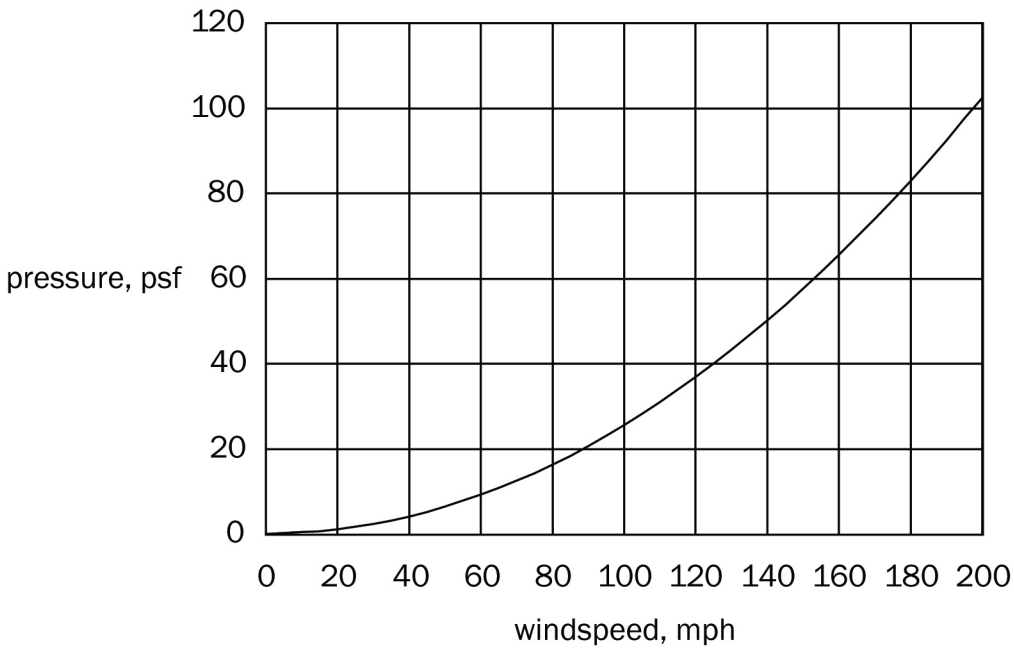
$p=0.00256 \cdot (135 \text{ mph})^2$

$p=0.00256 \cdot 18225$

$p=46.6$ lbs/ft^2

Information for this bulletin was obtained from Farm Structures, by H.B. Barre L.L. Samett. The graph and formula are to be used for approximating only. As always, the building plans and the calculations associated with this design should be reviewed by a registered design professional.

WINDSPEED vs. PRESSURE



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SIP No. 2020

Subject: **Combustion Products**

Date: **November 2007**

R-Control SIPs exhibit code required fire-performance as confirmed through extensive fire testing. These tests include ASTM E 84, ASTM E 119, UL 263, UL 1715, and UL 1256. These test are designed to measure fire resistance but are not meant to provide a hazard assessment. This bulletin provides basic information on the combustion products of R-Control SIPs.

R-Control SIPs are manufactured from components that are organic in composition. When organic compounds burn, the major combustion by-products generated are Carbon Monoxide (CO) and Carbon Dioxide (CO_2). These gases are the primary by-products in most fires.

R-Control SIPs, when sheathed with gypsum board, meet or exceed the requirements for fire safety as mandated by building codes. However, should an R-Control SIP become involved in a fire situation, the combustion gases given off are similar to those produced through the combustion of common building materials such as wood.

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SIP No. 2021

Subject: SIP Fasteners

Date: November 2007

R-Control Wood Screws and R-Control Metal Fasteners are available from your R-Control SIP supplier for attachment of R-Control SIPs to wood or metal substrates. These screws were developed to provide an engineered fastener to meet the needs of R-Control SIP installation.

Please find attached engineering properties for the R-Control Wood Screw, Metal Fastener, and Light Duty Metal Fastener. The properties include withdrawal, shear, pull through, and tensile strength.

The values provided for the R-Control Screws and Fasteners are maximum values. As determined by the project architect/engineer, appropriate safety factors should be used in design.

Wood Screw

R-Control Wood Screws are used to attach R-Control SIPs to wood structural members and substrates.

Metal Fastener

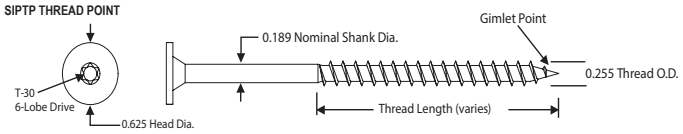
R-Control Metal Fasteners are used to attach R-Control SIPs to metal structural members and substrates. R-Control Heavy Duty Metal Fasteners can self drill into 3/16" steel without pilot hole predrilling. Installation is direct and fast - no wood nailers needed. This eliminates the need for wood nailers that would otherwise be required for the wood screw in metal building components. This results in time savings for the contractor and material savings for the building owner.

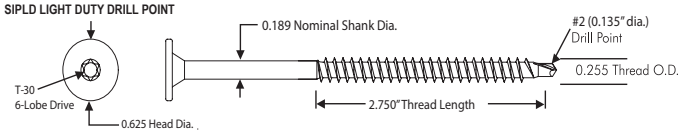
The metal fastener should be driven with a low rpm (<1500 rpm) high torque drill. Firm but not excessive pressure should be applied. This allows the drill point to engage the surface of the metal and drill through. Excessive pressure and/or rpm will dull the drill point and render the fastener ineffective.

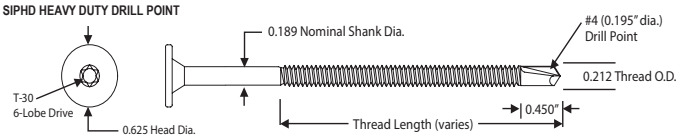
Metal Fastener - Light Duty

R-Control also supplies a Light Duty Metal Fastener.

R-Control Light Duty Metal Fasteners are used to attach R-Control SIPs to light duty (up to 18 gauge) metal substrates.







Average Ultimate Values - Fastener Properties

Fasteners	Property				Avg. Ult. Pull-Thru Values (lbs) ASTM D1761	
	Tensile (lbs) AISI S904	Shear (lbs) AISI S904	Bending Yield Strength -Fyb (psi) ASTM F1575	Corrosion Resistance ASTM D6294, ETAG 006	7/16" OSB	SIP Panel (7/16" OSB)
Wood	3555	2580	185,000	<15% Red Rust after 30 cycles	490	630
Light Duty Metal	3390	2490				
Heavy Duty Metal	3855	2625				

Average Ultimate SIPLD Pullout Values in Steel Deck (lbs)

Corrugated Steel Deck	24 ga.	22 ga.		20 ga.	18 ga.	16 ga.	
Yield Strength	36 ksi	36 ksi	85 ksi	36 ksi	36 ksi	36 ksi	100 ksi
SIPLD	250	381	435	449	694	896	1186

* Minimum 3/4" penetration of fastener through deck from underside of deck

Average Ultimate SIPHD Pullout Values in Structural Steel (lbs)

Structural Steel	16 ga.		12 ga.	1/8"	3/16"	1/4"
Yield Strength	36 ksi	100 ksi	50 ksi	36 ksi	60 ksi	60 ksi
SIPHD	491	794	1255	1454	3098	3814

* Minimum (3) threads of penetration of fastener through deck as measured from underside of steel

Average Ultimate Withdrawal Values in Lumber & Engineered Wood, Face Grain (lbs/in.)*

Wood Type (Specific Gravity)	SPF/HF (0.42)	DF/SP (0.50)	LVL (0.50)	LSL (0.50)
SIPTP	779	899	556	711
SIPLD	662	732	540	646

* Load values include fastener tip

Average Ultimate Withdrawal Values in Lumber & Engineered Wood, Edge Grain (lbs/in.)*

Wood Type (Specific Gravity)	SPF/HF (0.42)	DF/SP (0.50)	LVL (0.50)
SIPTP	36 ksi	100 ksi	50 ksi
SIPLD	491	794	1255

* Load values include fastener tip

Average Ultimate Values - Fastener Properties

Wood Type (Specific Gravity)	OSB				Plywood		
Thickness	7/16"	1/2"	19/32"	23/32"	15/32"	19/32"	23/32"
SIPTP	265	244	324	626	333	529	681
SIPLD	284	261	334	693	344	519	720

* Fastener penetrates through the full thickness of board

Average Ultimate Tension Values in Normal Weight Concrete & CMU (lbs)[1]

Comression Strength	2500 psi Concrete	5000 psi Concrete	CMU[2]
SIPTP	682	859	713
SIPLD	476	648	553

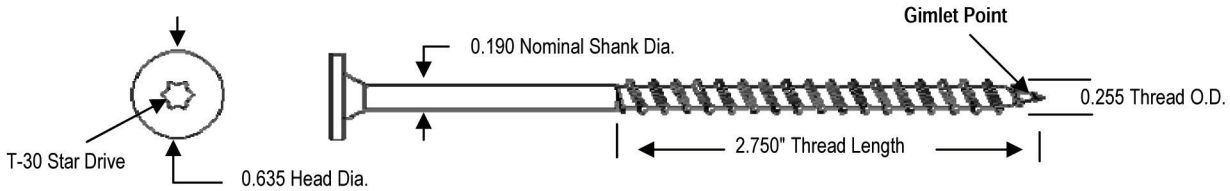
1. Fastener penetrates 1" into the concrete or CMU block, including the tip.
2. Concrete mansonry unit (CMU) conforming to ASTM C90.

Average Ultimate Lateral Load Resistance (lbs)

Fastener	Main Member	Side Member	Load
SIPTP	SPF[1]	8-1/4" SIP Panel	943
SIPLD	22 ga. Corrugated Steel Deck[2]	7-1/4" Nailbase Panel	411
SIPLD	7/16" OSB[3]	7-1/4" Nailbase Panel	112
SIPHD	1/8" Structural Steel[4]	8-1/4" SIP Panel	929

1. 1-3/4" fastener embedment into edge grain, including tip.
2. Minimum 3/4" penetration of fastener through deck as measured from underside of deck.
3. Fastener penetrates through the full thickness of board.
4. Minimum (3) threads of penetration through steel as measured from underside of steel

R-Control Wood Screws



Withdrawal	lbs./in. penetration	wood specific gravity
R-Control Wood Screw	1429	0.67
	1173	0.55
	1067	0.50
	981	0.46
	917	0.43
	768	0.36
	661	0.31

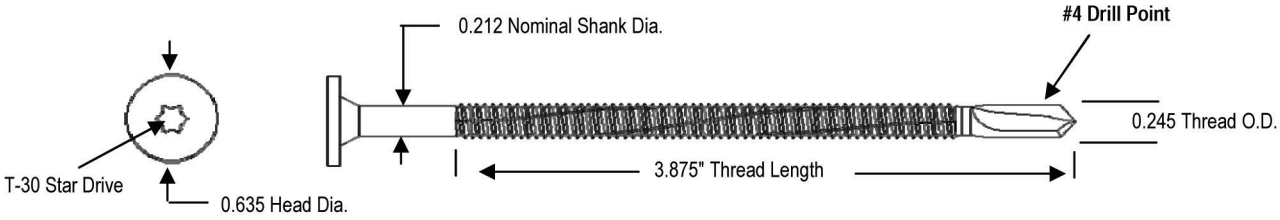
Shear	lbs.	wood specific gravity
R-Control Wood Screw / R-Control SIP assembly	790	0.64
	780	0.45
	720	0.38
R-Control Wood Screw	2900	

Pull Through	lbs.
R-Control Wood Screw / R-Control SIP assembly	630
R-Control Wood Screw / 7/16" OSB	545

Tensile Strength	lbs.
R-Control Wood Screw	3380

The values provided for the R-Control Screw Fastener are maximum values. As determined by the project architect/engineer, appropriate safety factors should be used in design.

R-Control Metal Fasteners



Withdrawal	lbs.	Steel
R-Control Metal Fastener	770	16 ga.
	1130	13 ga.
	1690	12 ga.
	3100	3/16"
	4500	1/4"

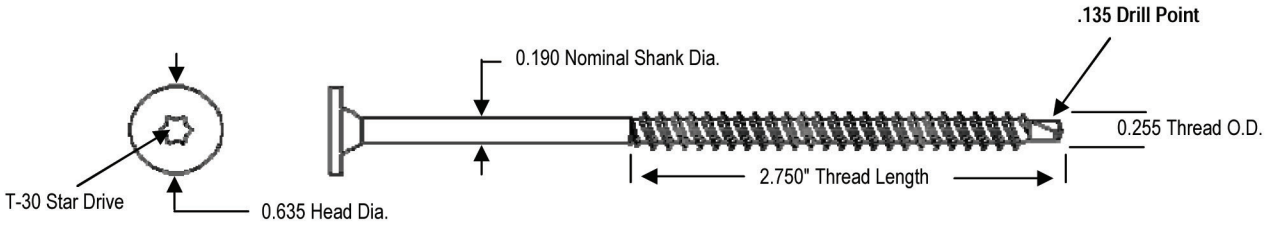
Shear	lbs.
R-Control Metal Fastener / R-Control SIP assembly	790
R-Control Metal Fastener	3400

Pull Through	lbs.
R-Control Metal Fastener / R-Control SIP assembly	630
R-Control Metal Fastener / 7/16" OSB	545

Tensile Strength	lbs.
R-Control Metal Fastener	6000

The values provided for the R-Control Metal Fastener are maximum values. As determined by the project architect/engineer, appropriate safety factors should be used in design.

R-Control Light Duty Fasteners



Withdrawal	lbs.	Steel
R-Control Light Duty Metal Fastener	510	22 ga.
	645	20 ga.
	920	18 ga.

Shear	lbs.
R-Control Light Duty Metal Fastener	2900

Pull Through	lbs.
R-Control Light Duty Metal Fastener / R-Control SIP assembly	630
R-Control Light Duty Metal Fastener / 7/16" OSB	545

Tensile Strength	lbs.
R-Control Light Duty Metal Fastener	3380

The values provided for the R-Control Screw Fastener are maximum values. As determined by the project architect/engineer, appropriate safety factors should be used in design.

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SIP No. 2022

Subject: **Water Vapor**

Date: **November 2007 (Revised January 2015)**

Water vapor is not normally a problem in construction, but when it is allowed to condense, problems can develop. There are two issues that must be considered:

1. air infiltration
2. diffusion of water vapor

In a building envelope the primary cause of condensation within a wall or roof is due to air infiltration - warm, moist air meeting a cool surface. Stick buildings, which utilize fiberglass batts, rock wool or blown cellulose are at risk of having condensation occur because the structure has a tendency to leak air. Consequently, vapor retarders, such as polyethylene sheets, are used frequently in stick construction.

R-Control SIPs utilized and installed per R-Control details reduce building air infiltration to a very low level. Therefore, the potential for condensation due to air leakage in R-Control SIP buildings is greatly minimized.

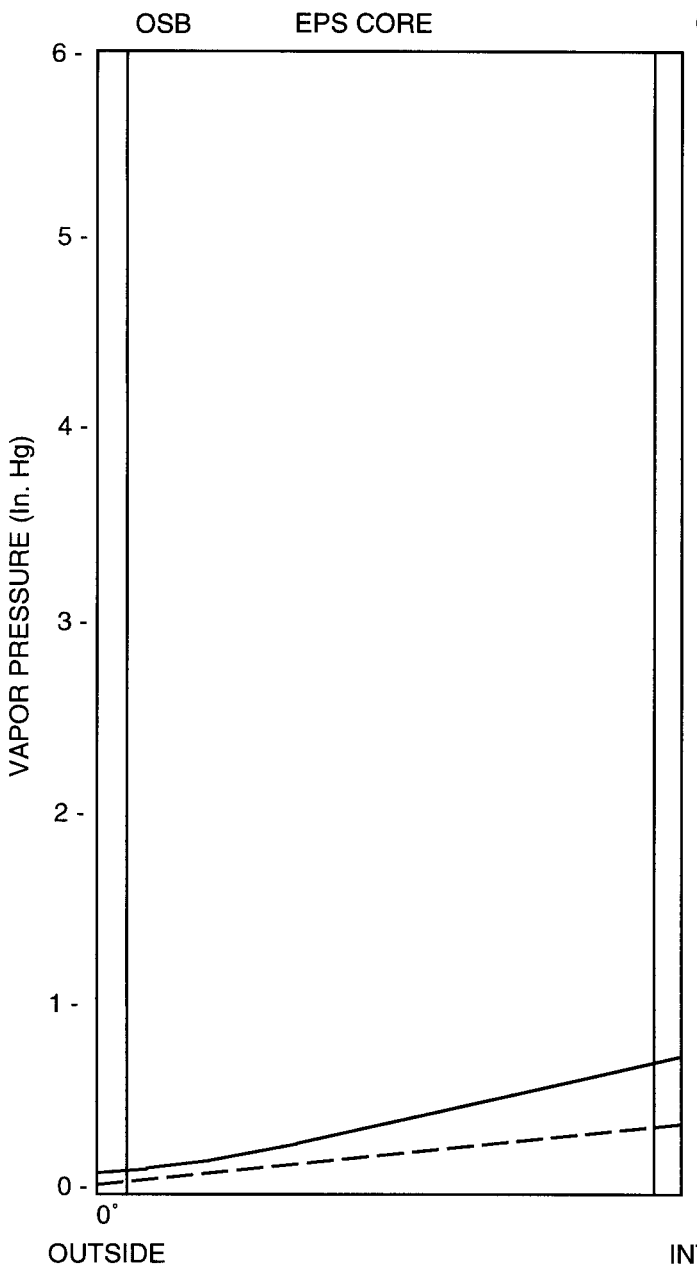
Due to the air infiltration resistance properties of R-Control SIPs and its safe vapor diffusion profile, R-Control SIPs deny the opportunity for condensation to occur. Proper spline and plate application sealing using R-Control Low VOC Do-All-Ply and SIP Tape is required.

Vapor diffusion contribution to moisture problems needs to be understood and addressed when looking at a construction assembly. For condensation to occur, an air temperature must be reached at which water vapor in the air reaches saturation.

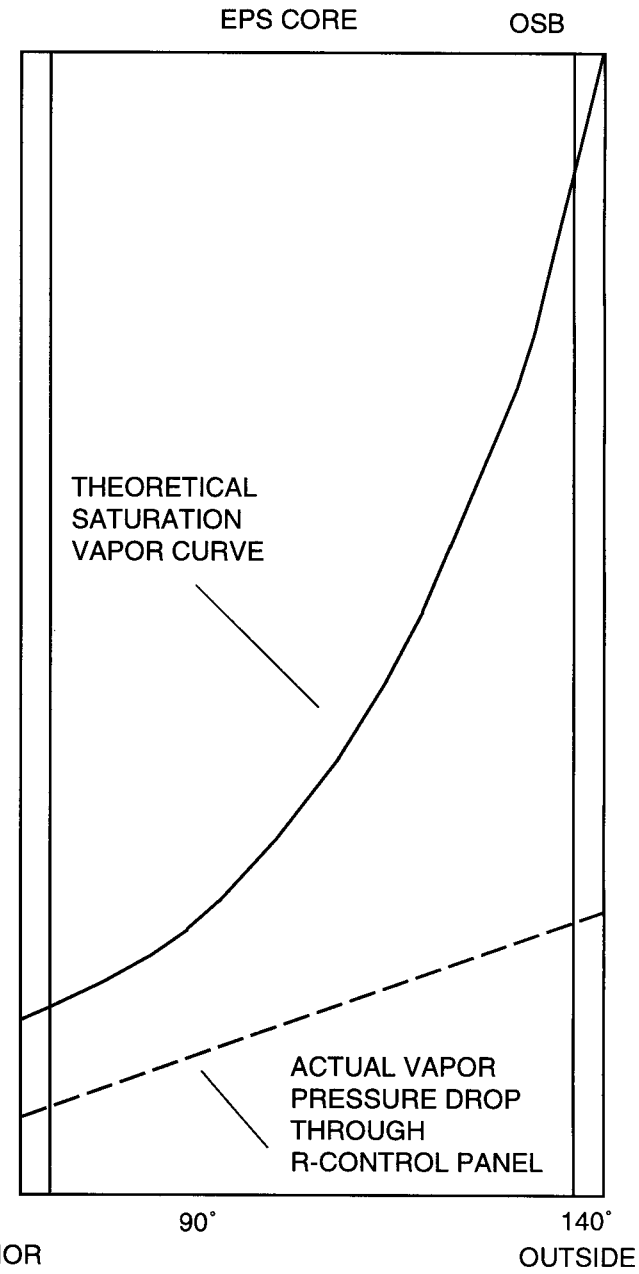
A vapor analysis of R-Control SIPs in both hot climates and cold climates determined that the vapor pressure curve typical for R-Control SIPs does not reach or exceed the saturation curve or dew point curve (See attached graph).

Structures housing swimming pools, refrigeration/freezer, or buildings humidified beyond 50% RH during the winter may require additional design considerations. These structures need to be reviewed on an individual basis as to whether a special vapor control design (including vapor retarders or other strategies) is required.

R-Control SIP
Winter Conditions



R-Control SIP
Summer Conditions



TEMPERATURE (F°)

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NOTE: Since vapor pressure through the R-Control SIP does exceed saturation curve, condensation does not occur.

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SIP No. 2028

Subject: **Concentrated Floor Load Testing**

Date: **November 2007**

Building codes have specific requirements for materials used to create floor assemblies. In residential applications, the floor system must be able to carry a uniform load of 40 psf. Commercial floor assemblies such as those found in churches, schools, banks, hotels, etc., have more stringent requirements. These include the capacity to support uniform loads greater than 40 psf and the ability to support specific concentrated loads. The concentrated load requirement for most commercial structures is 1000 or 2000 pounds over a 30" X 30" area.

Two typical R-Control SIP floor assemblies have been subjected to concentrated floor load testing. In these tests a 30" X 30" steel plate was placed over the floor system at several locations on the assembly. In each of the locations where the loaded plate was placed, the R-Control SIP floor panel assembly did not exceed the deflection limitations at a 2000 pound load. The panel assembly also performed adequately when 3 times the 2000 pound load, or 6000 pounds of pressure was applied to the steel plate.

The results from this testing demonstrate that R-Control SIP floor assemblies meet the code requirement for commercial floors of 2000 pound concentrated loads, while providing a factor of safety of three.

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SIP No. 2029

Subject: **Roof Cantilevers**

Date: **November 2007 (Revised May 2018)**

R-Control SIPs used as roofs are often extended beyond the building wall line to create overhangs. Overhangs result in the R-Control SIP being placed in a cantilever condition.

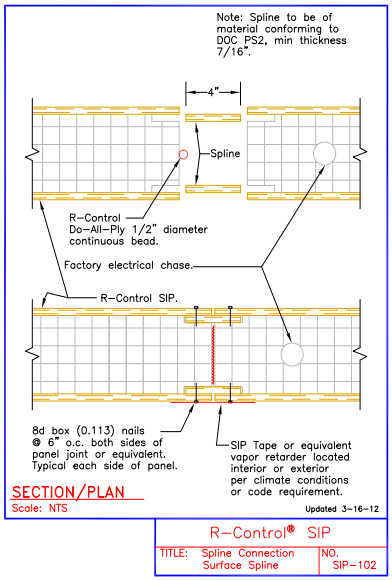
Engineering analysis and full scale loading tests have been used to determine the design recommendations for R-Control Roof SIPs placed in these cantilever roof conditions.

Roof Cantilevers - Transverse Loads - PSF
LOAD DESIGN CHART #9[1]
SPLINE DETAILS SIP-102, SIP-102g, or SIP-102m

SIP THICKNESS	DEFLECTION[2] LIMIT	SIP CANTILEVER (feet)			
		1	2	3	4
4-1/2”	L/240	43	43	43	
6-1/2”	L/240	66	65	60	42
8-1/4”	L/240	68	68	65	42
10-1/4”	L/240	69	69	60	49
12-1/4”	L/240	69	63	52	46

[1] VALUES ARE APPLICABLE TO SIPS INSTALLED WITH THE STRONG AXIS OF THE OSB FACINGS PARALLEL TO SIP SPAN AND WITH AN 8’ BACKSPAN.
[2] LIVE LOAD AT L/240 AND TOTAL LOAD AT L/180.

GENERAL NOTES:
- CHART VALUES ARE POUNDS PER SQUARE FOOT.
- SURFACE, BLOCK, OR LUMBER BLOCK SPLINE CONNECTED TO SIP FACING WITH 8D BOX (0.113) NAILS 6” O.C.
- CONTINUOUS SUPPORT WITH A MINIMUM BEARING OF 1-1/2” AT EACH SUPPORT REQUIRED.
- CHART IS BASED UPON UNIFORM LOADS.
- LOADS LIMITED BY DEFLECTION OR ULTIMATE FAILURE LOAD DIVIDED BY A FACTOR OF SAFETY OF THREE.
- FOR SLOPED SIPS, THE LOADING CONDITIONS AND SIP CAPACITIES SHOULD BE REVIEWED BASED UPON THE INCLINED SIP LENGTH. REFER TO R-CONTROL SIP TECHNICAL BULLETIN SIP NO. 2042.
- VALUES ARE FOR TOTAL LOAD (DEAD LOAD + LIVE LOAD).
- THE DEAD LOAD SHALL NOT EXCEED 20% OF THE TOTAL LOAD.

