

HALO INSTALLATION GUIDE

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For more information, or to contact a Halo representative, visit our website at www.buildWithHalo.com and click "Contact Us".

This manual will be updated regularly. Current updates will be available at www.BuildWithHalo.com.

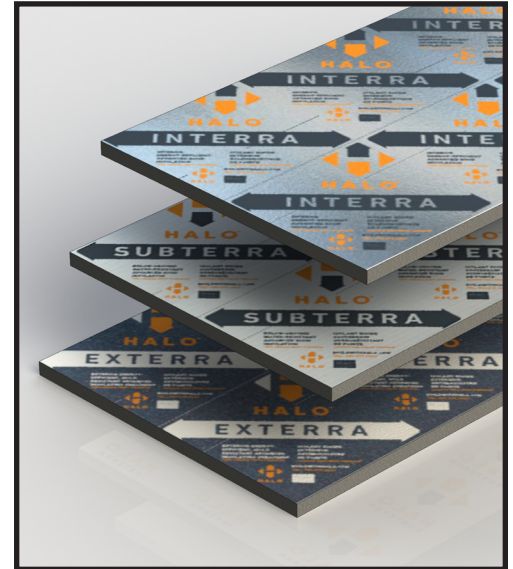
1.0 - PRODUCT DESCRIPTION

Suitable for use in residential, multi-residential, commercial, and industrial buildings Halo offers a range of rigid foam sheathing products each designed to seal and insulate certain parts of the building envelope from the roof to the walls and basement floors. As a result, Halo completely seals and insulates whole building envelopes contributing to an air tight structure, and acting as an air barrier, water-resistive barrier and a vapor barrier where required.

Halo carries three sheathing product lines:

- Exterra
- Interra
- Subterra

Exterra, Interra and Subterra are rigid foam sheathing insulation coated with various laminates. The rigid foam is made from BASF Neopor Plus graphite expanded polystyrene (GPS - conventional EPS with graphite particles).



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1.0 - PRODUCT DESCRIPTION cont'd

The combination of Neopor Plus GPS and the laminates used for Halo offers the following benefits:

- High R-values at par with XPS, and 30% more than Type 1 EPS. Neopor Plus provides an R-value of R-5 per nominal inch.
- Lower water absorption compared to conventional EPS and only 0.4 to 1% more than XPS.
- Higher long-term R-value compared to XPS. Most XPS insulation guarantee a 10% loss in R-value; Neopor GPS loses very little R-value overtime.
- Retains long-term R-value in wet conditions better than XPS. XPS is a low permeance material, which causes moisture trapped in XPS to be retained longer than EPS (or GPS) reducing its R-value. EPS releases moisture more readily due to its high permeance properties, resulting in better long-term R-value retention.
- Increased durability and flexibility. The laminates used for Halo makes Halo products stronger and more resilient to compressive and bending loads without cracking - can withstand high construction traffic loading. The laminates also provide a strong bond to sheathing and flashing tape.
- Breathable water-resistive barrier. Neopor is more breathable than XPS, which allows Exterra to act as a breathable water-resistive barrier.
- Air and vapor barrier. The laminates used for Interra and Subterra creates a durable air and vapor barrier.

1.0 - PRODUCT DESCRIPTION cont'd



EXTERRA SHEATHING

Exterra is coated with a reflective and clear laminate that is perforated to allow the sheathing to breathe. When installed the reflective side of Exterra should face to the exterior.

Ideal for use on the exterior side of above-grade walls, Exterra offers the following benefits.

- Provides continuous insulation, which reduces thermal breaks.
- Increases the R-value of wall assemblies that cannot be achieved with cavity insulation alone.
- Acts as a water-resistive barrier - eliminates the need for house wrap above-grade when the joints are sealed and taped. This reduces air leakage and ensures moisture transmission through the cladding will drain to the outside.



A house wrap is not required with Exterra for thicknesses 9/16" or greater.

- Contains perforations, which allow Exterra to breathe. Because Exterra is breathable, a vapor barrier may be required for the wall assembly

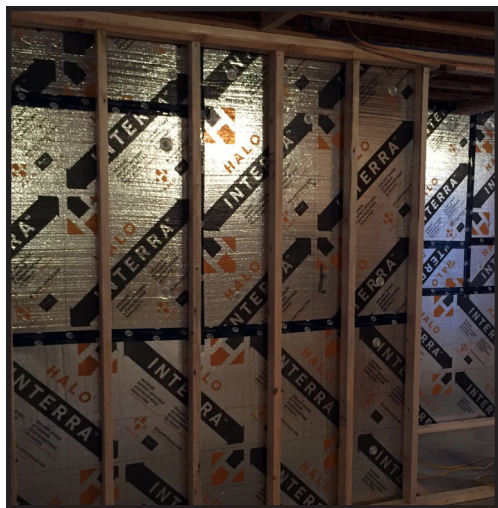


Exterra remains breathable up to 2 inches.



For Exterra physical properties see "6.0 - Material Properties."

1.0 - PRODUCT DESCRIPTION cont'd



INTERRA SHEATHING

Interra is coated with a reflective laminate. The reflective laminate helps reflect radiant heat away from the interior during the summer, and reflect heat back into heated spaces during the winter.

Ideal for the interior side of above- and below-grade walls, ceilings, roofs, and above concrete slabs, Interra provides higher performance R-values that can significantly reduce heat gains and heat losses.

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The combination of Neopor GPS with a coating of reflective laminate offers the following benefits.

- Reduces heat loss through the slab creating a warmer floor.
- Provides a continuous layer of insulation reducing thermal breaks, and increasing the R-value of wall, ceiling and roof assemblies that cannot be achieved with cavity insulation alone.
- Sealed and taped joints helps create an air tight structure, and acts as an air and vapor barrier.
- Reflects radiant heat away from the building during the summer, and reduces heat losses by keeping radiant heat in the building during the winter.

The benefit of reflective laminate to reflect radiant heat away is only effective when an air space is provided between the reflective surface and the wall component placed over the reflective surface.

In addition, air spaces that are sealed (i.e., no air movement) can increase the R-value of Interra. Without the air space, the R-value is provided by the foam insulation only.

For Interra physical properties see "6.0 - Material Properties."

1.0 - PRODUCT DESCRIPTION cont'd



SUBTERRA SHEATHING

Subterra is coated with a woven fabric. The woven fabric makes Subterra more durable and suited for use on the exterior side of foundation walls, and concrete slab applications.

Subterra is available in 4 densities, Subterra 16, Subterra 20, Subterra 25 and Subterra 30, which offer compressive strengths of 16, 20, 25 and 30 psi, respectively. (Higher compressive strengths in excess of 40 psi is also available upon request). Subterra 30 is a higher density product that is available where additional durability is required.



Check with your local Halo representative for available Subterra compressive strengths.

When used for foundation wall and slab applications Subterra offers the following benefits.

- Highly resilient and durable, Subterra withstands high loading and construction traffic conditions.
- Resistant to over 2 feet of standing water.
- Reduces heat loss through the slab creating a warmer floor.
- Provides a continuous layer of insulation, and acts a vapor barrier. Precautions should be taken to ensure taped seams are not broken due to construction traffic and during the concrete pour.
- Protects waterproofing applied to foundation walls, and helps drain water away from the wall.
- Reduces damage to foundation walls that can be caused by freeze-thaw cycles over time.

For Subterra physical properties see "6.0 - Material Properties."

2.0 - AVAILABLE SIZES

Halo sheathing products are available in 4ft x 8ft sheets, 9/16", 5/8", 1", 1.5" and 2" thickness. Custom sizes are available. Contact your local Halo representative for availability.

3.0 - USEFUL TOOLS & MATERIALS

Recommended for sealing joints, penetrations, perimeter edges and flashing details

- Perma R Products Sheathing Tape
- vapor barrier blue Tuck Tape,
- red Tuck Tape,
- 3M peel and stick membrane,
- Blueskin flashing tape and
- Expandable foam.

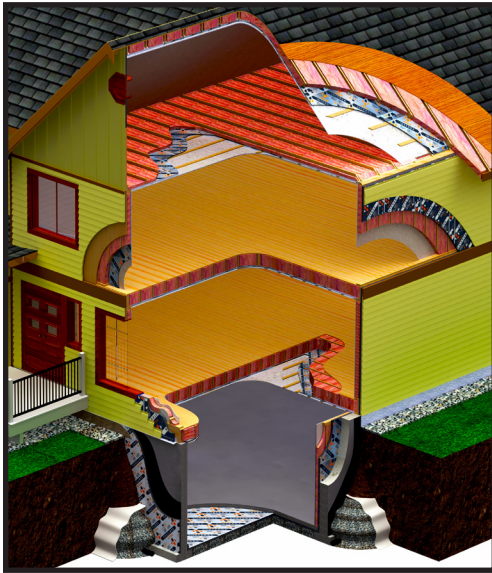
Recommended for fastening or gluing

- weather resistive construction glue, such as PL 300,
- plastic cap nails,
- roofing nails with at least 1/2" diameter washers,
- cap staples or
- wood screws with metal roof washers.

Additioan tools:

- Hammer
- Cordless drill
- Utility knife
- Straight edge

4.0 - APPLICATIONS



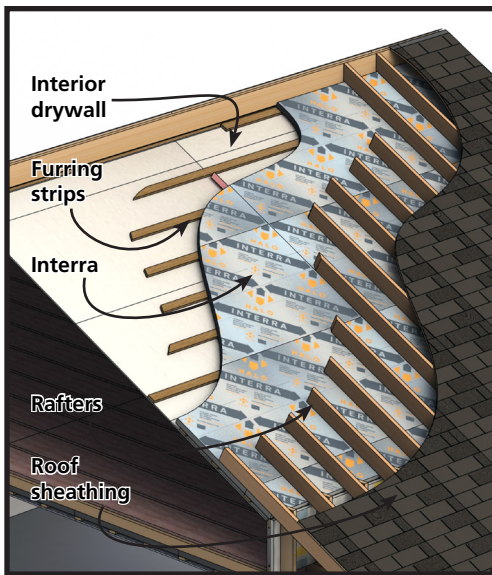
Halo products have been designed to deliver optimized performance in specific applications. Each product line offers the best and most economical choice for different applications. Those applications are summarized in the table below.

Application	Exterra	Interra	Subterra			
			16	20	25	30
Roof		x				
Ceiling		x				
Exterior above-grade wall	x					
Interior above-grade wall		x				
Exterior foundation wall			x	x	x	x
Interior foundation wall		x				
Above slab		x				
Below slab			x	x	x	x



Care should be taken to protect exposed foam surfaces from reflected sunlight and prolonged solar exposure until wall cladding is installed. Shade exposed foam areas, or remove sources of reflective surfaces, where heat build up onto exposed foam might occur.

4.1 - ROOFS & CATHEDRAL CEILINGS



Interra is recommended to insulate roofs and cathedral ceilings.

During the summer roofs absorb the radiant heat from the sun. The heat absorbed is then radiated into attic spaces which can result in very warm attics. The same principle applies to cathedral ceilings where the heat gain can result in uncomfortably warm indoor temperatures.

When placed against the roof rafters the reflective surface of Interra reflects radiant heat away from the roof reducing heat gains.

Installing Interra in roofs or cathedral ceilings involves 3 basic steps.

1. Place Interra to the underside of rafters.
2. Seal and tape all joints.
3. Attach drywall over Interra.

STEP 1: PLACING INTERRA

The cavity, or air space, created between the drywall and Interra will help ensure the reflective surface of Interra will reflect radiant heat back into the interior of the building.

- Fasten Interra to the underside of rafters. Interra should be placed from ceiling joist to top of roof for attics, or from top of wall to top of roof for cathedral ceilings.
- Tightly butt edges of Interra boards creating no more than a 1mm (1/32") gap between joints.
- Place vertical edges of Interra at rafter locations.

For information on fastening Interra to the rafters see Section 5, "Fastening Halo."

4.1 - ROOFS & CATHEDRAL CEILINGS cont'd

Interra is recommended to insulate roofs and cathedral ceilings.

