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CX LowPro Insulated Stud

The CX LowPro is designed for use on the interior or the exterior of a shipping container. The inserts can be installed in an alternating pattern or in every corrugation. The LowPro easily be trimmed for partial corrugations and around openings.

The PL Premium has a working time of about 25 minutes. To obtain a more uniform flat surface, work in sections. It is best to wait until the sheet foam is in place before firmly pressing the assembly in place. Avoid pressing on the LowPro inserts which may push the LowPro inserts too low.

Best Practice for a Flatter Surface

It is best to work in a section of three LowPro corrugations (See bottom of page 11). Glue in place the LowPro and Side Wall Inserts without fully pressing into place. Then install the sheet foam between the LowPro Inserts. Press firmly on either side of the LowPro Inserts to fully seat the inserts and sheet foam at one time. This method will produce a more uniform surface.

Install the LowPro Stud Inserts

Apply a 3/8" bead of PL Premium 3x Construction Adhesive horizontally across the top of the insert and over the ribbed surface on the backside of the stud to form a "T".

Apply an additional bead of adhesive along the bottom of the LowPro for the first row only.



Install the LowPro Inserts in the corrugations.

Install the Foam Side Wall Inserts

Run a horizontal bead of PL Premium 3x on the backside of the insert at the bottom, middle, and top. Press into place.



Install the Side Wall Inserts in the alternating corrugations.

Recommended Adhesive

PL Premium 3x Construction Adhesive is the recommended adhesive for adhering the InSoFast panels. Other formulas and brands may not work as expected.

TIP: When bonding InSoFast panel/studs, to metal add water in the form of a very light or atomized spray from a plant mister bottle to the adhesive, this accelerates the adhesive's set. If needed use mechanical support for 24 hours while the adhesive cures. When bonding the InSoFast panels/studs, avoid cure and surface temperatures below 40°F above 90°F.

Visit loctiteproducts.com for more info.



Install Sheet Foam Between the LowPro Stud Inserts

When LowPro inserts are installed in an alternating pattern, cut the sheet foam in approximately 16" wide panels. If the LowPro is installed in every corrugation, cut the sheet foam in 5" wide panels. The sheet foam should be sized to leave a ¼" wide gap to be air sealed with spray foam.

To prepare the surface of the container for the sheet foam, apply a bead of PL Premium 3x near the bottom, in the middle, and at the top where the sheet foam is to be placed. Then apply spray foam along the lip of the LowPro inserts vertically on each side.



Omit spray foam at bottom for drainage.



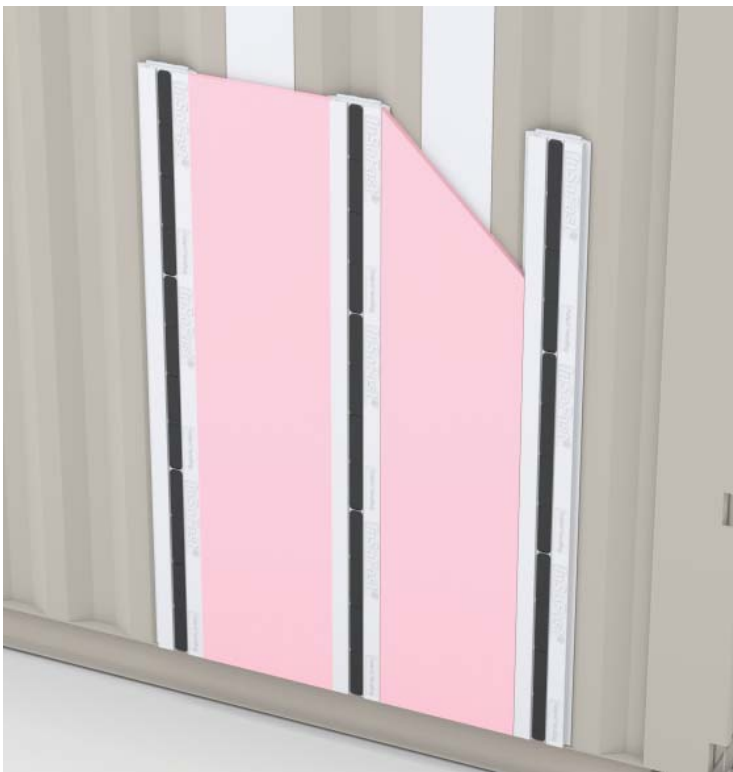
Place PL Premium horizontally and spray foam along the edges.

