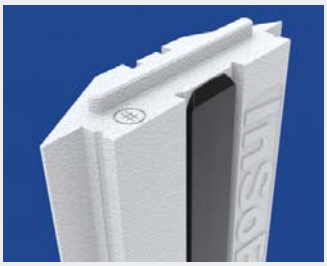
InSoFast
Engineered Insulation

Shipping Container Installation Guide

SIDE WALL OPTIONS

CX 44 Installation

Page 7



LowPro Installation

Pages 9-10

Flat Panels + Inserts Installation

Page 8

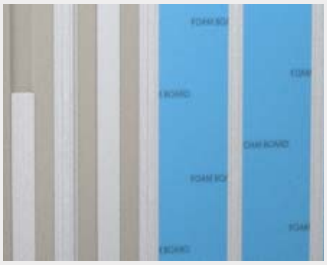
Inserts Only Installation

Page 8

END WALL OPTIONS

Flat Panel + Inserts Installation

Page 11



LowPro Installation

Page 11

Ceiling Installation

Pages 12-13

Floor Installation

Page 14

Door Installation

Pages 15-17

Roof Options

Pages 21

Electrical

Pages 18-19

Plumbing

Page 20

Drywall

Page 21

Exterior Siding

Pages 22-23

See www.InSoFast.com for the most up-to-date installation instructions and product information.

InSoFast Engineered Insulation and Framing Panels

InSoFast brings our specialized expertise in building insulation and thermal envelopes to the shipping container fabrication process. InSoFast makes it simple. Our family of products such as the CX-44, the LowPro Insulated Studs, and our other panels take the hassle out of framing and insulating shipping containers.

CX 44 Shaped Panel Insulation

Our premier 3D shaped panel is exclusively engineered to fit the long sidewalls of most containers. This one step panel which includes raceways for electric wiring and vertical framing 22" o.c. is built to fit the container's unique corrugation spacing. The CX 44 is ideal for lightly used or one trip container applications.

Flat Panels over Inserts

Our original two step method for framing and insulating containers. This method provides 16" o.c. horizontal framing as well as the built-in raceways for electrical wiring. A logical choice when attaching vertical board & batten and with older containers with character, this two part system lends itself well when dents and dings require special attention or when the weld seams are not 44" o.c. See diagram on Page 28.

LowPro and Insert

This is our thinnest and most versatile insulated framing choice. LowPro Insulated Studs are suitable for interior use where electrical is surface mounted and minimal insulation is required. LowPro can also be used on the exterior of the container where a rain screen is necessary. The LowPro system is well suited for virtually any type of siding. Additional sheet foam can be added to obtain higher R-Values.

Insert Only Installation

This method helps control steel wall condensation by filling and sealing just the corrugated area. These versatile inserts fit the contours of the container and can be used behind any type of conventional framing or insulation board.

Controlling Condensation

A shipping container provides the perfect air tight "building envelope". This type of construction requires a heating, ventilating, and air conditioning (HVAC) system that provides fresh air exchange and controls latent moisture. It is also very important to prevent condensation that is caused by air leakage or infiltration. This is done by air sealing with expanding spray foam:

- At and around any cutout, outlet, penetration or opening through the InSoFast panels, container walls, ceilings or floors.
- Anywhere the InSoFast panels intersect the container ceiling, sides or floors.
- The backside of the InSoFast panels to the container wall every 2' horizontally as the panels are being installed.

We do not recommend installing Flat Panels without the Inserts. The inserts are needed to prevent convective looping behind the finished wall.

Tools and Supplies

- Long snap off blade utility knife
- Saw – hand, jig, circular, or table saw
- Adhesive: Loctite PL Premium 3x Construction Adhesive
  - 28 oz. tube covers 50 s.f. of InSoFast Panels
  - 28 oz. tube covers 100 l.f. of Inserts
  - Do not use the small 10 oz. tubes
- Spray Foam: Great Stuff Gap and Crack Spray Foam or comparable
  - Do not use Window/Door foam sealant because it remains pliable and does not have the same bonding properties.

Required tools.

Loctite PL Premium 3X

Spray foam.

