



CONSTRUCTION DETAILS FOR ENERGY CODE COMPLIANCE

Polymeric Cladding Over Continuous Insulation



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INTRODUCTION AND EXECUTIVE SUMMARY

Polymeric claddings, such as vinyl siding, insulated vinyl siding, and polypropylene siding, are well suited for building envelopes incorporating continuous insulation. This compatibility is particularly relevant in meeting newer, more stringent wall insulation requirements set forth by the International Energy Conservation Code. In practice, rigid foam insulation is a common choice for achieving these International Energy Conservation Code requirements, demonstrating its effectiveness with various polymeric cladding options.

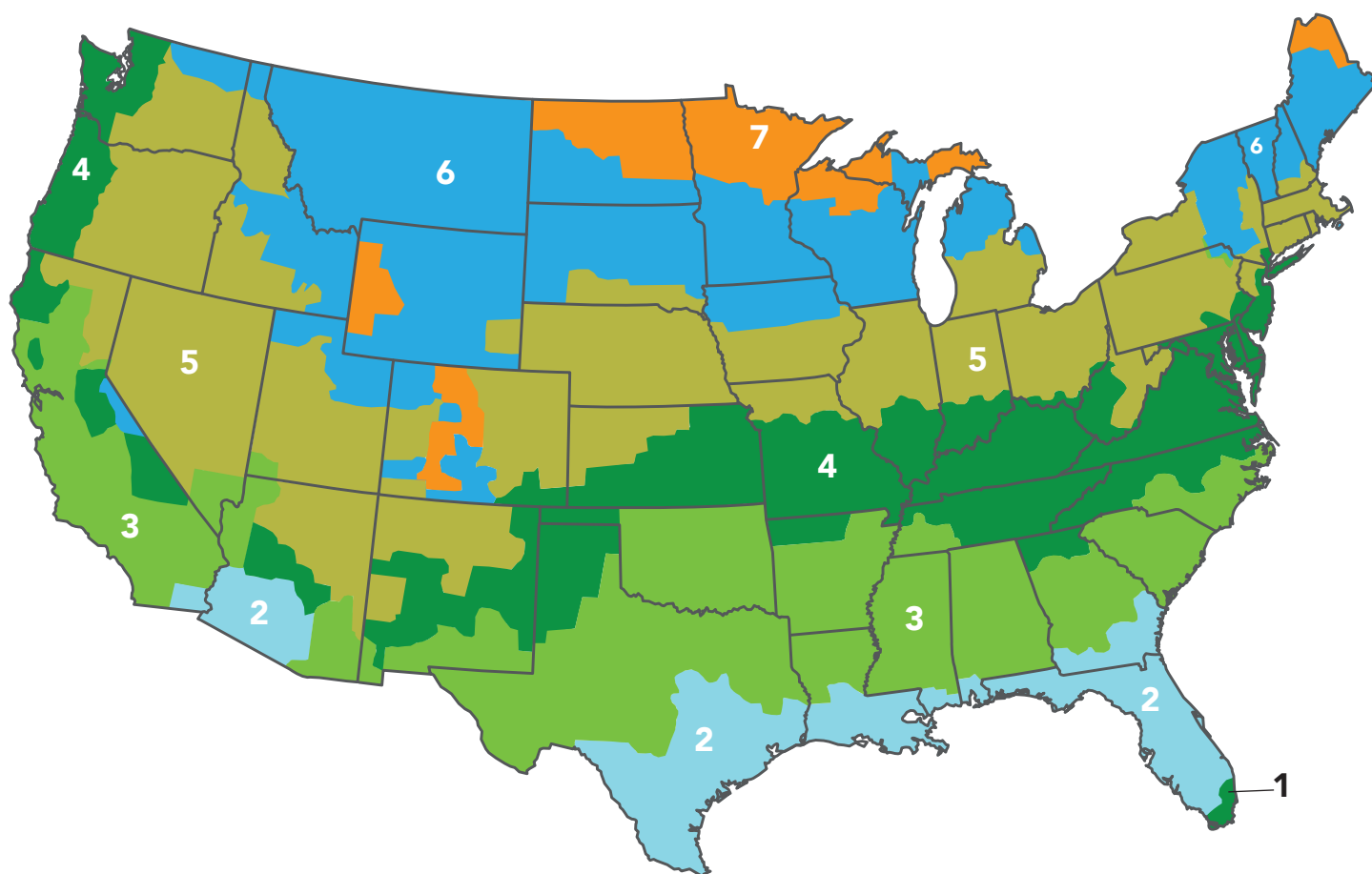
Continuous insulation is a type of insulating material applied across the entire exterior surface of a building, covering all structural members. The primary purpose of continuous insulation is to minimize “thermal bridges” — areas of the building that have higher heat transfer due to less insulation, such as the studs in wood framing. Insulated vinyl siding is a type of polymeric cladding that qualifies as continuous insulation. It can be used effectively in continuous insulation systems that require higher levels of insulation than available with insulated vinyl siding alone by adding a layer of rigid foam sheathing beneath the insulated vinyl siding.

This manual offers details on installing polymeric claddings with continuous insulation. Its information is based on the International Residential Code and the International Energy Conservation Code, as well as industry specifications and other resources, including VSI member research and state energy initiatives.

Installation details are specific to the use of vinyl siding, insulated vinyl siding, and polypropylene siding over continuous insulation thickness up to 2 in., including R-2.6 (nominal ½ in.), R-3 (nominal ¾ in.), R-5 (nominal 1 in.), R-7.5 (nominal 1½ in.), and R-10 (nominal 2 in.).

This manual is structured to provide users convenient access to information based on the 2021 International Energy Conservation Code’s Climate Zone map. Figure 1 displays a simplified climate zone map for reference. Users can quickly locate relevant information for their specific sales or installation territory by referring to their location on the map and then reading the corresponding section in this manual.

FIGURE 1 Simplified International Energy Conservation Code Climate Zone Map.
Note: Energy code compliance is based on the 2021 International Energy Conservation Code.





GENERAL FASTENER INFORMATION

The recommended type of nail fastener for installing vinyl siding over continuous insulation should have a shank thickness of at least 0.120 in. and a head-section diameter of 0.313 in. Typically, this is achieved using hot-dipped or electroplated galvanized siding (roofing) nails. Fasteners should generally be long enough to pass through the continuous insulation driven into the studs to a depth of at least 1¼ in.

An alternative method is allowed only when installing the siding over a nailable substrate¹ (such as a minimum 7⁄16 in. OSB or plywood), which involves ring-shank nails. These nails should be placed at 12 in. intervals with shanks long enough to pass through the continuous insulation and penetrate through the back of the substrate protruding by at least ¼ in. This attachment method can be used for installation over foam sheathing up to 2 in. thick.

FASTENER TABLE FOR VINYL (VS), INSULATED VINYL (IVS), AND POLYPROPYLENE (PP) SIDINGS BASED ON THE 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) AND INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

NAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into studs (framing members) VS, IVS (directly into studs or through wood structural panel sheathing)	Galvanized, stainless-steel, or aluminum siding (roofing) nails with ⅝ in. shank, ⅝ in. head	Corrosion-resistant 0.120 in. shank dia. nail with a 0.313 in. head	The total penetration into sheathing, furring, framing, or other nailable substrate shall be a minimum of 1¼ in.	VS or IVS max. 16 in. o.c. (or as specified by manufacturer instructions) PP is not permitted with this installation spacing
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zone 3*	VS + 1 in. ci = 2¼ in. IVS + ¾ in. ci = 2 in.			
Climate Zones 4–8*	VS + 2 in. ci = 3¼ in. IVS + 1½ in. ci = 3 in.			
Into wood-based sheathing only with nails VS, IVS, PP (wood structural panel sheathing only min. 7⁄16 in.)	Ring-shank (spiral) galvanized, stainless-steel (shaft size), or aluminum siding nail with a ⅝ in. head	Ring-shank roofing nail (0.120 in. min. dia., 12 in. o.c.) or No. 8 screw nail with a ⅝ in. dia. head or washer	The fastener shall penetrate the back side of the wood structural panel sheathing by at least ¼ in. The wood structural panel sheathing shall be not less than 7⁄16 in. thick	VS or IVS: with 0.120 in. min. dia. nail at 12 in. o.c. max. (or as specified by manufacturer instructions) PP max. 8 in. o.c. (or as specified by manufacturer instructions)
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zone 3*	VS/PP + 1 in. ci = 1¾ in. IVS + ¾ in. ci = 1½ in.			
Climate Zones 4–8*	VS/PP + 2 in. ci = 2¾ in. IVS + 1½ in. ci = 2¼ in.			

Table continued on page 3

¹ Climate Zone 2A is below the “warm-humid” line on the climate zone map (south and southeast), while 2B is dry (southwest).

GENERAL FASTENER INFORMATION



Table continued from page 2

NAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into wood-based sheathing only with screws VS, IVS, PP (into 7/16 in. wood structural panel sheathing only)	No. 8 screw (0.138 in. dia.) siding corrosion-resistant, with a 5/16 in. pan head	No. 8 screw (0.164 in. dia.) corrosion-resistant self-tapping, pan head, or washer-head siding with at least 5/16 in. dia. head, 1/8 in. dia. shaft, and at least 1 1/8 in. long	The fastener shall penetrate the back side of the wood structural panel sheathing by at least 1/4 in. The wood structural panel sheathing shall be not less than 7/16 in. thick	VS or IVS: No. 8 screw, 0.164 in. min. dia. @ 12 in. o.c. Or No. 8 screw with a 5/16 in. dia. head or washer at 16 in. o.c. PP max. 8 in. o.c. (or as specified by manufacturer instructions)
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zone 3*	VS/PP + 1 in. ci = 1 3/4 in.			
	IVS + 3/4 in. ci = 1 1/2 in.			
Climate Zones 4–8*	VS/PP + 2 in. ci = 2 3/4 in.			
	IVS + 1 1/2 in. ci = 2 1/4 in.			
Over foam into studs without nailbase sheathing Instructions for attaching polymeric sidings through foam directly into studs		Corrosion-resistant 0.120 in. shank dia. nail with a 0.313 in. head	Into wood framing (minimum 1 1/4 in. penetration)	VS or IVS max. 16 in. o.c. (or as specified by manufacturer instructions) PP is not permitted with this installation application and spacing
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zone 3*	VS + 1 in. ci = 2 1/4 in.			
	IVS + 3/4 in. ci = 2 in.			
Climate Zones 4–8*	VS + 2 in. ci = 3 1/4 in.			
	IVS + 1 1/2 in. ci = 3 in.			
Staples through any substrate or direct-to-studs (framing members)	Staples are not permitted through the foam of any thickness	Staples are not permitted through the foam of any thickness	N/A	N/A

*See Climate Zone Map on page 1



CONTINUOUS INSULATION IN CLIMATE ZONES 1 AND 2

ZONES 1 & 2

The International Code Council provides climate zone classifications used for the design and construction of buildings. Climate Zones 1 and 2 are two of the several climate zones defined in the International Energy Conservation Code. Here's a brief description of each:

Climate Zone 1

represents areas with a predominantly tropical climate. These areas usually experience hot and humid conditions. The temperature remains relatively warm throughout the year, with minimal seasonal variations. High annual rainfall levels and the possibility of tropical storms or hurricanes characterize Climate Zone 1.