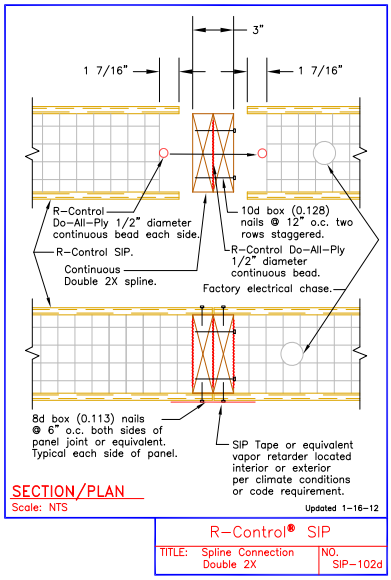


Roof Cantilevers - Transverse Loads - PSF
LOAD DESIGN CHART #9A[1]
SPLINE DETAILS SIP-102d

SIP THICKNESS	DEFLECTION[2] LIMIT	SIP CANTILEVER (inches)			
		12”	24”	36”	48”
4-1/2”	L/240	56[2]	60[2]	55[2]	47[2]
6-1/2”	L/240	80[2]	80[2]	80[2]	73[2]
8-1/4”	L/240	80[2]	80[2]	80[2]	80[2]
10-1/4”	L/240	80[2]	80[2]	80[2]	80[2]
12-1/4”	L/240	80[2]	80[2]	80[2]	80[2]

[1] VALUES ARE APPLICABLE TO SIPS INSTALLED WITH THE STRONG AXIS OF THE OSB FACINGS PARALLEL TO SIP SPAN AND WITH AN 8’ BACKSPAN.
[2] LIVE LOAD AT L/240 AND TOTAL LOAD AT L/180.

GENERAL NOTES:
- CHART VALUES ARE POUNDS PER SQUARE FOOT.
- 2X LUMBER SPLINE 4FT. O.C. CONNECTED TO SIP FACING WITH 8D BOX (0.113) NAILS 6” O.C.
- CONTINUOUS SUPPORT WITH A MINIMUM BEARING OF 1-1/2” AT EACH SUPPORT REQUIRED.
- CHART IS BASED UPON UNIFORM LOADS.
- LOADS LIMITED BY DEFLECTION OR ULTIMATE FAILURE LOAD DIVIDED BY A FACTOR OF SAFETY OF THREE.
- FOR SLOPED SIPS, THE LOADING CONDITIONS AND SIP CAPACITIES SHOULD BE REVIEWED BASED UPON THE INCLINED SIP LENGTH. REFER TO R-CONTROL SIP TECHNICAL BULLETIN SIP NO. 2042.
- VALUES ARE FOR TOTAL LOAD (DEAD LOAD + LIVE LOAD).
- THE DEAD LOAD SHALL NOT EXCEED 20% OF THE TOTAL LOAD.



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SIP No. 2030

Subject: **Diaphragms**

Date: **November 2007**

R-Control SIPs have been evaluated for use as diaphragms in structures. Diaphragm applications include both wall and roof assemblies that are subjected to seismic or wind loads.

Through large and small scale testing conducted at the APA laboratories using an independent structural consultant, it was determined that R-Control SIPs can develop design diaphragm capacities of up to 850 lbs/ft. Please refer to Load Design Chart #7 for R-Control Wood Screw and nail spacing required to obtain this capacity.

These tests have allowed for the determination of design capacities for R-Control Wood Screws and nails when used in diaphragms. The following lateral load capacities are recommended:

R-Control Wood Screws	250 lbs.
8d nails @ surface splines	62.5 lbs.

These design values include a factor of safety of three on the ultimate load.

In all diaphragm applications the design of the lateral load resisting system must be engineered to provide a load path for the forces that the structure will develop. This is provided by the engineer of record on the specific project.

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SIP No. 2032

Subject: **Staples**

Date: **November 2007 (Revised March 2012)**

R-Control SIP details primarily require the use of 8d box (0.113) nails for attachment of splines and plates. On occasion 10d box (0.128) and 12d box (0.135) nails are also shown.

Some contractors request the substitution of staples as an alternative to the nails. The substitution of staples or other fasteners for nails in the R-Control Construction Details is acceptable when the alternate fastener and spacing is such that the structural capacity meets or exceeds the nails as specified in the detail.

Note: The use of staples in Seismic Design Category D, E, and F regions is not recommended as staples do not have an equivalent ductility to nails as required for seismic resistance.

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SIP No. 2033

Subject: **Screw Shear and Pullout Capacities in OSB**

Date: **November 2007**

A test program was conducted to obtain data that characterizes pullout and shear capacities for various fasteners in 7/16" OSB.

Fifteen repetitions of each combination of variables were completed. A summary of the ultimate pullout and shear results are below.

The data in this bulletin is average ultimate pullout value. No factor of safety has been applied. An appropriate factor of safety should be used in design calculations.

The data is representative of the OSB tested. Results will vary with OSB source and lot. Data is based on dry OSB.

This data allows specifiers and manufacturers of finishing products and systems to determine correct fastener placement required for their materials.

Pullout (lbs)	
Screw Size	**7/16" OSB**
#6 Deck Screw	175
#8 Deck Screw	180
#10 Deck Screw	200
#12 Roofing Screw	190
#14 Roofing Screw	175

Shear (lbs)	
Screw Size	**7/16" OSB**
#6 Deck Screw	200
#8 Deck Screw	120
#10 Deck Screw	140
#12 Roofing Screw	435
#14 Roofing Screw	465

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SIP No. 2036

Subject: **Load Design Charts 2 & 2A: Combined Axial and Transverse (Bending) Loading**

Date: **November 2007**

Combined axial and transverse (bending) testing has been conducted on R-Control SIPs. The testing was performed as outlined in ASTM E 72, "Standard Test Methods of Conducting Strength Tests of Panels for Building Construction." The testing involved simultaneously loading the panel to both an axial load and a transverse load. The axial load was applied eccentrically to the panel at a location one-third of the panel thickness from the interior OSB facing. A uniform transverse load was applied to the exterior OSB facing.

R-Control SIPs can be designed to carry simultaneously both the maximum axial load and maximum transverse (bending) load in Load Design Chart #2 or #2A.

Wall - Combined Axial & Transverse Loading

Load Design Chart #2 (See Detail SIP-101)			
R-Control Structural Insulated Panels			
	Panel Height	SIP Thickness	
		4 1/2"	6 1/2"
Axial Load [PLF]	8'-0"	2200	2200
	10'-0"	2200	2200
Transverse (Bending) Load [PSF]	8'-0"	45	69
	10'-0"	33	38

[1] R-CONTROL SIPS CAN CARRY BOTH THE MAXIMUM AXIAL LOAD AND MAXIMUM TRANSVERSE (BENDING) LOAD SIMULTANEOUSLY.
(NO UNITY EQUATION ANALYSIS IS NEEDED)

[2] DESIGN VALUES ARE LIMITED BY THE LOWER OF TRANSVERSE DEFLECTION OR ULTIMATE FAILURE LOAD DIVIDED BY A FACTOR OF SAFETY OF THREE (3).

Wall - Combined Axial & Transverse Loading

Load Design Chart #2A (See Detail SIP-108c)			
R-Control Structural Insulated Panels			
	Panel Height	SIP Thickness	
		4 1/2”	6 1/2”
Axial Load [PLF]	12’-0”	2200	2200
	16’-0”		2200
	20’-0”		2200
Transverse (Bending) Load [PSF]	12’-0”	27	66
	16’-0”		41
	20’-0”		20

[1] R-CONTROL SIPS CAN CARRY BOTH THE MAXIMUM AXIAL LOAD AND MAXIMUM TRANSVERSE (BENDING) LOAD SIMULTANEOUSLY. (NO UNITY EQUATION ANALYSIS IS NEEDED)
[2] DESIGN VALUES ARE LIMITED BY THE LOWER OF TRANSVERSE DEFLECTION OR ULTIMATE FAILURE LOAD DIVIDED BY A FACTOR OF SAFETY OF THREE (3).

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SIP No. 2038

Subject: **Nail Pullout**

Date: **November 2007**

Pullout tests have been conducted on nails driven into R-Control SIP facings. Pullout values were determined by driving nails into and through the 7/16" OSB used to manufacture R-Control SIPs and extracting the nail. The following results are ultimate pullout values for R-Control SIPs using various nail types.

Nail Type	Ultimate Pullout Value
4D Drywall	96 Lbs.
6D Galvanized	69 Lbs.
Galvanized Roofing	61 Lbs.
8D Smooth	51 Lbs.
8D Galvanized	80 Lbs.
8D Coated	90 Lbs.
8D Ring Shank	156 Lbs.
10D Spiral Shank	38 Lbs.
16D Smooth	52 Lbs.
16D Galvanized	75 Lbs.

The data in this bulletin is average ultimate pullout value. No factor of safety has been applied. An appropriate factor of safety should be used in design calculations.

The data is representative of the OSB tested. Results will vary with OSB source and lot. Data is based on dry OSB.

This data allows specifiers and manufacturers of finishing products and systems to determine correct fastener placement required for their materials.

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SIP No. 2039

Subject: **Blazeguard - An Index 15 Thermal Barriers**

Date: **November 2007**

Blazeguard is a factory applied coating manufactured from specialized concrete and fiberglass strands. Blazeguard is applied directly to the OSB facing of R-Control SIPs. Blazeguard provides a code recognized thermal barrier for the panel, just like gypsum board. Blazeguard adheres tenaciously to the wood face. It is also very impact and moisture durable, due to the fact that concrete technology is used.

Where is it used?

Blazeguard is most commonly used as the interior side of an R-Control SIP in commercial and industrial buildings. Some applications have also been used for the outside of the panel where extra fire protection is needed, but only when the Blazeguard is additionally covered by a code approved exterior weather resistant barrier and cladding system.

What type finish is available?

The Blazeguard finish is relatively smooth and reminiscent of hand troweled plaster coat that was common in years past. This finish is used in applications where the design calls for a lightly modeled smooth appearance.

How are joints treated?

Building designs that hide or blind the joints are best for R-Control SIPs with Blazeguard. Also, designs that allow for the panel joints to be seen as a reveal joint from panel to panel work well. Another application that works for many designs is to cover panel joints with batten systems that blend into the field color or texture of the panel, or compliment the design scheme.

Does Blazeguard Meet Code Requirements?

Blazeguard is a proprietary fire resistive finish that can be applied to R-Control SIPs. This product results in an R-Control SIP which meets and exceeds the code requirement for an Index 15 Thermal Barrier.

R-Control SIPs with Blazeguard have been tested in accordance to the following code required tests:

UBC 26-2 (a modified ASTM E119 test) “Test Method for Evaluation of Thermal Barrier”.

Results - Blazeguard qualifies as a Thermal Barrier

UBC 26-3 (Corner Room Burn) “Room Fire Test Standard for Interior of Foam Plastics Systems”.

Results - R-Control SIPs with Blazeguard remained in position for the duration of the test and exhibited very light smoke, while protecting the EPS core from char outside the area of the ignited crib.

ASTM E-84 “Tested Method for Surface Burning Characteristics of Building Materials”.

Results - The Blazeguard material has a flame spread of 5 and a smoke develop of 10-35.

The results of these tests demonstrate that R-Control SIPs with Blazeguard meet code requirements for a thermal barrier and can be installed without fire protection.

For more information on Blazeguard, please refer to ICC ES ESR-1365 available from www.icc-es.org.

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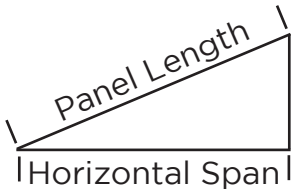
R-SIPS CONTROL

SIP No. 2042

Subject: **Load Design Chart Adjustments for Sloped Roofs**

Date: **November 2007**

R-Control SIP Load Design Charts are based upon tests and calculations using flat panel installations. In many applications, the panels will be installed at a slope. When installed at a slope, the building designer must make adjustments in the design procedure to ensure that R-Control SIPs with sufficient load capacity are chosen. This bulletin includes a worksheet to adjust the panel length and load based upon the roof slope. The correct panel length and loading are critical for proper panel selection.



LOAD ADJUSTMENT FOR PITCHED ROOF

Dead Load	_____(3)
Correction Factor	_____(4)
Net Dead Load (3)÷(4)	_____(5)
Live Load	_____(6)
Correction Factor	_____(7)
Net Live Load (6)÷(7)÷(7)	_____(8)
Total Load, (5)+(8)	_____

SPAN ADJUSTMENT FOR PITCHED ROOF

Horizontal Span	_____(1)
Correction Factor	_____(2)
Panel Length, (1)x(2)	_____

The actual panel length and loading should be calculated as follows:

- Determine the actual panel length by multiplying the horizontal span by the correction factor.
- Determine the actual dead load by dividing the dead load (including panel weight plus ceiling finish plus roofing) in psf by the correction factor.
- Determine the appropriate live (snow) load in accordance with the appropriate building code (considering sliding or snow drifting snow load increases or sliding snow load decreases where appropriate) and divide that load by the square of the correction factor.
- Compare the sum of the dead and live loads to the load design chart for the panel length required. It must be less than the allowable load for the desired total load deflection.

Roof Slope	Correction Factor
4/12	1.05
5/12	1.08
6/12	1.12
7/12	1.16
8/12	1.20
9/12	1.25
10/12	1.30
11/12	1.36
12/12	1.41

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SIP No. 2044

Subject: **Sound Transmission**

Date: **November 2007**

R-Control SIPs are suitable for designs requiring control of sound transmission.

Sound Transmission is measured by ASTM E 90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions. The test measures the sound transmission loss for sound with frequencies from 125-4000 Hz. This range is the most important part of the hearing range. The results of the test are further classified into a Sound Transmission Class (STC) which is useful in comparing different building systems.

The significance of STC ratings can be seen by a review of the following information on STC ratings.

STC rating

25	Normal speech can be understood quite clearly.
30	Loud speech can be understood fairly well.
35	Loud speech audible but not intelligible.
42	Loud speech audible as a murmur.
45	Must strain to hear loud speech.
48	Some loud speech barely audible.
50	Loud speech not audible.

R-Control SIP testing has resulted in four different assemblies:

NOTE: STC ratings do not include the impact of airborne noise which penetrates common openings in construction. These include poor assembly, heating and ventilation ducts, electrical boxes, and other imperfectly sealed penetrations that allow for building systems to "leak" airborne noise. R-Control SIPs are assembled without the common problems associated with site built construction and eliminate many of the openings which reduce sound transmission performance. Reports from R-Control SIP building owners confirm the improved sound control performance of R-Control SIP structures.

R-Control SIP Assembly with STC - 28

R-Control SIP with 1/2" gypsum board attached to one side.

R-Control SIP Assembly with STC - 38

R-Control SIP with two layers 5/8" Type X gypsum board on both sides.

R-Control SIP Assembly with STC - 39

R-Control SIP with 1/2" gypsum board attached to one side using USG RC-1 resilient channel (24" o.c.). Fiberglass (1/2") was placed between the RC-1 channel and the gypsum board.

R-Control SIP Assembly with STC - 51

R-Control SIP with two layers 5/8" Type X gypsum board attached to one side. The opposite side has one layer 5/8" Type X gypsum board, 1-1/2" Z furring channels and 1 USG Sound Attenuating Fiberglass batt, and an additional layer of 5/8" Type X gypsum board.

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SIP No. 2045

Subject: **Exterior Insulation & Finish Systems (EIFS)**

Date: **November 2007 (Revised January 2015)**

R-Control SIP structures can be finished with any code approved weather covering. Exterior Insulation Finish Systems (EIFS) are one type of code recognized weather covering. EIFS provide water tight protection and have been used successfully over R-Control SIP structures for many years. It is recommended that EIFS intended for use over OSB substrates be used. EIFS system installers must follow the EIFS Manufacturer's installation guidelines to achieve a warranted outcome.

Various code jurisdictions require that the EIFS be installed include a water drainage system. Many EIFS Manufacturers have systems that meet this requirement.

Sto System:

Sto Corp. has developed, StoTherm® ci, a water managed EIFS, utilizing an air/moisture barrier system, that works exceptionally well with R-Control SIPs. The Sto system features benefits that enhance the long term performance of R-Control SIPs:

(1) R-Control SIP OSB skins and penetrations are moisture protected.

(2) StoTherm ci is adhesively applied - fastener penetrations are not made into the R-Control SIP OSB facing.

(3) Incidental water that may get behind the EIFS is drained outside the system.

This Technical Bulletin gives guidelines for the application of the StoTherm ci with StoGuard® Moisture Protection, when applied over R-Control SIPs.

General Caution:

StoGuard protects the R-Control SIP OSB facing from moisture damage during the construction phase, as well as in service protection in the event of a moisture breach in the EIFS wall cladding. Proper application is required of the installer. Application of the StoGuard over R-Control SIPs is not intended to correct faulty workmanship. It is essential that proper flashing and details be integrated into the design that direct water to the outside of the cladding system. Defective components of construction, such as leaky windows and doors, should not be used.

Application Recommendations:

Sto Corp. publishes complete specifications for the installation of their StoGuard and StoTherm ci. The following recommendations are being provided as they apply to installations over R-Control SIPs. Prior to starting any work, completely read all specifications and installation guidelines.

Step 1:

Clean R-Control SIP OSB facing surfaces that are to receive the StoGuard Moisture Protection System. R-Control SIP OSB surfaces must be in good condition, free of dirt and all bond inhibiting contaminates. Surfaces must be dry, with the ambient air temperature at 40^0 F and rising before application can occur.

Step 2:

Apply Sto Gold Coat® to the entire R-Control SIP OSB facing receiving the Sto EIFS. Using a 3/4" (19mm) nap roller, apply Sto Gold Coat in a uniform wet thickness coating of 10 mils. Protect from weather and temperature until dry.

Step 3:

R-Control SIP joints, rough openings, corners and tops of wall parapets are filled and covered with Sto Gold Fill® and StoGuard Mesh, embedded into the Sto Gold Fill (additional Sto joint and rough-opening material options are listed at www.stocorp.com). Fastener and surface defects must be spot filled with Sto Gold Fill. Application is by trowel with maximum thickness on the R-Control SIP OSB surface being 1/16". Joints require a 4" minimum width mesh. Rough openings, corners and parapets require a 9" minimum width mesh detail.

Step 4:

Re-apply a second coat of Sto Gold Coat over the entire R-Control SIP OSB facing receiving the Sto EIFS, including all surfaces previously covered with Sto Gold Fill. Using a 3/4" (19mm) nap roller, apply Sto Gold Coat in a uniform wet thickness coating of 10 mils. Protect from weather and temperature until dry.

Step 5:

Coordinate the proper installation of flashing and other moisture protection components, such as windows, doors, fireplaces, chimneys, and other like penetrations that impact the water tightness of the StoTherm ci applied over the R-Control SIPs.

Step 6:

Install the StoTherm ci per the manufacturer's detailed specifications and installation guidelines including all accessories such as, but not limited to: Starter Track, Window/Door Head Flashing, Side Wall Step Flashing, Backwrapping, Adhesive and EPS Insulation Board, Trim and Reveals, Base Coat and Reinforcing Mesh, Primer, and Finish Coat.

This Technical Bulletin presents applications using Sto Gold Fill and StoGuard Mesh. Information regarding other Sto joint and rough opening product options is available at www.stocorp.com.

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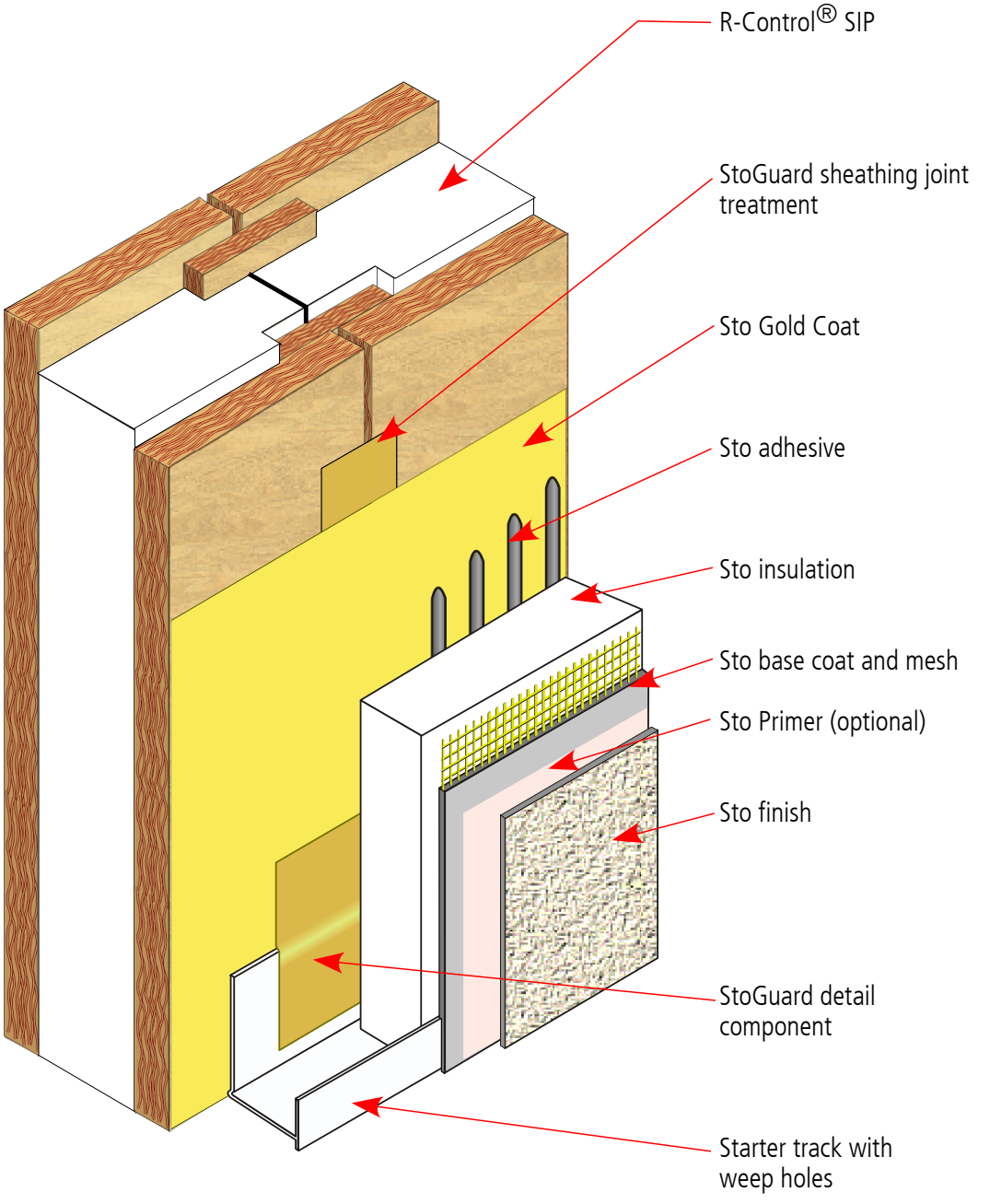
StoTherm® ci
System Components: R-Control® SIP

Detail No.: 10.00sip

Date: Dec. 2014



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Notes:

1] Detail shows the components of a StoTherm ci Exteror Insulation and Finish System (EIFS) with StoGuard Moisture Protection installed on an R-Control® SIP.

2] StoGuard detail component options:
- a) StoGuard RapidFill
- b) Sto Gold Fill and StoGuard Mesh
- c) Sto Gold Coat with StoGuard Fabric

3] StoGuard joint treatment options:
- a) StoGuard RapidFill
- b) Sto Gold Fill and StoGuard Mesh
- c) Sto Gold Coat with StoGuard Fabric
- d) StoGuard RapidSeal with StoGuard Mesh

4] StoGuard door and window rough opening options:
- a) StoGuard RapidSeal
- b) Sto Gold Fill and StoGuard Mesh
- c) Sto Gold Coat with StoGuard Fabric

5] See Sto specification A1000G and individual Sto product bulletins for additional information regarding selection and installation of Sto products

6} See additional Sto details at www.stocorp.com for rough opening preparation and penetration details.

IMPORTANT: Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

SIP No. 2046

Subject: **Roof Ridge Detailing**

Date: **November 2007 (Revised January 2015)**

Standard R-Control SIPs roof ridge details provide for a tight and sealed design. R-Control SIP roof ridge details rely on the tight fit of all component materials, the liberal and specific location application of R-Control Low VOC Do-All-Ply sealant and the proper placement of SIP Tape or vapor retarders.

There may be special conditions or difficult project applications that require additional considerations to enhance the long-term performance of the roof ridge. These special conditions may be: steeply sloped roof planes, converging multiple roof slopes, hard to access work areas on the roof, ill fitting roof panels caused by miss set beams, purlins, walls or miss cuts of the SIP roof panel.

When SIPs do not fit tightly at the roof ridge, they may be difficult to seal properly with R-Control Low VOC Do-All-Ply. Undue levels of moisture can then invade these non-sealed areas over time, eventually causing damage to the SIP and other components of the structure. Field applied expanding foams help to insulate roof ridge spaces, but do not provide adequate protection against moisture passage and build up.

Therefore, it is essential to follow exactly all application recommendations for R-Control SIP roof ridge installation.