During the summer roofs absorb the radiant heat from the sun. The heat absorbed is then radiated into attic spaces which can result in very warm attics. The same principle applies to cathedral ceilings where the heat gain can result in uncomfortably warm indoor temperatures.

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Installing Interra in roofs or cathedral ceilings involves 3 basic steps.

1. Place Interra to the underside of rafters.
2. Seal and tape all joints.
3. Attach drywall over Interra.

STEP 1: PLACING INTERRA

The cavity, or air space, created between the drywall and Interra will help ensure the reflective surface of Interra will reflect radiant heat back into the interior of the building.

- Fasten Interra to the underside of rafters. Interra should be placed from ceiling joist to top of roof for attics, or from top of wall to top of roof for cathedral ceilings.
- Tightly butt edges of Interra boards creating no more than a 1mm (1/32") gap between joints.
- Place vertical edges of Interra at rafter locations.

For information on fastening Interra to the rafters see Section 5, "Fastening Halo."

4.1 - ROOFS & CATHEDRAL CEILINGS cont'd

STEP 2: SEALING JOINTS

To ensure a proper air and vapor barrier is provided, seal and tape all joints between Interra boards.

- Seal all joints and penetrations with sheathing tape.
- Foam fill and tape over large gaps.
- Ensure proper air space is provided around heated fittings such as recessed lights, can light covers, and heater flues.

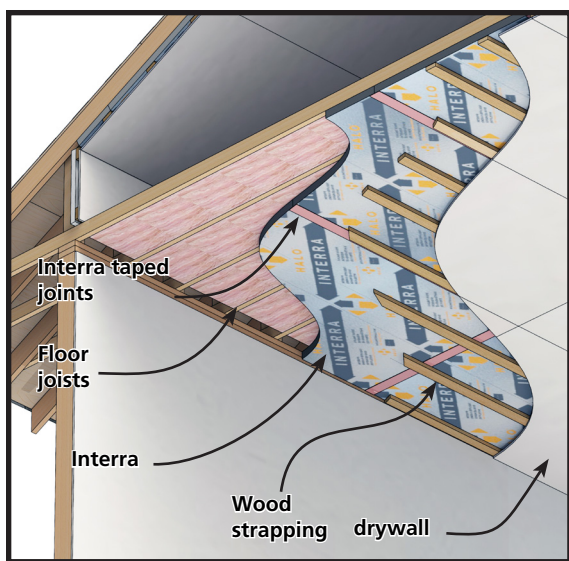
STEP 3: ATTACHING DRYWALL

Drywall can be placed over Interra and fastened to the rafters.

To get the full benefit of Interra an air space at least 3/4" between the drywall and Interra should be provided. This will help reduce heat loss during the winter as the heated interior space is reflected back into the interior. Wood strapping installed over Interra will provide the required air space.

For more information on fastening drywall or wood strapping over Interra see Section 5, "Fastening Halo."

4.2 - CEILINGS BELOW ATTICS



Using Interra to insulate the ceiling between unused attic space and living space can prevent heat loss through the ceiling. In addition, the added R-value Interra provides can increase the R-value in ceilings that cannot be achieved with cavity insulation alone.

Installing Interra in ceilings below attics involves 3 basic steps.

1. Place Interra to the underside of ceiling joists.
2. Seal and tape all joints.
3. Attach drywall over Interra.

STEP 1: PLACING INTERRA

- Fasten Interra to the underside of ceiling joists. Tightly butt edges of Interra boards creating no more than a 1mm (1/32") gap between joints.
- Place the edges of Interra at ceiling joist locations.

For information on fastening Interra to ceiling joists see Section 5, "Fastening Halo."

STEP 2: SEALING JOINTS

To ensure a proper air and vapor barrier is provided, seal and tape all joints between Interra boards.

- Seal all joints and penetrations with sheathing tape.
- Foam fill and tape over large gaps.
- Ensure proper air space is provided around heated fittings such as recessed lights, can light covers, and heater flues.

4.2 - CEILINGS BELOW ATTICS cont'd

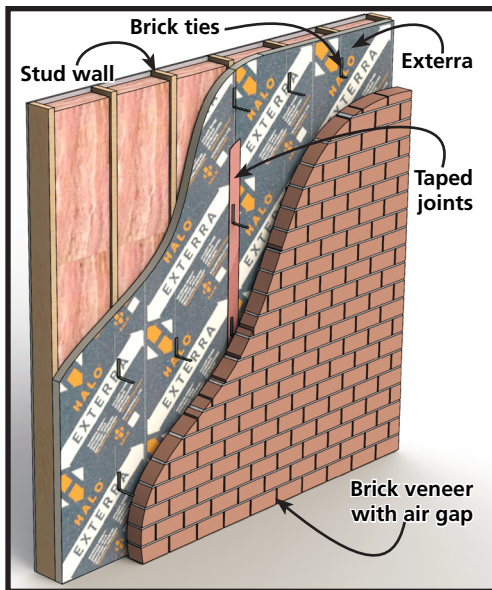
STEP 3: ATTACHING DRYWALL

Drywall can be placed over Interra and fastened to the ceiling joists.

To obtain the reflective properties of Interra provide a minimum 3/4" air gap between the drywall and Interra. Wood strapping installed over Interra will provide the required air space.

For more information on fastening drywall or wood strapping over Interra see Section 5, "Fastening Halo."

4.3 - ABOVE-GRADE WALLS



4.3.1 EXTERIOR INSULATION

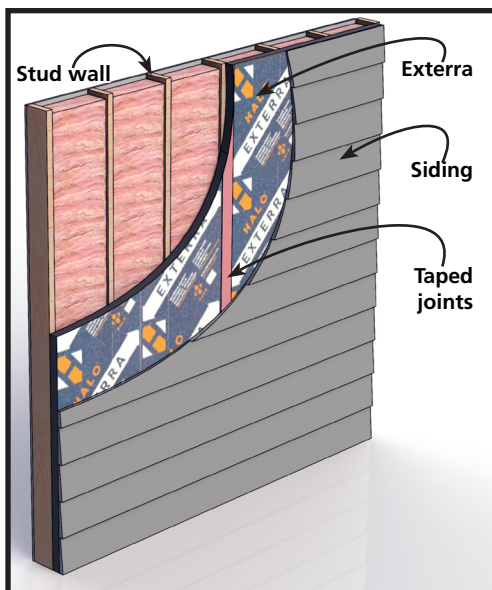
Exterra sheathing is recommended to insulate the exterior of above-grade perimeter walls.

Exterra consists of a reflective and clear laminate that is perforated allowing the sheathing to breath. Therefore, an additional vapor barrier may be required for the wall assembly.

Installing Exterra above-grade involves 3 basic steps.

1. Fasten Exterra against the wall substrate.

When installing Exterra it is recommended the fasteners be taped over with seam tape to maintain the water-resistive barrier properties of Exterra.



2. Measure and cut Exterra to suit openings and penetrations.
3. Seal and tape all joints.
4. Place cladding over Exterra

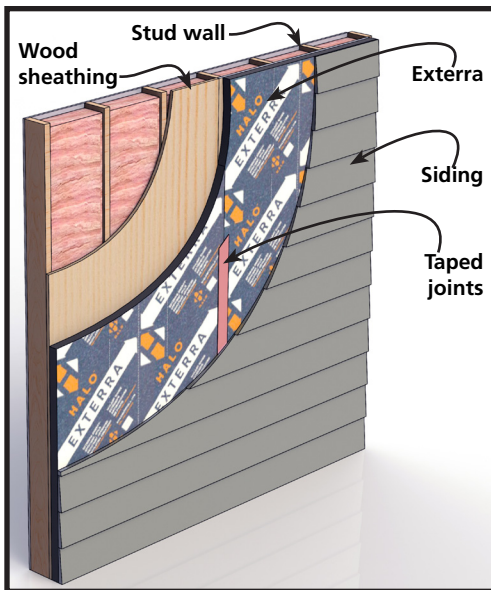
STEP 1 - PLACING EXTERRA:

Exterra should be placed so that the reflective side faces the exterior.

Exterra sheathing can be fastened directly to the wall substrate, such as wood or steel stud walls, concrete or masonry walls. Or in the case of existing buildings of framed walls, Exterra can be placed directly over the existing wood sheathing.

Place Exterra against the wall substrate either vertically or horizontally. For tall walls installing vertically is preferable.

4.3 - ABOVE-GRADE WALLS cont'd

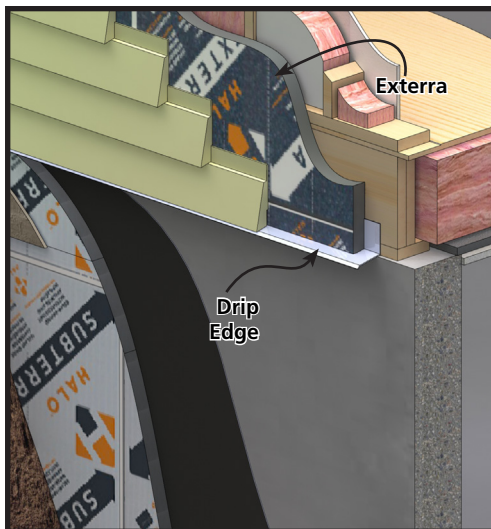


Installing Over Framed Walls with Wood Sheathing

- Place Exterra directly over the wood sheathing.
- Tightly butt edges of Exterra creating no more than a 1mm (1/32") gap between joints.

For existing framed wall buildings remove the cladding material and house wrap to expose the wood sheathing. Exterra is then placed directly on the wood sheathing.

For information on fastening Exterra over wood sheathing see Section 5, "Fastening Halo."



Installing Over Framed Walls without Wood Sheathing

Exterra can be installed directly over wall studs. Since Exterra is not structural sheathing the walls may require bracing, per local building codes.

Some examples of typical bracing include metal T-steps, or 1x4 wood let-in. Typical corner bracing includes wood sheathing at the corners, such as OSB or plywood.

When Exterra is placed over wood sheathing used for corner bracing, furring out the remaining framing members along the wall may be necessary to ensure

Exterra sheathing boards are flush with the Exterra sheathing at corners.

For information on fastening Exterra direct to wall studs see Section 5, "Fastening Halo."

4.3 - ABOVE-GRADE WALLS cont'd

Installing Over Concrete or Masonry walls

- Remove any protrusions that can damage or prevent Exterra from laying flat against the wall.
- Tightly butt edges of Exterra creating no more than a 1mm (1/32") gap between joints.
- Use weather resistant construction glue compatible with EPS, such as PL 300, to secure Exterra to the wall. If the wall is too rough or uneven concrete screws with washers can be used along with adhesives to help secure Exterra.

STEP 2 - OPENINGS AND PENETRATIONS

Measure and cut Exterra to suit window/door openings and penetrations. Exterra boards can be cut using a utility knife.

Using Exterra can add additional thickness to a wall assembly. Jam extensions can be provided by the window or door manufacturer to ensure proper window and door placement when using Exterra sheathing.

STEP 3 - SEALING JOINTS

Joints between Exterra boards should be sealed to ensure a proper water-resistive barrier.

- Seal all joints with sheathing or flashing tape.
- Foam fill and tape over large gaps to maintain thermal and air barrier integrity.
- Ensure around window/door and vent openings are sealed with sheathing or flashing tape. Sealing around openings will eliminate potential moisture entering within the wall assembly.

STEP 4 - CLADDING

Cladding

Cladding or wood strapping can be installed directly over Exterra with the use of fasteners.

For more information on fastening cladding or wood strapping over Exterra see Section 5, "Fastening Halo."

4.3 - ABOVE-GRADE WALLS cont'd

Cavity Walls

Fasten Exterra directly to the wall substrate using appropriate fasteners.