Climate Zone 2

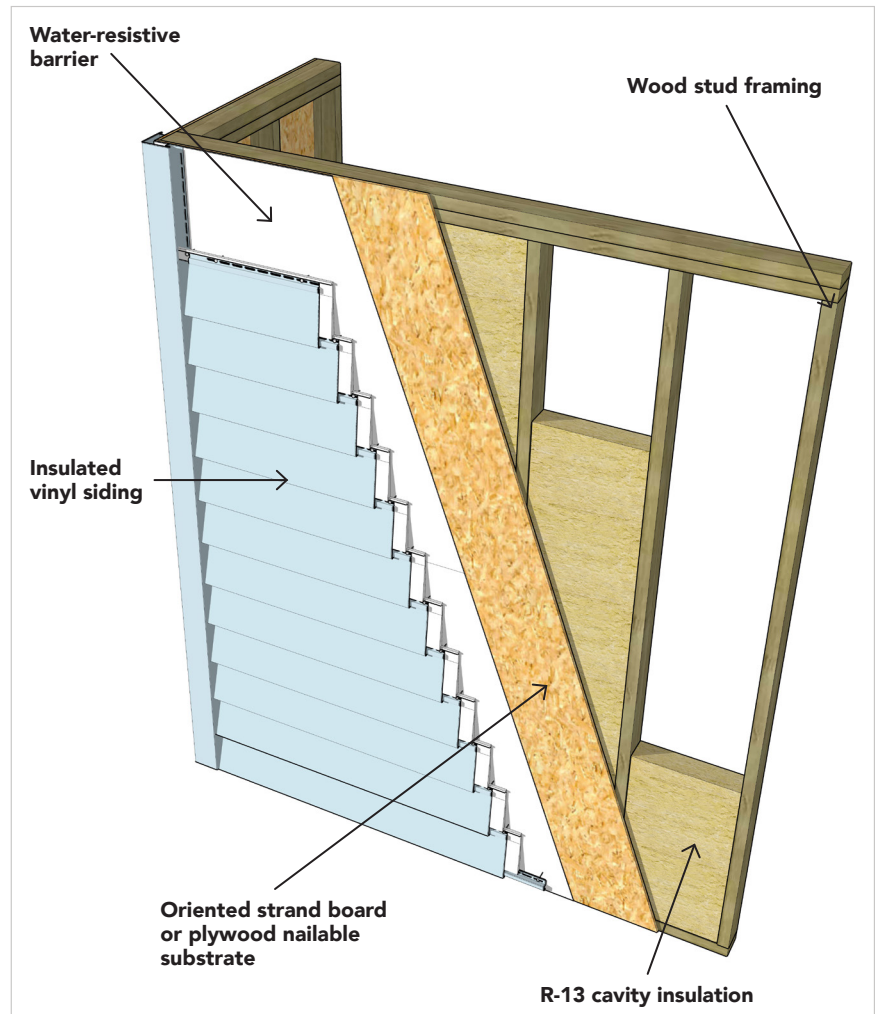
covers regions with a hot-dry or warm-temperate climate. These areas generally have hot summers and mild winters. Summer temperatures can be high, while winter temperatures tend to be milder than in colder climate zones. Precipitation levels may vary, with some areas experiencing dry conditions and others having moderate to heavy rainfall patterns.

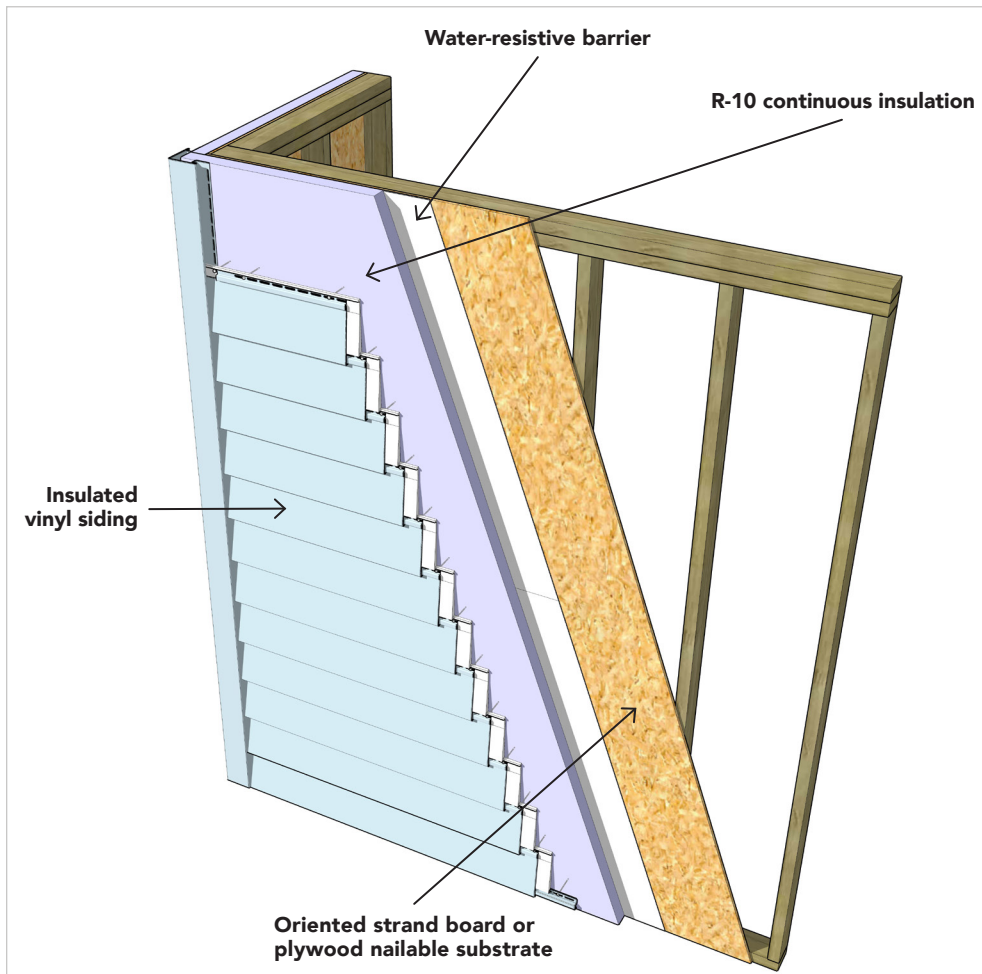
Vinyl Siding in Climate Zones 1 and 2

The International Energy Conservation Code does not require continuous insulation in Climate Zones 1 and 2. However, a compliance path exists for using R-10 continuous insulation while excluding cavity wall insulation. While few builders will use this approach, given the minimum cavity wall requirements of R-13, homeowners may benefit in energy savings and indoor comfort by adding even minimum values of continuous exterior insulation.

In Climate Zone 1, where hot and humid conditions prevail, the primary goal of continuous insulation is to control solar heat gain and water vapor drive through the exterior surface of the wall to the interior. The insulation should be designed to minimize vapor drive toward the interior and maintain comfortable indoor temperatures. Common insulation materials providing thermal and water vapor resistance in this climate zone include rigid foam boards, such as expanded polystyrene (EPS) or extruded polystyrene (XPS), foil-faced polyisocyanurate (Polyiso), and graphite-enhanced polystyrene (GSP).

Installing an R-2.5 insulated vinyl siding over a wall with R-13 cavity insulation improves the code-minimum insulation requirement by almost 20% while reducing thermal bridging across framing members.





Installing an R-3.1 insulated vinyl siding over R-7.5 continuous insulation complies with the R-0 + 10 continuous insulation option ($R-3.1 - R-0.6 + R-7.5 = R-10$ continuous insulation total). Adapted from U.S. Office of Energy Efficiency & Renewable Energy, <https://basc.pnnl.gov/resource-guides/vinyl-siding-integrated-rigid-foam-existing-walls>.

In Climate Zone 2, where hot, dry conditions prevail, the primary goal of continuous insulation is to control solar heat gain through the exterior surface of the wall to the interior and water vapor drive through the exterior surface of the wall to the interior in moist regions of Climate Zone 2. Common insulation materials providing thermal and water vapor resistance in this climate zone include rigid foam boards, such as EPS or XPS, Polyiso, and GSP.

Insulated Vinyl Siding in Climate Zones 1 and 2

With conventional construction in Climate Zones 1 and 2, adding nominal R-2.6 continuous exterior insulation by using insulated vinyl siding over walls complying with the minimum cavity insulation requirement of R-13 yields a 25% increase in R-value, improving air conditioning comfort and efficiency and earning potential energy savings for consumers during the cooling season.

In Climate Zones 1 and 2, the International Energy Conservation Code also permits using R-10 (nominal 2 in.) continuous insulation as stand-alone insulation (R-0 + 10 continuous insulation) instead of R-13 insulation within the wall cavity. Installing an R-3.1 insulated vinyl siding over R-7.5 continuous insulation will also comply with the R-0 + 10 continuous insulation option ($R-3.1 - R-0.6 + R-7.5 = R-10$ continuous insulation total). One advantage of this approach is that it leaves the wall cavity free of water-holding insulation for rapid drying in the event of flooding.

CONTINUOUS INSULATION IN CLIMATE ZONE 3

ZONE 3

Climate Zone 3 represents regions with a warm-temperate climate. This zone typically experiences hot summers and mild winters. Summer temperatures can be high, while

winter temperatures tend to be milder than in colder climate zones. Precipitation levels may vary widely, with some areas experiencing moderate to heavy rainfall patterns.

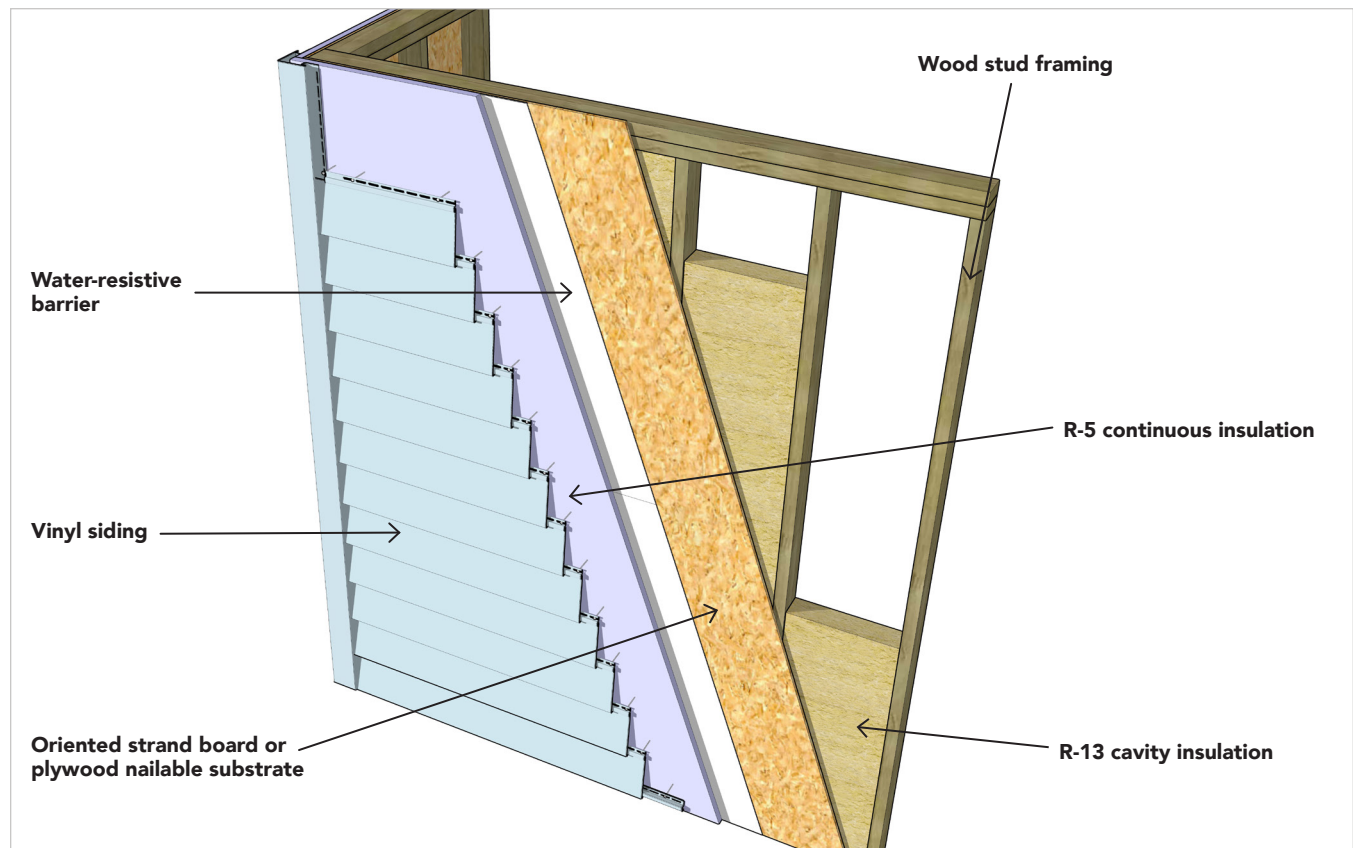
Vinyl Siding over continuous insulation in Climate Zone 3

In Climate Zone 3, the International Energy Conservation Code prescribes R-20 wall cavity insulation or R-13 cavity insulation with R-5 continuous exterior insulation. The combination of R-13 with R-5 continuous insulation can often yield a more economical wall than the provision for R-20 wall cavity insulation that requires 2x6 vs. 2x4 stud construction.