Install the sheet foam. Press firmly in place to seat the inserts properly. If the sheet foam will not sit tightly, use a nail or pin to hold in place until the adhesive sets up.

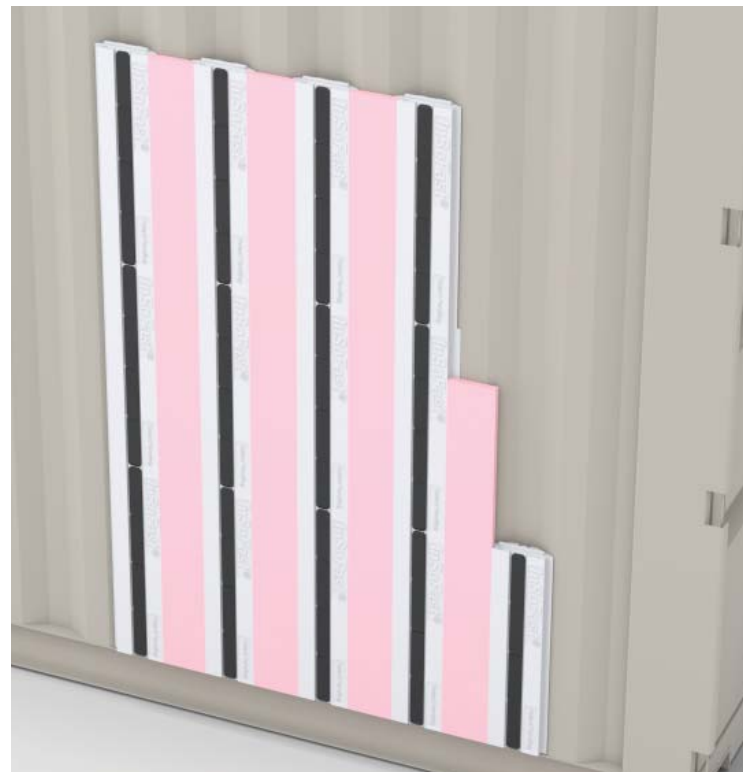
Fit inserts and sheet foam tight to the bottom rail. Do not caulk or seal to the bottom rail to provide for drainage.

Seal Top of Wall

For exterior applications with siding, seal the insulation system at the top of the wall. Cut the inserts and foam board, leaving a ¼" gap, to allow for a continuous bead of sealant along top edge of the inserts and foam board.



Insert 16" sheet foam between the LowPro Inserts.



Use 5" wide sheet foam when LowPro is installed in every corrugation.

Additional Insulation for Higher R-Values

LowPro Plus

Allow the adhesive of the LowPro Basic assembly to set up before continuing with additional sheet foam. Fasten additional sheet foam over top of the finished LowPro wall using plastic foam board washers and screws into the InSoFast studs. Make sure to mark the stud location as the sheet foam is installed. Only use enough fasteners to hold the sheet foam in place until the siding is installed.



LowPro Plus Method #2



LowPro Plus

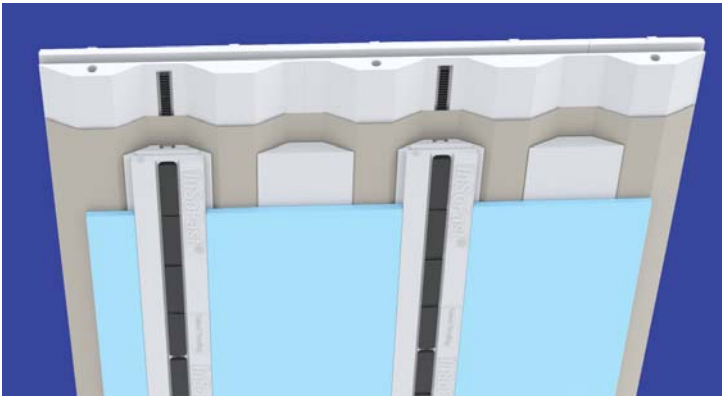
Method Two

Instead of using multiple layers of foam, this method uses a single 16" wide piece of 1-½" foam between the LowPro stud inserts and strips of ¾" foam on top of the LowPro. There is no need to mark stud locations as they are centered between the strips. Use spray foam to seal all of the gaps.