If it is determined that project conditions could possibly compromise the integrity of the roof ridge detail, the installation of a ventilated roof over the R-Control SIP is recommended.

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SIP No. 2047

Subject: **Water Vapor Transmission through Splines**

Date: **November 2007 (Revised January 2015)**

R-Control SIP connection details rely on the tight fit of all component materials and the specific application of R-Control Low VOC Do-All-Ply sealant as shown in R-Control SIP details.

This bulletin describes the tested performance of these materials with respect to moisture vapor transmission. ASTM E 96, "Standard Test Methods for Water Vapor Transmission of Materials," was used to measure the performance of Do-All-Ply and SIP connection details.

R-Control Low VOC Do-All-Ply

R-Control Low VOC Do-All-Ply was tested as a thin film. R-Control Low VOC Do-All-Ply had a water vapor transmission rate of less than 0.1 perm.

A material with a perm rating of less than 1.0 perms is considered a vapor retarder.

R-Control SIPs

R-Control SIP (6-1/2" thick) sections were tested as follows:

No joint

w/surface spline joint

w/block spline joint

R-Control SIP surface spline (detail SIP-102) and block spline (detail SIP-102g) are the most commonly used R-Control SIP connection details.

The results of the testing were as follows:

Sample Type	Perms[1]
No joint	< 1.0
w/surface spline joint	< 1.0
w/block spline joint	< 1.0

[1] Perm = grains/h x ft x ft x in. Hg

These results clearly demonstrate that the use of R-Control surface spline or block spline connection details with proper application of R-Control Low VOC Do-All-Ply maintains suitable control of moisture transmission.

Following the R-Control details provide for a tight and sealed design.

As point of interest, the R-Control SIP sample with a surface spline connection was also tested without the application of R-Control Low VOC Do-All-Ply. The results from this testing were dramatic.

The moisture transmission through a surface spline joint with no R-Control Low VOC Do-All-Ply was over 100 times that of the joint with R-Control Low VOC Do-All-Ply.

These results clearly demonstrate the need for proper application of R-Control Low VOC Do-All-Ply as shown in R-Control details.

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SIP No. 2048

Subject: **Joint Detailing**

Date: **November 2007 (Revised January 2015)**

R-Control SIPs are a high performance building material. In order to provide maximum comfort, energy savings, and durability, R-Control SIPs must be installed in compliance with R-Control SIP details. A key component of a R-Control building envelope is the proper use and application of R-Control Low VOC Do-All-Ply, SIP Tape and foam sealants.

R-Control Low VOC Do-All-Ply

R-Control Low VOC Do-All-Ply was specifically designed for application to R-Control SIPs.

R-Control Low VOC Do-All-Ply is the only recommended sealant product for installation between the R-Control SIP core, splines, wood plating, and internal wood members.

Other adhesive or sealants have been shown to cause damage to the EPS core or become brittle over time. R-Control Low VOC Do-All-Ply is EPS foam compatible and will retain flexibility. In addition, some products cannot be applied under damp or cold conditions. Again, R-Control Low VOC Do-All-Ply was developed to meet these needs. R-Control Low VOC Do-All-Ply can be applied under damp conditions, is water washout resistant, and can be applied at low temperatures.

Of key importance, R-Control Low VOC Do-All-Ply prevents the passage of water vapor due to its low water vapor permeability (see Technical Bulletin sip no. 2047).

R-Control Low VOC Do-All-Ply must always be installed in a continuous unbroken pattern and applied in sufficient amounts to ensure that contact is maintained with the core, splines, wood plating, and internal members.

Failure to apply the R-Control Low VOC Do-All-Ply in a continuous pattern or maintain contact with adjacent materials will provide paths for moisture vapor to pass through panel joints causing eventual moisture problems.

SIP Tape

R-Control SIP Tape was specifically designed for application to R-Control SIPs.

R-Control SIP Tape is the only recommended Tape product for installation on the surface of R-Control SIPs.

Other tapes are often manufactured with asphalt adhesives which are not suitable for use in interior environments.

Expanding Foam Sealants

R-Control does not recommend the use of expanding foam sealants in the critical area of joint detailing between the R-Control SIP core, splines, wood plating, and internal wood members.

The field installation of expanding foam sealants can be difficult under typical construction site environments such as cold or damp weather conditions. In addition, the long term volume stability and flexibility of foam sealants cannot be guaranteed. Field inspection of past foam sealant panel applications has shown that problems with foam sealant performance are common.

However, the use of low expanding foam sealants in the application of filling voids around electrical boxes and window and door openings is recommended (see R-Control SIP details SIP-116, SIP-117, SIP-123, SIP129a). These applications take place in the controlled environment on the inside of a standing SIP structure.

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SIP No. 2050

Subject: **Cladding Systems**

Date: **November 2007 (Revised January 2015)**

R-Control SIPs are manufactured from 3 basic components:

1. Exposure I Rated OSB for the outer faces
2. Foam-Control EPS (Expanded Polystyrene) with Perform Guard foam for the core
3. Crosslinked exterior rated adhesives

The Foam-Control EPS core and the adhesives are capable of withstanding long term exposure to moisture. Thus, the exposure to moisture for the OSB is the key to the durability of an R-Control SIP.

Construction Issues:

Exposure I Rated OSB is designed for limited exposure to moisture that can occur during construction.

R-Control SIPs must be covered during storage to protect from exposure to rain, snow and other elements.

After installation, the R-Control SIPs should be covered with a secondary weather resistive system as soon as possible. This is required to protect the OSB from exposure to moisture long term.

Note: Installation of R-Control SIPs and the secondary weather resistive system should not occur during periods of heavy rain or snow.

Long term Issues:

Installation details must ensure that the OSB facings and other wood components of the SIP construction are not subjected to moisture over the life of the structure.

Moisture exposure could be exterior by means of bulk water making its way through the siding system or from the interior of the structure in the form of water vapor. In order to manage these potential sources of moisture, proper detailing must be accomplished.

By following these key detailing considerations, the long term durability of R-Control SIPs is achieved:

1. Application of R-Control Low VOC Do-All-Ply at panel joints. R-Control Low VOC Do-All-Ply must always be installed in a sufficient amount and applied in a continuous unbroken fashion.

2. Proper use of SIP Tape or vapor retarders as required by R-Control SIP details.

3. Proper use of code recognized exterior weather resistive systems which must include both a primary AND secondary system. The cladding must provide a rain screen design which provides an avenue for water that penetrates the primary weather resistive system to drain from the wall.

   a. Vinyl, aluminum, cement and wood sidings are typical types of primary systems approved for use over R-Control SIPs. These systems MUST BE INSTALLED OVER SECONDARY SYSTEMS that are rated as weather resistant, such as building paper or house wrap products (i.e. Tyvek, housewrap, etc.).

   b. Stucco is another common type of primary system. Stucco must be applied over a secondary weather resistive system.

   c. Exterior Insulated Finish Systems (EIFS) can be applied over R-Control SIPs. For example, see Technical Bulletin sip no. 2045 for application of STO's system which includes a field applied secondary system.

4. Proper flashing and detailing of all window openings and penetrations. Ensure that the detailing of openings is consistent with forming a drainage plane which works in conjunction with the exterior weather resistive system.

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SIP No. 2051

Subject: **HVAC Design**

Date: **November 2007 (Revised January 2015)**

All buildings should be analyzed by a HVAC professional to properly specify the heating, cooling, and ductwork to ensure desired performance.

Design factors to be considered include:

- Size of Building (each floor analyzed individually)
- Orientation of Building
- Type of Wall Construction (and associated R-value)
- Window information (number, location, insulation value, fenestration rating)
- Door information (number, location, insulation value, fenestration rating)
- Duct location (in heated space, in unheated space, in attic, in crawl space)
- Fireplaces (number, type)
- Air Infiltration

All these factors must be analyzed to provide an accurate HVAC design.

A rule of thumb approach is not suitable for HVAC design, especially with high performance systems such as SIPs.

A process for the accurate design of HVAC systems is available from the American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE). Detailed information on HVAC design is available in the ASHRAE Fundamentals Handbook.

ASHARE publishes the ASHRAE Manual J procedures which are used to design the HVAC system.

R-Control SIPs provide inherent energy savings when used for walls and/or roof components on buildings. The energy savings can be attributed to two main factors:

1. Increased R-value
2. Lowered air infiltration

Applying Manual J calculations provides for the increased R-value and the reduced air infiltration of building with R-Control SIPs. These two factors will allow for downsizing of the heating and cooling equipment. This will provide immediate cost savings at the time of construction. In addition, proper sizing of the HVAC system will provide a more comfortable environment.

Architects/engineers, builders, building owners, and other building professionals have learned from experience that the energy savings for a typical SIPs structure can be 30-50%.

Note: Please also review Technical Bulletin sip no. 2000 for information on heat recovery ventilator requirements.

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SIP No. 2053

Subject: **Mold in Houses**

Date: **November 2007 (Revised January 2015)**

The building industry is continually learning about the growth of mold in homes. Homeowners and building professionals are concerned over the potential for mold growth and the impact on the living environment. This bulletin is designed to provide a basic overview of mold in structures.

Mold problems in structures are normally directly related to a moisture problem. Common moisture problems are the result of water leaks and/or the lack of attention to flashing and building details.

Molds are a type of fungi in the same family as mushrooms and yeasts. Molds need the right conditions to grow. This is typically a temperature between 40°F and 100°F and 20% moisture content in the product they are attacking. Thus, an area of a building with a water problem is an ideal environment for mold growth. Under warm and humid conditions, they can quickly multiply and spread over wall surfaces and building materials.

Molds are an essential part of the world with the function of breaking down the basic components of plants and other natural organic materials. The molds of concern to the building industry get their nutrients from the starches and sugars in wood and paper products.

R-Control SIPs are a composite of Foam-Control Expanded Polystyrene (EPS) and Oriented Strand Board (OSB). Foam-Control EPS provides no nutrient value to plants, animals, or microorganisms. The OSB which is part of R-Control SIPs is organic and could be attacked by mold in the presence of excessive moisture.

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R-Control SIPs can be manufactured with the FrameGuard® treatment, thereby reducing the opportunity for mold growth to occur within the OSB skin. Regardless of the OSB requested by the customer, code approved water management design should always be used in R-Control SIP construction.

R-Control SIP details provides for the proper installation of R-Control SIPs. R-Control Low VOC Do-All-Ply sealant and SIP Tape are critical components for the installation of R-Control SIPs (See Technical Bulletin sip no. 2047 and sip no. 2057). This is coupled with HVAC design (See Technical Bulletin sip no. 2051 and sip no. 2000) to ensure sufficient air changes and humidity control within the building. Following R-Control SIP details and proper HVAC design will help control moisture which could lead to a mold issue.

Moisture issues that occur in buildings should be addressed immediately. The list below shows many of the common items that could lead to the development of a moisture problem and subsequent mold issues.

1. Plumbing leaks
2. Ice Dams
3. Sky lights
4. Foundations (basements and crawl spaces)
5. Unvented combustion appliances
6. Improperly sized air conditioners
7. Leaky heating and air conditioning ducts
8. Excessive interior humidity
9. Lack of attention to flashing and building details.

If a mold problem is encountered in a structure, a building professional should be consulted immediately.

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SIP No. 2054

Subject: **Recessed Lights**

Date: **November 2007**

The primary considerations for the installation of recessed lighting in R-Control SIPs include potential excessive cutting of the structural facing and excessive heat (refer to Technical Bulletin sip. no. 2064).

Since the R-Control SIP facing is a key structural component, excessive cutting of the facing along with the foam core will lead to a reduction in the structural capacity of the R-Control SIP.

Heat buildup with recessed lights is the result of being installed in a fully insulated cavity. Although some recessed lights are designated for insulated cavities, these lights are not designed for the superior performance of the solid core of Foam-Control EPS (Expanded Polystyrene) within the R-Control SIP.

R-Control recommends the installation of surface mount or track lighting for R-Control SIP ceiling applications. If a flush appearance is required, a cavity or soffit application is recommended. A cavity or soffit is created through the installation of framing material attached to the surface of the R-Control SIP before the installation of gypsum board. This creates a cavity or soffit in which lighting can be installed without cutting the face of the R-Control SIP (see SIP-143 & SIP-143a).

The use of recessed lighting is not recommended for application within R-Control SIPs.

However, if recessed lights are desired to be installed in an R-Control SIP, the engineer of record for the project should be consulted with regard to the number and location of planned cuts in the R-Control SIP. The engineer must review these cuts to ensure the structural integrity of the R-Control SIP. In addition, since the core of the R-Control SIP is EPS, the opening into the R-Control SIP will expose EPS. A minimum of 2X dimensional lumber blocking or 1/2" gypsum board must be installed over the exposed EPS prior to the installation of the fixture.

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SIP No. 2055

Subject: **SENCO Nail and Staple Pullout**

Date: **November 2007 (Revised May 2013)**

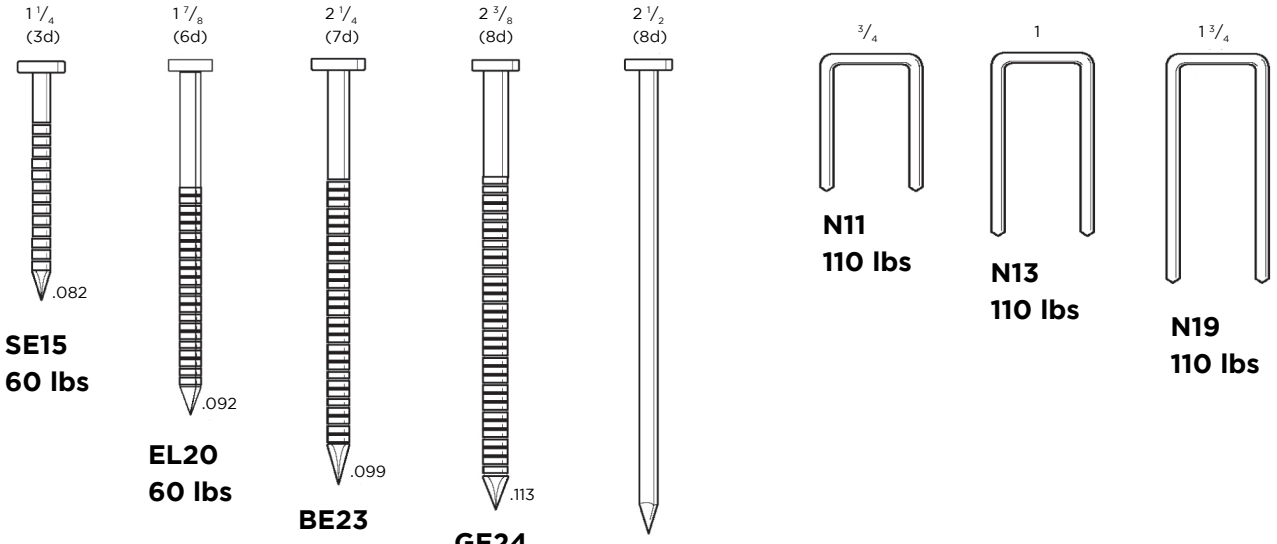
Senco staple and nail products driven into the OSB (oriented strand board) facing of R-Control SIPs were tested for pullout. Pullout values were determined by driving nails or staples through the 7/16" OSB and extracting the nail or staple. The staples were left exposed above the surface 1/4".

The following pullout values were obtained for 7/16" OSB faced R-Control SIP.

The data in this bulletin is average ultimate pullout value. No factor of safety has been applied. An appropriate factor of safety should be used in design calculations.

The data is representative of the OSB tested. Results will vary with OSB source and lot. Data is based on dry OSB.

This data allows specifiers and manufacturers of finishing products and systems to determine correct fastener placement required for their materials.



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SIP No. 2056

Subject: **Point Loading of Walls**

Date: **November 2007**

R-Control SIP walls are used in combination with various types of roof systems. These include R-Control SIPs, rafter and ridge beam systems, and roof trusses.

Roof systems, such as roof trusses, often result in the need to transfer a point load from the roof system uniformly onto the wall. R-Control has evaluated the point load capacity of R-Control SIPs as shown in the attached Wall-Point Loading Chart. The total load should never exceed the lesser of the point load capacity or the R-Control SIP axial and transverse capacity from the R-Control wall load design charts. If the design load exceeds these point loads, the R-Control SIP can be fabricated to accept 2X posting or other posting as determined by the engineer of record.

Wall - Point Loading

Load Design Chart #2C (See Detail SIP-101)		
R-Control Structural Insulated Panels		
	Point Load Width	
	1 1/2”	**3”**
Single Top Plate	2000 lbs.[3]	2150 lbs.[3]
w/Spacer Board[1]	2100 lbs.[3]	3000 lbs.[3]
w/Optional Cap Plate[2]	4000 lbs.[3]	4150 lbs.[3]

[1] MINIMUM 3/8” CDX PLYWOOD OR EQUIVALENT
[2] MINIMUM SPF#2 2X OR EQUIVALENT
[3] ULTIMATE LOAD DIVIDED BY SAFETY FACTOR OF THREE OR 1/8” DEFLECTION, WHICHEVER IS LOWER.
[4] WALL LOADING SHALL BE DESIGNED TO THE LESSER OF THE POINT LOAD CAPACITY OF LOAD DESIGN CHART #2C OR THE R-CONTROL SIP AXIAL CAPACITY FROM THE WALL LOAD DESIGN CHARTS.
[5] FOR POINT LOADS EXCEEDING THESE CAPACITIES, SPECIFY POSTING AS DESIGNED BY THE ENGINEER.
[6] ALL VALUES ARE FOR NORMAL DURATION LOADS. NO INCREASES FOR OTHER LOAD DURATIONS ARE ALLOWED.

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SIP No. 2057

Subject: SIP Tape

Date: November 2007 (Revised January 2015)

R-Control SIP joint detailing is commonly accomplished with R-Control Low VOC Do-All-Ply, SIP Tape, or vapor barriers. The proper sealing of joints during the installation of R-Control SIPs is an essential aspect to ensure both energy efficiency and long term durability of the structure.

R-Control has conducted extensive testing on the performance of R-Control Low VOC Do-All-Ply used to seal SIP joints. Testing has shown that the use of R-Control Low VOC Do-All-Ply installed according to the R-Control SIP details will provide long term durable joints.

This bulletin describes using SIP Tape for the sealing joints of R-Control SIPs when used in roof/ceiling panel applications. The method consists of using R-Control SIP tape along with R-Control Low VOC Do-All-Ply sealant.

R-Control SIP Tape is an adhesive tape product developed specifically for use with SIPs. The adhesive is designed specifically for use indoors and does not impact indoor air quality. Many other construction tapes are available, such as asphalt based adhesive, but these products are not suitable for indoor applications.

R-Control SIP details show the placement of R-Control SIP Tape on the interior of the structure. The basis for placement is the building science practice of placing vapor barriers on the warm in winter side of the roof/ceiling. However, in hot/humid climates the R-Control SIP Tape may be placed on the exterior of the structure as the cooling season dominates (the warm side of the roof/ceiling is the exterior).

Advantages of the R-Control SIP Tape installation are that the R-Control SIP Tape eliminates the application of a separate vapor barrier and provides for an external visual inspection.

Testing by R-Control has shown that the performance of the R-Control SIP Tape details along with R-Control Low VOC Do-All-Ply or the use of R-Control Low VOC Do-All-Ply and vapor barriers are both acceptable methods of construction for R-Control SIPs.

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SIP No. 2058

Subject: **Window Installation Detailing**

Date: **November 2007 (Revised January 2015)**

R-Control SIPs are a high performance building material. In order to provide maximum comfort, energy savings, and durability for the building envelope, the selection of high performance windows are required to complement the performance of R-Control SIPs.

Regardless of window type selected, proper installation of window flashing materials is required. Window flashing consists of the following basic steps for installation of integral flanged windows in new construction:

1. Installation of weather-resistive barrier on wall.
2. Proper cutting of weather-resistive barrier to conform to window openings. The weather resistive barrier at the head opening is held up temporarily.
3. Installation of sill flashing.
4. Installation of caulk to jambs and head of window opening (not sill) or to window directly.
5. Fasten window into opening according to manufacturer's instructions.
6. Install jamb and head flashing over window flange.
7. Install weather resistive barrier over head flashing.

These basic steps above are a general outline of the process that must be completed to properly flash a window opening.

Many commercial products are available which are suitable for use as flashing products with R-Control SIPs.

Regardless of product selected for your flashing of R-Control windows, the flashing manufacturers' and window manufacturers' guidelines must be followed completely.

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SIP No. 2059

Subject: **SIP Fastener Use in ACQ Treated Lumber**

Date: **November 2007**

In 2004, the treated wood industry halted production of lumber pressure-treated with Chromated Copper Arsenate (CCA) for residential applications in response to EPA concerns about arsenic (a known carcinogen). The primary product replacing CCA is Alkaline Copper Quaternary or ACQ. While ACQ is deemed safer because of its non-arsenic content, studies have shown it may be more corrosive to metal fasteners than CCA.

The corrosive nature of ACQ and its impact on metal fasteners has created concern in the construction industry. Initial efforts by the manufacturers of ACQ treated lumber to identify acceptable metal fasteners resulted in the recommendation that stainless steel fasteners or hot-dipped galvanized fasteners be used with ACQ treated wood products.

R-Control also recommends that 8d nails or staples used with R-Control SIPs be stainless steel or hot-dipped galvanized fasteners when ACQ lumber is used.

In light of the ACQ issue, R-Control SIP Wood Screws and Metal Fasteners have been evaluated by an independent, third party to perform accelerated corrosion resistance tests in ACQ treated lumber.

These independent test results indicate that the R-Control SIP Screws and Fasteners barrier coating performs well in ACQ treated lumber and even out perform hot-dipped galvanized. As a result of these performance tests, we can recommend that R-Control SIP Wood Screws and Metal Fasteners are “compatible for ACQ” treated wood applications.

As with any fastener in an ACQ treated lumber application, estimates of its service life cannot be provided due to the many variables that the fastener is exposed to, including (but not limited to) the chemical retention level in the wood, species of wood, and environment.

Note: R-Control SIP screws are intended for use with R-Control SIPs as described in the R-Control SIP details and are not intended for other applications.

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SIP No. 2060

Subject: **Building Green and LEED v4 New Construction**

Date: **November 2007 (Revised January 2015)**

The United States Green Building Council (USGBC) publishes the Leadership in Energy and Environmental Design (LEED) rating system. The latest LEED, version v4, includes new market sector adaptations for data centers, warehouses and distribution centers, hospitality, existing schools, existing retail and mid-rise residential projects

LEED v4 establishes requirements for design components that impact sustainable design. Credits or points are earned for meeting specific milestones in various categories. These categories include Location and Transportation (LT), Sustainable Sites (SS), Water Efficiency WE), Energy and Atmosphere (EA), Materials and Resources (MR), Indoor Environmental Quality (EQ) , Innovation (IN), and Regional Priority (RP). A minimum number of available points are required to achieve a LEED Certified rating. Silver, Gold, and Platinum levels are also available by meeting higher point thresholds.

R-Control SIPs are an ideal structural and insulation choice for inclusion into LEED certified building designs. The key benefit of using R-Control SIPs is a reduction in energy consumption.

The following are the key categories associated with the use of R-Control SIP in LEED certified building.

Energy & Atmosphere

Minimum Energy Performance
R-Control SIPs help reduce the environmental and economic harms of excessive energy use by achieving a minimum level of energy efficiency for the building and its systems.
(required)

Optimized Energy Performance
R-Control SIPs are a key building envelope component to achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic harms associated with excessive energy use.
(up to 20 points)

Innovation in Design:

Innovation in Design
R-Control SIP are an innovative product used to achieve exceptional or innovative performance.
(1 point)

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SIP No. 2061

Subject: **ICC ES Evaluation Report**

Date: **November 2007 (Revised January 2015)**

R-Control SIPs have a long history of complying with the model building codes of the U.S. The most common method to demonstrate compliance with a building code is to work with the International Code Council Evaluation Service (ICC ES) to develop an evaluation report. ICC ES is recognized as the leader in the evaluation of building products.

ICC ES developed AC04, "Acceptance Criteria for Sandwich Panels" as a method to evaluate SIPs. A SIP manufacturer must meet the requirements of AC04 to be recognized in an ICC ES evaluation report.

R-Control SIPs have been evaluated by ICC ES and are recognized by ICC ES evaluation report ESR-2233. ESR-2233 covers the use of R-Control SIPs in compliance with the 2012 International Building Code® (IBC) and 2012 International Residential Code® (IRC).

For more information on ICC ES, please visit their website at www.icc-es.org. A current copy of the R-Control SIP evaluation report is also available on their website.

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SIP No. 2063

Subject: **Low Slope Roofing Installation**

Date: **November 2007**

R-Control SIPs are commonly used as a structural roof decking component due to the fact that they provide both insulation and structure in a single component. Although R-Control SIPs are manufactured with Exposure I rated Oriented Strand Board (OSB), the panel should be covered as soon a possible with temporary weather protection after installation. R-Control SIPs are a key load bearing structural element of the roof assembly and the OSB must be protected from weather and damage for the intended life of the structure.

R-Control SIPs can be covered with traditional roof coverings, including shingles, tile, metal, as well as low slope roofing systems. This bulletin describes the steps for proper installation of low slope roofing systems over R-Control SIP roof decks.