While various thicknesses and R-values of continuous insulation can be used for code compliance, R-5 continuous insulation is commonly used because of its moderate thickness (generally about 1 in., depending on foam sheathing type) and because it is referenced as a prescriptive exterior insulation option (together with cavity insulation of R-13 or R-20) by the International Energy Conservation Code for Climate Zones 3 to 8 (i.e., most of the U.S.). If used on a 2x4 wall construction, the 1 in. thick continuous insulation is less than that of a thermally equivalent 2x6 wall with no exterior insulation.

When used on a 2x4 or 2x6 wall, window extension jambs or drywall returns require a simple adjustment of standard details for interior finishing of window openings (e.g., length of jamb extension or drywall return). Commonly used flanged windows can be mounted over the continuous insulation (up to 1½ in. thickness) without significant changes except for longer fasteners. For doors, thresholds will require full support with blocking. Home improvement stores readily offer fasteners of appropriate length for vinyl siding, with fasteners up to 3½ in. long for 2 in. continuous insulation.

Climate Zone 3 code-compliance vinyl siding over a nailable substrate and R-5 continuous insulation with R-13 cavity insulation.



CONTINUOUS INSULATION IN CLIMATE ZONE 3



ZONE 3

FASTENER TABLE FOR VINYL (VS), INSULATED VINYL (IVS), AND POLYPROPYLENE (PP) SIDINGS BASED ON THE 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) AND INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

AVAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into studs (framing members) VS, IVS (directly into studs or through wood structural panel sheathing)	IECC ci requirements for: Galvanized, stainless-steel, or aluminum siding (roofing) nails with ⅜ in. shank, ⅝ in head	Corrosion-resistant 0.120 in. shank dia. nail with a 0.313 in. head	The total penetration into sheathing, furring, framing, or other nailable substrate shall be a minimum of 1¼ in.	VS or IVS max. 16 in. o.c. (or as specified by manufacturer instructions) PP is not permitted with this installation spacing
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zone 3*	VS + 1 in. ci = 2¼ in.			

*See Climate Zone Map on page 1

INSTALLATION RECOMMENDATIONS

Vinyl siding is generally installed on continuous insulation over a substrate, such as wood, fiberboard, or gypsum. But vinyl siding can also cover foam plastic sheathing alone, without a nailable sheathing. If installed without a substrate, the design rating of the siding must be specified based on Table R703.11.2 of the International Residential Code (see Wind Zone Variations on page 18). The siding is generally fastened at 16 in. on center, or as specified by the manufacturer's printed installation instructions, using corrosion-resistant fasteners long enough to pass through the continuous insulation and penetrate a nailable substrate or framing 1¼ in. or more, unless fastening to the nailable sheathing alone at the corresponding spacing required and penetrating through the substrate at least ¼ in.

FASTENER RECOMMENDATIONS ON VARIOUS SUBSTRATES

The recommended type of nail fastener for installing vinyl siding over continuous insulation should have a shank thickness of at least 0.120 in., a head-section diameter of 0.313 in., and a length sufficient to accommodate the thickness of the foam. Typically, this is achieved using corrosion-resistant (such as hot-dipped galvanized) siding (or roofing) nails or 16-gauge staples with a crown width of ⅜ to ½ in. These fasteners should be driven into the studs to a depth of 1¼ in.

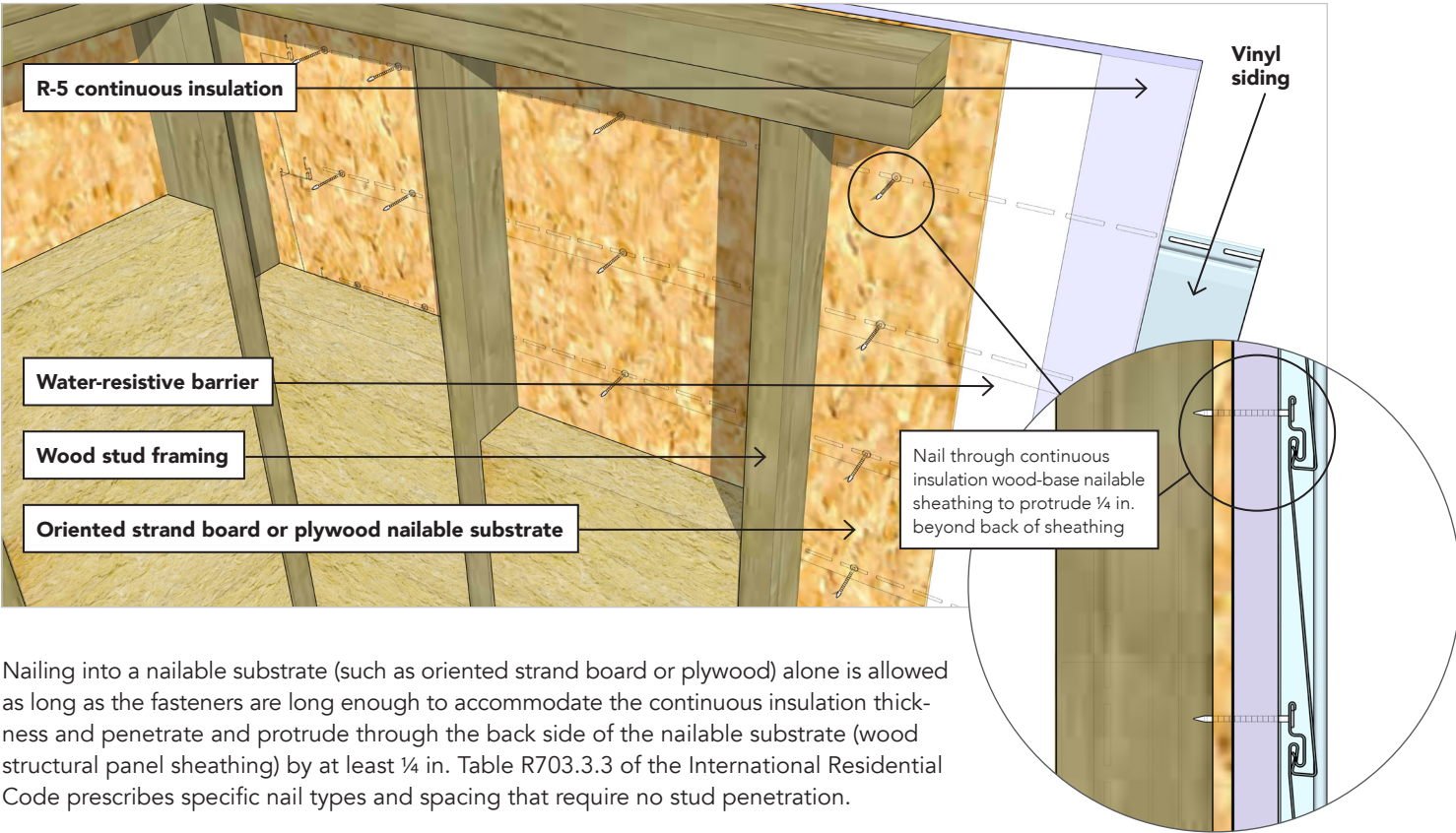
An alternative method, allowed only when installing the siding over a nailable substrate (such as oriented strand board or plywood), involves using ring-shank nails. These nails should be placed at 12 in. intervals and be long enough to pass through the continuous insulation and protrude through the back of the substrate by ¼ in.



ZONE 3

CONTINUOUS INSULATION IN CLIMATE ZONE 3

Nailing into the sheathing without stud penetration can be convenient when the foam and water-resistive barrier makes stud location challenging to identify. Vinyl siding nailed through R-5 continuous insulation (1 in. thick) into $\frac{7}{16}$ oriented strand board with fasteners at 12 in. using $1\frac{3}{4}$ in. long ring-shank nails penetrating and protruding through the sheathing a minimum of $\frac{1}{4}$ in.



Nailing into a nailable substrate (such as oriented strand board or plywood) alone is allowed as long as the fasteners are long enough to accommodate the continuous insulation thickness and penetrate and protrude through the back side of the nailable substrate (wood structural panel sheathing) by at least $\frac{1}{4}$ in. Table R703.3.3 of the International Residential Code prescribes specific nail types and spacing that require no stud penetration.

Note: Foam, structural fiberboard, and gypsum sheathing are not nailable substrates.