Figuring Interior and Exterior R-Value

Both CX 44 and LowPro can be used on the interior or the exterior. You can optimize the amount of insulation on the interior or exterior to suit your needs.

Interior & Exterior Wall Assembly R-Value	
Component	R-Value
Interior Air Film	.68
½" Drywall	.45
CX 44 Panel	11.0
Container Sidewall	0
LowPro Basic	7.0
Exterior Air Film	.17
Assembly R-Value*	R-19.3
Add R-Value of Exterior Cladding	



Interior and Exterior

Rain Screen Assemblies for Exterior Applications

For applications requiring rain screen, wood furring strips installed to allow moisture to migrate down. An alternative "no wood" method, utilizes thicker foam over the LowPro Insulated Stud.



LowPro Foam Rain Screen



LowPro Wood Furring Rain Screen

R-Value vs Space - Evaluating your Project's Insulation Requirements

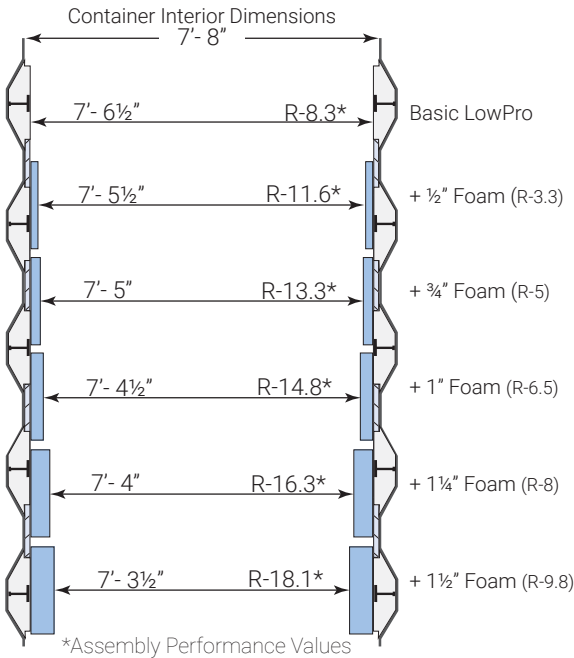
LowPro Basic Plus Additional Sheet Foam



LowPro Basic



LowPro Plus



LowPro Basic Wall Assembly R-Value	
Component	R-Value
Interior Air Film	.68
1/2" Drywall	.45
LowPro Basic	7.0
Container Sidewall	0
Exterior Air Film	.17
Assembly R-Value*	R-8.3
Add R-Value of Additional Foam	

Sheet foam R-Values vary by manufacturer. Examples shown use polyiso foam. Verify manufacturer's specifications.

Building Codes allow fastening drywall and exterior finishes through 1-1/2" of continuous insulation. Thicker applications require furring strips.

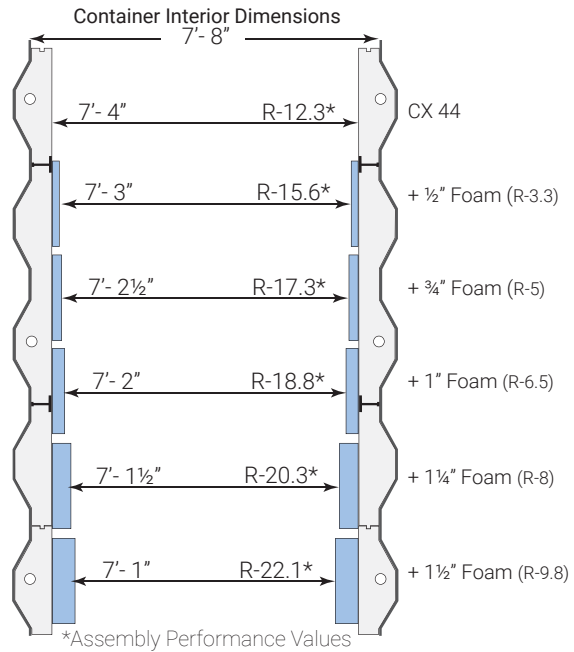
CX 44 Panel Plus Additional Sheet Foam



CX 44



CX 44 Plus



CX 44 Wall Assembly R-Value	
Component	R-Value
Interior Air Film	.68
1/2" Drywall	.45
CX 44 Panel	11.0
Container Sidewall	0
Exterior Air Film	.17
Assembly R-Value*	R-12.3
Add R-Value of Additional Foam	