Tools for the Professional

- Pro Series Spray Foam Cans with applicator gun
- Power Caulk Gun
- Hot Knife
- Table Saw

Spray Foam with Applicator Gun

Power Caulk Gun

Hot Knife

PL Premium Adhesive and Spray Foam Usage Chart

Side Walls, End Wall & Ceiling	28 oz. Tube Adhesive	24 oz. Can Spray Foam
20' CX 44 or Flat Panels +Inserts	13-14	3-4
20' LowPro	15-18	10
40' CX 44 or Flat Panels +Inserts	28-29	5-6
40' LowPro	30-35	15
Optional: 2 Doors	1	1
Optional: Floor with Floating Installation	--	--
Optional: Floor with Adhered Install	3	--

Adhesive and spray foam usage varies greatly depending on the bead size, number of openings, gap size, and volume of can.

Adhesive for Panels

Loctite PL Premium 3x Construction Adhesive (LaPage in Canada) is the only recommended adhesive for adhering the InSoFast panels. Other formulas and brands may not work as expected.

PL Premium 3x is a moisture-cured adhesive. Under cold or dry conditions, the adhesive will take longer to cure.

When applying adhesive to the InSoFast studs, spray a fine water mist over the wet beads of adhesive following the adhesive manufacturer's instructions. Use a plant mister bottle or garden sprayer to provide a light atomized spray. The addition of moisture to the adhesive will allow the cure process to be activated.

It will be necessary to brace panels on the ceiling while the adhesive sets. See page 13.

Ensure adequate time for the adhesive to cure before attaching finished materials such as drywall and cabinets.

PL Premium 3x is used on the back side of the InSoFast stud as well as directly on the foam of the InSoFast panels and inserts.

Applying adhesive on stud and around a cut.

Adhesive on the studs and foam of a flat panel.

Adhesive and spray foam on CX panels.

Adhesive on LowPro Insert.

Applying adhesive to side wall insert.

PL Premium plus additional spray foam for ceiling panels.

IMPORTANT NOTICE: Container Surface Temperatures

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

When bonding InSoFast foam insulation, use only when temperatures are above 40°F (4°C) and avoid cure and surface temperatures above 90°F (32°C). See manufacturer's website for further information. Shade cloth maybe necessary in hot climates.

Surfaces must be clean and free of frost, grease, dust and other contaminates. It is up to the installer to determine the suitability of the adhesive for the surface you are bonding to. If in doubt, an adhesive performance test should be done. See www.insofast.com for more details.

Cold Weather Tip for Interior Installation

In cold conditions, heating the interior of the container will not be sufficient for the adhesive to cure. The insulation panels will not allow heat to transfer to the container surface during the curing process. 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 Tip for Exterior Installation

The interior of the container can be heated until the adhesive has cured for the panels installed on the exterior.

General Bonding Issues

To verify that enough adhesive is used, press the panel into place. Pull the panel back and check to see if the adhesive has spread out the width of the stud.

It is normal for the panels to "float out" from the side of the container as the adhesive bridges irregularities in the container walls. This allows for a flatter finished wall surface. We do not recommend bracing tight to the wall.

If panels will not stay up against the wall, lean a brace against the panels for the short time until the spray foam sets.

If you find an area that has not bonded to the container after 24 hours, simply drill a hole through the foam and inject additional adhesive.

Lean a brace if panels don't sit tight.

Container Preparation

If the container has large dented areas, we recommend hammering them as smooth as possible before installing InSoFast products. As an alternative, the foam of the panel or insert can be removed to accommodate the dented area by scraping or cutting out the excess foam.

Eliminate any leaks before installing InSoFast panels. Apply sealant caulk or peel and stick window sealant tape around any penetrations or fasteners. Make sure to seal the air vents with spray foam or adhesive before panels are installed. It is not necessary to remove the cargo hook. The foam can be cut away on the back side of the panel.

Cut out all openings and perform any welding or grinding BEFORE installing any InSoFast panels or inserts. Do not weld on the inside or outside of the container once the InSoFast panels are installed.

A simple way of cutting openings is to punch holes in the corners of the opening using a right angle grinder with a thin cut off wheel about 1/16 of an inch thick. Follow up with a reciprocating saw with a metal cutting blade.

Seal off vents.