FASTENER TABLE FOR VINYL (VS), INSULATED VINYL (IVS), AND POLYPROPYLENE (PP) SIDINGS BASED ON THE 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) AND INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

NAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into wood-based sheathing only with nails VS, IVS, PP (wood structural panel sheathing only min. $\frac{7}{16}$ in.)	IECC ci requirements for: Ring-shank (spiral) galvanized, stainless (shaft size) steel, or aluminum siding nail with a $\frac{5}{16}$ in. head	Ring-shank roofing nail (0.120 in. min. dia.) or Ring-shank nail (0.148 in. min. dia.)	The fastener shall penetrate the back side of the wood structural panel sheathing by at least $\frac{1}{4}$ in. The wood structural panel sheathing shall be not less than $\frac{7}{16}$ in. thick	VS or IVS with 0.120 in. min. nail at 12 in. o.c. max. (or as specified by manufacturer instructions) VS or IVS with 0.148 in. min. nail at 16 in. o.c. max. (or as specified by manufacturer instructions) PP max. 8 in. o.c. (or as specified by manufacturer instructions)
	IECC ci requirements for:			
	Min. fastener lengths as listed below:			
Climate Zone 3*	VS/PP + 1 in. ci = $1\frac{3}{4}$ in.			
	IVS + $\frac{3}{4}$ in. ci = $1\frac{1}{2}$ in.			
Into wood-based sheathing only with screws VS, IVS, PP (into $\frac{7}{16}$ in. wood structural panel sheathing only)	No. 8 screw (0.138 in. dia.) siding corrosion-resistant, with a $\frac{5}{16}$ in. pan head	No. 8 screw (0.164 in. dia.) corrosion-resistant self-tapping, pan head, or washer-head siding with at least $\frac{5}{16}$ in. dia. head, $\frac{1}{8}$ in. dia. shaft, and at least $1\frac{1}{8}$ in. long	The fastener shall penetrate the back side of the wood structural panel sheathing by at least $\frac{1}{4}$ in. The wood structural panel sheathing shall be not less than $\frac{7}{16}$ in. thick	VS or IVS: No. 8 screw, 0.164 in. min. dia. @ 12 in. o.c. Or No. 8 screw with a $\frac{5}{16}$ in. dia. head or washer at 16 in. o.c. PP max. 8 in. o.c. (or as specified by manufacturer instructions)

*See Climate Zone Map on page 1

CONTINUOUS INSULATION IN CLIMATE ZONE 3

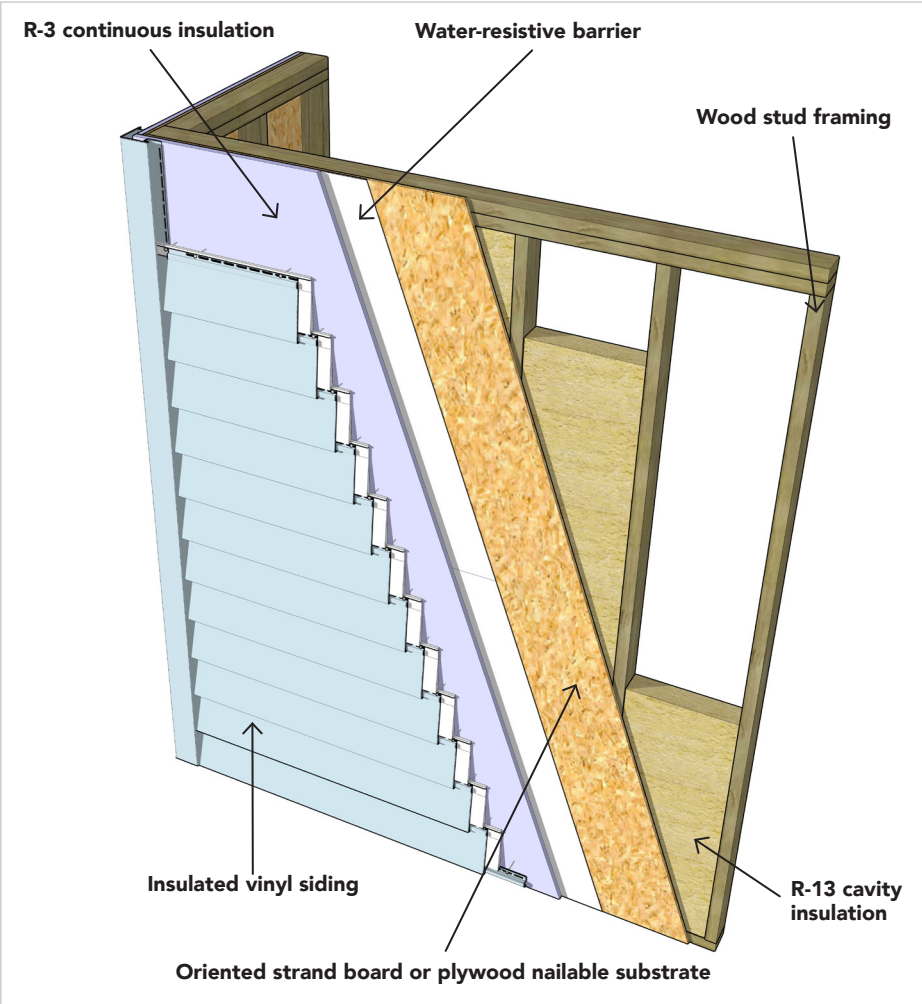
ZONE 3

Insulated Vinyl Siding over R-3 continuous insulation in Climate Zone 3

In Climate Zone 3, builders can comply with the International Energy Conservation Code's wall insulation requirements by layering R-2.6 insulated vinyl siding over R-3 continuous insulation panels on walls with R-13 cavity insulation or R-3 insulated vinyl siding over 2 in. Polyiso or graphite polystyrene of at least R-12 for walls using the continuous insulation approach without cavity insulation.

Whenever layering, the total R-value for continuous insulation and insulated vinyl siding must add up to the required or designed amount of continuous insulation R-value for compliance, less R-0.6. For example, in Climate Zone 3, a builder can comply with the prescriptive requirements of the International Energy Conservation Code using an R-13 wall cavity insulation and an R-3 continuous insulation with insulated siding having an R-value of 2.6 (R-3 continuous insulation + R-2.6 insulated siding – R-0.6 = R-5.0), slightly exceeding the requirement. The energy code requires you to deduct R-0.6 from the published R-value of VSI because the energy code already assumes the R-value of the siding material. Not deducting R-0.6 would duplicate this assumption.

In Climate Zone 3, a builder can comply with the International Energy Conservation Code's prescriptive requirements of R-13 + R-5 using R-13 wall cavity insulation and R-3 continuous insulation clad with insulated siding presenting a minimum R-value of 2.6.



FASTENER TABLE FOR VINYL (VS), INSULATED VINYL (IVS), AND POLYPROPYLENE (PP) SIDINGS BASED ON THE 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) AND INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

AVAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into studs (framing members) VS, IVS (directly into studs or through wood structural panel sheathing)	IECC ci requirements for: Galvanized, stainless-steel, or aluminum siding (roofing) nails with 1/8 in. shank, 5/16 in. head	Corrosion-resistant 0.120 in. shank dia. nail with a 0.313 in. head	The total penetration into sheathing, furring, framing, or other nailable substrate shall be a minimum of 1 1/4 in.	VS or IVS max. 16 in. o.c. (or as specified by manufacturer instructions) PP is not permitted with this installation spacing
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zone 3*	IVS + 3/4 in. ci = 2 in.			

*See Climate Zone Map on page 1

CONTINUOUS INSULATION IN CLIMATE ZONE 3

INSTALLATION RECOMMENDATIONS

Insulated vinyl siding is generally installed on continuous insulation over a substrate, such as wood, fiberboard, or gypsum. But insulated vinyl siding can also cover foam plastic sheathing alone, without a nailable substrate. If installed without a substrate, the design rating of the siding must be increased based on Table R703.11.2 of the International Residential Code (see Wind Zone Variations on page 18). The siding is generally fastened at 16 in. on center, or as specified by the manufacturer's printed installation instructions, using corrosion-resistant fasteners long enough to pass through the continuous insulation and penetrate the nailable substrate and frame 1¼ in. or more.

FASTENER RECOMMENDATIONS ON VARIOUS SUBSTRATES

The recommended type of nail fastener for installing insulated vinyl siding over continuous insulation should have a shank thickness of at least 0.120 in. and a head-section diameter of 0.313 in. Typically, this is achieved using noncorrosive siding (or roofing) nails or 16-gauge staples with a crown width of ⅜ to ½ in. These fasteners should be driven into the studs to a depth of 1¼ in.

FASTENER TABLE FOR VINYL (VS), INSULATED VINYL (IVS), AND POLYPROPYLENE (PP) SIDINGS BASED ON THE 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) AND INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

NAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into wood-based sheathing only with nails VS, IVS, PP (wood structural panel sheathing only min. 7⁄16 in.)	IECC ci requirements for: Ring-shank (spiral) galvanized, stainless-steel (shaft size), or aluminum siding nail with a 5⁄16 in. head	Ring-shank roofing nail (0.120 in. min. dia.) or Ring-shank nail (0.148 in. min. dia.)	The fastener shall penetrate the back side of the wood structural panel sheathing by at least ¼ in. The wood structural panel sheathing shall be not less than 7⁄16 in. thick	VS or IVS with 0.120 in. min. nail at 12 in. o.c. max. (or as specified by manufacturer instructions) VS or IVS with 0.148 in. min. nail at 15 in. o.c. Max. (or as specified by manufacturer instructions)
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zone 3*	IVS + ¾ in. ci = 1¾ in.			PP max. 8 in. o.c. (or as specified by manufacturer instructions)

*See Climate Zone Map on page 1

Polypropylene Siding over continuous insulation in Climate Zone 3

The climate zone recommendations for polypropylene siding are the same as those for vinyl siding.

INSTALLATION RECOMMENDATIONS

The installation recommendations for polypropylene siding are similar to those for vinyl siding, except that fastener spacing is generally 8 in. on center or per the manufacturer's recommendation. Installing polypropylene siding directly over continuous insulation without a nailable substrate is not permitted.

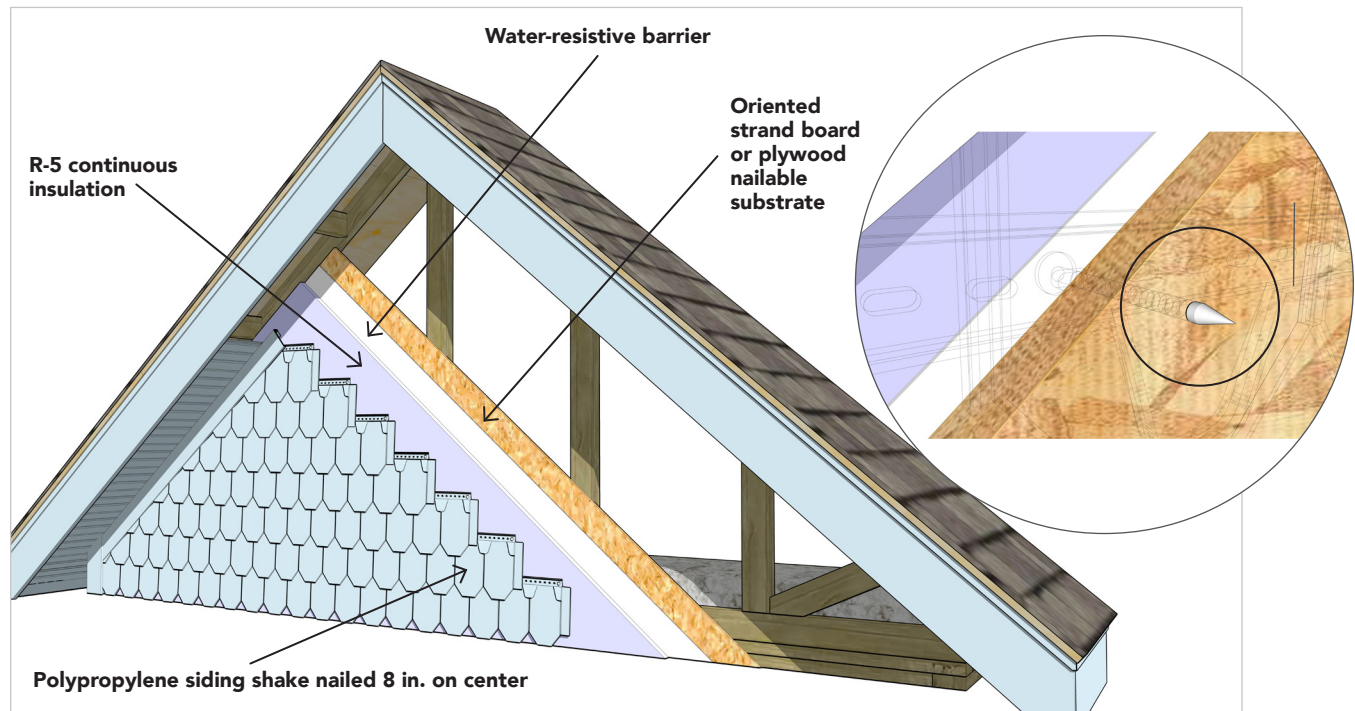
FASTENER RECOMMENDATIONS ON VARIOUS SUBSTRATES

The recommended fasteners for installing polypropylene siding over R-5 and R-10 continuous insulation are identical to those used for vinyl siding when installation is carried out on a nailable substrate. The spacing of fasteners on polypropylene siding varies depending on the specific product and siding design; typical spacing is 8 in. on center, limiting its installation to nailable substrates only. It is essential to adhere to the manufacturer's installation instructions for nail spacing in all scenarios, adjusting the nail length to accommodate the additional thickness of the foam.