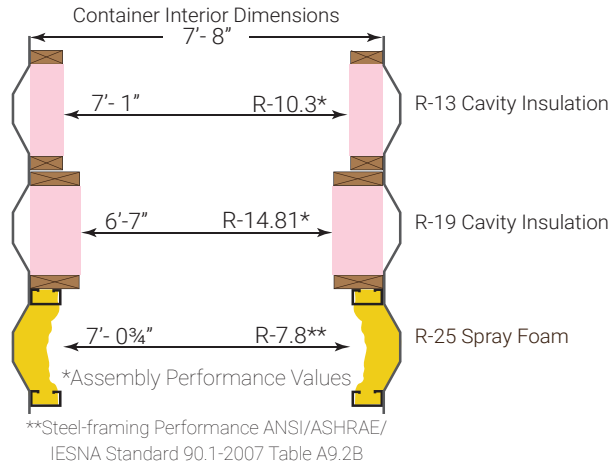
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Wood and Steel Framing 16" o.c.



Wood Framing



2x4 Framing with R-13 Wall Assembly R-Value		
Component	Framing R-Value	Cavity R-Value
Interior Air Film	.68	.68
1/2" Drywall	.45	.45
2x4 Stud	4.38	--
R-13 Fiberglass	--	13.0
Container Sidewall	0	0
Exterior Air Film	.17	.17
R-Value	5.68	14.30
% of Wall	25%	75%
Assembly Performance R-Value*	R-10.3	

End Wall - Nose Corner Detail

If you start with the side wall panels first, follow the illustrations noted below. Another option is to install the End Wall Inserts and flat panels all the way to the side wall of the container. Then the side wall pieces will be trimmed to fit against the end wall flat panels.

Fitting Pieces in the Corner

The end of the shipping container uses scrap pieces of panels cut to fit into the corner. The image illustrates the cut pieces used in each corner.

Cutting the First CX 44 Panels

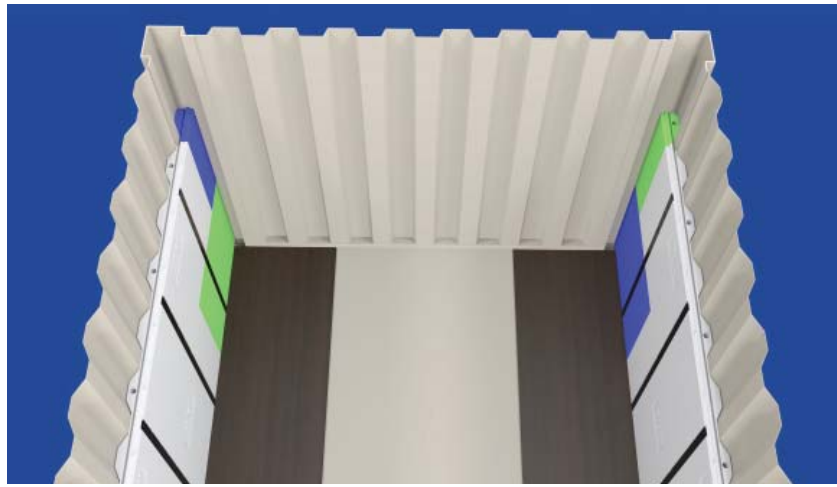
With the CX 44 panel facing up, mark a cutting line between 13" and 14" from the left side of the panel (dimensions will vary per container).

Starting with the larger piece, finish the bottom row on the right side of the container. The cut off piece will need to be trimmed to fit the second row on the left side as shown with blue shaded panels.

Repeat this process, making sure to cut the green shaded panel from the left side.