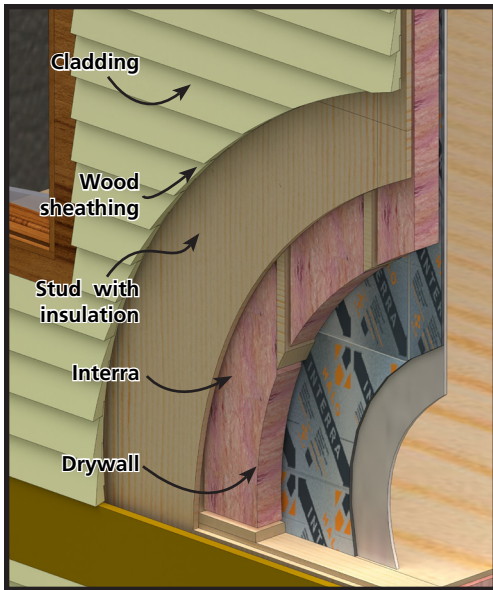
For information on fastening Exterra see Section 5, "Fastening Halo."

Fasteners for brick ties must penetrate the Exterra layer and fasten into the wall substrate at least 3/4".

There are a number of available brick ties designed to be compatible for foam sheathing. Below is a list of compatible brick ties.

- Slotted Stud Tie, Fero Corp., ferocorp.com
- Pos-i-Tie, Heckmann Building Products, heckmannbuildingprods.com
- X-Seal Anchor, Hohmann & Barnard, H-b.com
- Dur-O-Wal Veneer Anchors, Dayton Superior, daytonsuperior.com.

4.3 - ABOVE-GRADE WALLS cont'd



4.3.2 - INTERIOR INSULATION

Interra is recommended to insulate the interior of new and existing above-grade perimeter walls.

When used to insulate the interior of above-grade perimeter walls, Interra can provide both continuous insulation, air and vapor barrier properties.

Installing Interra involves 3 basic steps.

1. Fasten Interra directly to the wall studs.
2. Seal and tape all joints.
3. Attach drywall over Interra.

STEP 1: PLACING INTERRA

For existing walls, drywall and vapor barrier must be removed to expose the wall studs. In addition, all fasteners or protrusions still attached to studs must be removed to ensure Interra can be placed flush against the studs.

- Fasten Interra to the studs. For existing walls, the polyethylene vapor barrier will be replaced with Interra. Interra should be placed from the subfloor to the underside of the ceiling joists. For existing walls, expose the subfloor if possible and place Interra from the subfloor to the ceiling.
- Tightly butt edges of Interra boards creating no more than a 1mm (1/32") gap between joints.
- Place vertical edges of Interra at stud locations.

For information on fastening Interra to wall studs see Section 5, "Fastening Halo."

4.3 - ABOVE-GRADE WALLS cont'd

STEP 2: SEALING JOINTS

To ensure a proper air and vapor barrier is provided, seal and tape all joints between Interra boards, including joints between ceiling, floors and adjacent walls.

- Use sheathing tape to seal all joints between Interra boards and over vapor hats.
- Use acoustic sealant around the perimeter, around window and door openings, and at wall intersections.
- Foam fill and tape over large gaps, and service penetrations.
- Ensure proper air space is provided around heated fittings such as recessed lights, can light covers, and heater flues.

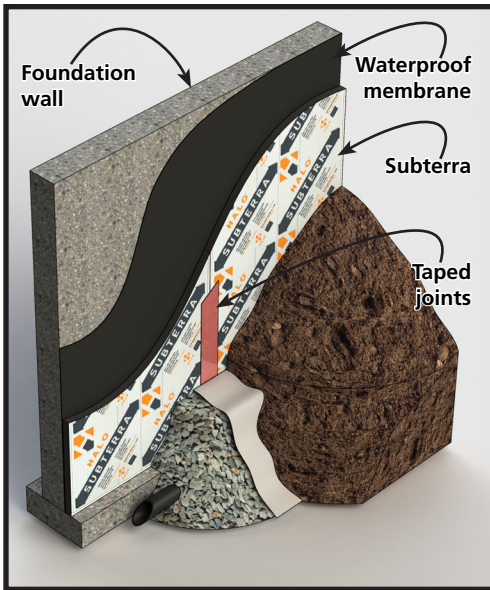
STEP 3: ATTACHING DRYWALL

Drywall can be placed over Interra and fastened to the wall studs.

To obtain the reflective properties of Interra provide a minimum 3/4" air gap between the drywall and Interra. Wood strapping installed over Interra will provide the required air space.

For more information on fastening drywall or wood strapping over Interra see Section 5, "Fastening Halo."

4.4 - FOUNDATION WALLS



4.4.1 - EXTERIOR INSULATION

Subterra is recommended to insulate the exterior of foundation walls.

Installing Subterra below-grade involves 4 basic steps.

1. Prep the exterior side of the foundation wall.
2. Place Subterra against exterior side of the foundation wall.
3. Seal and tape all joints.
4. Properly backfill against the foundation wall.

STEP 1: PREPARING THE FOUNDATION WALL

Prior to placing Exterra the foundation wall should be treated with waterproofing.

- Remove any protrusions that can damage or prevent Subterra from laying flat against the foundation wall.
- For existing foundation walls remove the backfill away from the foundation wall and remove any loose dirt and debris from the wall.

STEP 2: PLACING SUBTERRA

For new construction allow the waterproofing to set, if required, before applying Subterra.

- Subterra is placed over the waterproofing treatment on the foundation wall.
- Tightly butt edges of Subterra creating no more than a 1mm (1/32") gap between joints.
- Place Subterra vertically so that the bottom edge of Subterra is sitting on top of the footing.
- Use weather resistant construction glue compatible with EPS, such as PL 300, to secure Subterra to the wall. If the wall is too rough or uneven concrete screws with washers can be used along with adhesives to help secure Subterra.
- Continue placing Subterra from the top of the footing to the sill above-grade.

4.4 - FOUNDATION WALLS cont'd

Openings

Subterra boards can be cut using a utility knife.

- Measure and cut Subterra sheathing to suit window openings and penetrations.

STEP 3: SEALING JOINTS

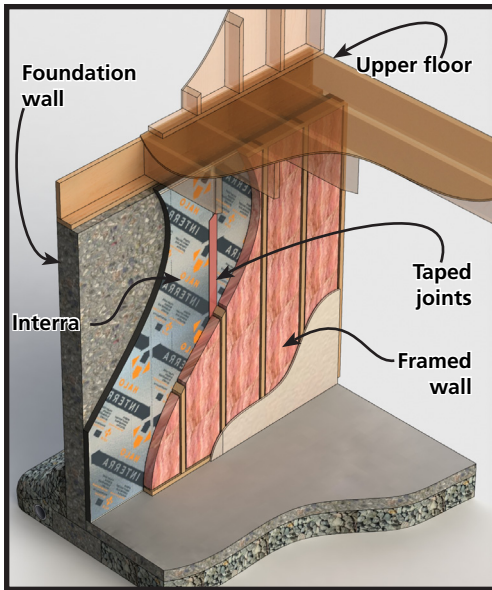
Seal and tape all joints between Subterra boards.

- Seal all joints with sheathing or flashing tape. In cold weather applications, a primer may be required to ensure proper adhesion of the tape or flashing to Subterra. Water based primers are suitable for temperatures up to -4°C (25°F). For colder temperatures solvent based primers are recommended.
- Foam fill and tape over large gaps.
- Seal around window and vent openings with sheathing or flashing tape. Sealing around openings will eliminate potential moisture entering within the wall assembly.

STEP 4: BACKFILLING

- Carefully place the backfill against the foundation wall to required grade.
- Seal the top of Subterra with a compatible sealant to prevent moisture from getting behind the Subterra sheathing.
- Protect Subterra that is exposed above-grade with compatible parging materials such as Stuccoflex or Styroflex.
- Provide a 2" inspection strip in areas with high termite infestation. The inspection strip involves removing a 2" strip of Subterra to expose the underlying concrete. Locate the inspection strip just above-grade below the exterior cladding.

4.4 - FOUNDATION WALLS cont'd



4.4.2 - INTERIOR INSULATION

Interra is recommended to insulate the interior of foundation walls.

In addition to providing a more comfortable and insulated basement, installing Interra to the interior side of foundation walls will help prevent moisture getting through concrete, or masonry walls, and into the interior causing mold.

When the joints are taped, Interra will act as a vapor barrier, which will prevent moisture in the basement from condensing onto the basement wall.

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Installing Interra below-grade involves 4 basic steps.

1. Prep the interior side of the foundation wall.
2. Place Interra against the interior side of the foundation wall.
3. Seal and tape all joints.
4. Install framed wall.

STEP 1: PREPARING THE FOUNDATION WALL

Prior to placing Interra prepare the foundation to accept the Interra sheathing.

- Make sure the foundation wall is dry, and free of dirt and debris.
- Remove any protrusions that could damage the Interra laminate, or prevent Interra from being placed flush against the foundation wall.

4.4 - FOUNDATION WALLS cont'd

STEP 2: PLACING INTERRA

Interra can be attached directly to the concrete or masonry foundation wall.

Place Interra with the longest edge either vertically or horizontally. For tall walls installing vertically is preferable.

- Tightly butt edges of Interra creating no more than a 1mm (1/32") gap between joints.
- Place Interra so that the bottom edge of Interra is sitting on top of the basement slab.
- Use construction glue compatible with EPS, such as PL 300, to secure Interra to the wall. If the wall is too rough or uneven concrete screws with washers can be used along with adhesives to help secure Interra.
- Measure and cut Interra to suit any openings or penetrations.
- Continue placing Interra from the top of the slab to the underside of the ceiling joists.

STEP 3: SEALING JOINTS

Joints between Interra should be sealed to ensure a proper vapor barrier.

- Use sheathing tape to seal all joints between Interra boards.
- Use acoustic sealant around the perimeter, around window and door openings, and at wall intersections.
- Foam fill and tape over large gaps, and service penetrations.
- Ensure proper air space is provided around heated fittings such as recessed lights, can light covers, and heater flues.

STEP 4: INSTALL FRAMED WALL

Once Interra is placed and sealed a framed wall can be installed, if desired.

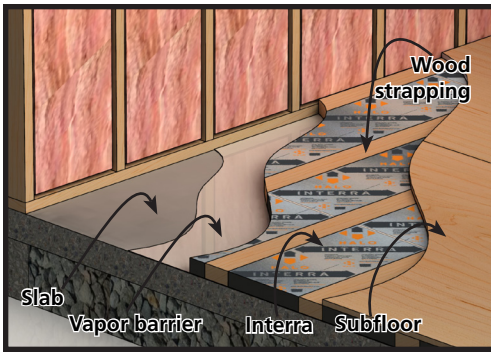
A framed wall installed against Interra will provide a cavity for electrical and plumbing services, as well as providing fastening points for drywall. In addition, adding cavity insulation will increase the insulation of the foundation wall.

In addition to insulating basements and providing a built-in vapor barrier, Interra has the added benefit of reflecting radiant heat back into a heated basement.

4.4 - FOUNDATION WALLS cont'd

For the reflective barrier to be effective, an air space is required between the Interra surface and drywall. Therefore, a basement with Interra framed for drywall but without cavity insulation, or leaving Interra exposed to the basement, will ensure the full benefits of the Interra reflective barrier properties.

4.5 - BASEMENT SLABS



Interra and Subterra is recommended to insulate concrete floor slabs. Using either Interra or Subterra will help reduce heat loss through the floor, and provide a thermal break resulting in a warmer, comfortable floor.

4.5.1 - ABOVE-SLAB INSULATION

When providing insulation to existing basement slabs the insulation is installed above the slab. Interra is used to insulate on top of concrete slabs, and involves 5 basic steps.

1. Prepare the slab for insulation.
2. Install vapor barrier.
3. Install strapping.
4. Install Interra.
5. Install Subflooring.

STEP 1: PREPARE THE SLAB

To prepare an existing basement floor for insulation:

- Remove existing finished floor and subfloor to expose the concrete slab.
- Clean the slab of debris and protrusions that could damage the Interra laminate, or prevent Interra from being placed flush against the slab.

STEP 2: INSTALL VAPOR BARRIER

An acceptable vapor barrier should be properly placed to cover the entire surface of the floor slab. The slab should be dry before placing the vapor barrier. The vapor barrier will be held in place with wood strappings discussed in Step 3.