CONTINUOUS INSULATION IN CLIMATE ZONE 3

ZONE 3

In Climate Zone 3, a builder can meet energy requirements using polypropylene siding installed over R-5 continuous insulation and wall cavity insulation of at least R-13. Nailing should be at a maximum of 8 in. on center, with ring-shank nails penetrating the sheathing and protruding ¼ in. through the back of the sheathing.



FASTENER TABLE FOR VINYL (VS), INSULATED VINYL (IVS), AND POLYPROPYLENE (PP) SIDINGS BASED ON THE 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) AND INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

NAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into wood-based sheathing only with nails PP (wood structural panel sheathing only min. 7/16 in.)	IECC ci requirements for: Ring-shank (spiral) galvanized, stainless-steel (shaft size), or aluminum siding nail with a 5/16 in. head	Ring-shank roofing nail (0.120 in. min. dia.) or Ring-shank nail (0.148 in. min. dia.)	The fastener shall penetrate the back side of the wood structural panel sheathing by at least ¼ in. The wood structural panel sheathing shall be not less than 7/16 in. thick	VS or IVS with 0.120 in. min. nail at 12 in. o.c. max. (or as specified by manufacturer instructions) VS or IVS with 0.148 in. min. nail at 15 in. o.c. max. (or as specified by manufacturer instructions) PP max. 8 in. o.c. (or as specified by manufacturer instructions)
IECC ci requirements for: Climate Zone 3*	Min. fastener lengths as listed below: IVS + ¾ in. ci = 2 in. VS/PP + 1 in. ci = 1¾ in. IVS + ¾ in. ci = 1½ in.			
Into wood-based sheathing only with screws VS, IVS, PP (into 7/16 in. wood structural panel sheathing only)	No. 8 screw (0.138 in. dia.) siding screw corrosion-resistant, with a 5/16 in. pan head	No. 8 screw (0.164 in. dia.) corrosion-resistant self-tapping, pan head, or washer-head siding with at least 5/16 in. dia. head, 1/8 in. dia. shaft, and at least 1½ in. long	The fastener shall penetrate the back side of the wood structural panel sheathing by at least ¼ in. The wood structural panel sheathing shall be not less than 7/16 in. thick	VS or IVS: No. 8 screw, 0.164 in. min. dia. @ 12 in. o.c. or No. 8 screw with a 5/16 in. dia. head or washer at 16 in. o.c. PP max. 8 in. o.c. (or as specified by manufacturer instructions)

*See Climate Zone Map on page 1

CONTINUOUS INSULATION IN CLIMATE ZONES 4 THROUGH 8

ZONE 4 – 8

ICC Climate Zones 4 through 8 represent progressively colder climates. Here's a brief description of each of these climate zones:

Climate Zone 4

is characterized by a cold-temperate climate with mild summers and cold winters. This zone experiences significant temperature variation between seasons. Insulation in Zone 4 should focus on reducing heat loss during winter and maintaining comfortable indoor temperatures.

Climate Zone 5

represents a cool-temperate climate with warm summers and cold winters. This zone experiences moderate to high precipitation levels. Insulation in Zone 5 should prioritize both thermal resistance and moisture control.

Climate Zone 6

is associated with a cold climate with mild summers and cold winters. This zone experiences longer and colder winter seasons. Insulation in Zone 6 should focus on preventing heat loss and creating a thermal barrier.

Climate Zone 7

represents a frigid climate with cool summers and cold winters. This zone experiences extended periods of freezing temperatures. Insulation in Zone 7 should prioritize high thermal resistance and effective indoor moisture control.

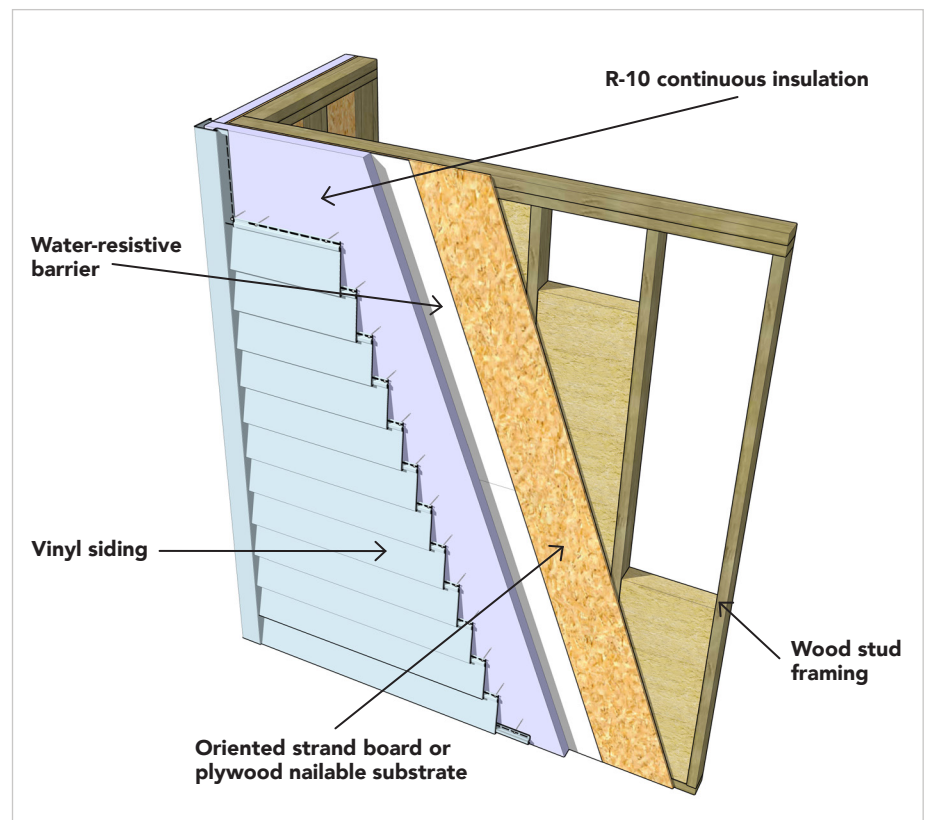
Climate Zone 8

is associated with a frigid climate. This zone experiences long, harsh winters with freezing temperatures. Insulation in Zone 8 should provide excellent thermal resistance and prevent heat loss.

Common insulation materials in all zones include high-density fiberglass batts, blown-in cellulose, and rigid foam sheathing. However, the specific requirements for insulation and building practices within these climate zones may vary based on local building codes and standards. Consulting local regulations and guidelines is crucial to ensure compliance and the selection of appropriate insulation methods for each specific climate zone.

The International Energy Conservation Code provides a practical, prescriptive path for wall insulation in Climate Zones 4 through 8, combining R-13 wall cavity insulation and R-10 continuous insulation (13+10 continuous insulation) or R-20 wall cavity insulation and R-5 continuous insulation (20+5 continuous insulation).

In Climate Zones 4 to 8, a builder can meet energy requirements using any polymeric cladding installed over R-10 ci and wall cavity insulation of at least R-13.



FASTENER TABLE FOR VINYL (VS), INSULATED VINYL (IVS), AND POLYPROPYLENE (PP) SIDINGS BASED ON THE 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) AND INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

NAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into studs (framing members) VS, IVS (directly into studs or through wood structural panel sheathing)	IECC ci requirements for: Galvanized, stainless steel, or aluminum siding (roofing) nails with ½ in. shank, 5⁄16 in. head	Corrosion-resistant 0.120 in. shank dia. nail with a 0.313 in. head	The total penetration into sheathing, furring, framing, or other nailable substrate shall be a minimum of 1¼ in.	VS or IVS max. 16 in. o.c. (or as specified by manufacturer instructions) PP is not permitted with this installation spacing
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zones 4-8*	VS + 2 in. ci = 2¾ in.			

*See Climate Zone Map on page 1

Vinyl Siding over R-10 continuous insulation in Climate Zones 4 through 8

Under the prescriptive provisions of the International Energy Conservation Code, R-10 continuous insulation is an option in almost all climate zones except Climate Zone 3. As continuous insulation sheathing becomes thicker, the lightness of vinyl siding becomes advantageous because heavier

cladding may not be permitted over 2 in. of continuous insulation or require engineering design. A builder can also use 2x6 walls with R-20 cavity insulation and R-5 continuous insulation in Climate Zones 4 to 8.

INSTALLATION RECOMMENDATIONS

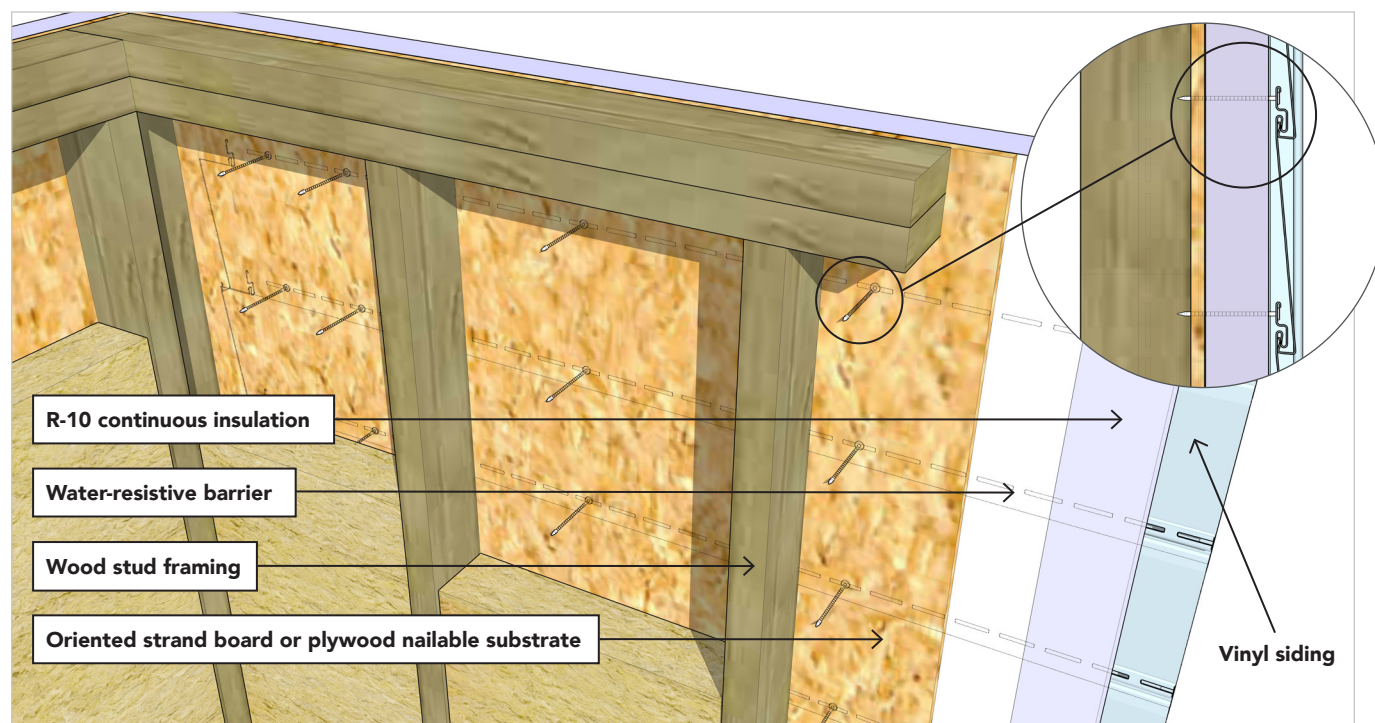
Vinyl siding is generally installed on continuous insulation over a substrate, such as wood, fiberboard, or gypsum. However, vinyl siding can cover foam plastic sheathing alone without a nailable substrate. If installed without a nailable substrate, the design rating of the siding must be reduced based on Table R703.11.2 of the International Residential Code (see Wind Zone Variations on page 18). The siding is generally fastened at 16 in. on center, or as specified by the manufacturer's printed installation instructions, using corrosion-resistant fasteners long enough to pass through the continuous insulation and penetrate framing $1\frac{1}{4}$ in. or more, unless into nailable sheathing alone with corresponding spacing and penetration.