Corner Void

Fill the void in the corner with scrap pieces of InSo-Fast panels, sheet foam, or spray foam.



Colored panels show how to minimize waste.



Fill the corner with foam.



Finish installing inserts and panels on the end wall.



Corner detail for LowPro. Spray foam gaps.

Finish the End Wall

Install the inserts and InSoFast panels on the end wall. Seal the corners with spray foam.

Additional Ceiling Information

Installation and Bracing

The UX 2.0 or EXi 2.5 flat panels installed on the ceiling will need to be braced until the adhesive has set. See page 4 of the Container Installation Guide.

Installing the side wall panels first enables you to shim the panels up in place at the edges. This eliminates a row of bracing on each side.

The shims are removed after the adhesive has set. After utilities have been installed, fill gap with foam.

Make a "T" style brace with 2x4s to hold the panels in place until the adhesive cures. Because the panels have a tongue and groove edge, the braces can be installed roughly 4' o.c. Be gentle - don't pound the vertical braces into place to avoid bowing the ceiling.

Do not install drywall until adhesive is cured. Low temperature or low humidity will increase the cure time needed.



Installing the ceiling panels.



Installing blocks to hold panel in place around perimeter.

Increasing Ceiling R-Value

Additional insulation can be added to the InSoFast system to obtain higher R-Values. Install the ceiling inserts along with the UX 2.0 or EXi 2.5 flat panels.

Install ceiling framing fastened to the InSoFast studs of the side wall panels.

Framing may be lowered to allow for additional continuous insulation above the framing.

Install cavity insulation.



2x4 framework for allows for additional insulation.

Ceiling Assembly R-Values				
per Equivalent 2015 IECC (R402.1.2, R402.1.4)				
Insulation and Fenestration Requirements by Component				
Ceiling Insert	Ceiling Insert	Ceiling Insert	Ceiling Insert	Ceiling Insert
InSoFast UX 2.0	InSoFast EXi 2.5	InSoFast UX 2.0	InSoFast UX 2.0	InSoFast UX 2.0
		R-4.1 R-15	R-9 R-15 24" o.c. Framing	R-15 R-15 24" o.c. Framing
R-13 U-Factor .092	R-15 U-Factor .078	R-30 U-Factor .035	R-38 U-Factor .030	R-49 U-Factor .025

Insulating the Inside of Swing Doors

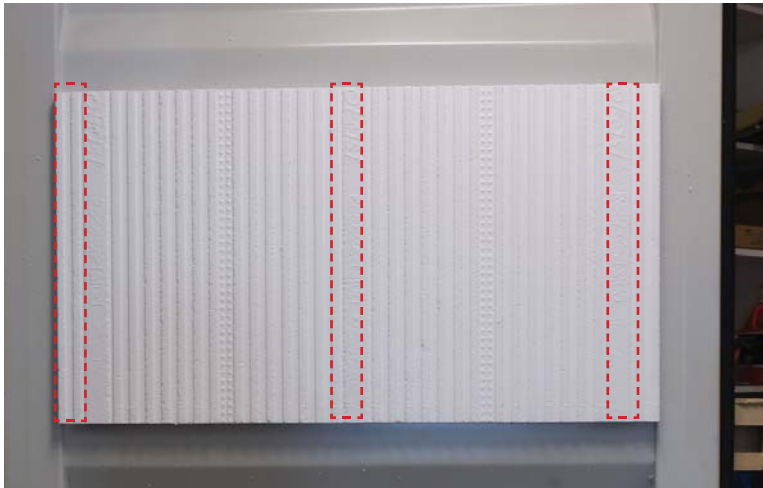
Before you start

There are many styles of shipping container doors and just as many ways to insulate them. We will show how to use the InSoFast EXe 2.5 flat panel to insulate this door.

The EX Series panels are 2-½" thick and will stick out past the door frame. Additional insulation will be added over the door frame to make a flush surface. See page 18.

Cutting Panels to Width

The EX panel is 48" long. You will need to cut the center piece out of four panels for each door. It should be friction fit but not so tight that the panel bows. This will eliminate the need to have to brace the panels while the adhesive sets. You want to make sure that the three studs in the panel are centered in the opening.