Avoid penetrating the steel walls of your container with screws or fasteners. This compromises the continuous seal and can introduce moisture-related issues. Seal around any screws or fasteners that are used.

Light colored or reflective paint is recommended on the exposed roof and container walls to help prevent excessive heat build up.

Windows and Doors

There are many methods for installing windows and doors. Shown below is one method utilizing a wood jamb when a structural header is not required. Whatever method chosen to use, the jambs or framing for any openings should be done before the InSoFast panels are installed.

Quick Wood Jamb Method

Once the opening has been cut out, the corrugated metal loses its shape. In order to maintain the correct shape, a 2x4 can be screwed or clamped into place before tracing the corrugations on the 2x material.

Trace the pattern of the corrugation, leaving 2" on the interior side. This allows the InSoFast panels to butt up flush with the wooden jamb.

Cut the 2x4 apart. This creates the interior and exterior part of the bottom and top jamb. The side jambs are created in a similar manner, cutting lengthwise with a circular saw set to the angle of the container to accommodate the corrugation. See website video for complete instructions.

Pre-drill holes through the metal to accommodate screws around the perimeter of the window. Screw the exterior jamb from the inside using the pre-drilled holes. Then screw the interior jamb in place using self-taping metal screws.

Use adhesive on each side to seal the jambs, sandwiching the container in between.

The wood jamb should protrude inward so that it will be flush with the InSoFast panels or inserts.

Flash, seal, and install the window per manufacturer's instructions.

Wood jamb is cut to fit the corrugations.

Wood jamb installed.

Installing InSoFast Panels around Windows/Doors

An additional bead of PL Premium 3x is required around all openings to provide additional bonding around the cuts.

Self-drilling metal screws with break off wing tips.

Always add additional adhesive to the back of the panel around openings

When fitting panels around openings, leave a ¼" gap for spray foam.

Sealing around Windows/Doors/Penetrations

Leave a 1/4" gap around all window/door openings so that after all the panels are installed the gap can be filled with spray foam.

Side Walls: CX-44 Panels

The InSoFast CX Container Panel is designed for the interior or exterior side walls of most shipping containers. The CX panels are set up for an 11” repeating pattern of the corrugation and the panel size is 44” x 24”. They are installed horizontally with the studs running vertically.

Pre-fit panels to ensure Layout

Lay out the first row of CX panels to determine the fit to the container. Variations in the container’s corrugations may require the 44” long panels to be trimmed or spaced out slightly. If the panels need to be adjusted, it is best to then stack bond the panels instead of installing in a running bond pattern. Cut out for cargo hooks.

Apply Adhesive on the Backside of the Panel

PL Premium 3x adhesive is applied in a 3/8” bead on the backside of the studs which have the ribbed surfaces. It is important that there is enough adhesive to squish into the dovetails on the back side of the stud when pressed to the container wall.

Apply Spray Foam on the Backside of the Panel

To avoid air movement, it is important to seal each panel to the wall using spray foam. Apply a bead of spray foam along the top of every panel to stop air flow behind the panels.

Placing the First Row of Panels

Just before setting the first row of panels, apply a 3/4” bead of spray foam along the floor at the edge of the wall. Set the first row of panels.

Since there are no studs at the cut ends of the panels, an additional bead of PL Premium 3x is applied to the back of the panels at the start and end of each wall.

Install CX Panels in a Running Bond Pattern

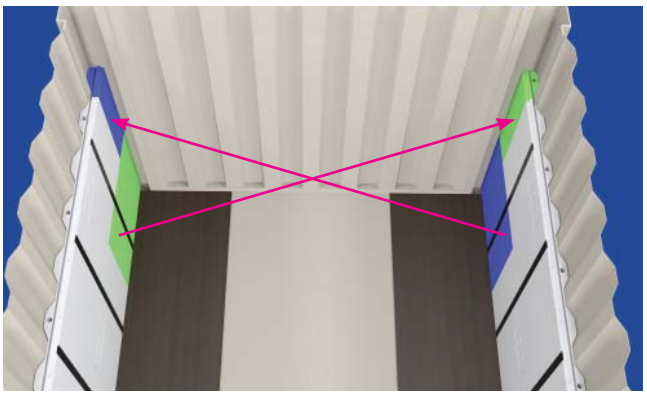
To start the second row, cut a panel in the center with a long snap off blade utility knife. This will start the running bond or staggered pattern. The half piece cut off will be used on the opposite sidewall.