4.5 - BASEMENT SLABS cont'd

STEP 3: INSTALL STRAPPING

Wood strapping placed on top of the vapor barrier will help secure the vapor barrier in place. In addition, the wood strapping will provide a solid fastening surface and a stable floor when the subfloor is installed.

- Fasten 2" to 3" wide wood strapping along the floor perimeter using self-tapping concrete screws, or concrete nails.
- Fasten additional wood strapping every 16" or 24" for the remaining floor area.
- The thickness of the wood strapping should be the same thickness of the Interra sheathing in use, or slightly thicker.

STEP 4: PLACE INTERRA

Interra is placed between the strapping.

- Measure and cut Interra to fill the floor space between the wood strappings. Interra should fit snug against the wood strapping edges.
- Tightly butt edges of Interra creating no more than a 1mm (1/32") gap between joints.

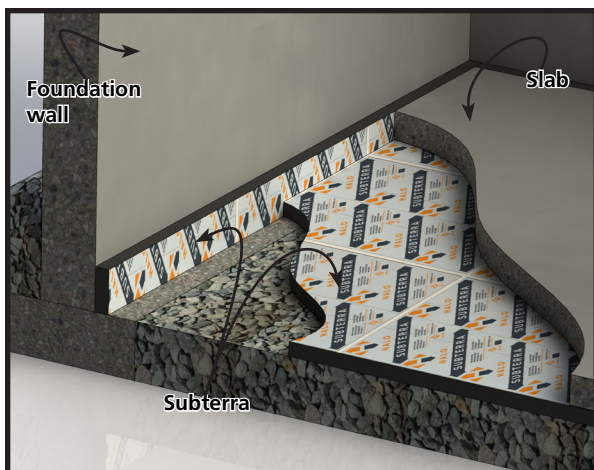
STEP 5: INSTALL SUBFLOORING

The subflooring is placed on top of the wood strappings and Interra. The subflooring, typically wood sheathing, should be thick enough to adequately span the wood strappings without significant flexing.

- Mark the walls to indicate location of wood strappings. This will be used as reference when fastening the subfloor to the wood strappings.
- Apply proper adhesive, such as PL 400, to secure the subfloor. Using screws fasten the subfloor to the wood strapping at 8" on center.
- Stagger the subfloor joints.

Once the subfloor is secured the finished floor can be applied.

4.5 - BASEMENT SLABS cont'd



4.5.2 - BELOW-SLAB INSULATION

In new construction Subterra is placed prior to pouring the concrete slab.

Subterra is available different densities to provide compressive strengths of 16, 20, 25 and 30 psi (Subterra, 16, Subterra 20, Subterra 25 and Subterra 30, respectively). Higher density Subterra products can provide a stronger, more durable working surface where heavier loading conditions, or high construction traffic, may occur.



Check with your local Halo representative for available Subterra compressive strengths.

Installing Subterra below the slab involves 4 basic steps.

1. Place Subterra.
2. Seal and tape joints.
3. Pour the concrete slab.

STEP 1: PLACE SUBTERRA

Subterra is placed on top of the granular backfill.

- Place Subterra so that it covers the same area as the concrete slab.
- Extend Subterra vertically against the foundation wall along the top of the footing. The height of Subterra placed vertically should be the same height as the slab thickness. This will create a continuous layer of insulation along the sides and underside of slab removing thermal breaks at the footing and foundation wall.
- Stagger Subterra joints and tightly butt edges creating no more than a 1mm (1/32") gap between joints.

4.5 - BASEMENT SLABS cont'd

STEP 2: SEAL AND TAPE JOINTS

To ensure Subterra acts as a continuous vapor barrier, seal and tape all joints between Subterra boards.

- Seal all joints and penetrations with sheathing or flashing tape.
- Foam fill and tape over large gaps.



Subterra acts as a continuous vapor barrier when joints are taped. Precautions should be taken to ensure taped joints are not broken during construction.

STEP 3: POUR THE CONCRETE SLAB

Pour and finish the slab as required.

5.0 - FASTENING HALO

This section is a guide to fastening cladding, drywall or wood strapping to Halo Exterra and Interra, including fastening Exterra and Interra to wall assemblies.

Applications mainly include exterior and Interior above-grade insulation where fasteners are typically required.

For detailed installation instructions refer to Section 4, Applications.

5.1 - EXTERRA FASTENER INFORMATION

OVER FRAMED WALLS

A minimal number of fasteners is required to tack Exterra sheets in place – the attachment of cladding, or strapping will fully secure Exterra sheets.

Fasten Exterra at the corner edges. The top of the fasteners should be flush to the surface of Exterra.



Install fasteners at corner edges

Exterra Over Wood Sheathing

Fasteners should be long enough to penetrate Exterra and completely through the wood sheathing substrate.

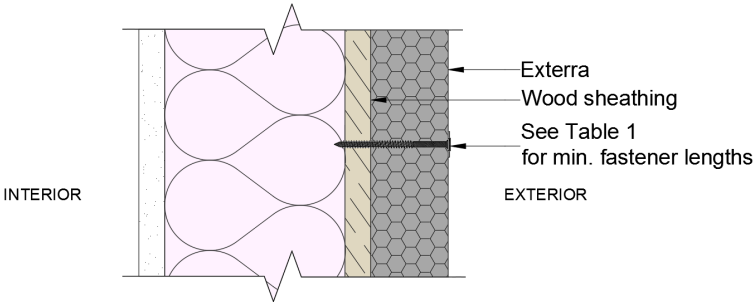


Table 1: Exterra Fastened to Wood Sheathing

Exterra Thickness	Minimum Fastener Lengths	
	1/2" Wood Sheathing	5/8" Wood Sheathing
9/16" or 5/8"	1 1/8"	1 1/4"
1"	1 1/2"	1 5/8"
1 1/2"	2"	2 1/8"
2"	2 1/2"	2 5/8"

Exterra Over Framing Studs

Fasteners should be long enough to penetrate Exterra and at least 3/4" into the framing studs or blocking between studs.

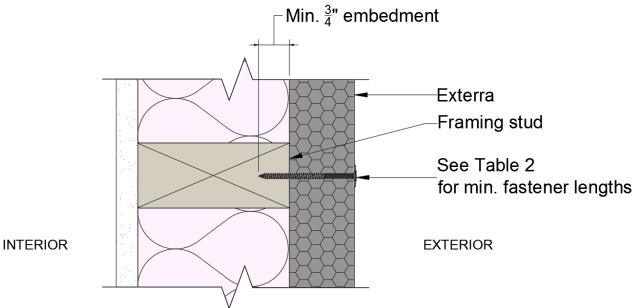


Table 2: Exterra Fastened Direct to Framing Studs

Exterra Thickness	Minimum Fastener Lengths
9/16" or 5/8"	1 3/8"
1"	1 3/4"
1 1/2"	2 1/4"
2"	2 3/4"

5.1 - EXTERRA FASTENER INFORMATION cont'd

Typical Fastener Types

When installing Exterra it is recommended the fasteners be taped over with seam tape to maintain the water-resistive barrier properties of Exterra.

- Plastic cap nails,
- roofing nails with at least ½" diameter washers,
- cap staples,
- or wood screws with metal roof washers.
- When fastening to metal studs use screws with at least 1" diameter metal washers.

OVER CONCRETE OR MASONRY WALLS

Use weather resistant construction glue compatible with EPS, such as PL 300, to secure Exterra to the wall. If the wall is too rough or uneven concrete screws with washers can be used along with adhesives to help secure Exterra.

IN CAVITY WALLS

For cavity walls, Exterra will either be placed over wood, concrete or masonry substrates. Refer to "Over Framed Walls" or "Over Concrete or Masonry Walls" sections for appropriate fastening requirements.

NOTE: Avoid damaging the laminate film on Exterra when using fasteners with washers. If the laminate is damaged apply sheathing tape over the damaged laminate to maintain the water-resistive barrier properties of Exterra.

5.2 - CLADDING OVER EXTERRA

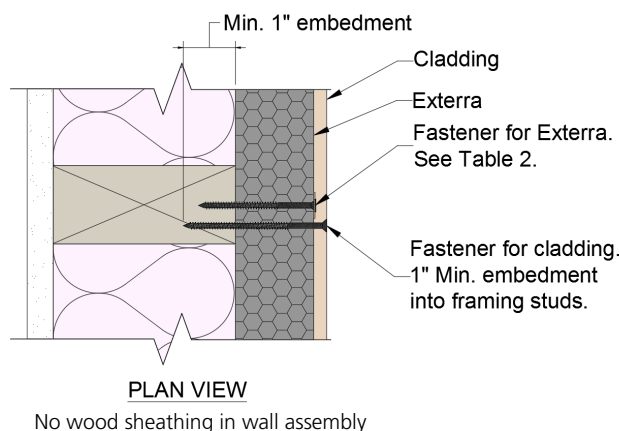
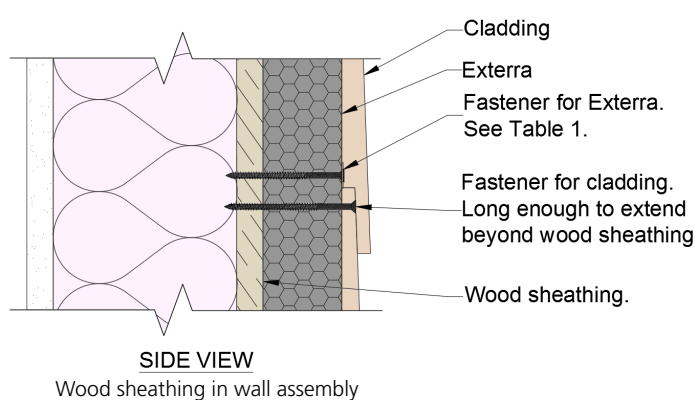
The following is a guide to attaching cladding and wood strapping over Halo Exterra. For detailed installation instructions refer to Section 4, "Applications."

CLADDING OVER EXTERRA *WITHOUT* WOOD STRAPPING

When cladding is attached without wood strapping, nails or screws used to attach cladding directly over Exterra should penetrate Exterra and completely through the wood sheathing.

In cases where wood sheathing is not present, the nails or screws should penetrate Exterra and at least 1" into the framing studs, or blocking between framing studs.

HALO
INSTALLATION GUIDE



CLADDING OVER EXTERRA *WITH* WOOD STRAPPING

When using wood strapping over Exterra, the cladding will be fastened to the strapping.

1. Wood Strapping Size:
Minimum $\frac{3}{4}$ " thick. 1 x 3 strapping is recommended.
2. Wood Strapping Location:
Place vertically or horizontally, as required, and should be spaced a maximum of 16" on center. If placing vertically, align the strapping to the framing studs.
3. Fastener Types:
Use #8 or #10 non-corrosive wood screws spaced maximum 16" on center.
4. Fastener Length:
Screws should be long enough to penetrate wood strapping, Exterra, and at least 1" into the framing studs.
5. Attach cladding to wood strapping. Ensure the nails or screws fully penetrate the strapping.