Center the panel in the opening.

Cutting the Panels to Height

When measuring the bottom panel, include the angled part in the measurement as shown with the black dotted lines.

Cutting the Angles

Cut the angles on the panels. The beveled cut starts about 1" back from the front face of the panel. Use scrap foam to get the angle correct with a test cut. The angle is generally around 25°.



Cutting diagram that illustrates when InSoFast panels and sheet foam is used.



Don't cut the angle all the way through. Keep a flat area on the bottom.

Cutting out for the Rails of the Top and Bottom Panels

Measure the depth of the top and bottom rails which are about 1-½" deep. Roll the panel up and into place over the top of the bottom rail. Make an impression on the back of the panel by striking the front surface. This will leave an impression for the groove cut across the panel.

This can also be done in two pieces instead of creating the groove cut on the back of the panel.

Removing Foam for Fastener Heads

Press the panel firmly against the door to leave bolt impressions in the panel. Drill out with a 1" spade bit. Remove enough foam so the panels sit tight against the door. Dry fit the panels and leave in place.



Press the panel against the rail.



Foam is removed to accommodate the rail.



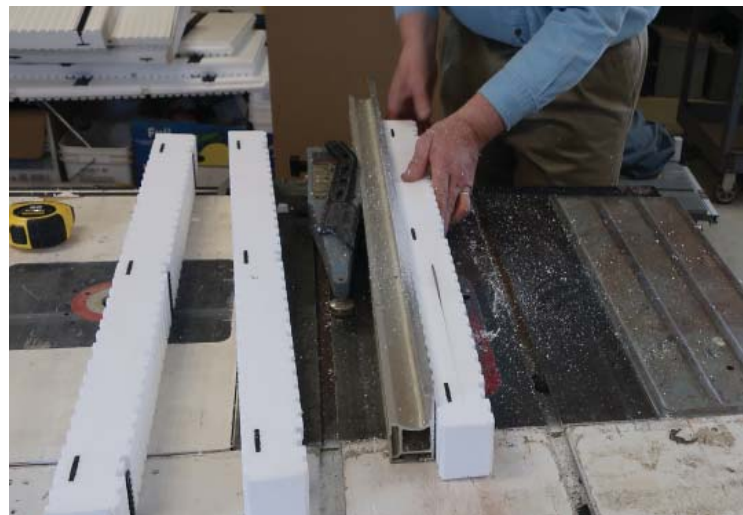
Drill out the foam where the fastener heads are located.

Filling between the Panels

Use sheet foam (by others) to fill in around the cut panels. An alternate method is to use the InSoFast cut off pieces trimmed down to the correct height to fit between panels and then cut to the proper thickness to cover the exposed rib of the door which is about 1".



Measure for the thickness needed.



Make the cut so that the front of the panel is useable (cut off the back side).

Cutting Vertical Side Pieces

You can either use the cut off ends of the panels that were set aside that are cut and ripped to thickness or use 3/4" foam board. Hold back the foam to accommodate a wood trim piece to avoid seeing the foam.

Glue Panels in Place

Remove all the dry fit pieces. Add a liberal amount of Loctite PL Premium 3x adhesive to the studs and foam. The vertical foam pieces will have to be taped in place until the adhesive has set.

Finishing the Door

Allow the adhesive to fully cure before applying finishes.



The pink foam is kept back to allow for the trim piece.



Apply adhesive.



Use plenty of adhesive on the doors.



3/4" foam on the vertical rails.



Nailing on cedar siding.

Plumbing Installation in the CX 44 Panel

When possible, waste lines and especially water supply lines should be located on interior walls. Colored electrical tape was used to layout the plumbing and electrical runs before any foam was cut. A hot knife is a great tool for quickly removing foam without the mess.

In the CX 44 panel, 1-½" and 2" waste pipes can be located in the thicker part of the foam. 1-½" waste pipes can also run horizontally anywhere in the panel. Larger waste pipes will need to be boxed out.

When running waste pipes through the floor and ceiling, avoid cutting the structural beams of the side of the container as well as in the floor system.