When installed in low slope roof designed buildings, R-Control SIPs are typically covered with single ply, modified bitumen, or built up roofing materials. These various roofing covering systems all offer excellent protection for the R-Control SIP roof deck from weather. These roofing materials may include 10, 20, 30 year, or longer periods of warranty protection offered by the Low Slope Roofing System Manufacturer. Inevitably, all roof covering systems age and wear out and need to be replaced. When the roof covering system is removed for re-roof replacement, the OSB top facing of the SIP must be protected to ensure it maintains its integrity.

Mechanically Attached Systems

Mechanically attached low slope roof systems shall be installed in accordance with the Low Slope Roofing Manufacturer's recommendations for application to a 7/16" OSB deck.

Fully Adhered Systems

If the roof covering system is adhered directly to the OSB top facing, the removal of the roof covering system in the future would likely lead to damage of the R-Control SIP OSB facing and possible structural compromise of the R-Control SIP roof deck.

Therefore, R-Control requires that a Dens-Deck (1/4" thickness or greater) or wood fiber board (1/2" or greater), or similar coverboard, in the type and style approved by the Low Slope Roofing System Manufacturer, be attached on top of the R-Control SIP roof deck prior to the installation of fully adhered low slope roof covering systems. Mechanical attachment of the coverboard shall be installed in accordance with the Low Slope Roofing Manufacturer's recommendations for application to a 7/16" OSB deck.

In addition to the foregoing, R-Control requires that low slope roofing systems which approve the use of adhesives for the attachment of their system to approved coverboards, use a water based adhesive approved by the Low Slope Roofing System Manufacturer. The use of solvent based adhesives could lead to damage of the expanded polystyrene (EPS) foam core of the R-Control SIP (see Technical Bulletin sip no. 2065).

Note: The use of water based adhesives, sealants, coatings, cleaning solutions, etc. help to meet the ever growing need to eliminate solvent based VOC emitting materials used in construction. Water based materials also further Green building practices to improve air quality performance in buildings. R-Control supports these important initiatives.

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SIP No. 2064

Subject: **Exposure to Excessive Temperatures**

Date: **November 2007**

R-Control SIPs are commonly used as a structural component due to the fact that they provide both insulation and structure in a single component. R-Control SIPs are manufactured with Exposure I rated Oriented Strand Board (OSB) facings and a Foam-Control Expanded Polystyrene (EPS) foam core. The Foam-Control EPS provides the structural connection between the OSB facings and must be protected for the life of the structure from exposure to excessive heat that may damage the EPS.

Temperature:

The maximum recommended use temperature for Foam-Control EPS is 165°F (75°C). The temperature that the R-Control SIPs are exposed to is a function of exterior temperature, building orientation relative to the sun, building elevation, and the type of roof covering material(s) used. In most locations across the United States and with the use of standard roof covering material(s), the R-Control EPS will not be exposed to temperatures over 165°F.

Peak temperatures typically occur under the following conditions: south facing, low or medium slope, and dark colored roofs. In these situations, roof surface temperatures have been documented to reach temperatures of 200°F or higher on sunny days in the southern U.S. Roof designs which includes wall/roof intersections oriented toward the sun may also result in high roof temperatures.

If the roof temperature is anticipated to exceed 175°F a ventilated roofing system is recommended over R-Control SIPs.

Metal roof systems have inherent properties that transfer and build heat that potentially could cause an R-Control SIP roof deck to exceed a safe use temperature. When installing metal roof systems over R-Control SIPs, additional design considerations may be necessary to protect the roofing underlayment and the R-Control SIP from excessive temperatures. These design strategies may include the use of a ventilated air space above the R-Control SIP to minimize temperature exposure. Consult your local R-Control representative for specific recommendations for your geographical location and building design.

In addition, temporary roof, wall or floor coverings must be breathable to ensure that R-Control SIP structures are not subjected to excessive temperatures. For example, the use of clear poly (not breathable) as a temporary roof covering may lead to a greenhouse effect that could damage the SIP structure.

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SIP No. 2065

Subject: **Exposure to Solvents**

Date: **November 2007**

R-Control SIPs are commonly used as a structural component due to the fact that they provide both insulation and structure in a single component. R-Control SIPs are manufactured with Exposure I rated Oriented Strand Board (OSB) facings and a Foam-Control Expanded Polystyrene (EPS) foam core. The Foam-Control EPS provides the structural connection between the OSB facings and must be protected for the life of the structure from exposure to solvents that may damage the EPS.

Solvents:

Foam-Control EPS may be attacked and damaged by some solvents and/or their vapors. The installation of roof coverings, wall covering, or other materials attached to R-Control SIPs must be completed with water based materials as materials containing solvents could lead to damage of the Foam-Control EPS.

In addition, temporary roof, wall or floor coverings must be breathable to ensure that any solvent vapors present in the construction of the R-Control SIP structure are able to breathe quickly through the temporary covering materials.

For example, the use of clear poly (not breathable) over asphalt paper may lead to a trapping of solvents that could damage the SIP structure.

Note: The use of water based adhesives, sealants, coatings, cleaning solutions, etc. help to meet the ever growing need to eliminate solvent based VOC emitting materials used in construction. Water based materials also further Green building practices to improve air quality performance in buildings. R-Control supports these important initiatives.

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SIP No. 2066

Subject: **Metal Roofing**

Date: **January 2008**

R-Control SIP roofs can be finished with a wide range of roofing products. Metal Roofing is one type of roof covering that has been used successfully over R-Control SIPs for many years. Metal roofing provides a water tight roof system and has a long life expectancy when compared to many other roofing systems. One major advantage of metal roofing is that minimal maintenance is required over the life of the roof.

As with all roofing materials, the installation must be in compliance with the metal roofing manufacturer's recommended installation details. The primary consideration when installing metal roofing over R-Control SIPs is to ensure the roofing manufacturer provides installation recommendations for installation into the 7/16" OSB facing of the R-Control SIP. Some metal roofing manufacturer's may request an increase in the R-Control OSB facing thickness to 5/8" to meet their installation requirements or alternatively the installation of wood nailers on the R-Control SIP. The reason for this is that their installation recommendations and engineering is based upon the thicker substrate that the 5/8" deck or nailers provide.

MBCI, a leader in the metal roofing industry, has reviewed their roofing products and can provide installation recommendations for the installation of their roofing products directly into the 7/16" OSB facing of R-Control SIPs. Following these installation recommendations provides assurance that the roofing materials will provide the long term durability that is expected when metal roofing is selected.

An additional consideration when installing any roofing material is to ensure that excessive temperatures are not transferred to the R-Control SIP roof deck. While metal roofing has a higher emissivity rating than other roofing materials and is available with paint finishes that have a higher reflectivity than most other roofing materials, under some conditions there is a potential for excessive temperatures between the SIPS roof deck and the roof membrane. This could cause an R-Control SIP roof deck to exceed its safe use temperature. When installing metal roof systems over R-Control SIPs, additional design considerations may be necessary to protect the roofing underlayment and the R-Control SIP from excessive temperatures. These design strategies may include the use of a ventilated air space above the R-Control SIP to minimize temperature exposure. Consult your local R-Control representative for specific recommendations for your geographical location and building design.

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SIP No. 2067

Subject: **Seismic Performance**

Date: **February 2008 (Revised January 2015)**

R-Control SIPs have a history of performance in seismic events. In particular, a number of R-Control SIP structures were located close to the epicenter of the magnitude 6.9 earthquake that struck Kobe, Japan in 1995 (please refer to R-Control SIP Project Profile on the Kobe Earthquake). A review of these structures after the earthquake demonstrated that the inherent performance of R-Control SIPs in seismic events is exceptional.

R-Control SIPs develop their shear strength from the use of outer facings of 7/16" OSB manufactured in conformance with the PS2 standard for sheathing. Each R-Control SIP wall panel is connected to base plates, top plates, and vertical boundary members with fasteners, typically 8d nails. The 8d nails provide for the transfer of the shear loads from the OSB facings to the wood plating materials while the adhesive bond of the OSB to the Foam-Control EPS core provide resistance for the OSB from buckling. This performance is identical to conventionally built OSB sheathed shear walls where the OSB provides shear resistance by using fasteners to transfer shear loads to the framing members.

In order to ensure the performance of R-Control SIPs in seismic events, R-Control SIPs have been evaluated side by side with OSB sheathed conventional walls. The testing was conducted by the leader in the development of shear wall design data for light frame walls, APA – The Engineered Wood Association. The testing consisted of building a high capacity conventional OSB sheathed 2X shear walls and comparing the performance to R-Control SIPs.

The conventional wall consisted of 2X framing members spaced 24" o.c., 4X bottom and top plates, and 4X vertical boundary members. The walls were sheathed on both sides with 7/16" OSB attached with 8d cooler nails in two staggered rows with spacing at 2" o.c. The 4X members were necessary due to the high capacity that was anticipated for the testing. The 4X6's were No. 2 Douglass-fir larch.

In a similar fashion, R-Control SIP walls were built using the same 4X bottom and top plates and 4X vertical boundary members. The R-Control SIP spline also consisted of a 4X. Please refer to R-Control SIP details SIP-101b for the plate connection and SIP-102k for the spline connection. The intention of the testing was to compare side by side the performance of conventional OSB sheathed shear walls and R-Control SIPs.

Since the International Building Code has a restriction on the application of adhesives for attachment of shear wall sheathing, the application of R-Control Low VOC Do-All-Ply Sealant was modified to ensure that the R-Control SIP facing was only attached to the plating lumber with fasteners. The modified R-Control Low VOC Do-All-Ply application consisted of sealant being applied between the 4X plating and the Foam-Control EPS instead of between the 4X plating and the OSB facing of the R-Control SIP.

The testing was conducted following a seismic test protocol developed by the Structural Engineering Association of Southern California (SEAOSC). The test consists of imposing a simulated seismic event to a shear wall and recording the response. The test protocol consists of 72 cycles of loading for the shear wall. A sample of the test data is shown in Figure 1. Note that the resulting loads and deflection for the conventional shear wall and the R-Control SIP wall appear nearly identical.

To further analyze the results, a "backbone" curve was extracted from the test data. The backbone curve is used to compare two tests to each other by comparing the load versus deflection performance of the walls. The backbone test data is shown in Figure 2. The load versus deflection of the conventional shear wall and the R-Control SIP wall appear very similar.

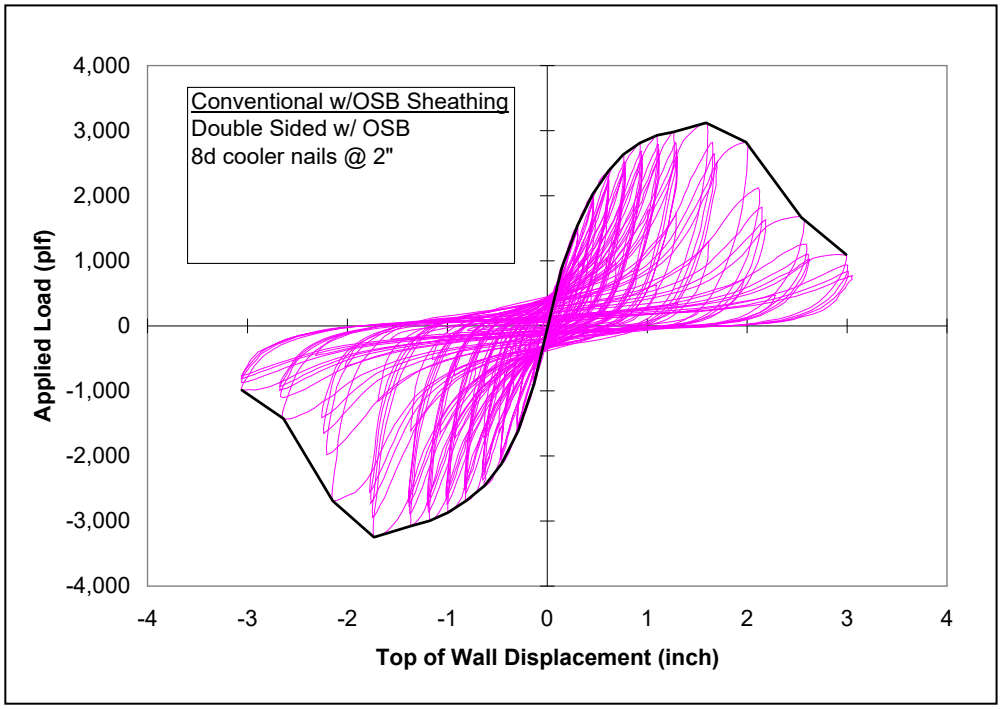
A final check on the comparative results was to calculate the cumulative dissipated during the testing (see Figure 3). Again the performance of R-Control SIPs is nearly identical to the performance of the conventional shear wall.

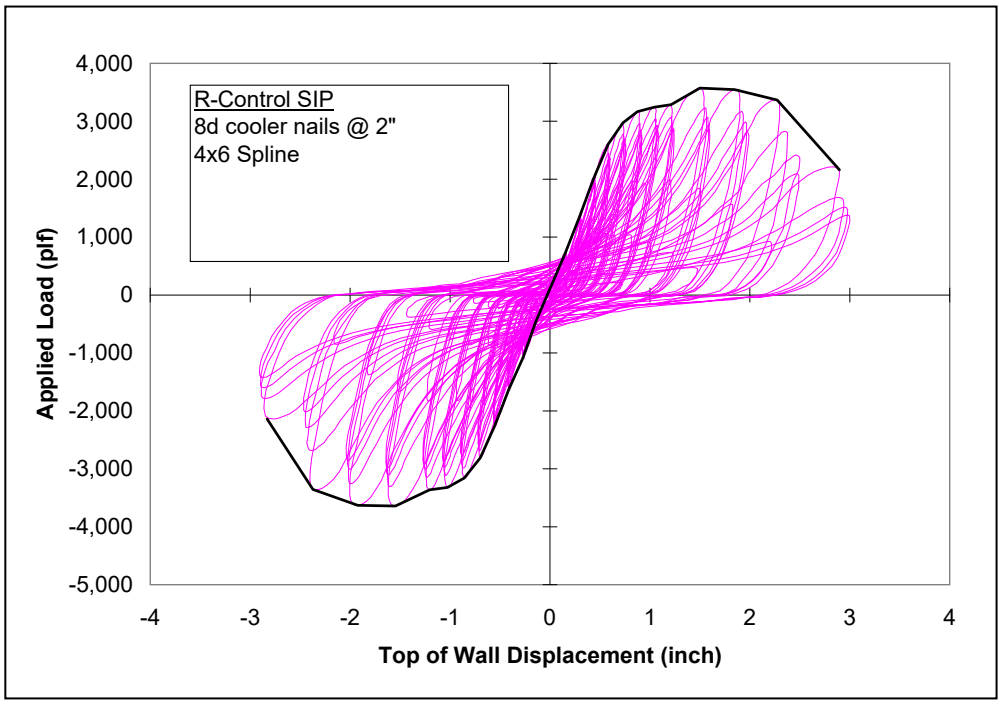
A structural review of the APA testing and the deflection requirements for shear walls as stated in ICC-ES AC04 acceptance criteria for Sandwich Panels suggests a design limit of 920 plf for the R-Control SIP assembly as described in this bulletin.

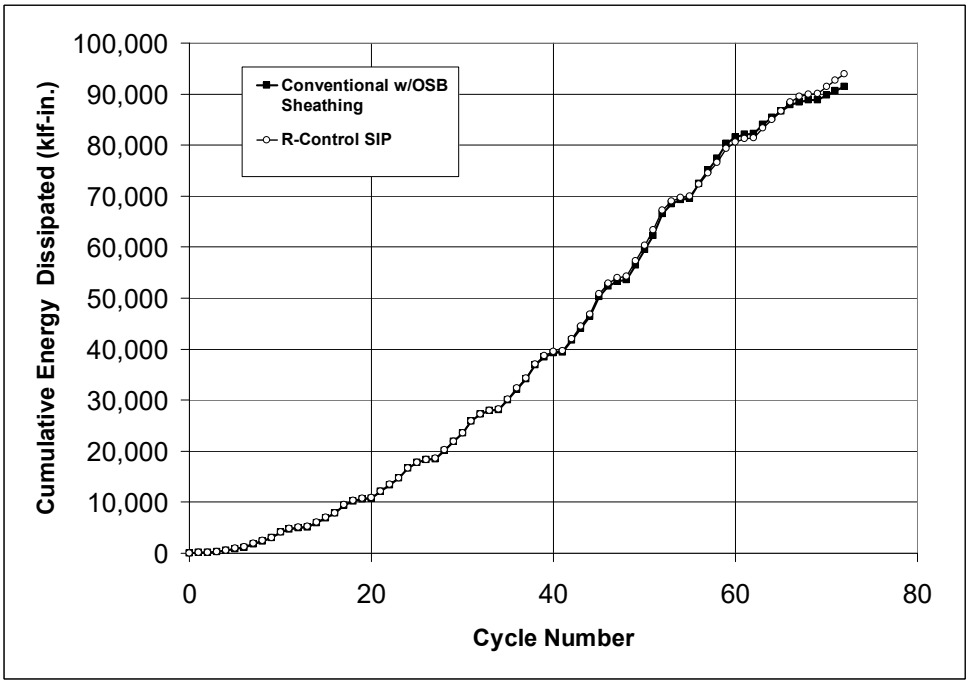
Please refer to the R-Control SIP Load Design Chart #6 for information on wall shear loads.

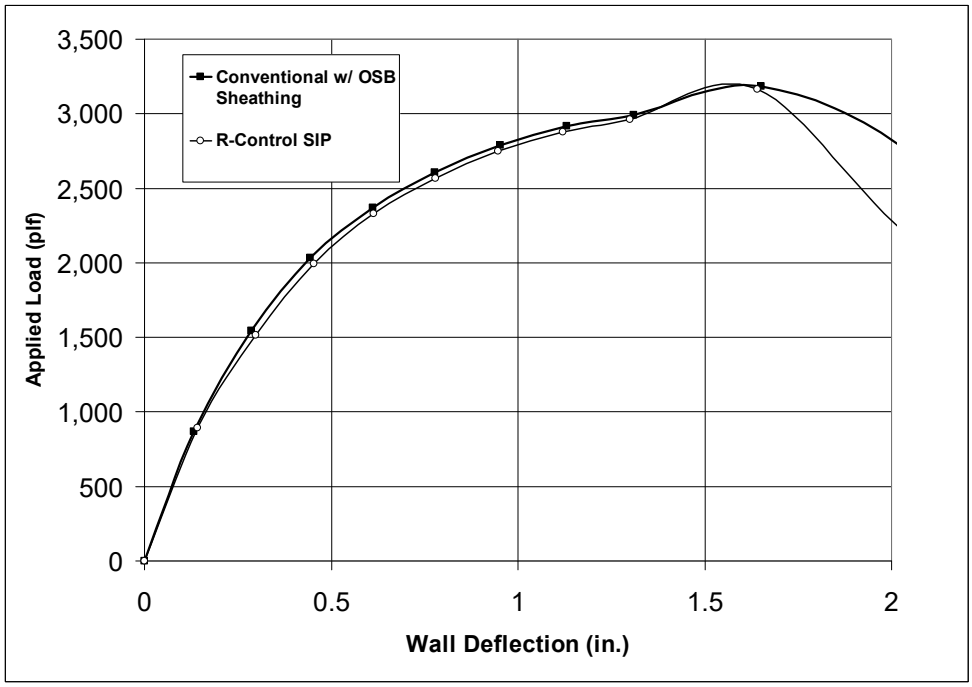
It is recommended that R-Control SIPs be treated as equivalent to conventional light frame shear walls with OSB sheathing for performance in seismic events.

Figure 1









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SIP No. 2068

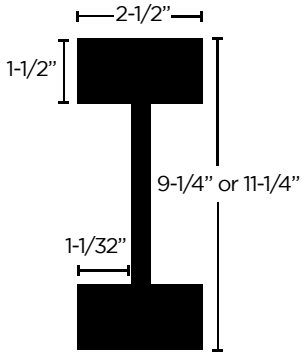
Subject: **SIP Engineered Splines – Design Data**

Date: **May 2008 (Revised February 2012)**

R-Control I-Beam splines are a companion product that provide additional strength and span capacity to R-Control SIPs assemblies. When the I-Beam splines are used with R-Control SIPs the composite panel/spline engineering data is detailed in the R-Control Load Design Charts.

However, on occasion it may be necessary to engineer a portion of a structure using the design capacities of the I-Beam. This bulletin provides the design capacities of the R-Control I-Beam for use in these instances.

R-Control I-Beams



R-Control I-Beam Spline Reference Design Values[1]						
Joist Depth (in)	**Joist Weight (plf)**	**EI (10^6 lbs-in^2)**	**K**	**Moment[2] M_r (ft-lb)**	**Shear[2] V_r (lb)**	**End Reaction[2] $R_{r,e}$ (lb)**
9-1/4"	3.3	246	5.3	5050	1685	1375
11-1/4"	3.5	395	5.3	6545	2120	1375

[1] Please refer to ICC-ES ESR-2994 for general design information
[2] Moment and shear values and end reactions are for normal duration of load
[3] Maximum end reaction is based 1-3/4" (44 mm) bearing length
[4] The formula below shall be used to determine total deflection of uniformly loaded simple span.

$$\text{Defl.} = (22.5WL^4/EI) + (12WL^2/Kdx10^5)$$

Defl. = Deflection in inches.
W = Uniform Load (plf).
L = Clear Span (ft).
D = Out to Out depth of joist in inches.

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SIP No. 2069

Subject: LEED for Homes

Date: November 2009 (Revised January 2015)

The United States Green Building Council (USGBC) publishes the Leadership in Energy and Environmental Design (LEED) rating system to help encourage sustainable design.

The LEED for Homes Rating System has been specifically designed to help advance sustainable design in the construction of residential homes. Credits or points are earned for meeting specific milestones in various categories. A minimum number of available points are required to achieve a LEED Certified rating. Silver, Gold, and Platinum levels are also available by meeting higher point thresholds. The categories covered by the LEED for Homes Rating System include:

- Innovation & Design Process
- Location & Linkages
- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Awareness & Education

LEED Point Potential when using R-Control SIPs

Innovation & Design Process

ID3: Innovation or Regional Design
R-Control SIP use can be shown to be an innovative design measure for 1 point.

Sustainable Sites

SS5: Nontoxic Pest Control
R-Control SIPs with FrameGuard are protected with a borate product that can qualify as a non toxic pest control strategy for 1/2 point.

Energy & Atmosphere

EA1: Optimize Energy Performance
R-Control SIPs can help build a Energy Star qualified home and a suitable HERS Index that will provide numerous points (up to 34).

EA2: Insulation
R-Control SIPs can be selected with an R-value 5% higher than the Energy code to achieve 2 points for enhances insulation.

EA3: Air Infiltration
The tight construction of R-Control SIPs make it easy to meet the minimal envelope leakage requirement (3 points).

Materials & Resources

MR1: Material-Efficient Framing
R-Control SIPs can be provided fully fabricated to a home plan. The framing efficiencies of R-Control SIPs meet the requirement of Credit 1.4 (up to 3 points) or Off-Site Fabrication (4 points).

Materials & Resources - cont'd

MR2: Environmentally Preferable Products
R-Control SIPs are available FSC Chain of Custody certified when manufacture with FSC certified OSB (up to 1 point).

MR3: Waste Management
R-Control SIPs can be provided fully fabricated to reduce on-site waste (up to 3 points).

Indoor Environmental Quality

EQ4: Outdoor Air Ventilation
As part of the airtight construction with R-Control SIPs, a ventilation design to incorporate outdoor air ventilation is part of the process when building with R-Control SIPs (up to 3 points).

For more information on LEED for Homes, please visit www.usgbc.org

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SIP No. 2070

Subject: **Mold Resistant SIPs - FrameGuard® Coating**

Date: **October 2008 (Revised January 2015)**

R-Control SIPs when coated with FrameGuard provide protection against mold, mildew, and termite damage to the oriented strand board (OSB) facings. An important aspect of choosing a mold, mildew, and termite resistant coating for a SIP panel is to understand the regulatory, manufacturing, testing, air quality, and warranty details of the system.

EPA Registration

A critical regulatory issue is that all chemicals and components claiming to provide protection against mold and termites must be registered with the Environmental Protection Agency (EPA).

The moldecide component of FrameGuard coating is covered by EPA registration # 72616-1-62190 and the termite resistant component is covered by EPA registration # 64405-1-62190. Other products may use an EPA registered component recognized for termites, but we recommend that you verify their registration with the EPA to ensure it includes recognition for mold resistance.