To minimize waste, save the cut off piece at the end of the row for use on the opposite wall. See colored image below.

To prevent convective looping behind the panels, the top of each panel should be sealed. Run a bead of spray foam on the back side of the panel or directly onto the container wall.

Install the panels in a running bond pattern.

For the first row, use spray foam along the floor or on the bottom of the panel.



Avoid waste by using the scrap on the opposite wall.

Side Walls: Flat Panels + Inserts

The InSoFast Flat Panels plus Inserts are designed for the interior or exterior side walls of most shipping containers. The Side Wall Inserts fill each corrugation and the Flat Panel (48” x 24”) is installed over top of the inserts. The Flat Panels are installed vertically with the studs running horizontally. Installing the Flat Panels standing on end with the embedded studs running parallel to the floor, provides more uniform contact between the studs and steel, maximizing holding power.

Installing Side Wall Inserts

Place a bead of adhesive in an “S” pattern down the back sides of the sidewall insert. Set the inserts into the lower half of the sidewall corrugations. Continue to cut, fit and glue all the inserts onto the sidewall corrugations. Spray foam any gaps.

Installing Flat Panels

Start with a continuous bead of spray foam along the bottom of the sidewall of the container. Add a bead of adhesive along the inside corner where the first row of panels meet the corner of the container. This seals and locks the panel in place. You may want to trim the end of the Flat Panel to “move” the stud down closer to the floor allowing a baseboard to be attached later during the finishes section. On the back of the panel, run a 3/8" bead of adhesive along dove-tailed ribbing of each stud. Press in place.

Install Flat Panels in a Running Bond Pattern

For a standard 8’ high container, the panels can be installed in a stacked method or in a running bond pattern. The running bond pattern works better to eliminate waste on a 9’ high container. Use the cut off end of the top panel to start the next column.

When installing panels in a running bond pattern, start the second row by cutting a panel at the 16” or 32” cutting mark with a long snap off blade utility knife.

Vertical running bond pattern.

Side Walls: Inserts Only

There may be instances were the Side Wall Inserts only are needed. The inserts are used to infill the corrugations and provide a flat surface. Locally sourced (48" x 96") flat stock sheet insulation can installed over the inserts completing the continuous thermal layer before the traditional interior framing.

Place a bead of adhesive in an “S” pattern down the back sides of the sidewall insert. Set the inserts into the lower half of the sidewall corrugations. Spray foam any gaps.

Installing side wall inserts.

Side Walls: CX LowPro

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

The PL Premium has a working time of about 25 minutes. To obtain a uniform flat surface, work in sections of three corrugations. It is best to wait for the final step of installing the sheet foam before firmly pressing the assembly in place. Avoid pressing on the LowPro inserts themselves which may push them lower than the surface of the sheet foam installed in the last step.

Best Practice for a Flatter Surface

It is best to work in a section of three LowPro corrugations (See bottom of page 10). 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 Inserts in the corrugations.

Installing the LowPro Stud Inserts

Apply a 3/8” bead of PL Premium 3x horizontally near 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.

Installing the Foam Side Wall Inserts

Run a horizontal “S” pattern bead of PL Premium 3x on the back and tapered faces of the insert. Press into place.

Adhesive on insert.

Install the Side Wall Inserts in the alternating corrugations.

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 into approximately 5” wide panels. The sheet foam should be sized to leave a 1/4” wide gap on both sides to be air sealed with spray foam. See chart below for the amount of 3/4” sheet foam required when using LowPro in an alternating pattern.

3/4” Sheet Foam Required per Container (LowPro in every other corrugation - ~16” pieces)	
Container Size	# of 4’x8’ Sheet
20’ Std Side Walls	6
20’ HC Side Walls	6.67
40’ Std Side Walls	14
40’ HC Side Walls	15.33
End Wall Std	1.33
End Wall HC	1.5

Place PL Premium horizontally and spray foam along the edges.

To prepare the surface of the container for the sheet foam, apply a horizontal 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.