FASTENER RECOMMENDATIONS ON VARIOUS SUBSTRATES

The recommended type of nail fastener for installing vinyl siding over continuous insulation should have a shank thickness of at least 0.120 in. and a head-section diameter of 0.313 in. Typically, this is achieved using corrosion-resistant siding (roofing) nails or 16-gauge staples with a crown width of $\frac{3}{8}$ in. to $\frac{1}{2}$ in. These fasteners should be driven into the studs to a depth of $1\frac{1}{4}$ in.

An alternative method, allowed only when installing the siding over a nailable substrate (such as oriented strand board or plywood), involves using ring-shank nails. These nails should be placed at 12 in. intervals and be long enough to pass through the continuous insulation and protrude through the back of the substrate by $\frac{1}{4}$ in.

For installing vinyl or insulated vinyl siding over continuous insulation, using 12 in. spaced nailing into the sheathing (by passing the studs) simplifies the process. To meet the Energy Conservation Code in climate zones 4 through 8, this illustration features a 2 x 4 wall insulated with R-13 cavity insulation, oriented strand board sheathing, and R-10 continuous insulation clad with vinyl siding. The siding is secured with $2\frac{1}{4}$ -inch long ring-shank nails at 12 in. intervals, penetrating and extending $\frac{1}{4}$ inch beyond the sheathing.



CONTINUOUS INSULATION IN CLIMATE ZONES 4 THROUGH 8

ZONE 4 – 8

FASTENER TABLE FOR VINYL (VS), INSULATED VINYL (IVS), AND POLYPROPYLENE (PP) SIDINGS BASED ON THE 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) AND INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

AVAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into wood-based sheathing only with nails PP (wood structural panel sheathing only min. $\frac{7}{16}$ in.)	IECC ci requirements for: Ring-shank (spiral) galvanized, stainless-steel (shaft size), or aluminum siding nail with a $\frac{5}{16}$ in. head	Ring-shank roofing nail (0.120 in. min. dia., 12 in. o.c.) or Ring-shank nail (0.148 in. min. dia.	The fastener shall penetrate the back side of the wood structural panel sheathing by at least $\frac{1}{4}$ in. The wood structural panel sheathing shall be not less than $\frac{7}{16}$ in. thick	VS or IVS with 0.120 in. min. nail at 12 in. o.c. max. (or as specified by manufacturer instructions) PP max. 8 in. o.c. (or as specified by manufacturer instructions)
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zone 4-8*	VS + 2 in. ci = $2\frac{3}{4}$ in.			
	VS/PP + 2 in. ci = $2\frac{3}{4}$ in.			
	IVS + $1\frac{1}{2}$ in. ci = $2\frac{1}{4}$ in.			
Into wood-based sheathing only with screws VS, IVS, PP (into $\frac{7}{16}$ in. wood structural panel sheathing only)	No. 8 screw (0.138 in. dia.) siding corrosion-resistant, with a $\frac{5}{16}$ in. pan head	No. 8 screw (0.164 in. dia.) corrosion-resistant self-tapping, pan head, or washer-head siding with at least $\frac{5}{16}$ in. dia. head, $\frac{1}{8}$ in. dia. shaft, and at least $1\frac{1}{8}$ in. long	The fastener shall penetrate the back side of the wood structural panel sheathing by at least $\frac{1}{4}$ in. The wood structural panel sheathing shall be not less than $\frac{7}{16}$ in. thick	VS or IVS: No. 8 screw, 0.164 in. min. dia. @ 12 in. o.c. or No. 8 screw with a $\frac{5}{16}$ in. dia. head or washer at 16 in. o.c. PP max. 8 in. o.c. (or as specified by manufacturer instructions)

*See Climate Zone Map on page 1

Nailing into a nailable substrate (such as oriented strand board or plywood) alone is allowed as long as the fasteners are long enough to accommodate the continuous insulation thickness and penetrate through the back side of the nailable substrate (wood structural panel sheathing) by at least $\frac{1}{4}$ in. Table R703.3.3 from the International Residential Code prescribes specific nail types and spacing that require no stud penetration.

Note: Plastic foam, structural fiberboard, and gypsum sheathing are not nailable substrates.

Insulated Vinyl Siding over R-8 continuous insulation in Climate Zones 4 through 8

Throughout Climate Zones 4 through 8, builders will seek to comply with the International Energy Conservation Code's simplified exterior insulation prescriptions.

The total R-value for continuous insulation and insulated vinyl siding must add up to the required or designed amount of continuous insulation R-value, R-10, for compliance minus R-0.6 (the included value for siding). For example, in Climate Zones 4 through 8, a builder can

comply with the prescriptive requirements of the International Energy Conservation Code using an R-13 wall cavity and an R-8 continuous insulation with insulated siding having an R-value of R-2.6 (R-8 continuous insulation + R-2.6 insulated vinyl siding - R-0.6 = R-12).

Note: With these prescriptive models, R-0.6 must be deducted from the continuous insulation calculation because the energy code assumes the R-value of the siding.

INSTALLATION RECOMMENDATIONS

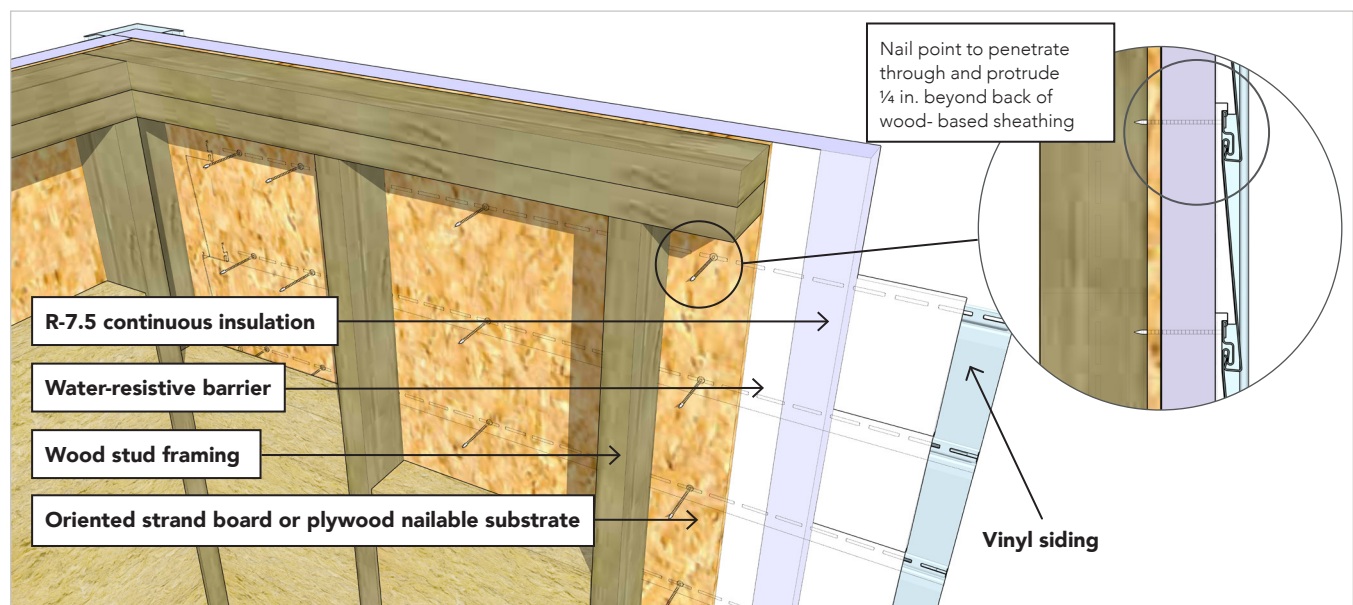
Insulated vinyl siding is generally installed on continuous insulation over a substrate, such as wood, fiberboard, or gypsum. But insulated vinyl siding can also cover foam plastic sheathing alone, without a substrate. If installed without a substrate, the design rating of the siding must be reduced based on Table R703.11.2 of the International Residential Code (see Wind Zone Variations on page 18). The siding is generally fastened at 16 in. on center, or as specified by the manufacturer's printed installation instructions, using corrosion-resistant fasteners long enough to pass through the continuous insulation and penetrate the nailable substrate and frame 1¼ in. or more.

FASTENER RECOMMENDATIONS ON VARIOUS SUBSTRATES

The recommended type of nail fastener for installing insulated vinyl siding over continuous insulation should have a shank thickness of at least 0.120 in. and a head-section diameter of 0.313 in. Typically, this is achieved using corrosion-resistant siding (roofing) nails or 16-gauge staples with a crown width of ⅜ in. to ½ in. These fasteners should be driven into the studs to a depth of 1¼ in.

An alternative method, allowed only when installing the siding over a nailable substrate (such as oriented strand board or plywood), involves using ring-shank nails. These nails should be placed at 12 in. intervals and be long enough to pass through the continuous insulation and protrude through the back of the substrate by ¼ in.

To install vinyl or insulated vinyl siding over continuous insulation on a sheathed wall, use ring shank nails at 12 in. on center. To comply with the Energy Conservation Code in climate zones 4 through 8, use a combination of R-13 cavity insulation, ⅞ in. oriented strand board, and R-7.5 continuous insulation. Ensure the nails penetrate and extend ¼ inch beyond the sheathing for secure siding attachment.