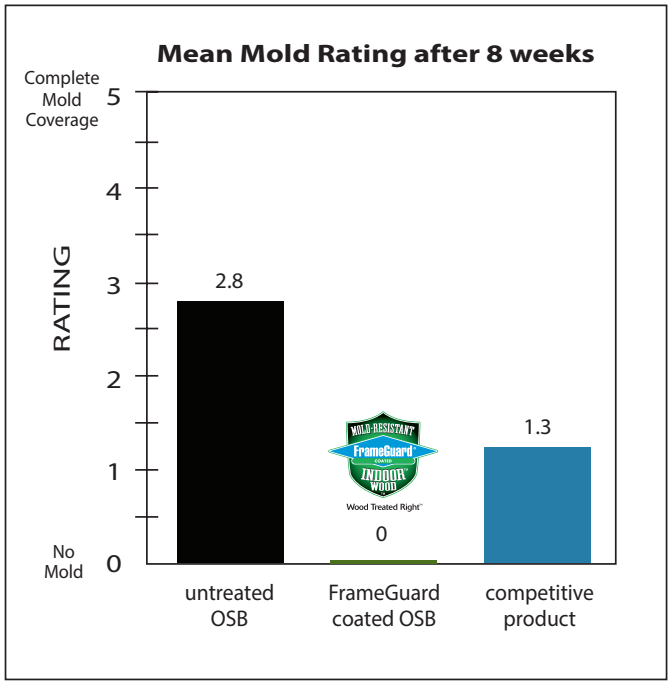
Quality Controlled Manufacturing

FrameGuard coating is a blend of components factory applied with advanced manufacturing equipment and processes to provide thorough coverage to the surface of R-Control SIPs. Quality control records are maintained and ongoing tests are conducted to ensure proper treatment.

Independent Testing - Mold

The FrameGuard coating has been tested side by side with many other wood protection products claiming protection against mold. Testing was conducted by Forintek, an independent third party agency recognized as a leader in wood protection testing. The testing followed ASTM D3273, "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber". This mold growth study examined coated and uncoated samples over eight weeks, at a temperature of 77 ^{0}F, and a relative humidity of 100%. The product performance was rated on a scale from 0 (no mold) to 5 (complete mold coverage). The FrameGuard formulation was the clear leader in performance when compared against competitive products used to treat the wood facings of SIP panels.

Mold Control Study
Third Party Testing[1]



[1] Independent testing by Forintek Canada Corporation, using ASTM D-3273. Project 4528

Warranty Coverage

R-Control sources the FrameGuard coating exclusively from Arch Wood Protection, Inc. The FrameGuard limited warranty (see the warranty document for details) is backed by your R-Control supplier and Arch Wood Protection, Inc. You can be assured the warranty protection is backed by companies with a long history of performance servicing the SIP and wood protection markets. Lonza, the parent company of Arch Wood Protection, is an international leader in biocides with over $3.5 billion in sales.

There is no cost for your FrameGuard limited warranty nor are there any special registration requirements. Some other competitive products may charge a fee for their warranty and require registration.

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SIP No. 2071

Subject: **Metal Roof Ventilation with Enkamat 7020**

Date: **September 2009**

The ventilation of metal roofing when installed over R-Control SIPs is a recommended procedure that provides a number of building science benefits.

The primary benefit of venting above an R-Control SIP roof is the removal of unintended moisture vapor that may emanate from the interior of the building from misapplication of R-Control Do-All-Ply and R-Control SIP tape at joints. The venting of moisture vapor between the roof covering and the top of the R-Control SIP reduces the risk of condensation and the potential of moisture damage. In addition to the venting of interior moisture, any rainwater or melting snow that circumvents the metal roofing materials is also removed by virtue of the ventilation space.

Additional benefits of a ventilation cavity is the reduction in the temperature of the R-Control SIP upper surface which reduces the cooling loads for a roof system in the summer. Some metal roofing systems, particularly Zinc and Copper, can expose R-Control SIP roof decks to high temperatures and this reduction of temperature is required. In winter, the ventilated space assists by reducing ice damns when the depth of snow is significant. Impact noise of rain and hail are mitigated as well.

R-Control has investigated a unique product that is compatible and works well with R-Control SIP for above deck ventilation - Colbond's Enkamat 7020. Enkamat 7020 is commonly used in roofing applications to provide the ventilation, drainage, and thermal separation needed for a long service life.

Enkamat 7020 is a three-dimensional mat made of continuous nylon filaments fused at their intersections. The 95% open structure of the entangled filaments facilitates drying of condensed water vapor from the building interior while giving full support to the metal roof. The nylon filaments do not fail under the load of the roof and the rigors of the construction environment, including construction foot traffic. The space created between the R-Control SIP roof deck and the roof covering will allow moisture to flow away or evaporate.

Enkamat 7020 from Colbond

Testing has been conducted on the temperature difference that an R-Control SIP experiences when ventilated with Enkamat 7020 compared to no ventilation. A standing seam metal roof on a small scale R-Control SIP roof structure was constructed specifically for this evaluation. Dark standing seam metal roof panels were fixed to the roof over the Enkamat 7020/roofing underlayment combination and this was compared to the metal roof panels over roofing underlayment alone.

The top surface of the metal roofing was brought to a temperature of 194°F (90°C) with the use of infrared heat lamps. This temperature was held for 6 hours to ensure the temperatures through the assembly would stabilize.

SIP Ventilation	Temp Reduction From Metal Roof to Top Surface of R-Control SIP
None	10°F
Enkamat 7020	43°F

The temperature recorded on the top surface of the R-Control SIP was significantly lower with the use of the Enkamat 7020.

These results clearly demonstrate the effect of an air space on the temperature of an R-Control SIP roof deck when metal roofing is exposed to high temperatures and solar exposure.

R-Control recommends Colbond's Enkamat 7020 as a product that provides the important benefit of easy, cost effective installation with R-Control SIPs and the additional building science benefits of ventilation.

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SIP No. 2072

Subject: **Fiber Cement Siding from James Hardie**

Date: **February 2010 (Revised November 2015)**

James Hardie, a leader in the manufacture of fiber cement siding, has examined the use of their products with R-Control SIPs. James Hardie has served notice that their products applied directly over the 7/16" OSB facing of R-Control SIPs are acceptable following their recommended attachment patterns.

James Hardie's siding is recommended as a premium fiber cement siding product compatible with R-Control SIPs.

Information on the attachment requirement for James Hardie fiber cement siding is included in ICC-ES Evaluation Report ESR-2290 and ESR-1844. For further information on James Hardie siding products, please visit www.jameshardie.com

ICC-ES Evaluation Reports ESR-2290 and ESR-1844 are available from www.icc-es.org.

A summary of the key information for attachment of James Hardie products to R-Control SIPs is also available in the attached James Hardie Technical Bulletin.

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Technical Bulletin

HardiePlank™ Lap Siding, HardiePanel™ Vertical Siding, and Artisan® Lap Siding Directly Fastened Over Structurally Insulated Panels (SIP's)[1]

JamesHardie
Engineered for Climate™

January 2010

(replaces Technical Bulletin dated 9/4/09)

Based on ASTM E330 Transverse Uniform Load Tests (wind load tests) and ASTM D 1037 Fastener Withdrawal and Fastener Pull Through Tests, HardiePlank™ Lap Siding, HardiePanel™ Vertical Siding, and Artisan® Lap Siding over SIP's[1] shall be fastened according to the Allowable Fastener Spacing listed in Table 1 (HardiePlank), Table 2 (HardiePlank, Artisan Lap), or Table 3 (HardiePanel) on the subsequent pages.

James Hardie Building Products Installation Instructions (HardiePlank, HardiePanel, Artisan Lap Siding) shall be followed for basic installation requirements. This bulletin only addresses the mechanical connection schedule of James Hardie Building Products fiber-cement siding to the OSB[1] sheathing. SIP's[1] is an engineered factory built wall unit, hence it is important to follow the individual SIP[1] manufacture's structural design requirements and their installation instructions concerning the application of siding. Refer to the SIP[1] manufacturer for adhesive and cohesive strength limitations of the SIP[1] panel.

All national, state, and local building code requirements must be followed and where they are more stringent than the JamesHardie® installation requirements, state and local requirements will take precedence.

Current and detailed information on JamesHardie® product applications are found at http://www.jameshardie.com.

For further clarification, please contact your local sales representative, or, the JamesHardie® Technical Desk at 1-800-942-7343.

[1] Minimum 7/16 inch APA rated OSB

DESIGN ADVICE: Any information or assistance provided by James Hardie in relation to specific projects must be approved by the relevant specialists engaged for the project eg. builder, architect or engineer. James Hardie will not be responsible in connection with any such information or assistance.

IMPORTANT: Failure to install and finish this product in accordance with applicable building codes and James Hardie written application instructions may affect system performance, violate local building codes, void the product-only warranty and lead to personal injury.

Table 1, HardiePlank™ Lap Siding Blind Nail - Roofing Nail Fastening Method

IBC® & IRC®/2006

Fastner: No. 11 Gauge X 1-3/4" long corrosion resistant roofing nail - Blind Nailed[3]

Table Shows Allowable Fastener Spacing[5] (inches) for

5/16" Hardiplank™ Lap Siding fastened to APA rated minimum 7/16" thick OSB Sheathing

Basic Wind Speed	Building Height (feet)	5¼ -inch wide			6¼- & 6½-inch wide			7¼- & 7½-inch wide			8- & 8¼-inch wide			9¼- & 9½-inch wide		
		Exposure			Exposure			Exposure			Exposure			Exposure		
		B	C	D	B	C	D	B	C	D	B	C	D	B	C	D
90 mph	0-15	23	19	16	21	17	14	18	14	12	15	12	10	12	10	8
	20	23	18	15	21	16	13	18	14	11	15	11	10	12	9	8
	30	23	17	14	21	15	12	18	13	11	15	10	9	12	8	7
	40	22	16	13	19	14	12	16	12	10	14	10	8	11	8	7
	50	20	15	13	18	13	11	15	11	10	13	9	8	10	8	6
	60	19	14	12	17	13	11	14	11	9	12	9	8	10	7	6
100 mph	0-15	19	16	13	17	14	11	14	12	10	12	10	8	9	8	6
	20	19	15	12	17	13	11	14	11	9	12	9	8	9	7	6
	30	19	14	11	17	12	10	14	10	9	12	8	7	9	7	6
	40	17	13	11	15	11	10	13	10	8	11	8	7	9	6	5
	50	16	12	10	14	11	9	12	9	8	10	8	7	8	6	5
	60	16	12	10	14	10	9	12	9	8	10	7	6	8	6	5
110 mph	0-15	16	13	11	14	11	9	12	10	8	10	8	7	8	6	5
	20	16	12	10	14	11	9	12	9	8	10	8	6	8	6	5
	30	16	11	9	14	10	8	12	8	7	10	7	6	8	6	5
	40	14	11	9	13	9	8	11	8	7	9	7	6	7	5	4
	50	14	10	9	12	9	8	10	8	6	8	6	5	7	5	4
	60	13	10	8	11	9	7	10	7	6	8	6	5	6	5	4
120 mph	0-15	13	11	9	12	10	8	10	8	7	8	7	6	7	5	4
	20	13	10	9	12	9	7	10	8	6	8	6	5	7	5	4
	30	13	9	8	12	8	7	10	7	6	8	6	5	7	5	4
	40	12	9	8	11	8	7	9	7	6	8	6	5	6	4	4
	50	11	8	7	10	7	6	9	6	5	7	5	5	6	4	4
	60	11	8	7	10	7	6	8	6	5	7	5	4	5	4	4
130 mph	0-15	11	9	8	10	8	7	8	7	6	7	6	5	6	5	4
	20	11	9	7	10	8	6	8	7	5	7	5	5	6	4	4
	30	11	8	7	10	7	6	8	6	5	7	5	4	6	4	-
	40	10	8	6	9	7	6	8	6	5	6	5	4	5	4	-
	50	10	7	6	9	6	5	7	5	5	6	5	4	5	4	-
	60	9	7	6	8	6	5	7	5	5	6	4	4	5	-	-
140 mph	0-15	10	8	7	8	7	6	7	6	5	6	5	4	5	4	-
	20	10	8	6	8	7	6	7	6	5	6	5	4	5	4	-
	30	10	7	6	8	6	5	7	5	4	6	4	4	5	-	-
	40	9	7	6	8	6	5	7	5	4	6	4	-	4	-	-
	50	8	6	5	7	5	5	6	5	4	5	4	-	4	-	-
	60	8	6	5	7	5	5	6	5	4	5	4	-	4	-	-
150 mph	0-15	8	7	6	7	6	5	6	5	4	5	4	4	4	-	-
	20	8	7	5	7	6	5	6	5	4	5	4	-	4	-	-
	30	8	6	5	7	5	4	6	5	4	5	4	-	4	-	-
	40	8	6	5	7	5	4	6	4	4	5	4	-	4	-	-
	50	7	5	5	6	5	4	5	4	-	5	-	-	4	-	-
	60	7	5	4	6	5	4	5	4	-	4	-	-	-	-	-

Notes to Table:

1. Maximum basic wind speed shall be 150 mph.
2. Interpolation to address building height and other plank widths is permitted.
3. The lap conceals the fasteners of the previous course (Blind Nailed).
4. 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mph = 0.44 m/s
5. Based on ASCE 7-05 a pressure coefficient of 1.58 for h≤60ft, Importance factor of 1, Kzt = 1, Kd = 0.85

Table 2, HardiePlank™ Lap Siding or Artisan® Lap Siding Blind Screw – Wafer Head Screw Fastening Method

IBC® & IRC®/2006

Fastener: No. 8 X 1-5/8" Long X 0.375" Head Diameter Ribbed Wafer Head Screw - Blind Screwed[3]

Table Shows Allowable Fastener Spacing[5] (inches) for

5/16" Hardiplank™ Lap Siding fastened to APA rated minimum 7/16" thick OSB Sheathing

5/8" Artisan® Lap Siding fastened to APA rated minimum 7/16" thick OSB Sheathing

Basic Wind Speed	Building Height (feet)	5¼ -inch wide			6¼- & 6½-inch wide			7¼- & 7½-inch wide			8- & 8¼-inch wide			9¼- & 9½-inch wide		
		Exposure			Exposure			Exposure			Exposure			Exposure		
		B	C	D	B	C	D	B	C	D	B	C	D	B	C	D
90 mph	0-15	24	24	24	24	24	24	24	24	24	24	24	24	24	23	19
	20	24	24	24	24	24	24	24	24	24	24	24	24	24	22	18
	30	24	24	24	24	24	24	24	24	24	24	24	22	24	20	17
	40	24	24	24	24	24	24	24	24	24	24	24	21	24	19	16
	50	24	24	24	24	24	24	24	24	24	24	24	20	24	18	16
	60	24	24	24	24	24	24	24	24	24	24	23	20	23	18	15
100 mph	0-15	24	24	24	24	24	24	24	24	24	24	24	20	23	19	16
	20	24	24	24	24	24	24	24	24	24	24	23	19	23	18	15
	30	24	24	24	24	24	24	24	24	23	24	21	18	23	16	14
	40	24	24	24	24	24	24	24	24	21	24	20	17	21	15	13
	50	24	24	24	24	24	24	24	24	21	24	19	16	20	15	13
	60	24	24	24	24	24	24	24	23	20	24	19	16	19	14	12
110 mph	0-15	24	24	24	24	24	24	24	24	21	24	20	17	19	16	13
	20	24	24	24	24	24	24	24	24	20	24	19	16	19	15	12
	30	24	24	24	24	24	22	24	22	19	24	18	15	19	14	11
	40	24	24	24	24	24	21	24	21	18	23	17	14	17	13	11
	50	24	24	23	24	24	20	24	20	17	21	16	14	16	12	10
	60	24	24	23	24	23	20	24	19	17	20	15	13	16	12	10
120 mph	0-15	24	24	24	24	24	21	24	21	18	21	17	14	16	13	11
	20	24	24	23	24	24	20	24	20	17	21	16	13	16	12	10
	30	24	24	22	24	22	19	24	19	16	21	15	13	16	11	10
	40	24	24	20	24	21	18	24	17	15	19	14	12	15	11	9
	50	24	23	20	24	20	17	22	17	14	18	13	11	14	10	9
	60	24	22	19	24	19	16	21	16	14	17	13	11	13	10	9
130 mph	0-15	24	24	21	24	22	18	22	18	15	18	15	12	14	11	9
	20	24	24	20	24	20	17	22	17	14	18	14	11	14	11	9
	30	24	22	18	24	19	16	22	16	13	18	13	11	14	10	8
	40	24	20	17	24	18	15	20	15	13	16	12	10	13	9	8
	50	24	20	17	23	17	14	19	14	12	15	11	10	12	9	7
	60	24	19	16	22	16	14	18	14	12	15	11	9	11	8	7
140 mph	0-15	24	22	18	23	19	15	19	16	13	15	13	10	12	10	8
	20	24	20	17	23	18	15	19	15	12	15	12	10	12	9	8
	30	24	19	16	23	16	14	19	14	12	15	11	9	12	8	7
	40	24	18	15	21	15	13	18	13	11	14	10	9	11	8	7
	50	23	17	14	20	15	12	16	12	11	13	10	8	10	8	6
	60	22	16	14	19	14	12	16	12	10	13	9	8	10	7	6
150 mph	0-15	23	19	16	20	16	13	17	14	11	13	11	9	10	8	7
	20	23	18	15	20	15	13	17	13	11	13	10	9	10	8	7
	30	23	16	14	20	14	12	17	12	10	13	9	8	10	7	6
	40	21	15	13	18	13	11	15	11	10	12	9	8	9	7	6
	50	20	15	13	17	13	11	14	11	9	11	9	7	9	7	6
	60	19	14	12	16	12	11	14	10	9	11	8	7	8	6	5

Notes to Table:

1. Maximum basic wind speed shall be 150 mph.
2. Interpolation to address building height and other plank widths is permitted.
3. The lap conceals the fasteners of the previous course (Blind Screwed).
4. 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mph = 0.44 m/s
5. Based on ASCE 7-05 a pressure coefficient of 1.58 for h≤60ft, Importance factor of 1, Kzt = 1, Kd = 0.85

Table 3, HardiePanel™ Vertical Siding – Siding Nail Method or Wafer Head Screw Method

IBC® & IRC®/2006 Allowable Fastener Spacing HardiePanel™ Vertical Siding fastened to APA rated minimum 7/16" thick OSB Sheathing													
Basic Wind Speed (3-second gust MPH)	Building Height (feet)	Fastener: 0.092" Shank X 0.222" Head Diameter X 2" Long (6d) Galvenized Siding Nail						No. 8 X 1-5/8" Long X 0.375" Head Diameter Ribbed Wafer Head Screw					
		Exposure						Exposure					
		B		C		D		B		C		D	
		Fastener Spacing		Fastener Spacing		Fastener Spacing		Fastener Spacing		Fastener Spacing		Fastener Spacing	
		Vertical[4]	Horizontal[5]	Vertical[4]	Horizontal[5]	Vertical[4]	Horizontal[5]	Vertical[4]	Horizontal[5]	Vertical[4]	Horizontal[5]	Vertical[4]	Horizontal[5]
90 mph	0-15	7	12	6	12	5	12	17	12	14	12	11	12
	20	7	12	6	12	5	12	17	12	13	12	11	12
	30	7	12	5	12	4	12	17	12	12	12	10	12
	40	7	12	5	12	4	12	15	12	11	12	10	12
	50	6	12	5	12	-	-	14	12	11	12	9	12
	60	6	12	4	12	-	-	14	12	10	12	9	12
100 mph	0-15	6	12	5	12	-	-	13	12	11	12	9	12
	20	6	12	4	12	-	-	13	12	10	12	9	12
	30	6	12	4	12	-	-	13	12	10	12	8	12
	40	5	12	-	-	-	-	12	12	9	12	8	12
	50	5	12	-	-	-	-	12	12	9	12	7	12
	60	5	12	-	-	-	-	11	12	8	12	7	12
110 mph	0-15	5	12	-	-	-	-	11	12	9	12	8	12
	20	5	12	-	-	-	-	11	12	9	12	7	12
	30	5	12	-	-	-	-	11	12	8	12	7	12
	40	4	12	-	-	-	-	10	12	7	12	6	12
	50	4	12	-	-	-	-	10	12	7	12	6	12
	60	-	12	-	-	-	-	9	12	7	12	6	12
120 mph	0-15	4	12	-	-	-	-	9	12	8	12	6	12
	20	4	12	-	-	-	-	9	12	7	12	6	12
	30	4	12	-	-	-	-	9	12	7	12	6	12
	40	-	-	-	-	-	-	9	12	6	12	5	12
	50	-	-	-	-	-	-	8	12	6	12	5	12
	60	-	-	-	-	-	-	8	12	6	12	5	12
130 mph	0-15	-	-	-	-	-	-	8	12	7	12	5	12
	20	-	-	-	-	-	-	8	12	6	12	5	12
	30	-	-	-	-	-	-	8	12	6	12	5	12
	40	-	-	-	-	-	-	7	12	5	12	5	12
	50	-	-	-	-	-	-	7	12	5	12	4	12
	60	-	-	-	-	-	-	7	12	5	12	4	12
140 mph	0-15	-	-	-	-	-	-	7	12	6	12	5	12
	20	-	-	-	-	-	-	7	12	5	12	4	12
	30	-	-	-	-	-	-	7	12	5	12	4	12
	40	-	-	-	-	-	-	6	12	5	12	-	-
	50	-	-	-	-	-	-	6	12	4	12	-	-
	60	-	-	-	-	-	-	6	12	4	12	-	-
150 mph	0-15	-	-	-	-	-	-	6	12	5	12	4	12
	20	-	-	-	-	-	-	6	12	5	12	-	-
	30	-	-	-	-	-	-	6	12	4	12	-	-
	40	-	-	-	-	-	-	6	12	4	12	-	-
	50	-	-	-	-	-	-	5	12	-	-	-	-
	60	-	-	-	-	-	-	5	12	-	-	-	-

Notes to Table:

1. Maximum basic wind speed shall be 150 mph.
2. Interpolation to address building height and other plank widths is permitted.
3. 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mph = 0.44 m/s
4. Vertical Fastener Spacing refers to fasteners spaced from ground towards roof
5. Horizontal Fastener Spacing refers to fasteners spaced parallel to the ground
6. Based on ASCE 7-05 a pressure coefficient of 1.58 for height ≤ 60 feet, Importance Factor of 1, Kzt = 1, Kd = 0.85

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SIP No. 2073

Subject: **Fiber Cement Siding from Allura**

Date: **February 2010 (Revised January 2015)**

Allura, a leader in the manufacture of fiber cement siding, has examined the use of their Fiber Cement Siding with R-Control SIPs and have authored the attached Allura Product Compliance Memo. Allura has served notice that their products applied directly over R-Control SIPs are acceptable following their recommended attachment patterns.

Allura's siding is recommended as a premium fiber cement siding product compatible with R-Control SIPs.

Information on the attachment requirement for Allura's fiber cement siding is attached to this bulletin. For further information on Allura's siding products, please visit www.allurausa.com

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PRODUCT COMPLIANCE MEMO

Installation of Allura Fiber Cement Siding on Structural Insulated Panels (SIPs)

Based on testing in accordance with ASTM E330 (wind load) and ASTM D1037 (fastener withdrawal and pull through), below are siding attachment methods along with their allowable windload capacities[1] for Allura Fiber Cement Siding over Structural Insulated Panels (SIPs)[2].

Structural Insulated Panels (SIP) are a manufactured wall system, and as such, installation of the SIP's and application of siding should be in accordance with the specific SIP manufacturer's instructions.

Lap Siding (up to 8-1/4")

1-3/4" Roofing nails, Double HD Galvanized with 3/8" dia. head.
Blind nailed 8" o.c.
Allowable wind pressure: 40.44 psf, 125 mph in 'B' Exposures up to 30 ft.

1-3/4" Roofing nails, Double HD Galvanized with 3/8" dia. head.
Blind nailed 12" o.c.
Allowable wind pressure: 27.0 psf, 105 mph in 'B' Exposures up to 30 ft.

Lap Siding (9-1/4")

1-3/4" Roofing nails, Double HD Galvanized with 3/8" dia. head.
Blind nailed 8" o.c.
Allowable wind pressure: 32.22 psf, 110 mph in 'B' Exposures up to 30 ft.

6d 2" Siding nails, Double HD Galvanized
Face nailed 12" o.c.
Allowable wind pressure: 24.4 psf, 100 mph in 'B' Exposures up to 30ft.

Vertical Siding

6d 2" Siding nails, Double HD Galvanized
6" o.c. edges, 12" o.c. ea. way field.
Allowable wind pressure: 18.67 psf, 85 mph in 'B' Exposures up to 30ft.

Refer to the Allura Installation Instructions for additional installation requirements. All state and local building code requirements must be followed, and where found more stringent than Allura installation instructions or this memo, state and local code requirements will take precedence.

For questions and or additional information, please contact your local sales representative or Allura Sales Support Group at (844) 4 ALLURA.

(signature)

Tim Larson
Applications Specialist
Allura Fiber Cement Products by Plycem USA

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15055 Woodham Drive
Houston, Texas 77073

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www.AlluraUSA.com

1. Allowable Wind Load Capacities based on 2009 IBC / IRC, Wall Zone 5, Effective Wind Area 10, Importance factor 1.0.
2. Minimum 7/16" APA Rated OSB skin. The SIP system must be capable of supporting the imposed loads from the siding, including dead load and windloads.

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SIP No. 2074

Subject: **Engineered Wood Lap Siding from Louisiana-Pacific**

Date: **August 2010 (Revised January 2015)**

Louisiana-Pacific, a leader in the manufacture of Engineered-Wood lap siding, has examined the use of their Smartside Precision Treated Engineered-Wood lap siding with SIPs. Louisiana-Pacific worked with APA who authored the attached APA Product Report. Louisiana-Pacific has served notice that their products applied directly over R-Control SIPs are acceptable following their recommended attachment patterns. Louisiana-Pacific siding is recommended as a premium Engineered-Wood lap siding product compatible with R-Control SIPs. Information on the attachment requirement for Louisiana-Pacific's Engineered-Wood lap siding is attached to this bulletin (see Tables 4a and 4b). For further information on Louisiana-Pacific siding products, please visit www.lpsmartside.com.