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. To allow for spray foam at the top, cut the inserts and foam board ¼” short. This gap allows for a continuous bead of sealant along top edge of the inserts and foam board to prevent water from infiltrating behind the panels.

Insert approximately 16” sheet foam between the LowPro Inserts.

Use approximately 5” wide sheet foam when installed in every corrugation.

End Walls: Flat Panels + Inserts

The end wall of the shipping container is insulated with End Wall Inserts and then covered with 2.0 or 2.5 Flat Panels. These panels are 48” x 24” and are installed on end (vertically) so that the studs run horizontally across the corrugations. The goal is to provide as much contact between the studs and steel in order to maximize the holding power of the studs.

If the side wall panels have been installed first, follow the illustrations noted below.

Another option is to install the End Wall Inserts and Flat Panels first, before the side walls. In this case, the flat panels need to be installed all the way into the corner. Then the side wall pieces will be trimmed to fit against the end wall flat panels. This will require strips of 1-1/2” sheet foam to fill in the corner.

Adhesive on insert.

Installing End Wall Inserts

Run an “S” shaped bead of adhesive along the length of the insert and press into the corrugated space of the shipping container’s end wall.

Fill corner void

Use 1-1/2” pieces of scrap InSoFast panels to fill void in the corner.

Fill the corner with foam.

Installing Flat Panels

Start with a continuous bead of spray foam along the bottom of the end wall of the container.

Add a bead of adhesive along the corner where the first row of panels meet the corner of the container.

You may want to trim the end of the bottom Flat Panel to “move” the stud down closer to the floor allowing baseboard to be attached. The trimmed off piece can be used at the top if needed.

For a standard 8’ high container, the panels can be installed in a stacked method or a running bond pattern. The running bond pattern works better to eliminate waste on a 9’ high container. Use the cut off end of the top panel to start the next column.

On the back of the panel, run a 3/8" bead of adhesive along the back of each stud.

Seal the gaps at the tops and edges of the corners with spray foam.

Running bond pattern vertically.

End Walls: CX LowPro

The LowPro End Wall Inserts have a recess stud which is not visible on the surface. There are indicator lines on the front face to show where the stud is located. Longer screws will be required when installing finishes.

Follow instructions for LowPro Side Wall Installation found on pages 9 and 10.

Fill the void in the corners with sheet foam.

The End Wall installation is like the Side Wall.

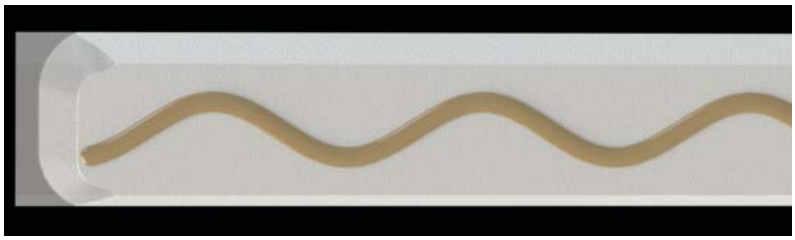
Ceiling Installation

The ceiling of the shipping container is insulated with Ceiling Inserts and 2.0 or 2.5 Flat Panels. The Flat Panels are 48” x 24”.

Install Ceiling Inserts

The Ceiling Inserts will need to be trimmed to fit the rounded ends of the corrugation. Use a long snap off blade utility knife with a sawing motion.

Run an “S” shaped bead of adhesive along the length of the insert and press into the corrugated space of the shipping container’s ceiling.



Trim ceiling inserts. Apply adhesive.

Spray Foam Sets Quickly Reducing Bracing Time

We recommend installing the Flat Panels with the embedded studs running perpendicular to a shipping containers corrugated rib. Two panels will cover the width of the container with the ends trimmed off each panel.

The goal is to provide as much contact between the studs and steel in order to maximize the holding power of the studs. The running bond pattern is not required on the ceiling.

To keep the studs centered in the container, trim off the ends of both panels.

Important: In addition to the generous 3/8” bead of adhesive on the ribbed surface of each stud, add a 3/4” to 1” bead of spray foam along each side of the stud directly to the foam panel. The spray foam cures faster than the adhesive allowing the floor to ceiling braces to be removed sooner.