5.2 - CLADDING OVER EXTERRA Cont'd

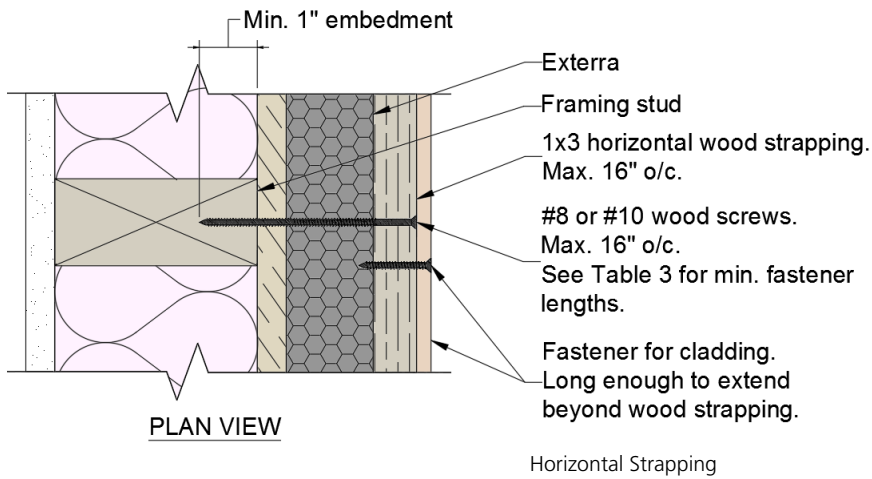
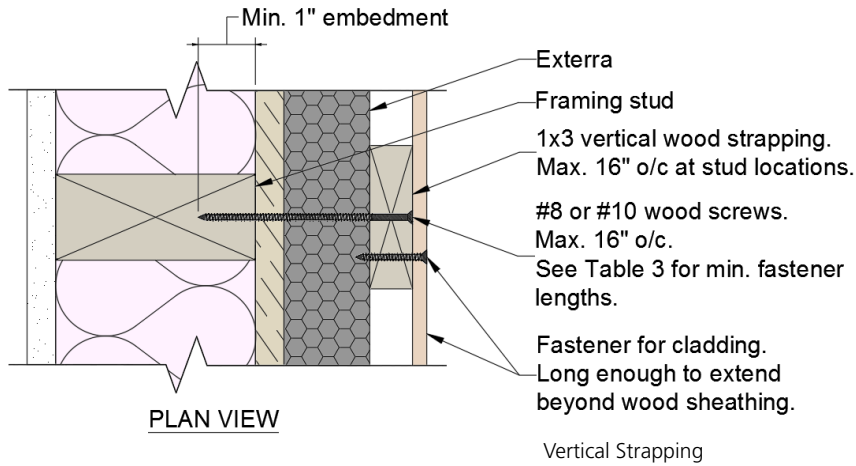


Table 3: 1x3 Wood Strapping Over Exterra

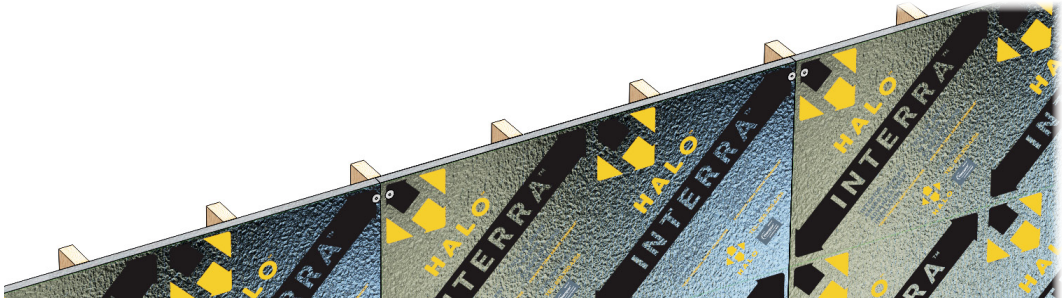
Exterra Thickness	Minimum Fastener Lengths	
	1/2" Wood Sheathing	5/8" Wood Sheathing
9/16" or 5/8"	2 7/8"	3"
1"	3 1/4"	3 3/8"
1 1/2"	3 3/4"	3 7/8"
2"	4 1/4"	4 3/8"

5.3 - INTERRA FASTENER INFORMATION

INTERIOR ABOVE-GRADE INSULATION

A minimal number of fasteners is required to tack Interra sheets in place – the attachment of cladding or drywall will fully secure Interra sheets.

Fasten Interra at the corner edges. The top of the fasteners should be flush to the surface of Interra.



Install fasteners at corner edges

Fasteners should be long enough to penetrate Interra and at least 3/4" into the framing studs, or blocking between framing studs.

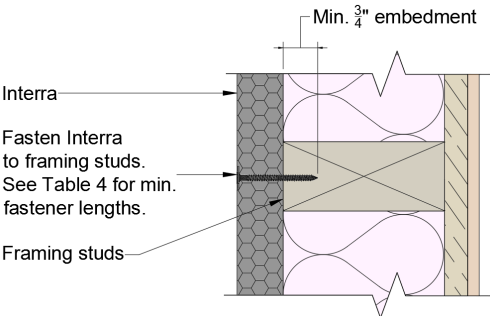


Table 4: Interra Fastened to Framing Studs

Exterra Thickness	Minimum Fastener Lengths	
	1/2" Wood Sheathing	5/8" Wood Sheathing
9/16" or 5/8"	1 1/8"	1 1/4"
1"	1 1/2"	1 5/8"
1 1/2"	2"	2 1/8"
2"	2 1/2"	2 5/8"

Typical Fastener Types

- Plastic cap nails,
- roofing nails with at least 1/2" diameter washers,
- cap staples,
- or wood screws with metal roof washers.
- When fastening to metal studs use screws with at least 1" diameter metal washers.

5.3 - INTERRA FASTENER INFORMATION

Cont'd

FOUNDATION WALL INTERIOR INSULATION

Use weather resistant construction glue compatible with EPS, such as PL 300, to secure Interra to the wall. If the wall is too rough or uneven concrete screws with washers can be used along with adhesives to help secure Interra.

ABOVE-SLAB INSULATION

Interra should fit snug between wood strapping – no fasteners required. For more information refer to Section 4, "Applications."

5.4 - CLADDING OVER INTERRA

The following is a guide to attaching cladding and wood strapping over Halo Interra, and applies to above-grade interior insulation. For detailed installation instructions refer to Section 4, "Applications."

DRYWALL OVER INTERRA *WITHOUT* WOOD STRAPPING

When drywall is attached without wood strapping, screws used to attach drywall directly over Interra should penetrate Interra and at least 1" into the framing studs.

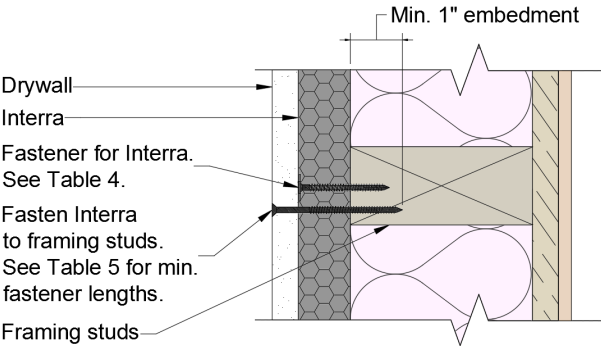


Table 5: Drywall Fastened Over Interra

Exterra Thickness	Minimum Fastener Lengths	
	1/2" Drywall	5/8" Drywall
9/16" or 5/8"	2 1/8"	2 1/4"
1"	2 1/2"	2 5/8"
1 1/2"	3"	3 1/8"
2"	3 1/2"	3 5/8"

DRYWALL OVER INTERRA *WITH* WOOD STRAPPING

When using wood strapping over Interra, the drywall will be fastened to the strapping.

1. Wood Strapping Size:
Minimum 3/4" thick. 1 x 3 strapping is recommended.
2. Wood Strapping Location:
Place vertically or horizontally, as required, and should be spaced a maximum of 16" on center. If placing vertically, align the strapping to the framing studs.
3. Fastener Types:
Use #8 or #10 non-corrosive wood screws spaced maximum 16" on center.
4. Fastener Length:
Screws should be long enough to penetrate wood strapping, Interra, and at least 1" into the framing studs.
5. Attach drywall to wood strapping. Ensure the screws fully penetrate the strapping.

5.4 - CLADDING OVER INTERRA Cont'd

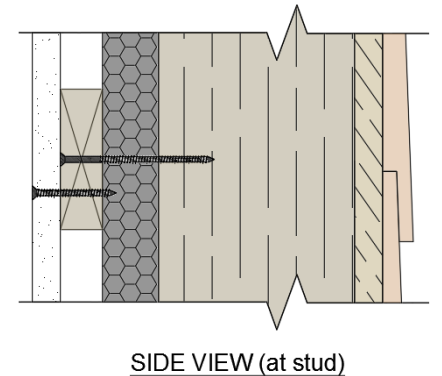
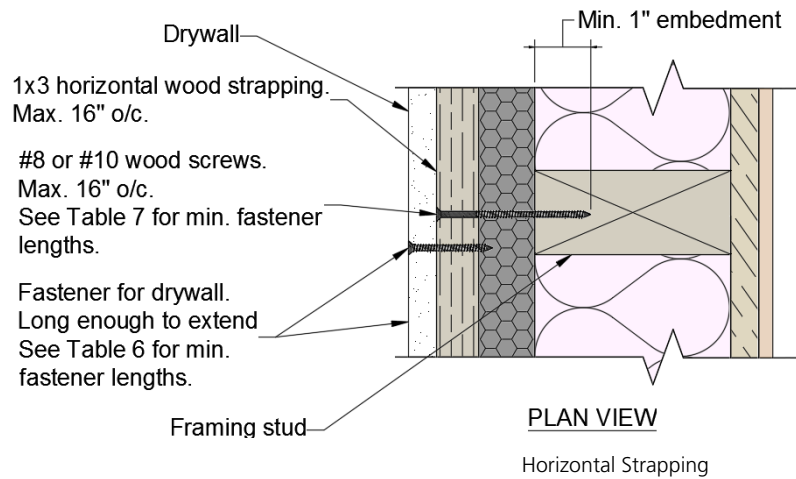
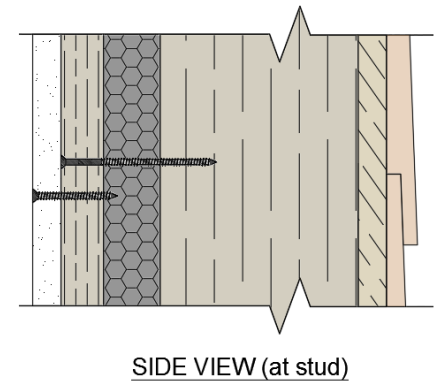
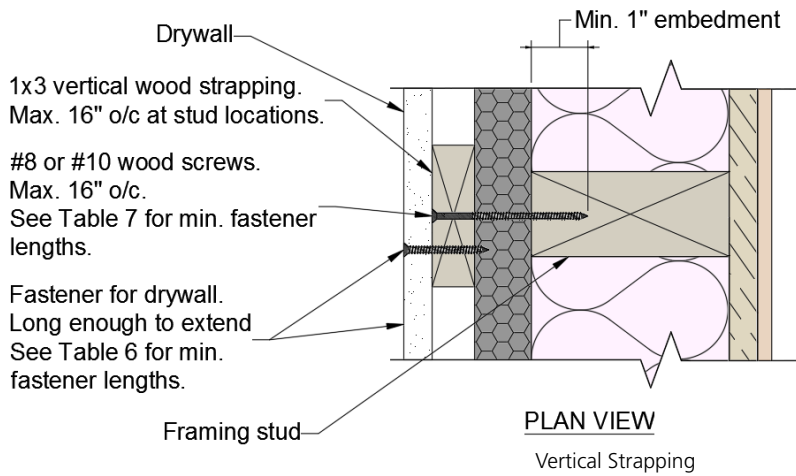


Table 6: 1x3 Drywall Over Wood Strapping

Exterra Thickness	Minimum Fastener Lengths	
	1/2" Drywall	5/8" Drywall
9/16" or 5/8"	1 7/8"	2"
1"	2 1/4"	2 3/8"
1 1/2"	2 3/4"	2 7/8"
2"	3 1/4"	3 3/8"

Table 7: 1x3 Wood Strapping Over Interra

Exterra Thickness	Minimum Fastener Lengths
9/16" or 5/8"	2 3/8"
1"	2 3/4"
1 1/2"	3 1/4"
2"	3 3/4"

6.0 - MATERIAL PROPERTIES

Halo Exterra, Interra and Subterra are rigid foam sheathing insulation coated with various laminates. The rigid foam is made from BASF Neopor Plus graphite expanded polystyrene (GPS - conventional EPS with graphite particles).