CONTINUOUS INSULATION IN CLIMATE ZONES 4 THROUGH 8

FASTENER TABLE FOR VINYL (VS), INSULATED VINYL (IVS), AND POLYPROPYLENE (PP) SIDINGS BASED ON THE 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) AND INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

NAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into wood-based sheathing only with nails IVS (wood structural panel sheathing only min. 7/16 in.)	IECC ci requirements for: Ring-shank (spiral) galvanized, stainless-steel (shaft size), or aluminum siding nail with a 5/16 in. head	Ring-shank roofing nail (0.120 in. min. dia.) or Ring-shank nail (0.148 in. min. dia.)	The fastener shall penetrate the back side of the wood structural panel sheathing by at least 1/4 in. The wood structural panel sheathing shall be not less than 7/16 in. thick	IVS with 0.120 in. min. nail at 12 in. o.c. max. (or as specified by manufacturer instructions) IVS with 0.148 in. min. nail at 16 in. o.c. max. (or as specified by manufacturer instructions)
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zone 4-8*	IVS + 2 in. ci = 2 1/2 in.			
	VS/PP + 2 in. ci = 2 3/4 in.			
	IVS + 1 1/2 in. ci = 2 1/4 in.			
Into wood-based sheathing only with screws VS, IVS, PP (into 7/16 in. wood structural panel sheathing only)	No. 8 screw (0.138 in. dia.) siding corrosion-resistant, with a 5/16 in. pan head	No. 8 screw (0.164 in. dia.) corrosion-resistant self-tapping, pan head, or washer-head siding with at least 5/16 in. dia. head, 1/8 in. dia. shaft, and at least 1 1/8 in. long	The fastener shall penetrate the back side of the wood structural panel sheathing by at least 1/4 in. The wood structural panel sheathing shall be not less than 7/16 in. thick	VS or IVS: No. 8 screw, 0.164 in. min. dia. @ 12 in. o.c. or No. 8 screw with a 5/16 in. dia. head or washer at 16 in. o.c. PP max. 8 in. o.c. (or as specified by manufacturer instructions)

*See Climate Zone Map on page 1

Nailing into a nailable substrate (such as oriented strand board or plywood) alone is allowed as long as the fasteners are long enough to accommodate the continuous insulation thickness to penetrate through the nailable substrate (wood structural panel sheathing) and protrude through the back of the sheathing at least 1/4 in. Table R703.3.3 from the International Residential Code prescribes specific nail types and spacing that require no stud penetration.

Note: Fiberboard and gypsum sheathing are not considered nailable substrates.

Polypropylene Siding in Climate Zones 4 through 8

The International Energy Conservation Code provides a practical, prescriptive path for wall insulation in Climate Zones 4 through 8, combining R-13 wall cavity insulation and R-10 continuous insulation (13+10 continuous insulation).

INSTALLATION RECOMMENDATIONS

The installation recommendations for polypropylene siding are the same as for vinyl siding, except that installation directly over continuous insulation without a nailable substrate is not permitted.

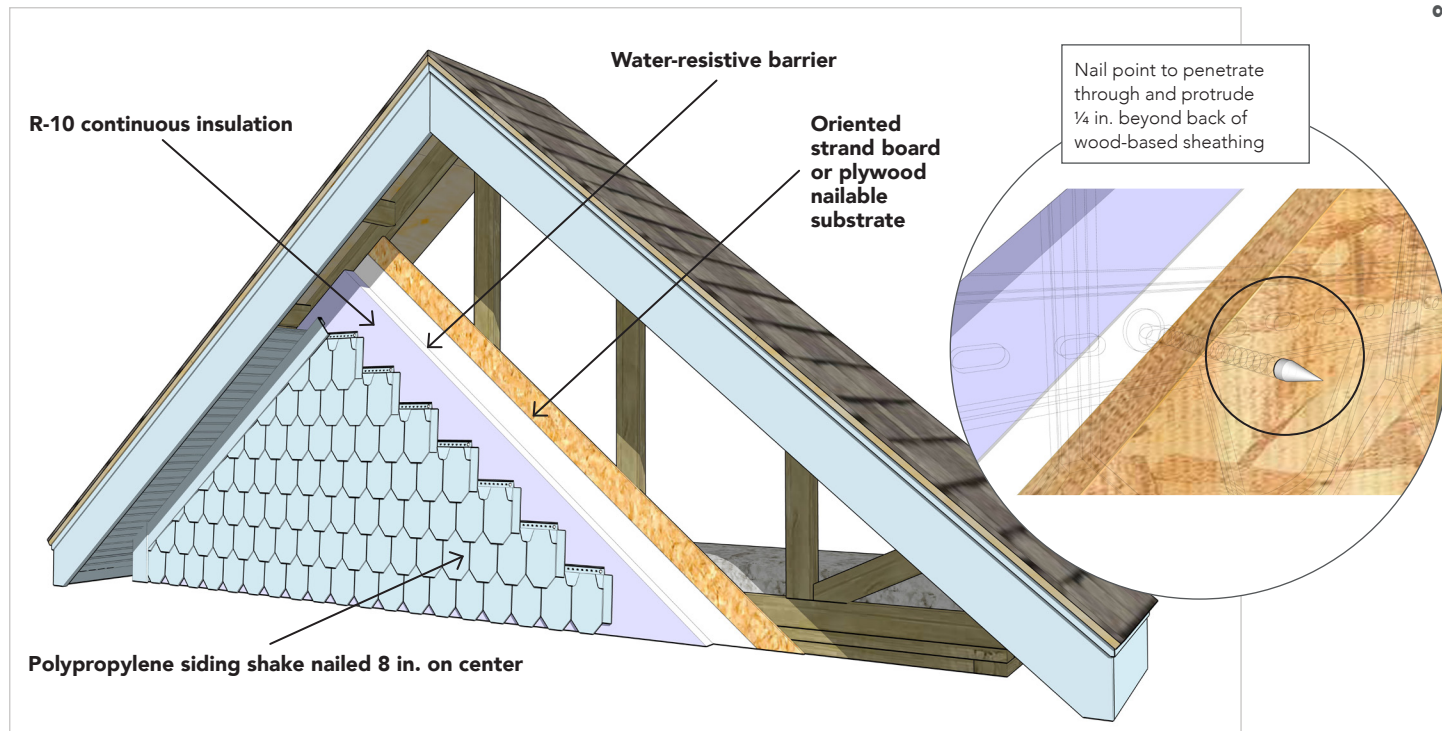
FASTENER RECOMMENDATIONS ON VARIOUS SUBSTRATES

The recommended type of nail fastener for installing polypropylene siding over continuous insulation should have a shank thickness of at least 0.120 in. and a head-section diameter of 0.313 in. Typically, this is achieved using corrosion-resistant siding (roofing) nails. These fasteners should be driven into a nailable substrate (such as oriented strand board or plywood) using ring-shank nails. The nails should be placed at 8 in. intervals and be long enough to pass through the continuous insulation and sheathing and protrude through the back of the substrate by 1/4 in.

CONTINUOUS INSULATION IN CLIMATE ZONES 4 THROUGH 8

ZONE 4 – 8

In Climate Zones 4 through 8, a builder can meet energy requirements using polypropylene siding installed over R-10 continuous insulation and wall cavity insulation of at least R-13. The fasteners should be driven into a nailable substrate using ring-shank nails at 8 in. on center. The nails must pass through the continuous insulation and sheathing to protrude through the back of the substrate by ¼ in.



FASTENER TABLE FOR VINYL (VS), INSULATED VINYL (IVS), AND POLYPROPYLENE (PP) SIDINGS BASED ON THE 2021 INTERNATIONAL RESIDENTIAL CODE (IRC) AND INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

NAILABLE SUBSTRATE (NAILING SURFACE)	FASTENER		PENETRATION	SPACING
	TRADE NAME	TECHNICAL NAME		
Into studs (framing member) VS, IVS (directly into stud or through wood structural panel sheathing)	Galvanized, stainless-steel, or aluminum siding (roofing) nails with ⅛ in. shank, ⅝ in. head	Corrosion-resistant 0.120 in. shank dia. nail with a 0.313 in. head	The total penetration into the sheathing, furring, framing, or other nailable substrates shall be a minimum of 1¼ in., or into nailable substrate penetrating through the substrate a minimum of ¼ in.	PP max. 12 in. o.c. (or as specified by manufacturer instructions)
IECC ci requirements for:	Min. fastener lengths as listed below:			
Climate Zone 4-8*	PP + 2 in. ci = 2¾ in.			

*See Climate Zone Map on page 1

Nailing into a nailable substrate (such as oriented strand board or plywood) alone is allowed as long as the fasteners are long enough to accommodate the continuous insulation thickness and penetrate through the back side of the nailable substrate (wood structural panel sheathing) by at least ¼ in. Table R703.3.3 of the International Residential Code prescribes specific nail types and spacing that require no stud penetration.

Note: Fiberboard and gypsum sheathing are not considered nailable substrates.



WIND ZONE VARIATIONS

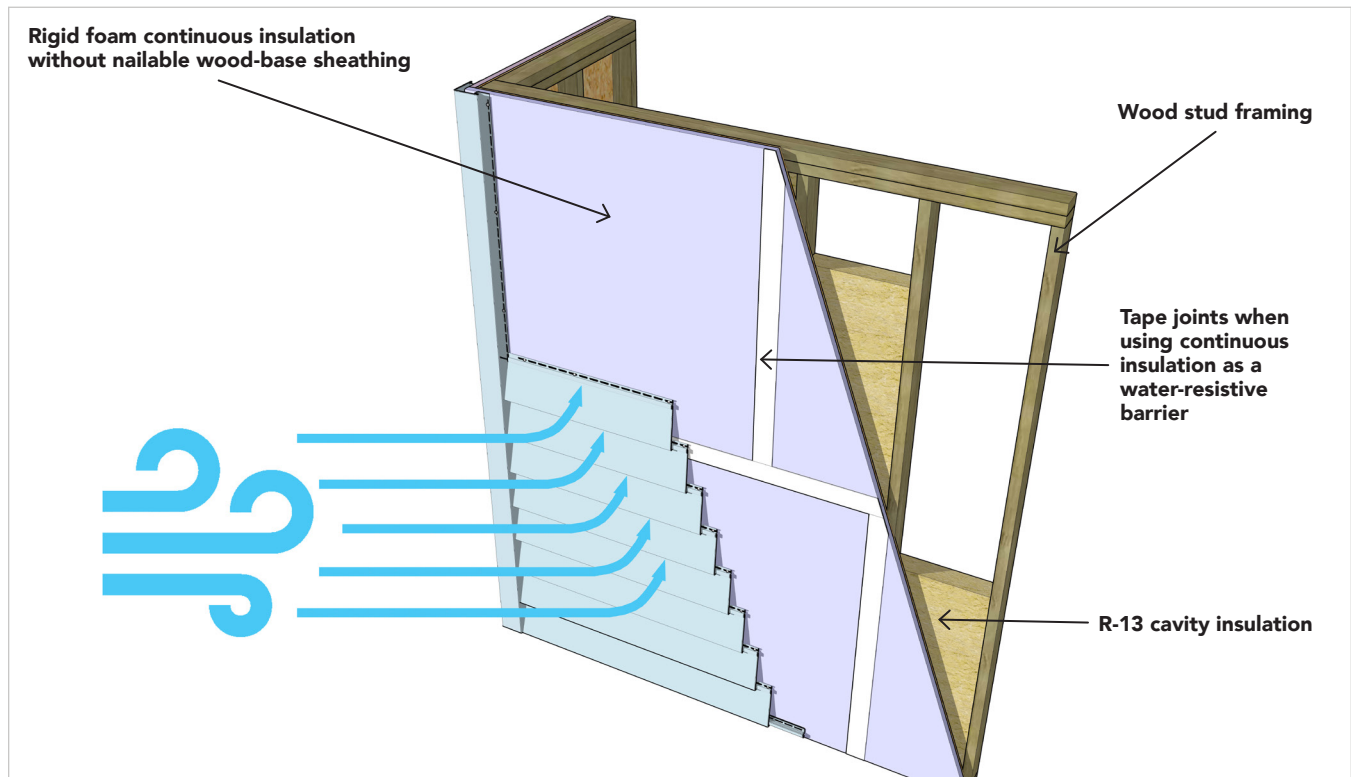
In every region, exterior cladding must meet minimum wind zone requirements. The ultimate design wind speed is 95.0 mph throughout most of the U.S. However, buildings taller than 30 ft., coastal regions subject to tropical storms and hurricanes, mountainous regions, and areas subject to frequent tornadoes will have higher designated wind speeds. It is essential to select cladding materials appropriate to the installation area's designated wind speeds as prescribed in the building codes and ASCE 7 (Minimum Design Loads and Associated Criteria for Buildings and Other Structures, ASCE/SEI 7, is a nationally adopted loading standard for general structural design as developed by the American Society of Civil Engineers).