Do no use window and door spray foam as it does not have sufficient holding power.

Do not block the electrical raceways with spray foam if you place to run electrical wiring in the ceiling.

WARNING: Do not apply any finishes until the adhesive has fully cured. Wait a minimum of seven days before applying finishes to the ceiling panels.

Installing the ceiling panels.

Bracing the Ceiling

The Flat Panels installed on the ceiling will need to be braced until the adhesive has set.

Installing the side wall panels first enables you to shim the panels up in place at the edges. This eliminates the need for additional bracing along the ends of the panels in the corners.

Use 1” material or scrap foam as shims. This eliminates a row of bracing on each side. Before shimming, make sure that the side wall panel’s adhesive is set.

The shims are removed after the adhesive has set. After installing all utilities, fill the gap with spray foam.

Install blocks or shims to hold panel in place around perimeter.

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 temperatures or low humidity will increase the cure time needed.

“T” bracing is installed every 4’ - Don’t pound into place.

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 2.0 or 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 as well.

Install cavity insulation.

Another option is it add insulation in the roof system in addition to the interior InSoFast ceiling system.

2x4 framework for allows for additional insulation.

Installing Flat Panels on the Floor

The floor of the shipping container is insulated with the 2.0 or 2.5 Flat Panels. These panels are 48” x 24” and are installed in a running bond pattern.

Most floor installation can be done using the “floating” method without any adhesive.

An alternative method is to bond the panels in place to the container with a 3/8" bead of adhesive along dove-tailed ribbing of each stud.

Allow time for the adhesive to set before walking on the panels.

Install Flat Panels in a running bond pattern.

Installing Subfloor

Install subfloor sheets with a gap for expansion.

Attach subfloor to studs with Backer-On screws or cement board screws that have nubs near the head so that the screws heads set flush with the subfloor. If using all purpose construction screws, it may be necessary to apply additional force when recessing the heads of the screw.

When panels are installed as a “floating” floor, it is important to layout the subfloor sheets so that the long seam (the length) of the subfloor does not line up with the seams in the InSoFast panels. The short seams (the end) should land over the top of a stud so they can be screwed in place.

Make sure the long seam of the plywood does not line up with the InSoFast panels.

Note: Adhesive does not bond to the 1-1/2” wide flat faced surface of the front of the InSoFast stud. If the subfloor needs to be bonded to the InSoFast panels, apply adhesive directly on the foam of the panel not the front face of the stud.

Backer-On Screws.

Insulating the Underside of container

InSoFast does not provide any insulation panels to effectively cover the underside of the shipping container. Due to the thermal bridging of the container’s steel beams, insulating underneath the container has an effective R-value that is typically 50% less than insulation installed on top of the floor.

Insulating the Inside of Swing Doors

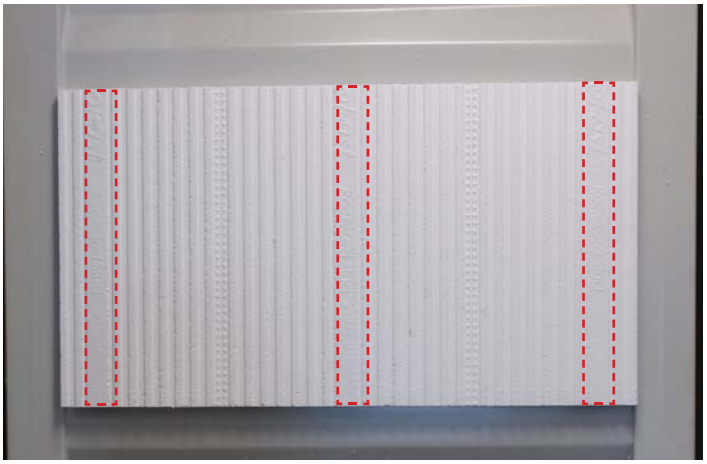
Before starting

There are many styles of shipping container doors and just as many ways to insulate them. Shown here is how to use the 2.5 Flat Panel to insulate this door. A 10” table saw is recommended.

The EX Series panels are 2-1/2” thick and will stick out past the door frame. Additional insulation will be added over the door frame to make a flush surface.