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APA PRODUCT REPORT®

www.apawood.org

LP® SmartSide® Precision Series Treated-Engineered-Wood Lap & Panel Siding Louisiana-Pacific Corporation

PR-N124

Revised July 2, 2014

Product: LP® SmartSide® Precision Series Treated-Engineered-Wood Lap and Panel Siding
Louisiana-Pacific Corporation, 414 Union Street, Suite 2000, Nashville, TN 37219
(800) 450-6106
www.lpcorp.com

1. Basis of the product report:
   - 2012 and 2009 International Building Code: Section 104.11 Alternative Materials
   - 2012 and 2009 International Residential Code: Section R104.11 Alternative Materials
   - ANSI/AF&PA SDPWS-2008 Special Design Provisions for Wind and Seismic
   - ASCE 7-10 and ASCE 7-05 Minimum Design Loads for Buildings and Other Structures
   - ICC-ES Acceptance Criteria for Treated-Engineered-Wood Siding, AC321
   - APA PRP-108 Performance Standards and Qualification Policy for Structural-Use Panels
   - NES Evaluation Protocol for Determination of Flood-Resistance Properties of Building Elements
   - APA Reports R&D 87Q-1, T87Q-45, T91Q-11, T91Q-20, T97Q-4, T97Q-10, T98Q-13, T98Q-17, T99Q-23, T2008Q-12, T2008P-73, T2008P-74, T2009Q-54, T2011Q-59, T2012P-22, and other qualification data.

2. Product description:
   Louisiana-Pacific Corporation (LP®) SmartSide® Precision Treated-Engineered-Wood Lap and Panel siding is overlaid with a resin treated paper and is available with either a smooth or embossed surface texture. The siding is available as laps or panels. The siding is treated with Zinc Borate for decay and insect resistance. All edges are factory sealed with a primer.

   LP® SmartSide® Precision Series Treated-Engineered-Wood lap siding is available in 3/8 and 7/16 Performance Categories, in nominal widths of 6, 8 and 12 inches and in lengths up to 16 feet.

   LP® SmartSide® Precision Series panel siding is available in 3/8, 7/16 and 19/32 Performance Categories, 4-foot width and in lengths of 8, 9, and 10 feet. The 3/8 Performance Category panels are available without grooves or with grooves spaced 8 inches on center. The 7/16 and 19/32 Performance Category panels are available without grooves or with grooves spaced either 4 or 8 inches on center. Minimum thicknesses at the groove and shiplap are documented in the plant Quality Manual.

3. Design properties:
   Allowable racking loads for LP® SmartSide® Precision Series panel siding are listed in Table 1. For 3/8 Performance Category panels nailed at shiplap edges, use 5/16 Performance Category shear values. For 7/16 and 19/32 Performance Category panel sidings nailed at shiplap edges, use 3/8 Performance Category shear values. Design wind loads LP® SmartSide® Precision Series lap and panel siding are listed in Tables 2 and 3, respectively.

4. Product installation:
   LP® SmartSide® Precision Series Treated-Engineered-Wood Lap and Panel sidings shall be installed in accordance with recommendations provided by the manufacturer (www.lpcorp.com/smartside/lap/ and www.lpcorp.com/smartside/panel/) and APA *Engineered Wood Construction Guide*, Form E30 (www.apawood.org/publications). The

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maximum span shall be in accordance with the Span Rating shown in the trademark. The LP® SmartSide® Precision Series lap siding shall be permitted to be installed over the facer of structural insulated panels (SIPs) in accordance with Table 4.

5. Fire-resistant construction:
Wood structural panels that are not fire-retardant-treated have been shown to meet a Class III (or C) category for flame spread. Unless otherwise specified, fire-resistant construction shall be in accordance with the recommendations in APA *Fire-Rated Systems*, Form W305 (see link above).

6. Flood resistance evaluation:
Selected properties critical to flood resistance of 3/8 and 7/16 Performance Category panel siding, including uniform loads, concentrated static loads, concentrated hard body and soft body impact loads, fastener performance, wall racking resistance, edge thickness swell, linear expansion, hygroscopicity, exterior bond performance and large panel and small specimen bending properties were evaluated at a 16 o.c. Span Rating in accordance with *NES Evaluation Protocol for Determination of Flood-Resistance Properties of Building Elements*. Test results in the dry (as-received) condition and after moisture cycling in accordance with the NES protocol were compared to the requirements specified in ICC Evaluation Service (ICC-ES) *Acceptance Criteria for Treated-Engineered-Wood Siding* (AC321).

7. Limitations:
   a) LP® SmartSide® Precision Series Treated-Engineered-Wood Lap and Panel siding used outdoors must be finished in accordance with recommendations provided by the manufacturer (see links above) and APA *Engineered Wood Construction Guide*, Form E30 (see link above).
   b) LP® SmartSide® Precision Series Treated-Engineered-Wood panel siding is flood resistant on the following properties: uniform loads, concentrated static loads, concentrated hard body and soft body impact loads, fastener performance, wall racking resistance, edge thickness swell, linear expansion, hygroscopicity, exterior bond performance and large panel and small specimen bending properties. This evaluation applies to 3/8 and 7/16 Performance Category panel siding at a 16 o.c. Span Rating.
   c) LP® SmartSide® Precision Series Treated-Engineered-Wood Lap and Panel siding is produced at Louisiana-Pacific Corporation facilities at Hayward, WI, Newberry, MI, Tomahawk, WI, and Two Harbors, MN under a quality assurance program audited by APA.
   d) This report is subject to re-examination in one year.

8. Identification:
LP® SmartSide® Precision Series Treated-Engineered-Wood Lap and Panel siding described in this report is identified by a label bearing the manufacturer's name (Louisiana-Pacific Corporation) and/or trademark, the APA assigned plant number (357 for the Hayward plant, 416 for the Newberry plant, 435 for the Tomahawk plant, or 399 for the Two Harbors plant), the product Performance Category, the Span Rating, the Exposure Rating, the APA logo, the report number PR-N124, and a means of identifying the date of manufacture.

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Table 1. Allowable Racking Shear (plf) for LP® SmartSide® Precision Series Treated-Engineered-Wood Panel Siding – Sheathing Shear Walls with Framing of Douglas-Fir-Larch or Southern Pine for Wind or Seismic Loading[1,2,3]

Performance Category	Minimum Nail Penetration In Framing (in.)	Panels Applied Directly to Framing					Panels Applied over 1/2-inch or 5/8-inch Gypsum Sheathing				
		Nail Size (Common or Galvanized Box)	Nail Spacing at Panel Edges (in.)				Nail Size (Common or Galvanized Box)	Nail Spacing at Panel Edges (in.)			
			6	4	3	2[4]		6	4	3	2[4]
5/16[5,6]	1-1/4	6d	180	270	350	450	8d	180	270	350	450
3/8[5,6]			200	300	390	510		200	300	390	510
3/8[5,6]	1-1/2	8d	220	320	410	530	10d	260	380	490[4]	640
7/16[5]			240	350	450	585		260	380	490[4]	640
19/32[5]	1-5/8	10d	340	510	665[4]	870	-	-	-	-	-

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

(1) For framing of other species: (a) Find specific gravity for species of lumber in AF&PA National Design Specification; (b) find shear value from table for nails size; (c) multiply value by 0.82 for species with specific gravity greater than or equal to 0.42 but less than 0.49, or 0.65 for species with specific gravity less than 0.42.

(2) All panel edges must be backed with 2-inch nominal or wider framing. Panels must be installed with the long dimension oriented in the vertical direction. Space nails 6 inches o.c. along intermediate framing members for 3/8 and 7/16 Performance Category panels installed on studs spaced 24 inches o.c. For other conditions and panel Performance Categories, space nails 12 inches o.c. on intermediate supports.

(3) For shear loads of normal or permanent load duration, the values in the table shall be multiplied by 0.63 or 0.56, respectively.

(4) Framing at panel edges must be 3 inches nominal or wider and nails must be staggered where nails are spaced 2 inches o.c., and where 10d nails having penetration into framing of more than 1-5/8 inches are spaced 3 inches or less, o.c. **Exception:** Unless otherwise required, 2-inch nominal framing may be used where full nailing surface is available and nails are staggered.

(5) Except as noted in Footnote 7, panel thickness at point of nailing at panel edges determines applicable shear values, except that 3/8 Performance Category panels nailed at shiplap edges use 5/16 Performance Category shear values, and 7/16 and 19-/32 Performance Category panel sidings nailed at shiplap edges use 3/8 Performance Category shear values.

(6) Shiplap edges must be double-nailed; one nail must be placed in the underlap and a second nail must be placed in the overlap at the nail spacing specified for the applicable shear value.

(7) Fasteners must not be installed in panel siding grooves in the field of the panel siding or when the panel siding grooves occur at cut edges of the panel siding.

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Table 2a. Lap Siding – **Maximum nominal (allowable) design wind speed, V_{asd}**[1]

Performance Category	Maximum Wall Stud Spacing[2] (in.)	Siding Width (in.)	Maximum Allowable Wind Pressure (psf)	Maximum Nominal (Allowable) Wind Speed, V_{asd}[3] (mph)		
				Wind Exposure Category		
				B	C	D
3/8	16	6	80	170	150	140
		8	79	170	150	140
		12	50	140	120	110
7/16	16	6	80	170	150	140
		8	76	170	150	130
		12	49	140	120	110
	24	6	71	170	145	130
		8	51	145	120	110
		12	32	110	90	90

For **SI**: 1 inch = 25.4 mm, 1 psf = 47.88 Pa, 1 mph = 0.447 m/s.

(1) One fastener per stud located 3/4 inch from the top edge of the siding. Each successive course of lap siding must overlap a minimum of 1 inch. Fastener must have a minimum head diameter of 0.297 inch, a minimum shaft diameter of 0.113 inch and a minimum length of 2.5 inches (8d box nail).

(2) Wall studs must have a minimum specific gravity of 0.42.

(3) Three-second-gust; based on wind pressures acting toward and away from building surfaces, at 30-ft height in Zone 5 with smallest effective area per Chapter 6 of ASCE 7-05, Section R301.2 of the 2009 and 2012 IRC, and Section 1609.1.1 of the 2009 IBC.

Table 2b. Lap Siding – **Maximum ultimate design wind speed, V_{ult}**[1]

Performance Category	Maximum Wall Stud Spacing[2] (in.)	Siding Width (in.)	Maximum Ultimate Wind Pressure (psf)	Maximum Ultimate Design Wind Speed, V_{ult}[3] (mph)		
				Wind Exposure Category		
				B	C	D
3/8	16	6	133	200	180	180
		8	131	200	180	180
		12	83	180	150	140
7/16	16	6	133	200	180	180
		8	127	200	180	160
		12	81	180	150	140
	24	6	119	200	180	160
		8	85	180	150	140
		12	54	140	120	115

For **SI**: 1 inch = 25.4 mm, 1 psf = 47.88 Pa, 1 mph = 0.447 m/s.

(1) One fastener per stud located 3/4 inch from the top edge of the siding. Each successive course of lap siding must overlap a minimum of 1 inch. Fastener must have a minimum head diameter of 0.297 inch, a minimum shaft diameter of 0.113 inch and a minimum length of 2.5 inches (8d box nail).

(2) Wall studs must have a minimum specific gravity of 0.42.

(3) Three-second-gust; based on wind pressures acting toward and away from building surfaces, at 30-ft height in Zone 5 with smallest effective area per Chapter 26 of ASCE 7-10 and Section 1609.1.1 of the 2012 IBC.

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Table 3a. Panel Siding – **Maximum nominal (allowable) design wind speed, V_{asd}**

Performance Category	Maximum Wall Stud Spacing[2] (in.)	Fastener Spacing[1] (in. o.c.)		Maximum Allowable Wind Pressure	Maximum Nominal (Allowable) Wind Speed, V_{asd}[3] (mph)		
					Wind Exposure Category		
		Edges	Field		B	C	D
3/8	16	6	12	46	130	110	105
			6	80	170	150	140
	24	6	12	31	110	90	85
			6	61	150	130	120
7/16	16	6	12	45	130	110	105
			6	80	170	150	140
	24	6	12	30	110	90	85
			6	59	150	130	120
19/32	16	6	12	41	130	110	100
			6	80	170	150	140
	24	6	12	27	105	90	-
			6	55	150	125	110

For **SI**: 1 inch = 25.4 mm, 1 psf = 47.88 Pa, 1 mph = 0.447 m/s.

(1) Fastener must have a minimum head diameter of 0.297 inch, a minimum shaft diameter of 0.113 inch and a minimum length of 2.5 inches (8d box nail).
(2) Wall studs must have a minimum specific gravity of 0.42.
(3) Three-second-gust; based on wind pressures acting toward and away from building surfaces, at 30-ft height in Zone 5 with smallest effective area per Chapter 6 of ASCE 7-05, Section R301.2 of the 2009 and 2012 IRC, and Section 1609.1.1 of the 2009 IBC.

Table 3b. Panel Siding – **Maximum ultimate design wind speed, V_{ult}**

Performance Category	Maximum Wall Stud Spacing[2] (in.)	Fastener Spacing[1] (in. o.c.)		Maximum Ultimate Wind Pressure (psf)	Maximum Ultimate Design Wind Speed, V_{ult}[3] (mph)		
					Wind Exposure Category		
		Edges	Field		B	C	D
3/8	16	6	12	77	160	150	130
			6	133	200	180	180
	24	6	12	51	140	120	110
			6	102	200	160	150
7/16	16	6	12	74	160	140	130
			6	133	200	180	180
	24	6	12	50	140	120	110
			6	99	200	160	150
19/32	16	6	12	69	160	140	130
			6	133	200	180	180
	24	6	12	46	130	115	-
			6	92	180	160	150

For **SI**: 1 inch = 25.4 mm, 1 psf = 47.88 Pa, 1 mph = 0.447 m/s.

(1) Fastener must have a minimum head diameter of 0.297 inch, a minimum shaft diameter of 0.113 inch and a minimum length of 2.5 inches (8d box nail).
(2) Wall studs must have a minimum specific gravity of 0.42.
(3) Three-second-gust; based on wind pressures acting toward and away from building surfaces, at 30-ft height in Zone 5 with smallest effective area per Chapter 26 of ASCE 7-10 and Section 1609.1.1 of the 2012 IBC.

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Table 4a. Lap Siding Installed Over the Facer of SIPs[1] – **Maximum nominal (allowable) design wind speed, V_{asd}[2]**

Performance Category	Maximum Ring Shank Nail Spacing[3] (in.)	Maximum Wood Screw Spacing[4] (in.)	Siding Width (in.)	Maximum Allowable Wind Pressure (psf)	Maximum Nominal (Allowable) Wind Speed, V_{asd}[5] (mph)		
					Wind Exposure Category		
					B	C	D
3/8	8	12	6	80	170	150	140
			8	63	150	130	125
			12	40	125	105	90
7/16	12	16	6	58	150	130	120
			8	42	130	110	100
			12	27	105	85	-

For **SI**: 1 inch = 25.4 mm, 1 psf = 47.88 Pa, 1 mph = 0.447 m/s.

(1) The facer of the structural insulated panels (SIPs) shall be 7/16 Performance Category or thicker OSB sheathing meeting DOC PS2 requirements.

(2) The tabulated values represent the capacity of the LP Lap Siding installed in accordance with the requirements of this table. **The tabulated wind speed shall not exceed the SIP capacity for wind load resistance**.

(3) One 6d ring shank nail (0.120 inch in diameter) located 1/2 inch from the top edge of the siding. The ring shank nails must have a minimum head diameter of 0.297 inch, a minimum shank diameter of 0.120 inch and a minimum length of 2 inches.

(4) One #8 wood screw (0.164 inch in diameter) located 1/2 inch from the top edge of the siding may be used. The wood screws must have a minimum head diameter of 0.297 inch, a minimum shank diameter of 0.164 inch and a minimum length of 2 inches.

(5) Three-second-gust; based on wind pressures acting toward and away from building surfaces, at 30-ft height in Zone 5 with smallest effective area per Chapter 6 of ASCE 7-05, Section R301.2 of the 2009 and 2012 IRC, and Section 1609.1.1 of the 2009 IBC.

Table 4b. Lap Siding Installed Over the Facer of SIPs[1] – **Maximum ultimate design wind speed, V_{ult}[2]**

Performance Category	Maximum Ring Shank Nail Spacing[3] (in.)	Maximum Wood Screw Spacing[4] (in.)	Siding Width (in.)	Maximum Ultimate Wind Pressure (psf)	Maximum Ultimate Design Wind Speed, V_{ult}[5] (mph)		
					Wind Exposure Category		
					B	C	D
3/8	8	12	6	133	200	180	180
			8	105	200	160	160
			12	67	160	140	120
7/16	12	16	6	97	200	160	150
			8	70	160	140	130
			12	45	130	115	-

For **SI**: 1 inch = 25.4 mm, 1 psf = 47.88 Pa, 1 mph = 0.447 m/s.

(1) The facer of the structural insulated panels (SIPs) shall be 7/16 Performance Category or thicker OSB sheathing meeting DOC PS2 requirements.

(2) The tabulated values represent the capacity of the LP Lap Siding installed in accordance with the requirements of this table. **The tabulated wind speed shall not exceed the SIP capacity for wind load resistance**.

(3) One 6d ring shank nail (0.120 inch in diameter) located 1/2 inch from the top edge of the siding. The ring shank nails must have a minimum head diameter of 0.297 inch, a minimum shank diameter of 0.120 inch and a minimum length of 2 inches.

(4) One #8 wood screw (0.164 inch in diameter) located 1/2 inch from the top edge of the siding may be used. The wood screws must have a minimum head diameter of 0.297 inch, a minimum shank diameter of 0.164 inch and a minimum length of 2 inches.

(5) Three-second-gust; based on wind pressures acting toward and away from building surfaces, at 30-ft height in Zone 5 with smallest effective area per Chapter 26 of ASCE 7-10 and Section 1609.1.1 of the 2012 IBC.

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SIP No. 2075

Subject: **Engineering Properties**

Date: **March 2011 (Revised January 2015)**

R-Control SIP have been long recognized as a structural component for use a wall, roof, or floor panels that resist structural loads. The structural capacity of R-Control SIPs has been determined through extensive testing with leading independent third party accredited test laboratories. The results of these tests have long been published in R-Control SIP Load Design Charts and recognized in ICC ES ESR-2233.

The complete package of structural information that supports R-Control Load Design Chart #1 has been analyzed and reviewed in order to provide basic SIP Engineering Properties for R-Control SIPs.

These R-Control SIP Engineering Properties are suitable for use with NTA IM 14 TIP 01, "Engineered Design of SIP Panels using NTA Listing Report Data". A copy of NTA IM 14 TIP 01 is attached to this bulletin for references.

R-Control SIP Engineering Properties [1,2]

Property	
Allowable Tensile Stress, F*t* (psi)	495
Allowable Compressive Stress, F*c* (psi)	619
Elastic Modulus (Bending), E*b* (psi)	1515800
Shear Modulus, G (psi)	267
Allowable Core Shear Stress, F*v* (psi)	4.5
Reference Depth, ho (in.)	4.5
Shear Depth Factor Exponent, m	0.85
Core Compressive Modulus, E*c* (psi)	400
Facing Flexural Stiffness, E*f*I*f* (lbf-in.^{2})	78000
Core Compressive Strength, F*cc* (psi)	13.1
Core Dispersion Factor, k	0.056

[1] All properties are based on a minimum panel width of 24-inches.

[2] Refer to NTA IM14 TIP 01 SIP Design Guide for details on engineered design using basic properties.

R-Control SIP Section Properties

h (in.)	c (in.)	A_V (in.^{2}/ft)	A_F (in.^{2}/ft)	I (in.^{4}/ft)
4.5	3.625	48.8	5.25	43.3
6.5	5.625	72.8	5.25	96.5
8.25	7.35	93.8	5.25	160.2
10.25	9.375	117.8	5.25	252.7
12.25	11.375	141.8	5.25	366.3

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ENGINEERED DESIGN OF SIP PANELS
USING NTA LISTING REPORT DATA

1. SCOPE

1.1. GENERAL

This document applies to structural insulated panels (SIPs), which shall be defined as a structural facing material with a foam core. This document does not apply to the design of reinforcement materials which may be incorporated into SIPs, such as dimensional lumber or cold-formed steel. All other materials shall be designed in accordance with the appropriate code adopted design standards.

It is intended that this document be used in conjunction with competent engineering design, accurate fabrication, and adequate supervision of construction. NTA, Inc. does not assume any responsibility for error or omissions in this document, nor for engineering design, plans or construction prepared from it. It shall be the final responsibility of the designer to relate design assumptions and reference design value, and to make design adjustments appropriate to the end use.

1.2. DESIGN PROCEDURES

This document provides requirements for the design of SIP panels by the Allowable Stress Design (ASD) method. The technical basis for this document is the *APA Plywood Design Specification Supplement 4—Design & Fabrication of Plywood Sandwich Panels*[1], which is adopted by reference in the International Building Code (IBC). Some provisions of the design guide have been modified to more closely model the actual behavior of the SIP system described in this report.

The design procedures provided herein generally assume uniform loads applied to a simply supported member. General loading and support conditions may be evaluated using rational analysis methods consistent with the methodology provided herein. If finite element analysis software is used, the designer must verify that the software considers shear deformations between model nodes as most commercially available finite element software packages only consider shear deformations at the nodes.

1.3. DESIGN LOADS

Minimum design loads shall be in accordance with the building code under which the structure is designed, or where applicable, other recognized minimum design load standards.

1.4. SERVICABILITY

Structural systems and members thereof shall be designed to have adequate stiffness to limit deflection and lateral drift. The deflections of structural members shall not exceed the limitations of the building code under which the structure is designed, or where applicable, other recognized minimum design load standards.

1.5. LOAD COMBINATIONS

Combinations of design load and forces, and load combinations factors, shall be in accordance with the building code under which the structure is designed, or where applicable, other recognized minimum design standards.

1.6. STRESS INCREASE

Duration of load increases in allowable stresses specified in the National Design Standard for Wood Construction (NDS) shall not be applied to SIP facings or core materials regardless of composition.

1.7. LIMITS OF USE

This document applies to NTA, Inc. listed SIP panels only and shall not be used with unlisted SIPs or SIPs listed/evaluated by other agencies. The design shall be limited to the specific panel thicknesses described in the listing report. This document shall not be applied to spans, heights, or aspect ratios not bounded by the limits of the listing report—extrapolation is not permitted.

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2. NOTATION

Except where otherwise noted, the symbols used in this document have the following meanings:

- Δ = Total deflection due to transverse load (in.)
- Δ_{LT} = Total immediate deflection due to the long-term component of the design load (in.)
- Δ_b = Deflection due to bending (in.)
- Δ_c = Deflection of core under concentrated load applied to facing (in.)
- Δ_i = Total immediate deflection due to application of a single design load acting alone (in.)
- Δ_s = Deflection due to shear (in.)
- Δ_{2nd} = Total immediate deflection considering secondary (P-delta) effects (in.)
- A = Total cross sectional area of facings (in.^{2}/ft)
- A_v = Shear area of panel. For symmetric panels $A_v = 6(h+c)$ (in.^{2}/ft)
- c = Core thickness (in.)
- C_e = Eccentric load factor, Section
- C_{Fv} = Size factor for shear, Section 4.4.3
- C_v = Shear support correction factor
- e = Load eccentricity, measured as the distance from the centroid of the section to the line of action of the applied load (in.)
- E_b = SIP modulus of elasticity under transverse bending (psi)
- E_c = Elastic modulus of core under compressive load (psi)
- E_f = Elastic modulus of facing under compressive load (psi)
- F_c = Allowable facing compressive stress (psi)
- F_t = Allowable facing tensile stress (psi)
- F_v = Allowable shear stress (through thickness) (psi)
- F_{vip} = Allowable shear load (in-plane) (plf)
- G = SIP shear modulus (psi)
- h = Overall SIP thickness (in.)
- h_o = Reference SIP thickness for size correction factors (in.)
- I = SIP moment of inertia (in.^{4}/ft)
- I_f = Facing moment of inertia (in.^{4}/ft)
- K_{cr} = Time dependent deformation (creep) factor for a specific load type, Section A3.5.3
- L = Span length (ft)
- L_v = Shear span length (ft)
- m = Shear size factor exponent
- M = Applied moment (in.-lbf/ft)
- P = Applied axial or concentrated load (lbf/ft.)
- P_{cr} = Allowable axial load (lbf/ft)
- r Radius of gyration (in.)
- S = SIP section modulus for flexure under transverse loads (in.^{3}/ft)
- V = Applied shear force (through thickness) (lbf)
- V_{ip} = Applied shear force (in-plane) plf
- w = Uniform transverse load (psf)
- y_c = Distance from the centroid to the extreme compression fiber (in.)
- β = Parameter of relative stiffness

3. USE CONSIDERATIONS

3.1. LOAD DURATION

Duration of load increases in allowable stress shall not be applied to SIP facings or cores. Duration of load increases may be applied to the design of connections and wood reinforcement as permitted in applicable material design specifications.