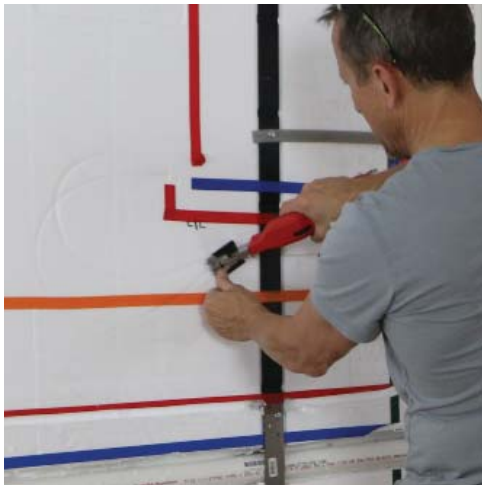
In mild climates, water lines can be flush with the interior face of the panels directly behind the drywall. Make sure to use protection plates where ever piping runs through the stud. Make sure to seal around pipes at any penetration to prevent air flow.

Pipes Running from Wall to Ceiling

Supply lines can be run from the wall to the ceiling. This can only be done in a mild climates or when the container is insulated on the exterior as well to protect pipes from freezing. See lower right photo.



The CX 44 panel can accommodate a 2" PVC pipe.



Use hot knife to cut out for pex pipe.



Drill behind the stud for the pex pipe.



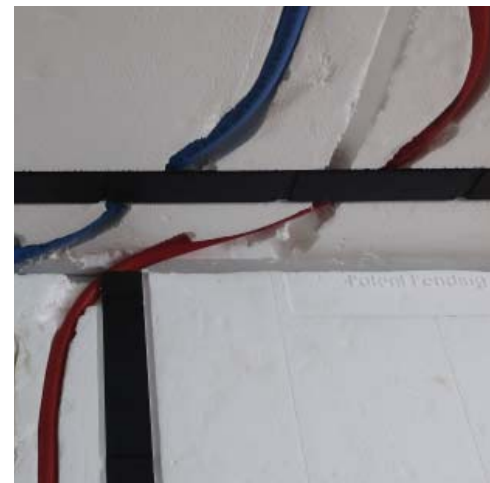
Install bend supports.



Use protection plates where necessary.



Pex pipe running along side waste.



Pex pipe can go around a corner without kinking.

Electrical Installation

The CX 44 panel has built in horizontal and vertical raceways, meeting the national electrical code depths requirements for Romex.

The steel container is no different than running wires through steel framing. Code requires the steel container be grounded. This is usually done at the electrical panel with a bonding screw. It is the same concept as grounding a metal electrical box.

A hot knife is useful for cutting out electrical boxes and to access the raceways. Electrical outlets can be located anywhere in the panel. You can also use a long snap off blade utility knife or small saw to cut the foam.



CX 44 Panel has horizontal and vertical raceways built into the panel.



Outlet located below horizontal raceway.



Cutting out using hot knife with sled attachment.



Foam in box after wiring has been run.



Bend over the tip of with wire when pushing through.



Pushing a long run.



Wire in horizontal raceway.

Running Wire around Corners

When changing direction, you will have to cut a hole to access the raceways. Save this piece to glue back in after your inspection.

When routing wires up the wall into the ceiling, cut access holes at the top of the wall and on the ceiling at the raceways locations. The raceways will not match up. Run the wire along the top of the CX 44 panel, making sure to push the wire all the way back to the beam. Code requires that the wire be 1- $\frac{1}{4}$ " back from the face otherwise a metal protection plate is required.

The electrical boxes can be adhered or mechanically attached. Verify with electrical inspector for local code requirement.



Cutting out raceway intersection.



Cutting out for round outlet box.



Run wire around the corner.



Running wiring down the wall.



Push with wiring all the way back to the beam.

Exterior Applications

Siding/Claddings

The InSoFast family of products is very adaptable to virtually any type of cladding. See insofast.com for technical details on siding attachment. The panels can support up to 2" thick adhered cultured stone. For all finish types, please refer to the finish manufacturer's installation instructions for fastener size and spacing.

Openings and Other Through-Wall Penetrations

Mechanical penetrations are treated as they would be for typical construction.