Cutting Panels to Width

The EX panel is 48” long. You will need to cut the center pieces 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. Make sure that the three studs in the panel are centered in the opening.



Center the panel in the door.

InSoFast is used for the middle and sheet foam for the pink areas.

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 25º.

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

Optional: Cutting out for the Rails

Measure the depth of the top and bottom rails which are about 1-1/2” 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.

Press the panel against the rail.

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.

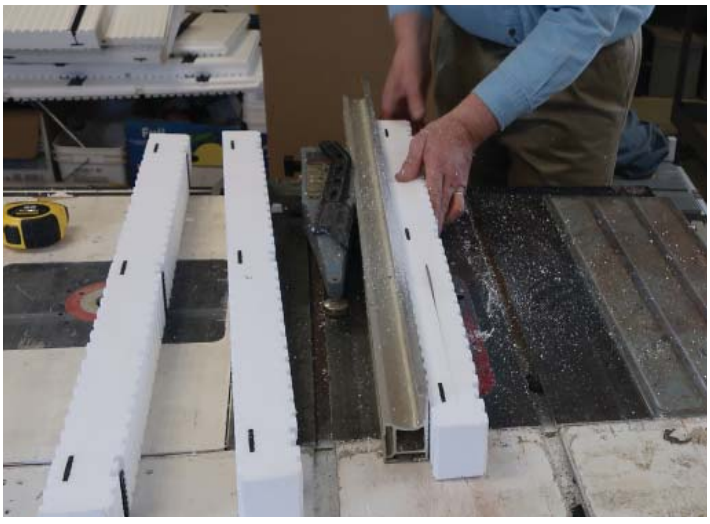
Foam is removed to accommodate the rail.

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 scrap 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

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.

Use plenty of adhesive on the doors.

3/4” foam on the vertical rails.

Nailing on cedar siding.

Hanging Cabinets and Connecting Interior Partition Walls

Prior to fastening cabinets or other heavy objects to the InSoFast studs, verify that the adhesive has fully cured.

Cabinets and shelving can be attached to the InSoFast studs using cabinet screws or fasteners for wood. When additional support is needed, recessed 1x3 material can be glued into the foam of the panels. Another method for attaching cabinets is to use plywood in place of drywall where the cabinets will be located. This spreads out the attachment load to multiple studs.

Interior Partition walls are generally adhered directly to the InSoFast panels using PL Premium. The recessed method can also be utilized.

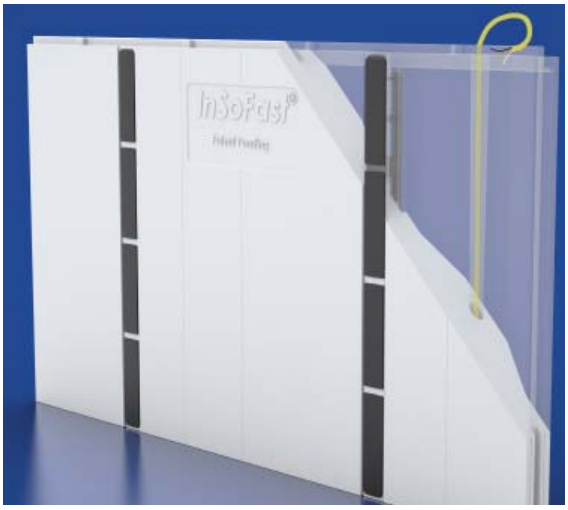
Attachment blocks for a small vanity cabinet.

Use PL Premium to glue the blocks in place.

Interior wall glued to panels.

Electrical Installation

The Flat Panels and CX 44 panels have built in horizontal and vertical raceways, meeting the national electrical code depth requirements for Romex. All raceways are referenced on the front face of the panels.



CX 44 Panel has horizontal and vertical raceways in the panel.

The LowPro Inserts do not have built in raceways. Conduit will be required for horizontal runs. Vertical runs can be cut in with a hot knife into the Side Wall Insert that is in the corrugations.

Running wires through a shipping container is no different than running wires through steel studs. 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. Colored electrical tape was used to layout the electrical runs before any foam was cut.


Cutting out using hot knife with sled attachment.


Bend over the tip of with wire when pushing through.