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3.2. MOISTURE
This document applies to SIP panels used under dry service conditions. For SIP facings of wood or wood composites the in-use moisture content shall not exceed 19%.

3.3. TEMPERATURE
This Document applies to SIP panels used as structural members were sustained temperatures do not exceed 100ºF.

4. BENDING MEMBERS
4.1. GENERAL
Each SIP panel subjected to transverse loads shall be of sufficient size and capacity to carry the applied loads without exceeding the allowable design values specified herein.

4.2. SPAN OF BENDING MEMBERS
For simple, continuous and cantilevered bending members, the design span shall be taken as the distance from face to face of support. When no bearing is provided, such as when a panel is supported by a spline only (C_v < 1.0), the design span shall extend the full height/length of the panel.

4.3. BENDING MEMBERS—FLEXURE
4.3.1. GENERAL
Panel flexural strength under transverse loading shall satisfy both equations below:

$$M \le F_t S \quad \textbf{(Eqn. 4.3.1a)}$$

$$M \le F_c S \quad \textbf{(Eqn. 4.3.1b)}$$

4.4. BENDING MEMBERS—SHEAR
4.4.1. GENERAL
The actual shear stress parallel to the facing at the core to facing interface shall not exceed the adjusted shear design value.

4.4.2. SHEAR DESIGN EQUATIONS
The panel shear strength under transverse loading shall satisfy the following equation:

$$V \le F_v C_{Fv} C_v A_v \quad \textbf{(Eqn. 4.4.2)}$$

4.4.3. SHEAR SIZE ADJUSTEMENT FACTOR, C_{Fv}
The allowable shear strength shall be multiplied by a adjustment factor for the depth of the panel. The shear size adjustment factor shall be calculated using Equation 4.4.3.

$$C_{Fv} = \left(\frac{h_o}{h} \right)^m \quad \textbf{(Eqn. 4.4.3)}$$

4.4.4. SUPPORT ADJUSTEMENT FACTOR, C_v
4.4.4.1. For panel ends supported by full bearing on one facing and uniform loads applied to the opposite facing, the shear adjustment factor, C_v = 1.0 (see Figure A4.4.4).

4.4.4.2. For panel ends without bearing, supported by a top/bottom spline only, with uniform loads applied to either facing, the shear adjustment factor, C_v, shall be based on testing specific to the following parameters (see Figure A4.4.4):

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1. Panel manufacturer;
2. Spline type, as it relates to the withdrawal/pullout strength of the fasteners (e.g. specific gravity for wood plates);
3. Fastener type and penetration.

4.4.4.3. Where C_v is less than 1.0, the allowable shear strength may be increased if the spline/fastener combination has a design withdrawal/pullout strength greater than the design withdrawal/pullout strength of the C_v assembly. The increase in strength shall not exceed the difference in the design withdrawal/pullout strength between the stronger assembly and the C_v assembly

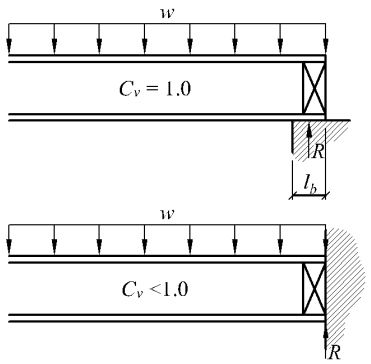

Figure 4.4.4: C_v Support Conditions

4.4.5. SHEAR DESIGN FORCE

When calculating the shear force, V, in bending members:

a) For panels supported by full bearing on one facing and uniform loads applied to the opposite facing (C_v = 1.0), uniformly distributed loads within a distance from the supports equal to the depth of the panel, h, shall be permitted to be ignored.

b) For all other support and loading conditions (C_v < 1.0), no load applied to the panel may be ignored and V shall be taken as the full reaction at the support under consideration.

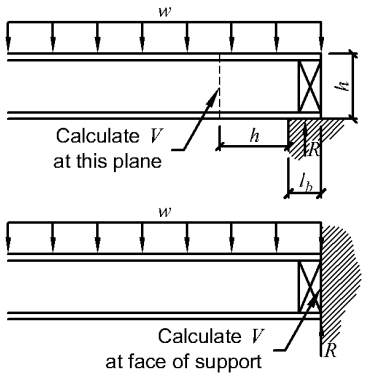

Figure 4.4.5: Design Shear Force

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4.5. BENDING MEMBERS—DEFLECTION

4.5.1. GENERAL

Deflection shall be calculated by standard methods of engineering mechanics considering both bending deflections and shear deflections.

4.5.2. DEFLECTION EQUATION

Deflection of a simply supported panel under uniform transverse load only shall be calculated as follows:

$$\Delta = \Delta_b + \Delta_s = \frac{5wL^4 \times 1728}{384E_bI} + \frac{3}{2}\frac{wL^2}{A_vG} \qquad \textbf{(Eqn. 4.5.2a)}$$

Deflections for panels subjected to combined loads shall consider the effects of axial load (P-delta effects). The total deflection of panels under combined loads may be approximated as follows.

$$\Delta_{2nd} = \frac{\Delta}{1 - P/P_{cr}} \qquad \textbf{(Eqn. 4.5.2b)}$$

4.5.3. LONG-TERM LOADING

Where deflection under long-term loading must be limited, the total deflection, including creep effects shall be calculated as follows:

$$\Delta_T = \sum K_{cr_i}\Delta_i \qquad \textbf{(Eqn. 4.5.3)}$$

Table 1: *Kcr* Based on Load Type[1]

Load Type[2]	EPS/XPS Core	Urethane Core
D, F, H, T	4.0	7.0
S, L	3.0	5.0
E, W, R, L_r, F_a	1.0	1.0

[1] Table values are for OSB facings used under dry service conditions.
[2] Load types are as defined in ASCE 7-05.

4.5.4. DEFLECTION LIMITS

The total deflection of structural or non-structural bending members, including consideration for long-term loading, shall not exceed the more restrictive of the following:

a) the span divided by 120 (L/120);
b) the limitations of the building code under which the structure is designed;
c) or, other recognized minimum design load standards.

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4.6. BEARING AND CONCENTRATED LOADS ON FACINGS

4.6.1. MINIMUM SUPPORT WIDTH

A minimum support width of 1.5-inches shall be provided at all supports where the SIP is designed for bearing (C_v = 1.0). The bearing support shall be continuous along the end of the panel.

4.6.2. BEARING STREGNTH

4.6.2.1. Where a full-depth structural spline is provided at a point of bearing, the bearing strength shall not exceed the design bearing strength of the facings or spline, whichever is less.

4.6.2.2. Where a full-depth structural spline is not provided at a point of bearing and the bearing face of the panel is supported by the core only. The allowable bearing strength shall be limited to the load producing a long-term total compression of the core equal to 1/8-inch. Long term deflections shall be calculated in accordance with Section 4.5.3. The core compression deflection shall be calculated using the component material properties of the facing and the core considering the facing as a beam on an elastic foundation. Formulas for common cases (Figure 4.6.2.2) are provided in Equations 6.2.2.2a and 6.2.2.2b. Equations are for loads uniformly applied along the end of the panel.

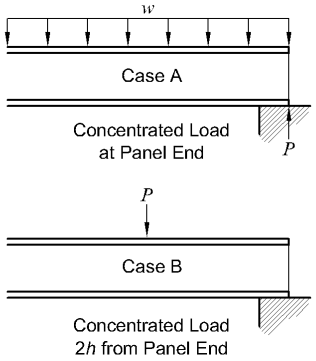

Figure 4.6.2.2: Bearing on Facings

$$\textbf{Case A: } \Delta_c = \frac{P}{4E_f I_f \beta^3} \qquad \textbf{(Eqn. 4.6.2.2a)}$$

$$\textbf{Case B: } \Delta_c = \frac{P}{8E_f I_f \beta^3} \qquad \textbf{(Eqn. 4.6.2.2b)}$$

$$\beta = \sqrt[4]{\frac{3E_c}{E_f I_f c}} \qquad \textbf{(Eqn. 4.6.2.2c)}$$

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5. COMPRESSION MEMBERS

5.1. GENERAL

Each SIP panel subjected to compressive loads shall be of sufficient size and capacity to carry the applied loads without exceeding the allowable design values in this section.

5.1.1. COMPRESSION MEMBERS—LOAD ECCENTRICITY

The panel compression strength under axial loading shall satisfy the following equation:

$$P \le P_e \quad \textit{where} \quad P_e = C_e F_c A_f \qquad \textbf{(Eqn. 5.1.1a)}$$

The eccentric load factor shall be calculated using Equation 5.1.1b considering a minimum eccentricity equal to not less than one-sixth the overall panel thickness ($e \ge h/6$).

$$C_e = \frac{1}{1 + \frac{ey_c}{r^2}\sec\left[\frac{12L}{2r}\sqrt{\frac{3P}{A_f E_b}}\right] + \frac{3Pey_c}{2A_v GI}} \qquad \textbf{(Eqn. 5.1.1b)}$$

5.1.2. COMPRESSION MEMBERS—GLOBAL BUCKLING

The critical buckling load for a pinned-pinned column under axial loading shall satisfy the following equation:

$$P \le P_{cr} \quad \textit{where} \quad P_{cr} = \frac{\pi^2 E_b I}{3\times(12L)^2\left[1 + \frac{\pi^2 E_b I}{(12L)^2 \times A_v G}\right]} \qquad \textbf{(Eqn. 5.1.2)}$$

5.1.3. COMPRESSION MEMBERS—BEARING

The axial compressive load shall not exceed the bearing strength of the supporting materials. The bearing strength of the supporting materials shall be verified in accordance with the appropriate design specification. Where one or more of the SIP facings are not in bearing, the connection between the facings and the spline shall be designed to transfer the full load from the facings to the plate.

6. TENSION MEMBERS

6.1. GENERAL

A continuous load path shall be provided to transfer tension forces through the structure in a way that does not impart tensile loads to the SIP panel facings or core.

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7. COMBINED LOADS

7.1. GENERAL

Panels subjected to combined loads shall of sufficient size and capacity to carry the applied loads without exceeding the allowable design values in this section.

7.1.1. COMBINED COMPRESSION, TRANSVERSE BENDING AND IN-PLANE SHEAR

Panel strength under combined axial compression, transverse bending and in-plane shear shall satisfy the following interaction equations:

$$\frac{P}{P_e} + \frac{M_{\max}}{F_c S} + \frac{V_{ip}}{F_{vip}} \le 1.0 \qquad \textbf{(Eqn. 7.1.1a)}$$

$$\frac{P}{P_{cr}} + \frac{M_{\max}}{F_c S} + \frac{V_{ip}}{F_{vip}} \le 1.0 \qquad \textbf{(Eqn. 7.1.1b)}$$

For simply supported beam columns M_{max} shall equal:

$$M_{\max} = 1.5wL^2 + P\Delta_{2nd} \qquad \textbf{(Eqn. 7.1.1c)}$$

8. CONNECTIONS

8.1. GENERAL

Connections between SIP panels, splines, plates, and non-SIP assemblies shall be designed in accordance with the appropriate material design standard referenced in the applicable building code.

9. SHEAR WALLS AND DIAPHRAGMS

9.1. GENERAL

SIP panel shear walls and diaphragms acting as elements of the lateral force-resisting system shall be designed in accordance with this section.

9.2. DEFINITIONS

Reserved for future use.

9.3. SHEAR WALLS

Reserved for future use.

9.3.1. DEFINITIONS

Reserved for future use.

9.3.2. SHEAR WALL ANCHORAGE

Reserved for future use.

9.3.3. SHEAR WALL STRENGTH

Reserved for future use.

9.3.4. SHEAR WALL DEFLECTION

Reserved for future use.

9.4. DIAPHRAGMS

Reserved for future use.

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10. REFERENCES

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APPENDIX AND COMMENTARY

A1. DERIVATION OF ENGINEERING PROPERTIES FROM TEST DATA

The manner in which laboratory test data is used is the primary difference between the methodology presented in this guide and the historical approaches for justification of SIP panels. Historical approaches are largely based on direct use of E72 test data. Unlike historical approaches, this guide uses engineering mechanics to establish models for the test data. These models are applied to the test data to yield general engineering properties that are used as the basis for performance.

The advantages of the engineering mechanics approach over the historical approach are many. Some advantages include: basis for use as a structural material is consistent with other code recognized structural materials; improved statistical significance behind overall panel behavior; improved understanding of panel behavior by separate consideration various limit states; generalization of properties to permit engineered design of support and loading conditions that cannot be simulated in the laboratory.

A1.1. TRANSVERSE BENDING STIFFNESS

Panel stiffness under transverse load is determined using the load-deflection data from tests performed in accordance with ASTM E72. This process begins by reducing the data from each transverse load test into two values, the apparent bending modulus, E_a, and a shear constant, K_s. By obtaining these two values from multiple test configurations the elastic modulus, E_b, and the shear modulus, G, are derived using a procedure similar to that described in the appendix of ASTM D198.

A1.1.1. TEST PROGRAM

The test program shall consist of transverse load tests conducted in accordance with ASTM E72. Specimen configurations should be selected with regard to the range of spans and panel thicknesses used by a given manufacturer. At a minimum, it is recommended that not less than the minimum and maximum panel thicknesses are tested at their minimum and maximum spans, in each orthogonal direction (4 series of tests, 12 specimens, in each direction). It is recommended that additional specimens are tested so not less than 28 total specimens are tested, in each orthogonal direction (assuming facing is orthotropic), during the initial qualification. The configuration of the specimens between the upper and lower limits of thickness and span should be selected based on the calculated value of K_s (see section A1.1.3) with the goal of obtaining data points that are approximately equally spaced between the values for K_s.

With regard to test procedure, efforts should be taken to isolate bending deflections from other sources of deformation during the test. Accordingly, it is recommended that panels are tested with a single solid top and bottom plate, deflection measurements are taken from the *loaded surface* of the panel and deformations at the supports are measured and subtracted from the measured midspan deflections.

A1.1.2. APPARENT BENDING MODULUS

The apparent bending modulus, E_a, is an elastic bending modulus specific to a particular panel support and loading configuration. Unlike the true elastic modulus, E_b, the apparent bending modulus accounts for both bending and shear distortions.

Using the test load-deflection data, the apparent bending stiffness, E_aI, is calculated for each test specimen (see Table A1). In this equation, the term w/Δ is taken as the slope of a line best-fit through the load-deflection data corresponding to the anticipated range of in-service loads. This range is recommended to be taken as 25% to 100% of the allowable load with the allowable load calculated as the ultimate strength divided by 3.

The apparent bending modulus, E_a, is calculated by dividing the bending stiffness by the moment of inertia. Considerations regarding data selection when determining the apparent bending modulus include:

1. The load-deflection plot for the test data should be reviewed to verify that the data points used for the regression are within the region of linear response.
2. The span used in the calculation of E_a shall be taken as the center-to-center spacing of the pin and roller supports and *not* the clear span between bearing plates.
3. The method of deflection measurement used in the test must be assessed. The data should correspond to the midspan deflection minus the average of the deflections occurring at the supports. The deflection apparatus required in E72 accomplishes this automatically, but additional gauges located over the supports may be used to achieve the same result.
4. The method of loading used in the test must be assessed. ASTM E72 permits loading using a 'vacuum' method or 'bag' method. The choice of loading method affects the manner in which the *deflection readings* are taken. Using the 'vacuum' method it is possible to measure deflections from the *loaded surface*, whereas the bag method requires deflections to be measured from the *supported surface*. Where deflections are measured from the supported surface it is not possible to measure and subtract out support deflections, as a result the apparent stiffness will be reduced. Additionally, if solid lumber splines are not provided at each end of the specimen, local

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deflections at the supports (see Section 4.6.2) further reduce the apparent stiffness and will result in a non-linear 'hook' in the $1/E_a$ verses $1/K_s$ plot. When using load-deflection data subjected to this effect, it is recommended that the data corresponding to a K_s (see Section A1.1.3) less than 250 are excluded from the analysis as the support deflections comprise a significant percentage of the midspan deflections for specimens below this limit.

A1.1.3. SHEAR CONSTANT

A shear constant is also determined from each test. This constant assigns a value to the test configuration and accounts for the depth of the panel, span length, and arrangement of the applied load. This value is derived for a given test configuration by equating the deflection equation using the apparent bending modulus to the deflection equation considering bending and shear deformations separately. An example of this formulation is provided below for a simply supported panel subjected to a uniformly applied load. Table A1 provides equations for other loading and support configurations.

$$\frac{5wL^4 \times 1728}{384E_a I} = \frac{5wL^4 \times 1728}{384E_b I} + \frac{3wL^2}{2A_v G} \qquad \textbf{(Eqn. A1.1.3a)}$$

Reducing this equation to a linear equation yields:

$$\frac{1}{E_a} = \frac{1}{E_b} + \frac{1}{G}\frac{384I}{40A_v L^2} \times \frac{1}{144} \qquad \textbf{(Eqn. A1.1.3b)}$$

The portion after the $1/G$ term is taken as the constant K_s.

$$K_s = \frac{40A_v L^2}{384I} \times 144 \qquad \textbf{(Eqn. A1.1.3c)}$$

It should be noted that the general formulation for shear deformation includes a dimensionless constant, κ; which describes the shear stress distribution across the shear area, A_v. For isotropic rectangular sections this constant typically ranges from 0.84 to 0.86; however, for the purposes of this analysis this constant is combined with the shear modulus, G (i.e. $G = \kappa \cdot G_{actual}$).

Table A1: Transverse Stiffness Equations

Test Configuration	Deflection Formula[1]	Apparent Bending Stiffness, $E_a I$ (psi-in.^{4})	Shear Constant, K_s
Simply Supported Uniform Load	$\Delta = \frac{5wL^4 \times 1728}{384E_b I} + \frac{3wL^2}{2A_v G}$	$E_a I = \frac{5L^4}{384}\frac{w}{\Delta} \times 1728$	$K_s = \frac{40A_v L^2}{384I} \times 144$
Simply Supported Point Load at Midspan	$\Delta = \frac{PL^3 \times 1728}{48E_b I} + \frac{PL \times 12}{4A_v G}$	$E_a I = \frac{L^3}{48}\frac{P}{\Delta} \times 1728$	$K_s = \frac{A_v L^2}{12I} \times 144$

[1] Deflection at midspan.

A1.1.4. BENDING AND SHEAR MODULI

The purpose of the equations in Table A1 is to linearize the test data across specimens of various depths, spans, and loading conditions (Equation A1.1.4). Each test yields one point on this line, with $x = 1/K_s$ and $y = 1/E_a$. The elastic modulus, E_b, and shear modulus, G, are determined from a line best-fit through all data points with $E_b = 1/$*Y-Intercept* and $G = 1/$*Slope*.

$$y = mx + b \Rightarrow \frac{1}{E_a} = \frac{1}{G}\frac{1}{K_s} + \frac{1}{E_b} \qquad \textbf{(Eqn. A1.1.4)}$$

As with all experimental correlations, some scatter is expected; however, if the data exhibits non-linear behavior at either end of the plot the test method should be more closely examined to determine whether bending deformations are sufficiently isolated from other deformations during the test (see Section A1.1.2).

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A1.1.5. LIMITS OF USE

In accordance with standard engineering practice, extrapolation beyond the limits of the test program should be avoided. For properties determined using the method described herein, the limits of use are established by the shear constant, K_s. Additionally, it is recommended that use of the parameters is limited to panel thicknesses bounded by the maximum and minimum tested thicknesses.

COMMENTS, QUESTIONS AND ERROR REPORTING

All efforts have been made to ensure the accuracy of this document; however, if errors are found please contact Eric Tompos, P.E., S.E. via email at etompos@ntainc.com.

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SIP No. 2076

Subject: LVL Splines

Date: April 2012

R-Control SIPs are most commonly connected with surface, block, I-Beam, or dimensional lumber splines. I-Beam and dimensional lumber splines are used to provide additional strength and span capacity to R-Control SIPs assemblies. Laminated veneer lumber (LVL) is an alternative engineered wood spline option.

R-Control LVL's are an alternative spline connection available for 8-1/4" R-Control SIPs. The following Load Design Chart provides the capacity of R-Control SIPs when connected with R-Control LVL's spaced 4' o.c.

Roof/Floor - Transverse Loading
LOAD DESIGN CHART
(SEE LVL SPLINE DETAIL SIP-102a)

R-CONTROL® SIPs					
PANEL SPAN		R-CONTROL LVL WIDTH	SIP THICKNESS		
			8 1/4"		
DEFLECTION			L/360	L/240	L/180
TRANSVERSE LOAD (PSF)	10'- 0"	1-3/4"	81[1]	81[1]	81[1]
	12'- 0"		63	68[1]	68[1]
	14'- 0"		49	58[1]	58[1]
	16'- 0"		38	51[1]	51[1]
	18'- 0"	2-1/2"	30	45[1]	45[1]
	20'- 0"		24	37	40[1]

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SIP No. 2078

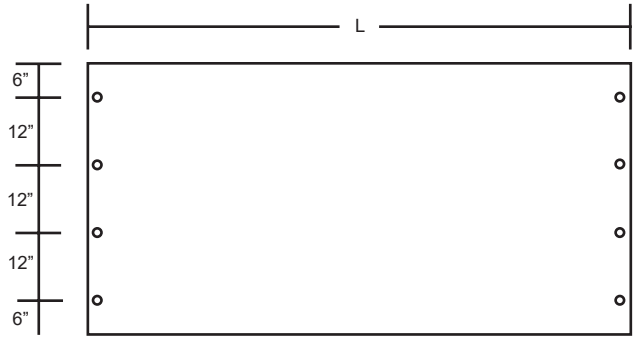
Subject: **R-Control SIP Attachment to Supports**

Date: **March 2013**

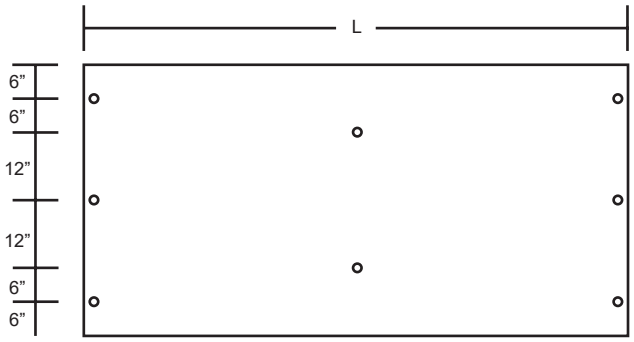
A major benefit of R-Control SIPs used for roof applications is their ability to span long distances. These distances are commonly from 8-12 feet for R-Control SIPs connected with surface or block splines and from 12-24 feet when connected with double 2X or engineered wood splines. When installed in a single span condition, the attachment of the R-Control SIP to the supports is accomplished with R-Control SIP fasteners at the end of the SIP. The spacing is commonly 6, 8, or 12 in. on center. Please refer to Load Design Chart #8 for screw spacing requirements for single span conditions.

R-Control SIPs are manufactured in sizes up to 8 ft. x 24 ft. The large size of R-Control SIPs provides the ability to install a single SIP very quickly and reduce the time and labor for installation. In many buildings the installation will be over multiple supports. When installed over multiple supports, the attachment of the R-Control SIP can be accomplished with an alternate fastening pattern. Multiple span connection patterns are based on the connection frequency required for the equivalent SIP single span length in accordance with Load Design Chart #8. Please refer to fastening patterns in this bulletin for conditions requiring R-Control screws at 6, 8, or 12 inches on center.