All through-wall penetrations should be installed and sealed back to the container before the InSoFast panels are installed. Install flashings and sealants per manufacturer's installation instructions. Cut and fit the InSoFast panel around the penetration, leaving a ¼" gap. Fill the gap between the penetration and the InSoFast panel with a foam sealant.

For exterior applications with siding it is important to seal the insulation system at the top of the wall. Properly detailing the roof and siding connection by providing flashing that extends over foam and siding.

Exterior applications with wood framing may require a weather resistant barrier (WRB). Follow WRB manufacturer's installation instructions.

Fastener Selection

Use corrosion-resistant fasteners long enough to penetrate 1" into the embedded InSoFast stud.

Architectural Build Outs

To show adaptability the following pictures show how the container was boxed out to create the needed depth for the vertical siding. Wood framing was screwed to the InSoFast studs. Weather resistant barrier was installed over the sheathing only.



Screw framing into InSoFast stud.



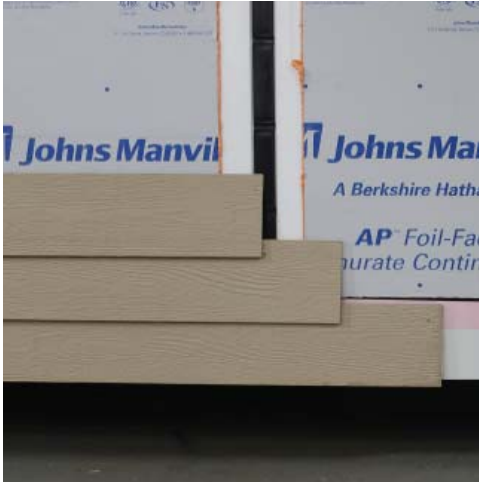
Boxing out the low part of the exterior.



Exterior build out is ready for WRB.

Bottom of Container

If you are insulating and siding down to cover the beam on the bottom of the container, below are two options. Container beam locations and style vary with manufacturer. The 2x6 framing can be screwed to horizontal beam with self tapping screws for steel.



Nail or screw on horizontal siding.



Option one for insulating and furring out the beam.



Option two for insulating and furring out the beam.

Install a metal flashing at the underside of the container to cover all foam along the bottom edge.



Bottom flashing installed over the WRB.



Raw steel was added on lower part of wall.

Corner Boards

For easy siding attachment at corners, install a metal flashing approximately 1-½" wider than the corner board.

For the corner, the UX 2.0 flat panel was glued vertically to the corner beam of the container to provide better attachment for the metal flashing.



Metal flashing installed for added attachment.



Finished corner.

Vertical Siding

Vertical siding can be installed easily by adding wood furring strips over the InSoFast panels.



Vertical siding is nailed to wood furring strips.

IMPORTANT NOTICE: Container Surface Temperatures

PL Premium 3x Construction Adhesive

PL Premium Construction Adhesive 3x is freeze/thaw stable. While freezing will not damage the adhesive, it will not cure until temperatures are warm enough to complete the cure process.

When bonding InSoFast panel/studs to metal, add water in the form of a very light or atomized spray from a plant mister bottle to the adhesive, this accelerates the adhesive's set. If needed use mechanical support for 24 hours while the adhesive cures. When bonding InSoFast foam insulation, use above 40°F (4°C) and avoid cure and surface temperatures above 90°F (32°C). See website for further information.

Cold Weather Tips: Interior Installation

Heating the interior of the container will not be sufficient for the adhesive to cure because the insulation panels will not allow heat to transfer to the container surface. It is recommended to either move the container to a heated area or tent and heat the exterior until the adhesive has cured.

Cold Weather Tips: Exterior Installation

The interior of the container can be heated until the adhesive has cured.

If you opt to use nail guns to install siding, it is only recommended when temperatures are above 60° F. Smaller nail size and shank diameter will perform better at lower temperatures. It is up to the contractor, and/or building official to determine the suitability for the use of nails when installing siding. It is important for the contractor to verify that the fasteners do not crack the stud and that they are not over-driven or under-driven into the stud.

Cold Weather Tips: Interior and Exterior Installation

Install the exterior panels first while heating the interior. Allow adhesive to cure before installing interior insulation.

For complete and up-to-date information, visit [InSoFast.com](https://www.insofast.com) and our YouTube channel.

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