The combination of Neopor Plus GPS and the laminates used for Halo offers the following benefits compared to XPS and conventional EPS:

- High R-values at par with XPS, and 30% more than Type 1 EPS. Neopor Plus provides an R-value of R-5 per nominal inch.
- Lower water absorption compared to conventional EPS and only 0.4 to 1% more than XPS.
- Higher long-term R-value compared to XPS. Most XPS insulation guarantee a 10% loss in R-value; Neopor GPS loses very little R-value overtime.
- Retains long-term R-value in wet conditions better than XPS. XPS is a low permeance material, which causes moisture trapped in XPS to be retained longer than EPS (or GPS) reducing its R-value. EPS releases moisture more readily due to its high permeance properties, resulting in better long-term R-value retention.
- Increased durability and flexibility. The laminates used for Halo makes Halo products stronger and more resilient to compressive and bending loads without cracking - can withstand high construction traffic loading. The laminates also provide a strong bond to sheathing and flashing tape.
- Breathable water-resistive barrier. Neopor is more breathable than XPS, which allows Exterra to act as a breathable water-resistive barrier.
- Air and vapor barrier. The laminates used for Interra and Subterra creates a durable air and vapor barrier.

The following tables list the material proerties of Halo Exterra, Interra and Subterra.

6.1 - EXTERRA MATERIAL PROPERTIES

Table 1: Thermal Insulation¹

Product	R-value @ 75°F (RSI @ 24°C) ²	R-value @ 40°F (RSI @ 4.4°C) ²
Halo Exterra	5 (0.88)	5.2 (0.92)

- In accordance with ASTM C578, "Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation", and CAN/ULC S701, "Standard For Thermal Insulation, Polystyrene, Boards and Pipe Covering", at 75°F (24°C), and at 40°F (4.4°C) from data provided by BASF.
- At 1" nominal thickness (actual thickness = 1.06").

Table 2: Material Properties

ASTM C578 ¹	Halo Exterra ³ Type I
Compressive Resistance at 10% def., Min., psi	10
Flexural Resistance Min., psi	25
Water Vapor Permeance Max., perms	1.34 ²
Water Absorption Max., %	1.1
Dimensional Stability Max., %	2
Oxygen Index Min., %	24

CAN/ULC S701 ¹	Halo Exterra ³ Type 1
Compressive Resistance at 10% def., Min., kPa	70
Flexural Resistance Min., kPa	170
Water Vapor Permeance Max., ng/Pa-s-m ²	77 ²
Water Absorption Max., %	1.1
Dimensional Stability Max., %	1.5
Oxygen Index Min., %	24

- Unless noted otherwise, properties are based on 1" thickness without laminate. Data provided by BASF.
- Based on independent testing conducted by QAI. Water vapor permeance properties tested with perforated laminate and 1.5" thick Neopor® Plus. The thinner the insulation the higher the permeability.
- Halo Exterra is breathable up to 2" thick, and does not require building wrap for thickness greater than 5/8".

Table 3: Surface Burning Characteristics

	Flame Spread Index Max.	Smoke Developed Index Max.	Thickness Max.	Density
ASTM E84	< 25	< 450	6 in.	2 pcf
CAN/ULC S102.2	230	> 500	102 mm	32 kg/m ³

Table 4: Additional Properties

	Results
Weather Resistive Barrier, per ASTM E331	Complies as a weather resistive barrier at thicknesses of 5/8" or thicker.

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6.2 - INTERRA MATERIAL PROPERTIES

Table 2: Thermal Insulation¹

Product	R-value @ 75°F (RSI @ 24°C) ²	R-value @ 40°F (RSI @ 4.4°C) ²
Halo Interra	5 (0.88)	5.2 (0.92)

1. In accordance with ASTM C578, "Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation", and CAN/ULC S701, "Standard For Thermal Insulation, Polystyrene, Boards and Pipe Covering", at 75°F (24°C), and at 40°F (4.4°C) from data provided by BASF.
2. At 1" nominal thickness (actual thickness = 1.06").

Table 3: Material Properties

ASTM C578 ¹	Halo Interra Type I
Compressive Resistance at 10% def., Min., psi	10
Flexural Resistance Min., psi	25
Water Vapor Permeance Max., perms	0.03 ²
Water Absorption Max., %	1.1
Dimensional Stability Max., %	2
Oxygen Index Min., %	24

CAN/ULC S701 ¹	Halo Interra Type 1
Compressive Resistance at 10% def., Min., kPa	70
Flexural Resistance Min., kPa	170
Water Vapor Permeance Max., ng/Pa-s-m ²	1.7 ²
Water Absorption Max., %	1.1
Dimensional Stability Max., %	1.5
Oxygen Index Min., %	24

1. Unless noted otherwise, properties are based on 1" thickness without laminate by data provided by BASF.
2. Based on indepent testing conducted by QAI. Water vapor permeance properties tested with laminate and 1" thick Neopor.

Table 4: Surface Burning Characteristics

	Flame Spread Index Max.	Smoke Developed Index Max.	Thickness Max.	Density
ASTM E84	< 25	< 450	5 in.	2 pcf
CAN/ULC S102.2	230	> 500	102 mm	32 kg/m ³

Table 5: Additional Properties

	Results
Air Leakage, per ASTM E2178	0.0010 L/s-m ² at 1" thickness Complies as an air barrier in accordance with the National Building Code of Canada and the International Residential Code

6.3 - SUBTERRA MATERIAL PROPERTIES

Table 2: Thermal Insulation¹

Product	R-value @ 75°F (RSI @ 24°C) ²	R-value @ 40°F (RSI @ 4.4°C) ²
³ Subterra 16	5 (0.88)	5.2 (0.92)
³ Subterra 20	5 (0.88)	5.3 (0.93)
³ Subterra 25	5 (0.88)	5.3 (0.93)
³ Subterra 30	5 (0.88)	5.3 (0.93)

1. In accordance with ASTM C578, "Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation", and CAN/ULC S701, "Standard For Thermal Insulation, Polystyrene, Boards and Pipe Covering", at 75°F (24°C), and at 40°F (4.4°C) from data provided by BASF.
2. At 1" nominal thickness (actual thickness = 1.06").
3. Subterra also available in 40 psi, or greater, compressive strength. Contact your local Halo representative for available compressive strengths.

Table 3: Material Properties

ASTM C578 ¹	Subterra ³ 16 Type II	Subterra ³ 25 Type IX	Subterra ³ 30 Type IX
Compressive Resistance at 10% def., Min., psi	16	25	30
Flexural Resistance Min., psi	70 ²	70 ²	70 ²
Water Vapor Permeance Max., perms	0.04 ²	0.04 ²	0.04 ²
Water Absorption Max., %	1.1	1.1	1.1
Dimensional Stability Max., %	2.0	2.0	2.0
Oxygen Index Min., %	24	24	24
CAN/ULC S701 ¹	Subterra ³ 16 Type 2	Subterra ³ 20 Type 3	Subterra ³ 30 Type 3
Compressive Resistance at 10% def.,Min., kPa	110	140	210
Flexural Resistance Min., kPa	483 ²	483 ²	483 ²
Water Vapor Permeance Max., ng/Pa-s-m ²	2.1 ²	2.1 ²	2.1 ²
Water Absorption Max., %	1.1	1.1	1.1
Dimensional Stability Max., %	1.5	1.5	1.5
Oxygen Index Min., %	24	24	24


1. Unless noted otherwise, properties are based on 1" thickness without laminate by data provided by BASF.
2. Based on independent testing conducted by QAI with laminate and 1" thick Neopor Plus.
3. Subterra also available in 40 psi, or more, compressive strength. Check with your local Halo representative for available Subterra compressive strengths

Table 4: Surface Burning Characteristics

	Flame Spread Index Max.	Smoke Developed Index Max.	Thickness Max.	Density
ASTM E84	5	25	5 in.	2 pcf
CAN/ULC S102.2	230	500	102 mm	32 kg/m ³

Table 5: Additional Properties

	Results
Water Resistance: Hydrostatic Pressure Test, per AATCC Test Method 127, and ICC ES AC71	Passed. No water leakage was observed at the underside of the Subterra boards.

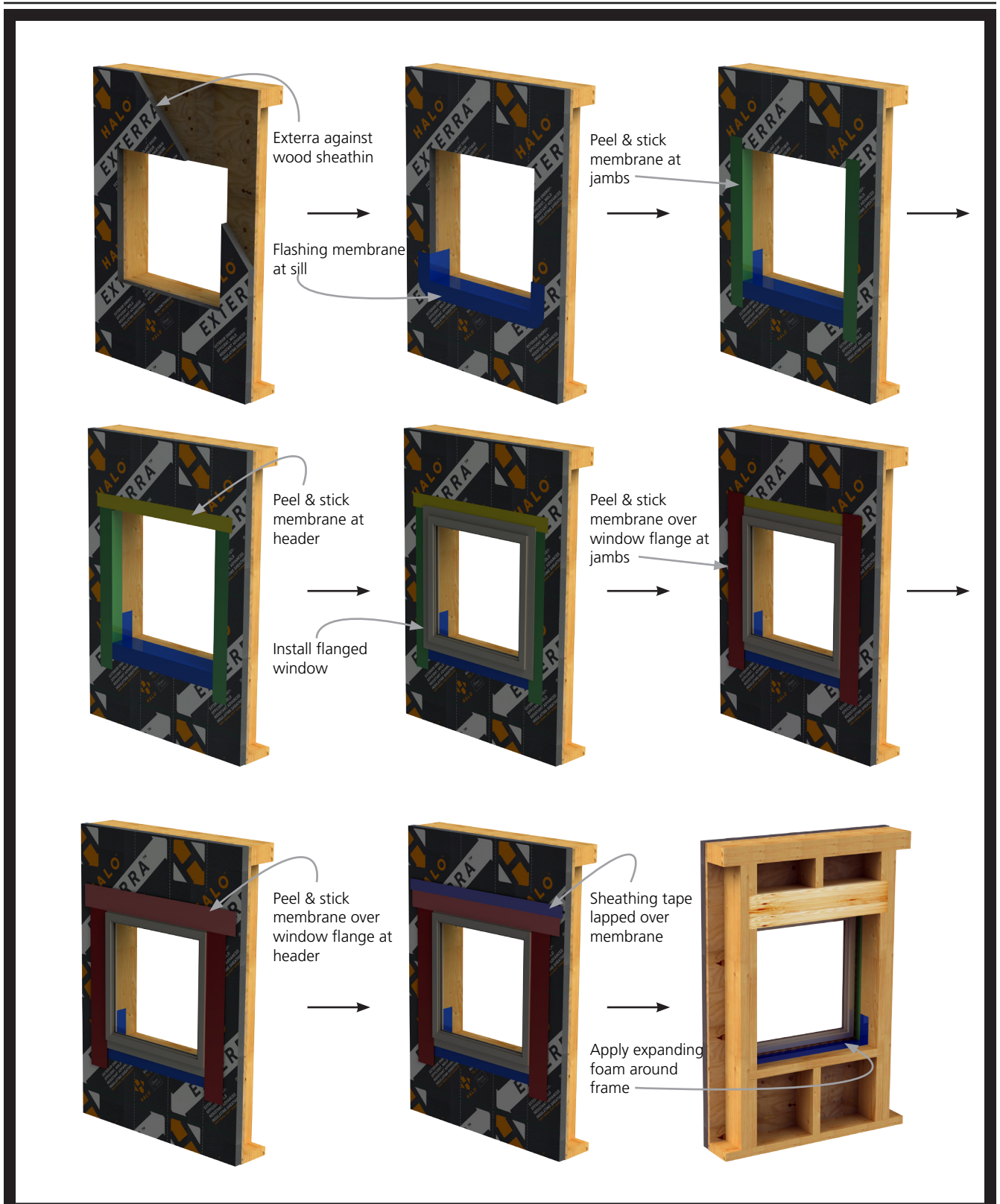
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7.0 - EXAMPLE DETAILS

The drawings represented herein are believed to be accurate and conforming to current design and construction practices. However, the drawings should be used as a reference guide only. The user shall check to ensure the drawing meets local building codes, design and construction practices by consulting local building officials and professionals, including any additional requirements. Halo reserves the right to make changes to the drawings without notice and assumes no liability in connection with the use of the drawings including modification, copying or distribution.