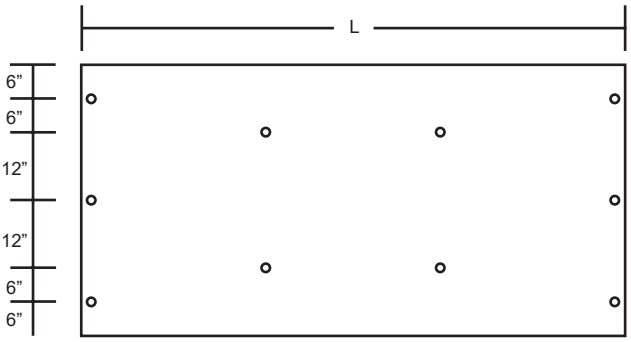
Connection Patterns for Condition with R-Control Screws 12 in. on Center



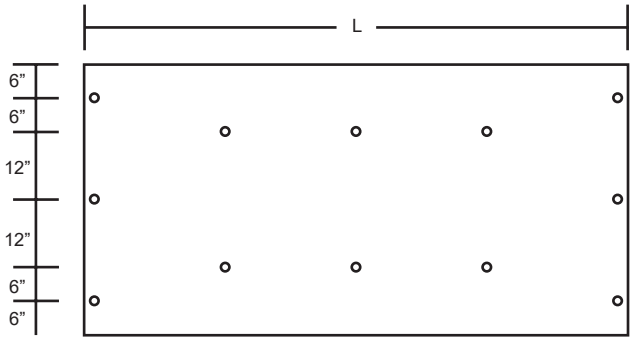
Connection patterns for single span condition



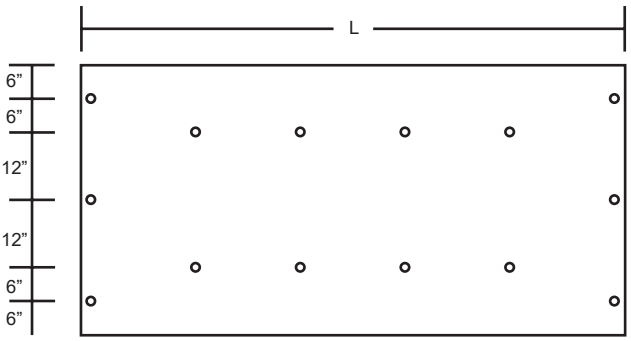
Connection patterns for two span condition



Connection patterns for three span condition



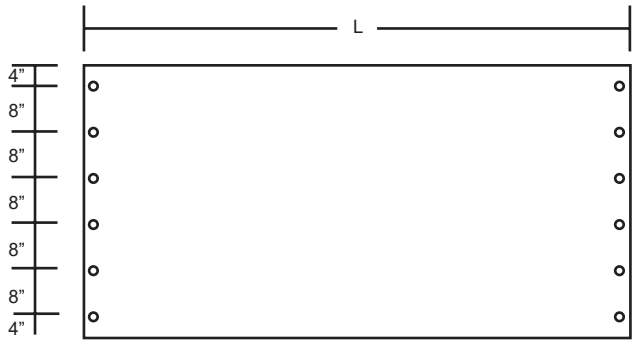
Connection patterns for four span condition



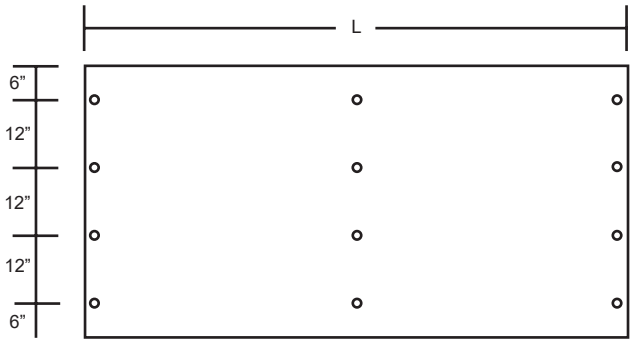
Connection patterns for five span condition

The figures illustrate the attachment pattern for a two to five span condition, but the general patterns can be extended to conditions with 6 or greater spans.

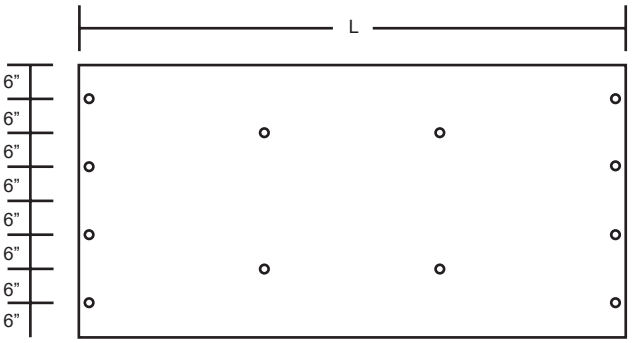
Connection Patterns for Condition with R-Control Screws 8 in. on Center



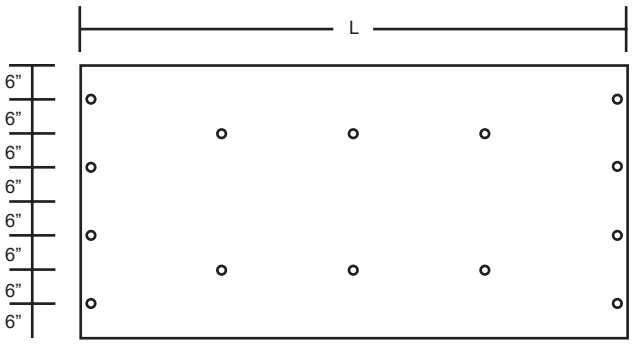
Connection patterns for single span condition



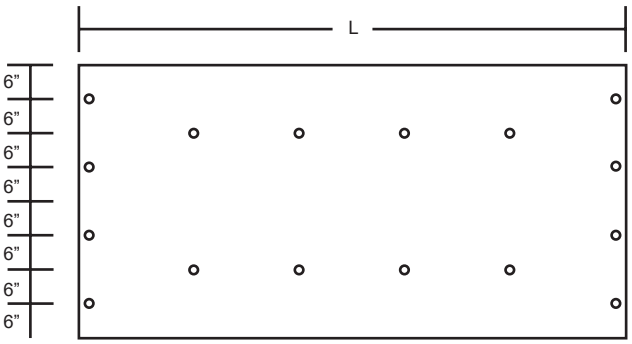
Connection patterns for two span condition



Connection patterns for three span condition



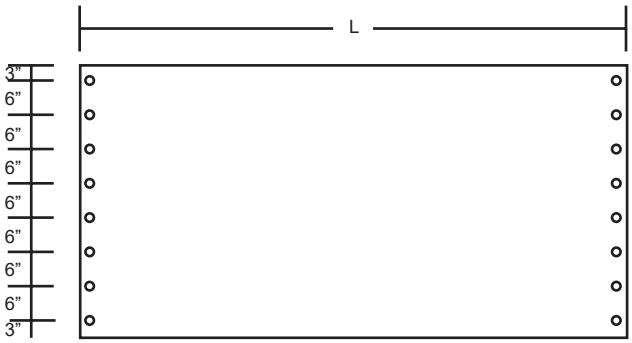
Connection patterns for four span condition



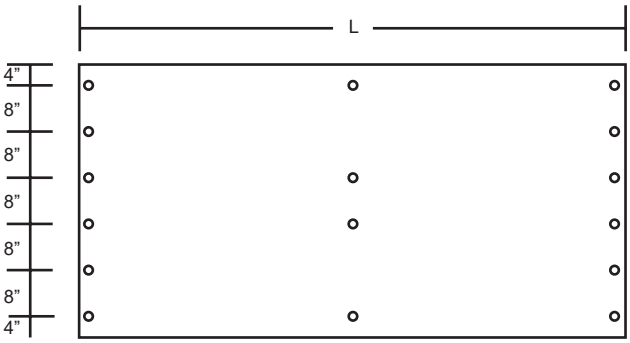
Connection patterns for five span condition

The figures illustrate the attachment pattern for a two to five span condition, but the general patterns can be extended to conditions with 6 or greater spans.

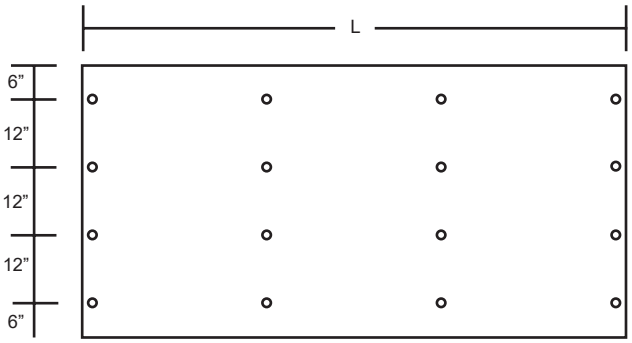
Connection Patterns for Condition with R-Control Screws 6 in. on Center



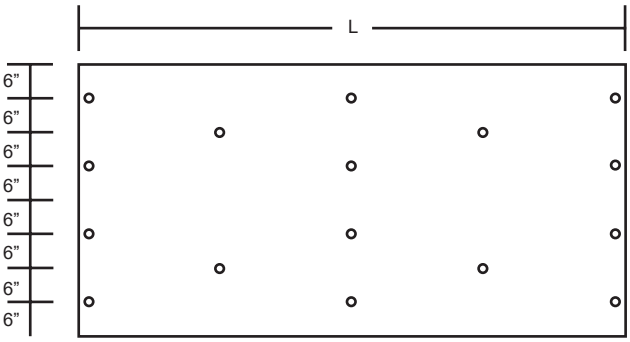
Connection patterns for single span condition



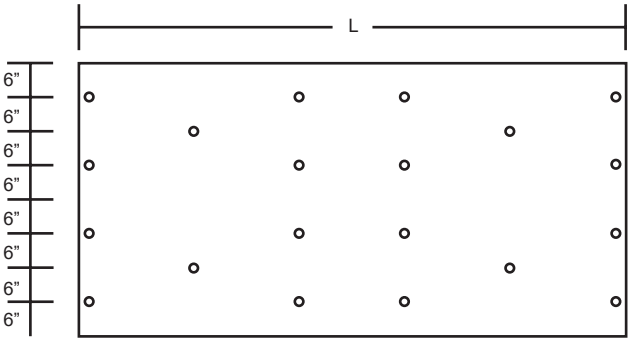
Connection patterns for two span condition



Connection patterns for three span condition



Connection patterns for four span condition



Connection patterns for five span condition

The figures illustrate the attachment pattern for a two to five span condition, but the general patterns can be extended to conditions with 6 or greater spans.

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SIP No. 2079

Subject: **Metal Roofing Attachment**

Date: **April 2013**

R-Control SIP roofs can be finished with a wide range of roof covering systems. Metal roofing is one type of roof covering that has been used successfully over R-Control SIPs for many years. Metal roofing provides a water tight roof system and has a long life expectancy when compared to many other roofing systems. One major advantage of metal roofing is that minimal maintenance is required over the life of the roof.

As with all roof covering systems, the installation must be in compliance with the metal roofing manufacturer's recommended installation details. The primary consideration when installing metal roofing over R-Control SIPs is to ensure the roofing manufacturer provides installation recommendations for proper attachment into the 7/16" OSB facing of the R-Control SIP.

Berridge Manufacturing Company, a leader in the metal roofing industry, provides installation recommendations for the attachment of their metal roof system directly into the 7/16" OSB facing of R-Control SIPs. Following their installation recommendations provides assurance that the metal roof system will provide the long term durability that is expected.

R-Control confirmed the strength of the Berridge attachment recommendations by testing the uplift resistance of the 24 gauge Zee-Lock panel in accordance with UL 580, "Tests for Uplift Resistance of Roof Assemblies". The tested assembly consisted of the Zee-Lock panel installed with a double lock, continuous Zee Rib, and #14 x 1-1/2 in. hex washer head Type A w/sealing washer from SFS Intec directly into the 7/16 in. OSB facing of an R-Control SIP. Two different fastening frequencies were evaluated.

Ultimate Pressure	Fastener Spacing
160 psf	14 in. o.c.
265 psf	8 in. o.c.

The test results clearly demonstrate that metal roofing can meet high wind uplift pressures when fastened directly into the 7/16 in. OSB of an R-Control SIP.

For further information regarding Berridge Manufacturing Company products, please visit www.berridge.com

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SIP No. 2080

Subject: **Roof Uplift Load Design Chart 8a — High Wind Regions**

Date: **April 2013**

R-Control SIP roofs are connected with R-Control Screws to underlying support. The spacing of R-Control Screws to resist wind uplift loads is typically determined in accordance with Load Design Chart #8. However, some regions of the U.S. require higher wind resistance. This is most commonly in coastal regions.

The attached Load Design Chart #8a provides R-Control Screw spacing requirements for wind speeds up to 180 mph as required by the 2012 IBC.

Roof - Uplift Loads
LOAD DESIGN CHART #8a
Maximum Spacing of R-Control Wood Screws At Supports - INCHES[1]

ROOF PITCH	SIP SPAN[2] (FT)	2009 IBC[3] 2009 IRC/2012 IRC WIND SPEED, V_{ASD}						2012 IBC[4] WIND SPEED, V_{ULT}				
		100 MPH	110 MPH	120 MPH	130 MPH	140 MPH	150 MPH	120 MPH	140 MPH	150 MPH	160 MPH	180 MPH
1.5:12	8	12	9	8	6	5	4	12	9	8	6	5
	12	9	7	6	5	4	3	9	7	6	5	4
	16	8	6	5	4	3	3	8	6	5	4	3
	20	6	5	4	3	3	2	6	5	4	3	3
	24	6	4	3	3	2	2	6	4	3	3	2
3:12	8	12	9	7	6	5	4	12	9	7	6	5
	12	9	7	6	5	4	3	9	7	6	5	4
	16	8	6	5	4	3	3	8	6	5	4	3
	20	6	5	4	3	3	2	6	5	4	3	3
	24	5	4	3	3	2	2	5	4	3	3	2
6:12	8	14	11	9	7	6	5	14	11	9	7	6
	12	9	7	6	5	4	3	9	7	6	5	4
	16	8	6	5	4	3	3	8	6	5	4	3
	20	6	5	4	3	3	2	6	5	4	3	3
	24	5	4	3	3	2	2	5	4	3	2	2
9:12	8	12	10	8	6	5	4	12	10	8	6	5
	12	9	7	6	5	4	3	9	7	6	5	4
	16	7	6	4	4	3	2	7	6	4	4	3
	20	6	5	4	3	2	2	6	5	4	3	2
	24	5	4	3	2	2	2	5	4	3	2	2
12:12	8	11	8	7	6	5	4	11	8	7	6	5
	12	8	6	5	4	3	3	8	6	5	4	3
	16	6	5	4	3	3	2	6	5	4	3	3
	20	5	4	3	3	2	2	5	4	3	3	2
	24	4	3	3	2	2	1	4	3	3	2	2

[1] FASTENER SPACING IS BASED ON FASTENER HEAD PULL-THROUGH AND WITHDRAWAL STRENGTH OF R-CONTROL WOOD SCREWS TESTED IN ACCORDANCE WITH ASTM D1037. THE ALLOWABLE WITHDRAWAL STRENGTH AND PULL-THROUGH STRENGTH WERE TAKEN AS THE AVERAGE ULTIMATE LOAD DIVIDED BY A FACTOR OF SAFETY OF 5.0 AND A LOAD DURATION FACTOR OF 1.6 (ALLOWABLE PULL-THROUGH STRENGTH = 179 LBF, ALLOWABLE WITHDRAWAL STRENGTH - 200 LBF). FASTENERS INSTALLED AT 3-INCHES ON-CENTER OR LESS SHALL BE STAGGERED.

[2] TABLE VALUES APPLY TO SIMPLY SUPPORTED SIP ROOF MEMBERS HAVING AN OVERHANG NOT TO EXCEED 24-INCHES. WOOD SUPPORT TO HAVE A MINIMUM SPECIFIC GRAVITY, G=0.42 (SPRUCE-PINE-FUR). SCREW SHALL HAVE SUFFICIENT LENGTH AND BE INSTALLED SO THAT IT PENETRATES THE WOOD SUPPORT A MINIMUM OF 1.5-INCHES.

[3] THREE-SECOND-GUST WIND SPEED BASED ON A BUILDING HEIGHT OF 40-FEET, ZONE 2E, IMPORTANCE FACTOR, L_W=1.0 AND TOPOGRAPHIC FACTOR, K_{21} = 1.0, INTERNAL PRESSURE COEFFICIENT, GC_{PL}=0.18 IN ACCORDANCE WITH ASCE 7, 2005 EDITION, SECTION 6.5.12.2.2 (MAIN WIND FORCE RESISTING SYSTEM, LOW-RISE BUILDING). A MINIMUM ROOF ASSEMBLY DEAD LOAD OF 10 PSF IS CONSIDERED IN THE TABULATED VALUES (UPLIFT PRESSURE REDUCE BY 0.6 TIMES 10 PSF).

[4] THREE-SECOND-GUST WIND SPEED; BASED ON A BUILDING HEIGHT OF 40-FEET, ZONE 2E, IMPORTANCE FACTOR, L_W=1.0 AND TOPOGRAPHIC FACTOR, K_{21}=1.0, INTERNAL PRESSURE COEFFICIENT, GC_{PL}=0.18 IN ACCORDANCE WITH ASCE 7, 2010 EDITION, CHAPTER 28 (WIND LOADS ON BUILDING - MWFRS (ENVELOPE PROCEDURE). A MINIMUM ROOF ASSEMBLY DEAD LOAD OF 10 PSF IS CONSIDERED IN THE TABULATED VALUES (UPLIFT PRESSURE REDUCE BY 0.6 TIMES 10 PSF).

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SIP No. 2081

Subject: **IECC Insulation U-Factor Requirements**

Date: **September 2013**

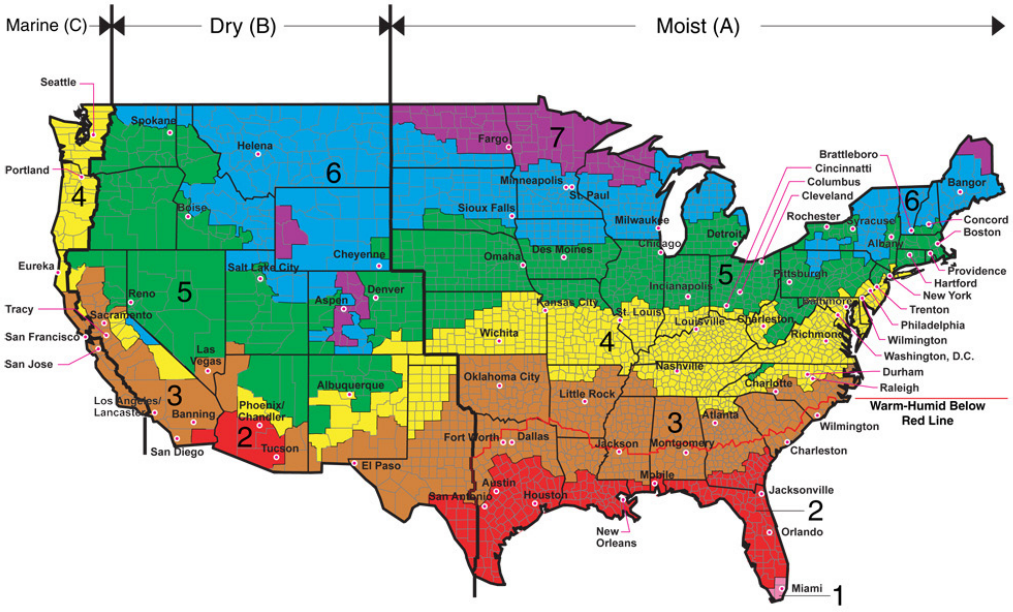
R-Control SIPs are a versatile construction material used as walls and ceilings/roofs of buildings. R-Control SIPs provide both structural capacity and insulation for building envelopes. R-Control SIPs are available in a wide range of thicknesses to ensure that building owners are able to meet the most advanced energy code requirements, such as those published by the International Code Council (ICC). This bulletin provides a summary of the prescriptive *U*-factor requirements of the 2012 edition of International Energy Conservation Code (IECC) published by ICC. Please refer to the 2012 IECC for detailed information.

The IECC is a leading energy code that is applicable to both commercial and residential buildings and is often adopted as a code requirement at the State level. State adoption of IECC may also be to the prior versions of the IECC issued in 2006 and 2009.

The tables within this bulletin provide the *U*-factor requirements of 2012 IECC Table R402.1.3 (residential) and Table C402.1.2 (commercial) and demonstrates which R-Control SIP thickness meets or exceeds the requirements. The *U*-factor is the rate of heat transfer per unit area and per unit temperature difference and the units are BTU/hr•ft²•°F. The lower the *U*-factor, the greater the resistance to heat flow. *U*-factors equal to or less than that specified in the tables are permitted as an alternative to the R-value requirements of the 2012 IECC Table R402.1.1 or Table C402.1.2.

Alternative paths for conformance through comparison to 2012 IECC "R-value Tables" and detailed analysis are also available within the standard. R-Control recommends that the *U*-factor path be followed since this accounts most appropriately for the insulation performance of SIPs in comparison to lumber framing with traditional insulations.

Climate Zones



All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands

2012 IECC Table R402.1.3 Equivalent *U*-Factors Residential Walls							
Zone	Wood-Framed Wall Requirement	R-Control SIP[1]					
		4-1/2"	Comply?	6-1/2"	Comply?	8-1/4"	Comply?
1	0.082	0.058	Yes	0.040	Yes	0.032	Yes
2	0.082	0.058	Yes	0.040	Yes	0.032	Yes
3	0.057	0.058	No	0.040	Yes	0.032	Yes
4	0.057	0.058	No	0.040	Yes	0.032	Yes
5	0.057	0.058	No	0.040	Yes	0.032	Yes
6	0.048	0.058	No	0.040	Yes	0.032	Yes
7	0.048	0.058	No	0.040	Yes	0.032	Yes
8	0.048	0.058	No	0.040	Yes	0.032	Yes

[1] R-Control SIP U-Factors include inside air film, 1/2" gypsum wallboard, R-Control SIP, wood siding, and outside air film.

2012 IECC Table R402.1.3 Equivalent *U*-Factors Residential Roof/Ceilings							
Zone	Roof/Ceiling Requirement	R-Control SIP[1]					
		8-1/4"	Comply?	10-1/4"	Comply?	12-1/4"	Comply?
1	0.035	0.032	Yes	0.026	Yes	0.022	Yes
2	0.030	0.032	No	0.026	Yes	0.022	Yes
3	0.030	0.032	No	0.026	Yes	0.022	Yes
4	0.026	0.032	No	0.026	Yes	0.022	Yes
5	0.026	0.032	No	0.026	Yes	0.022	Yes
6	0.026	0.032	No	0.026	Yes	0.022	Yes
7	0.026	0.032	No	0.026	Yes	0.022	Yes
8	0.026	0.032	No	0.026	Yes	0.022	Yes

[1] R-Control SIP U-Factors include inside air film, 1/2" gypsum wallboard, R-Control SIP, asphalt shingles, and outside air film.

2012 IECC Table C402.1.2 Equivalent *U*-Factors Commercial Walls							
Zone	Wood-Framed Wall Requirement	R-Control SIP[1]					
		4-1/2”	Comply?	6-1/2”	Comply?	8-1/4”	Comply?
1	0.064	0.058	Yes	0.040	Yes	0.032	Yes
2	0.064	0.058	Yes	0.040	Yes	0.032	Yes
3	0.064	0.058	Yes	0.040	Yes	0.032	Yes
4	0.064	0.058	Yes	0.040	Yes	0.032	Yes
5	0.064	0.058	Yes	0.040	Yes	0.032	Yes
6	0.051	0.058	No	0.040	Yes	0.032	Yes
7	0.051	0.058	No	0.040	Yes	0.032	Yes
8	0.036	0.058	No	0.040	No	0.032	Yes

[1] R-Control SIP U-Factors include inside air film, 1/2” gypsum wallboard, R-Control SIP, wood siding, and outside air film.

2012 IECC Table C402.1.2 Equivalent *U*-Factors Commercial Roof/Ceilings							
Zone	Roof/Ceiling Requirement	R-Control SIP[1]					
		8-1/4”	Comply?	10-1/4”	Comply?	12-1/4”	Comply?
1	0.048	0.032	Yes	0.026	Yes	0.022	Yes
2	0.048	0.032	Yes	0.026	Yes	0.022	Yes
3	0.048	0.032	Yes	0.026	Yes	0.022	Yes
4	0.039	0.032	Yes	0.026	Yes	0.022	Yes
5	0.039	0.032	Yes	0.026	Yes	0.022	Yes
6	0.032	0.032	Yes	0.026	Yes	0.022	Yes
7	0.028	0.032	No	0.026	Yes	0.022	Yes
8	0.028	0.032	No	0.026	Yes	0.022	Yes

[1] R-Control SIP U-Factors include inside air film, 1/2” gypsum wallboard, R-Control SIP, asphalt shingles, and outside air film.

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SIP No. 2082

Subject: **R-Control SIPs as an Air Barrier**

Date: **April 2014**

The 2012 International Energy Conservation Code (IECC) includes specific requirements concerning air barriers to control the air leakage of buildings. Air barriers normally consist of materials assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material or a combination of materials.

The IECC (Section C402.4.1.2.1) requires materials acting as air barriers to have an air permeability no greater than 0.004 cfm/ft² (0.02 L/s • m²) under a pressure differential of 0.3 inches water (75 Pa) when tested in accordance with ASTM E 2178.

A number of materials are deemed to comply with the IECC requirement provided joints are sealed. Two of the products complying with the requirement are oriented strand board (OSB) having a thickness of not less than 3/8 inch (10 mm) and gypsum board having a thickness of not less than 1/2 inch (12 mm).

An R-Control SIP which has 7/16 inch OSB facings meets the IECC requirement. In addition, the interior of an R-Control SIP is normally covered with 1/2 inch gypsum board for fire protection reasons. This interior gypsum board also meets the IECC requirement.

The IECC (Section C402.4.1.2.2) provides a requirement for assemblies acting as air barriers. Assemblies of materials are required to have an air leakage not to exceed 0.04 cfm/ft² (0.2 L/s • m²) under a pressure differential of 0.3 inches of water (75Pa).

R-Control SIPs were tested to demonstrate compliance with the IECC requirement for air barriers and to evaluate the air leakage of a SIP spline joint. A test assembly consisting of two R-Control SIPs, R-Control Low VOC Do-All-Ply, and R-Control SIP Tape was tested by a third party accredited laboratory. The two R-Control SIPs were joined in accordance with R-Control SIP detail SIP-102g.

The air leakage of the R-Control SIP assembly was less than 0.001 cfm/ft² (0.005 L/s • m²).

The R-Control assembly demonstrated performance which meets both the IECC requirements for an air barrier material and an air barrier assembly.

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