When installing vinyl siding over continuous insulation sheathing alone without an approved backing capable of independently resisting the design wind pressure², the

vinyl siding pressure chosen must carry a wind pressure rating according to International Residential Code Table R703.11.2, Required Minimum Wind Load Design Pressure Rating for Vinyl Siding Installed over Foam Plastic Sheathing Alone. Depending on whether the wall has drywall at the interior face and based on exposures B, C, and D³, the up-rating (or selection of a higher wind-rated siding) can range from -30.0 to -106, so you must reference International Residential Code Table R703.11.2 when installing vinyl siding over foam sheathing alone to ensure that the siding complies with the minimum requirements.

Another essential consideration in windborne debris regions when using foam sheathing alone is that the wall assembly must still resist an impact without puncture, at least equivalent to that of a wood-frame wall with a minimum of $\frac{7}{16}$ in. oriented strand board sheathing as tested per ASTM E1886.

Calculate the required wind-resistance characteristics according to International Residential Code Table R703.11.2 to obtain an accurate wind rating when installing vinyl siding over foam sheathing without a substrate. A higher wind-pressure-rated vinyl siding product may be required if the product is used over foam without sheathing. For instance, in exposure C, siding rated for 100 MPH loses 36.8 MPH when installed over foam sheathing with interior wallboard. To achieve a 100 MPH rating under these conditions, choose a siding rated for at least 140 MPH.



² This provision does not apply if the foam sheathing is wind pressure rated (as required by code for use over open studs) and attached using fasteners capable of resisting the full negative wind pressure on the foam sheathing (e.g., fasteners with a structural washer).

³ The Exposure category is based on ground-surface features determined by the topography, including existing structures. ASCE 7 defines four exposure categories: A, B, C, and D. Exposure A is extremely sheltered, such as large city centers with tall buildings. Exposure B is urban or wooded areas with many obstructions. Exposure C is an open terrain with scattered obstructions. Exposure D is flat, unobstructed areas and water surfaces, such as smooth mud flats, salt flats, and unbroken ice. Exposure D also includes a structure that is close to an "open waterway" that is one mile or more across.

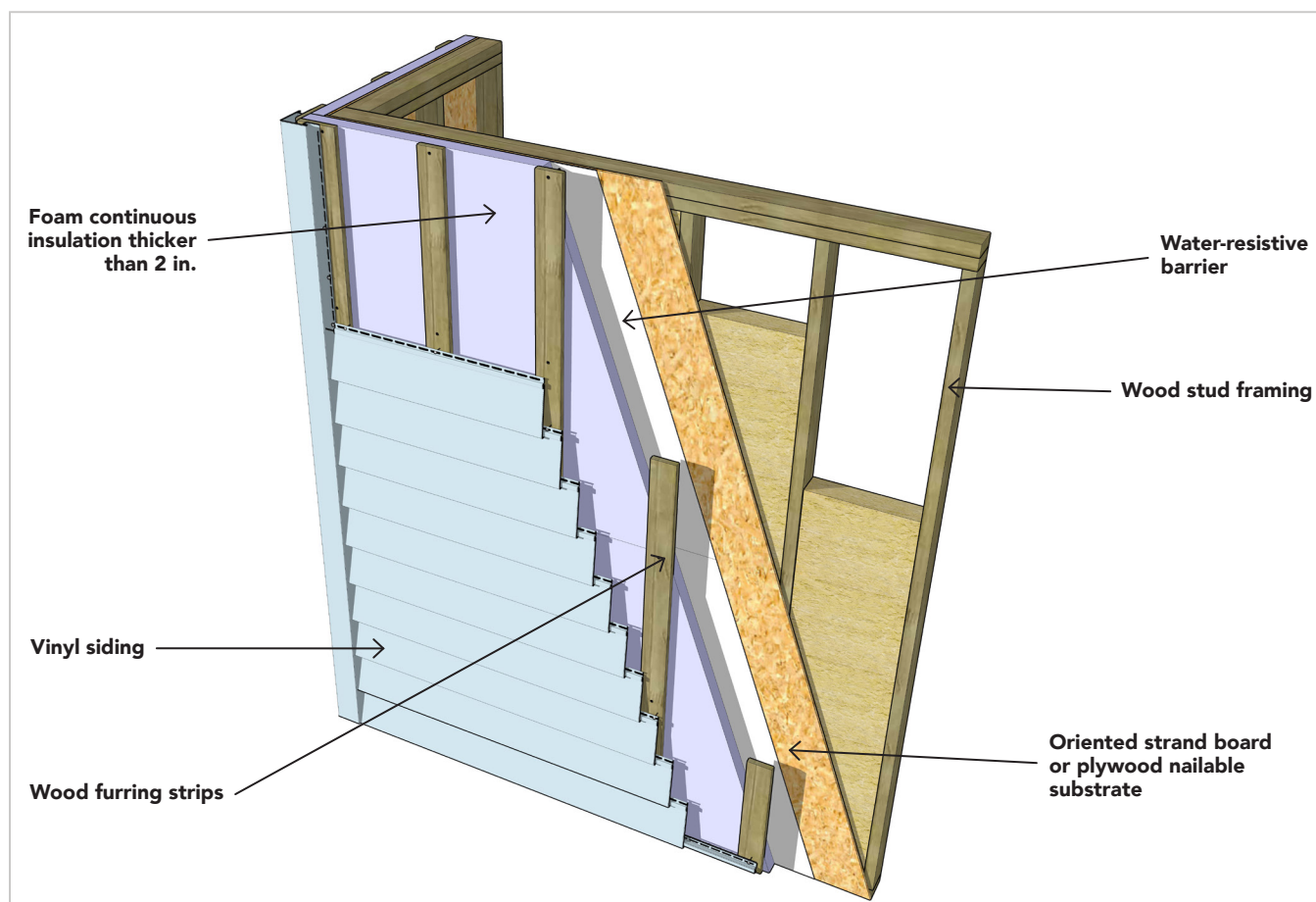
THICKER CONTINUOUS INSULATION PANELS

Installers may encounter trade practices in the northeastern United States, Upper Midwest, and Canada using double 2 in. rigid foam layers. This extra material thickness requires furring nailed through the foam and into the framing. Cladding is then nailed conventionally to the furring. Some materials, such as polypropylene and vertical siding, may not be installed over furring as these materials require solid sheathing underneath. Some builders may opt to install nailbase sheathing over the top of the foam. Some foam sheathing products come with furring strips embedded. Additional provisions when installing over furring include built-out wood frames around fenestrations and corners to permit trim nailing.

WINDOWS AND DOORS INSTALLED UNDER FOAM SHEATHING

When trimming windows and doors installed under 2 in. or thicker continuous insulation, it becomes necessary to add trim covering the edge of the foam insulation.

When installing vinyl siding over continuous siding thicker than 2 in., it may be necessary to use furring to provide a nailable substrate. Check with the manufacturer's installation instructions about the suitability of the material installed on plain nailing members without backing and the type of nails or screws required if the furring does not permit 1¼ in. nail penetration. In some cases, the manufacturer may have recommendations and/or requirements that require a continuous substrate which could include continuous foam sheathing between the furring that is the same thickness as the furring.



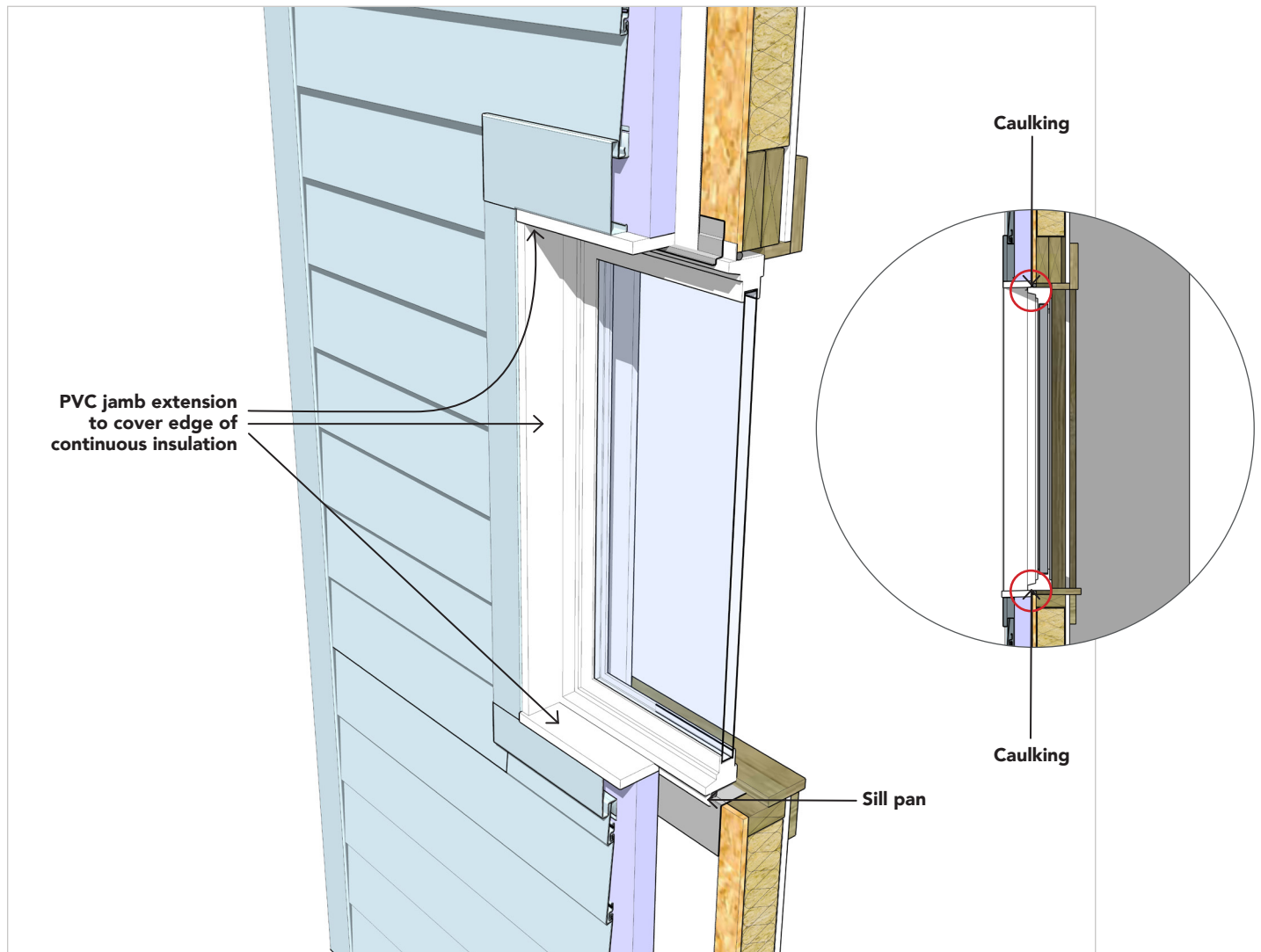


THICKER CONTINUOUS INSULATION PANELS

THICKER CONTINUOUS INSULATION PANELS

When trimming windows and doors installed directly on the sheathing and under 2 in. or thicker continuous insulation, the siding installer must create a cover for the exposed foam edge with either aluminum coil or PVC trim (recommended).

Always install windows in accordance with window manufacturers instructions.



NOTES





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*We extend our gratitude to
Pel-Ona Architects & Urbanists
for their expertise in shaping this guide*