7.1 - WINDOW/DOOR OPENINGS

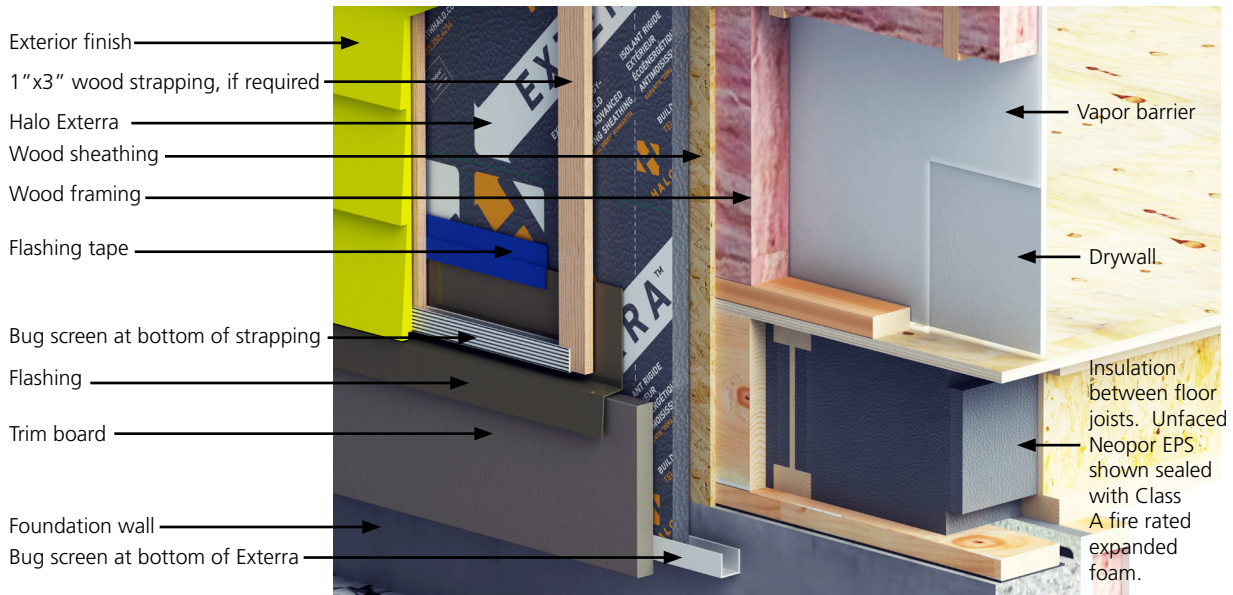
7.1.1 - FLANGED WINDOW



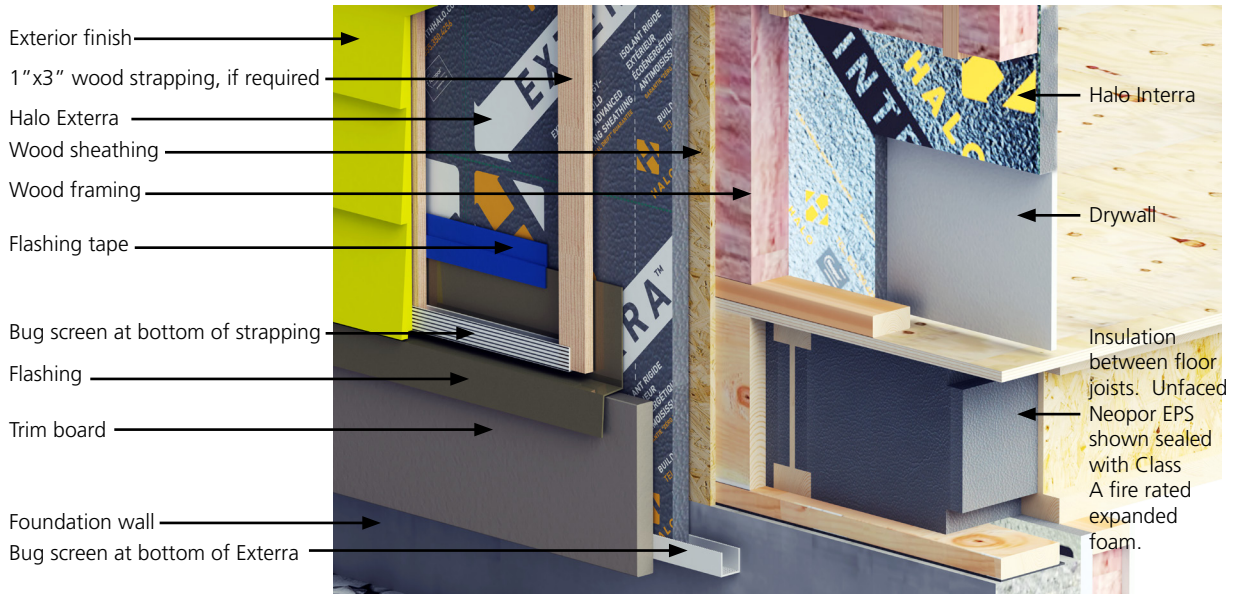
7.2 - ABOVE-GRADE DETAILS

7.2.1 - FOUNDATION TRANSITION

EXTERRA INSULATION



EXTERRA AND INTERRA INSULATION

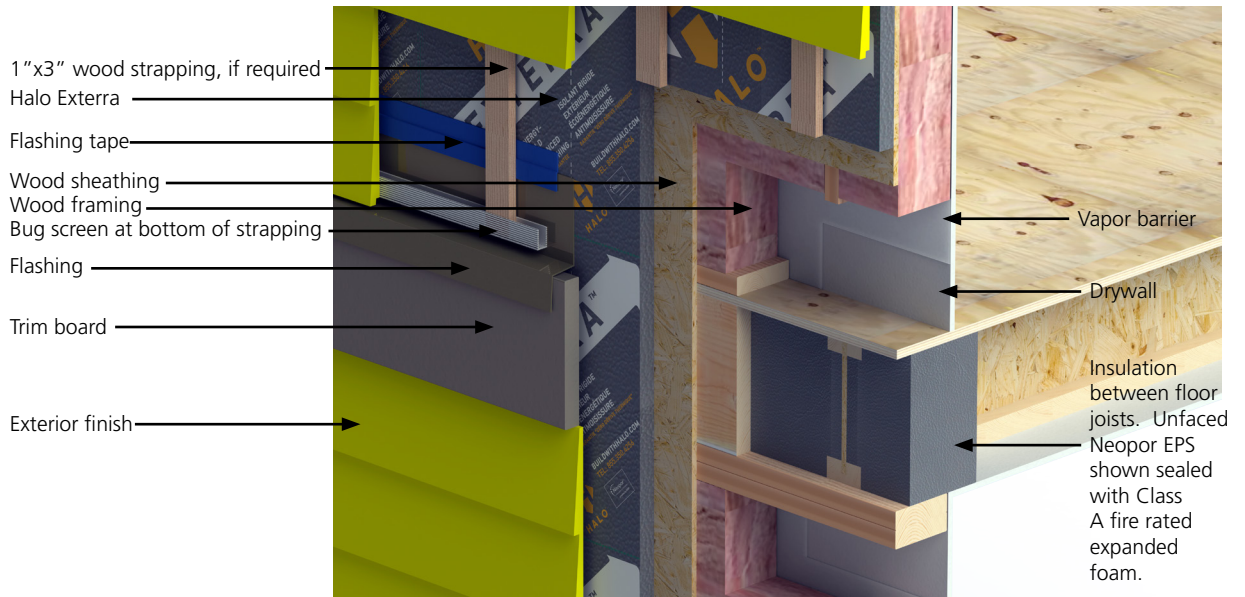


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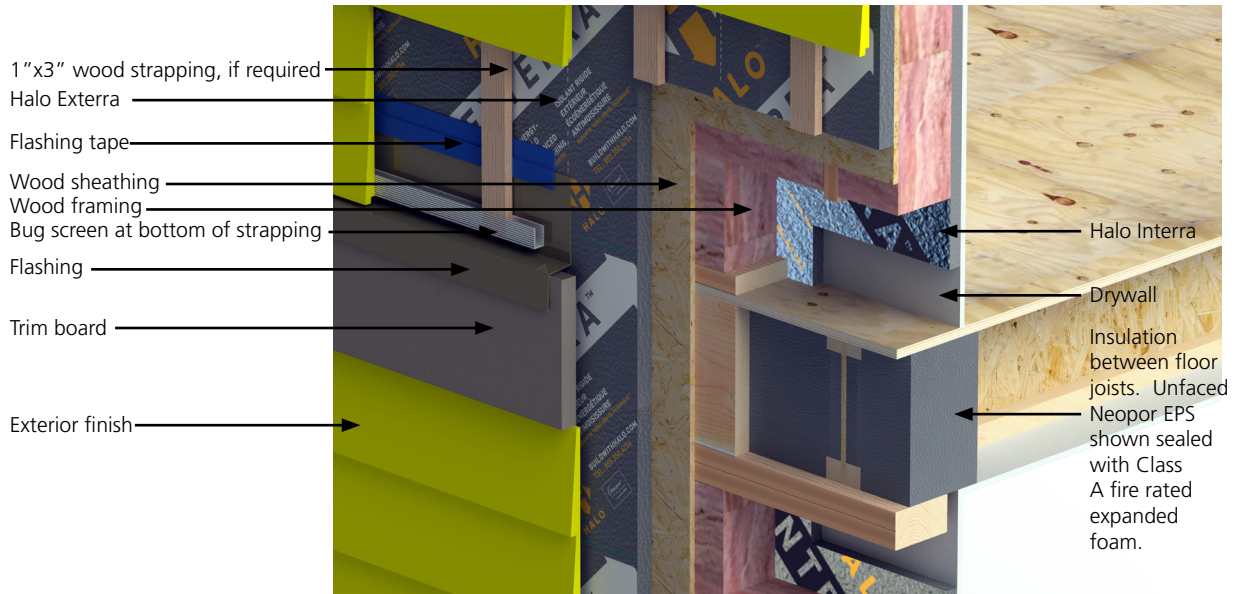
1. Exterra acts as a breathable water-resistive barrier when joints are sealed. No house wrap is required for Exterra thickness at 9/16" or greater.
2. Exterra is breathable up to 2" thickness.
3. Interra acts as a air and vapor barrier when joints are sealed, and when used as interior insulation. No additional polyethylene vapor barrier is required.

7.2.2 - FLOOR TRANSITION

EXTERRA INSULATION



EXTERRA AND INTERRA INSULATION

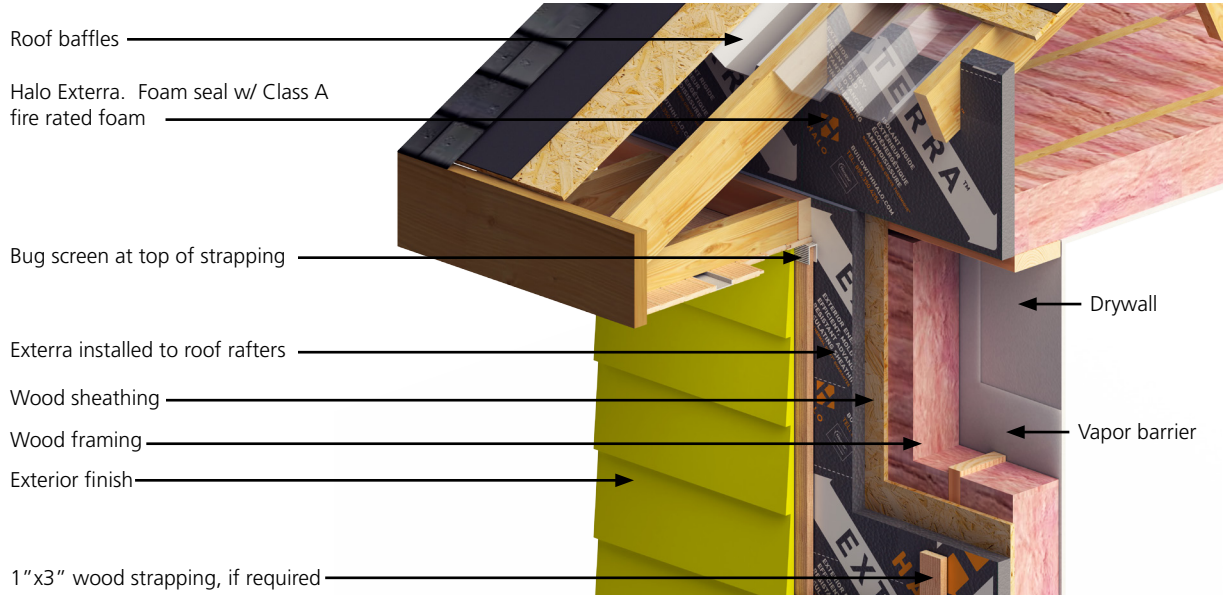


NOTES:

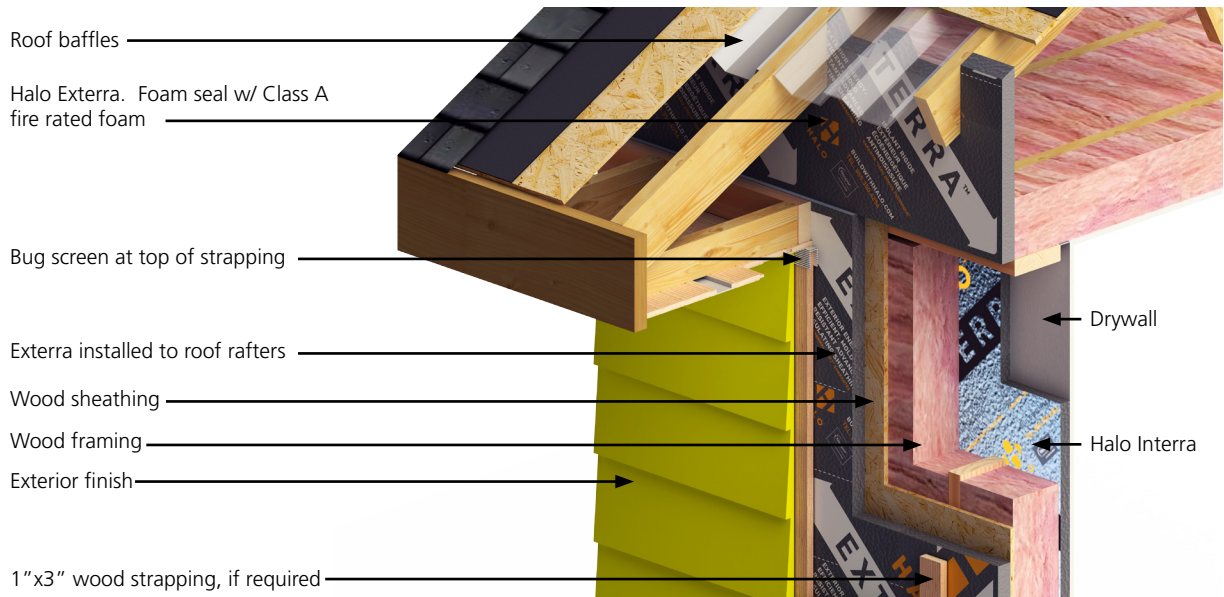
1. Exterra acts as a breathable water-resistive barrier when joints are sealed. No house wrap is required for Exterra thickness at 9/16" or greater.
2. Exterra is breathable up to 2" thickness.
3. Interra acts as a air and vapor barrier when joints are sealed, and when used as interior insulation. No additional polyethylene vapor barrier is required.

7.2.3 - ROOF TRANSITION

EXTERRA INSULATION



EXTERRA AND INTERRA INSULATION



NOTES:

1. Exterra acts as a breathable water-resistive barrier when joints are sealed. No house wrap is required for Exterra thickness at 9/16" or greater.
2. Exterra is breathable up to 2" thickness.
3. Interra acts as an air and vapor barrier when joints are sealed, and when used as interior insulation. No additional polyethylene vapor barrier is required.

7.3 - FOUNDATION WALL DETAILS

7.3.1 - EXTERIOR/INTERIOR INSULATION

FOUNDATION WALL SUBTERRA EXTERIOR INSULATION

Waterproof application against
concrete foundation wall

Halo Subterra

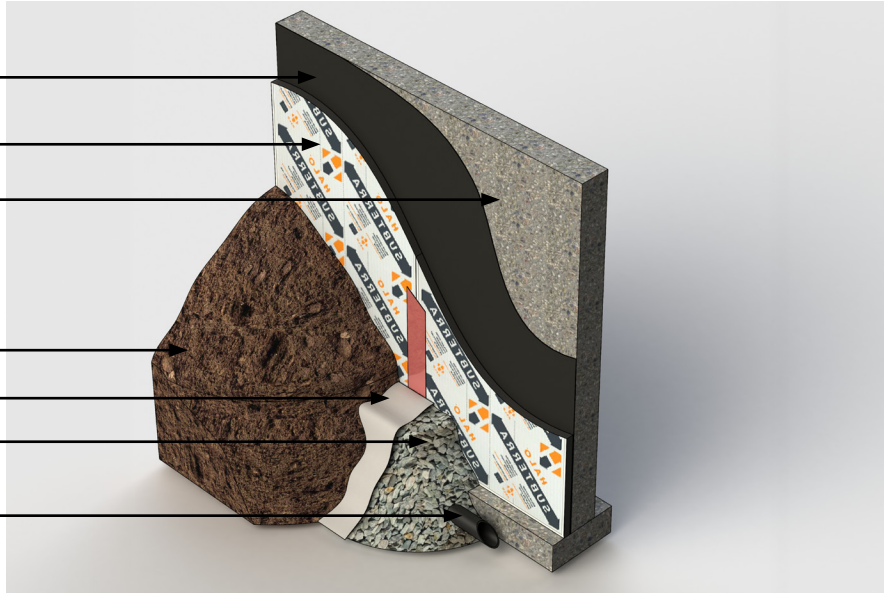
Concrete foundation wall

Backfill

Filter fabric

Crushed gravel

Drain tile



FOUNDATION WALL INTERRA INTERIOR INSULATION

Above-grade framed wall

Floor system

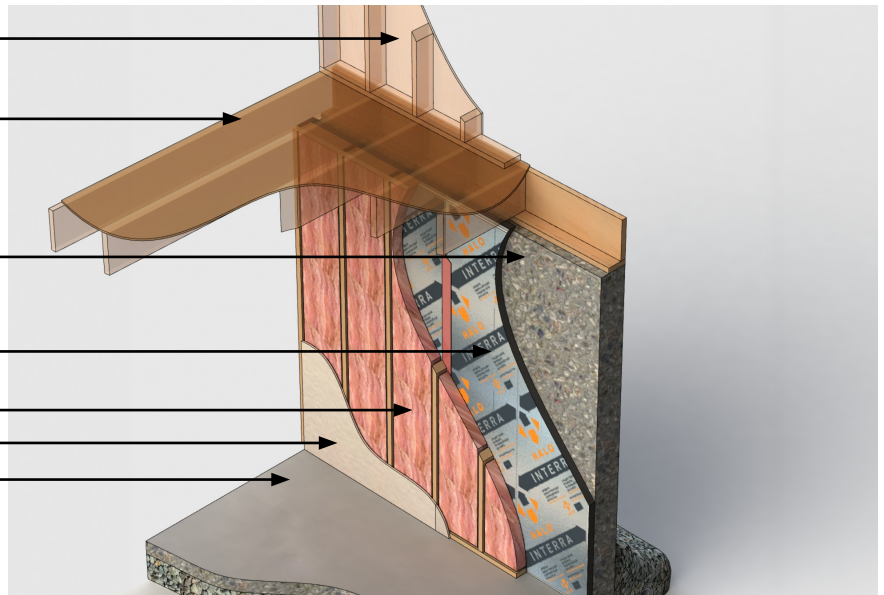
Concrete foundation wall

Install Interra from subfloor to
ceiling joists

Framed wall

Drywall

Finished floor



NOTES:

1. Interra acts as a air and vapor barrier when joints are sealed, and when used as interior insulation. No additional polyethylene vapor barrier is required.

7.4 - SLAB DETAILS

7.4.1 - ABOVE-/BELOW-SLAB INSULATION

BELOW SLAB SUBTERRA INSULATION

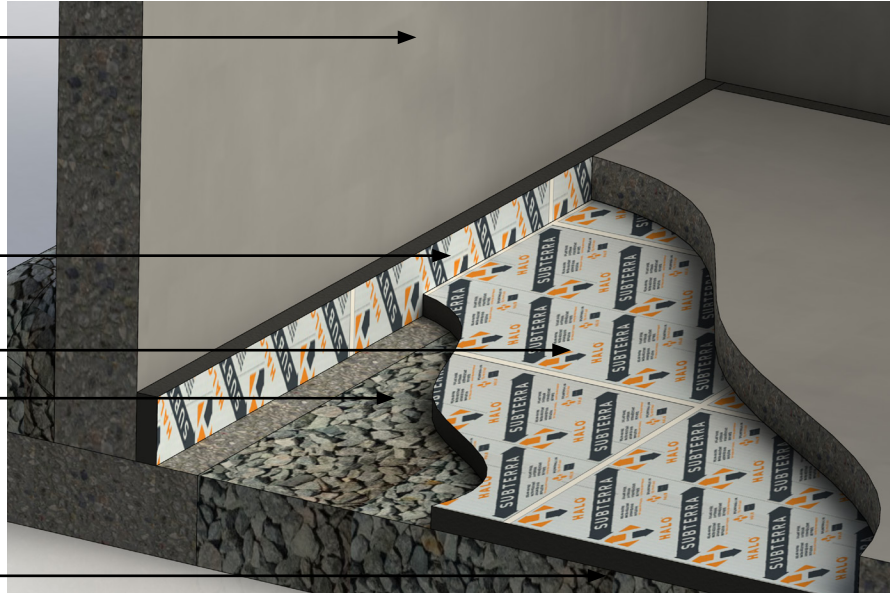
Concrete foundation wall

Apply Subterra between
foundation wall and slab

Subterra installed over substrate

Substrate

1"x3" wood strapping, if required



ABOVE SLAB INTERRA INSULATION

Wall framing in front of
foundation wall

Interra between framed wall
and foundation wall

Foundation wall

Install wood furring around
perimeter

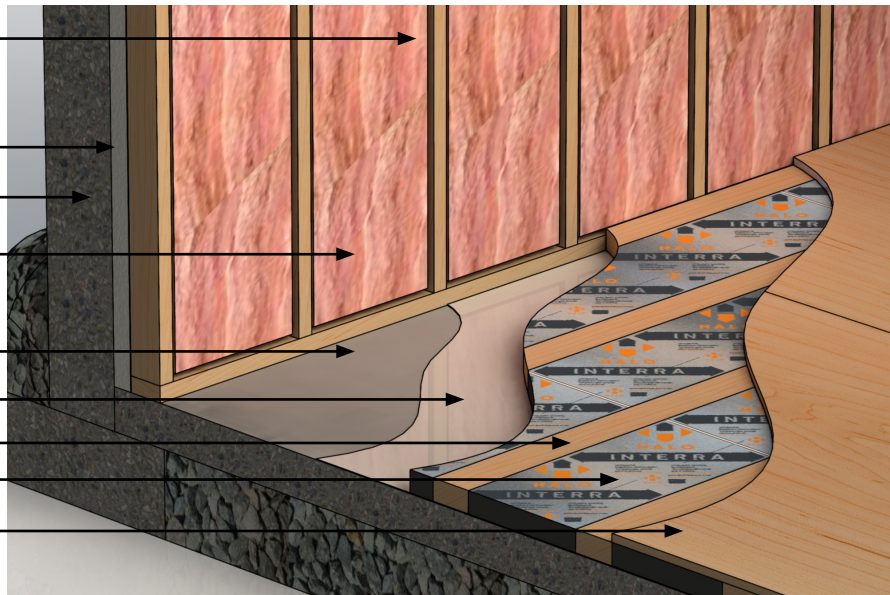
Concrete slab

Vapor barrier

Wood furring. Fasten to slab

Interra

Subflooring installed over
Interra



NOTES:

1. Subterra acts as a vapor barrier. No additional polyethylene vapor barrier is required.