Steps for Electrical Installation:

- Cut out for the boxes.
- Run wires through the raceways.
- Wire can be pushed or slid through raceways if the wire is straight and untwisted.
- Use adhesive to secure the boxes in place.
- The electrical boxes can be adhered or mechanically attached. Ceiling fans will require mechanical attachment to the container. Verify with electrical inspector for local code requirement.
- Use spray foam to cover the wiring and fill the opening. This satisfies the code requirement for wire attachment coming out of the box.


Face mount electrical box makes installation easier.


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. Make sure that the wire is tucked backed against the container. Save this piece to glue back in after your inspection or fill with spray foam.

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 1-1/4" back from the face otherwise a metal protection plate is required.

Cutting out raceway intersection.

Cutting out for round outlet box.

Running wiring down the wall.

Running wire around the corner requires an access hole.

No protective nail plate required provided the wire is a minimum of 1-1/4" back from the surface of the foam.

Plumbing Installation

Waste lines and especially water supply lines should be located on the interior walls in cold climates. A hot knife is a great tool for quickly removing the foam without the mess.

When using the CX 44 panel or the Flat Panel with Inserts, 1-1/2" and 2" waste pipes can be located in the thicker part of the foam located in the corrugation. 1-1/2" waste pipes can also run horizontally anywhere in the panel. Larger waste pipes will need to be boxed out.

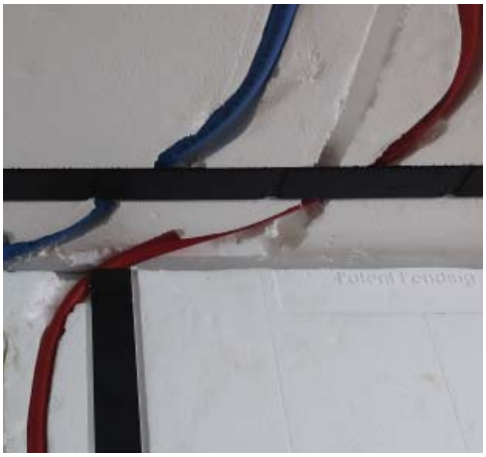
When running waste pipes through the floor and ceiling, avoid cutting the structural beams of the side of the container as well as in the floor system.

In mild climates, water lines must 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 infiltration.

Pipes Running from Wall to Ceiling

Supply lines can be run from the wall to the ceiling. See photo below for the transition of the Pex pipes around a corner.

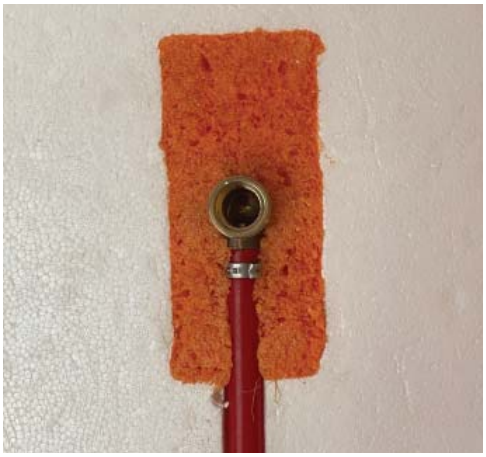
Use protection plates where necessary.



Pex pipe can go around a corner without kinking.

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

Use recessed 1x3 to secure shower plumbing.



Spray foam trimmed.

Sealing all Gaps and Cracks

After utilities have been installed, seal all gaps and openings.

- Along ceiling edge
- In corners
- Along floor
- Around electrical outlets
- Around window/door openings
- All penetrations

Spray foam in corners to prevent air movement.

Interior Finishes

Installing 48” Wide Sheet Goods

Use a hot knife to cut out for 1x3.

Shipping container have corrugations that are typically 11” o.c. The CX 44 panel was designed to fit those corrugations and so the panel has the length of 44”. While that works perfectly in the container, it does pose some challenges when using 48” wide sheet goods such as drywall, FRP board, and other paneling.

Options when using CX 44 Panels or LowPro Inserts on side walls with vertical studs 22” o.c.:

- Float the 48” seam with additional adhesive
- Cut down sheets to 44” o.c.
- Install recessed furring strips into the foam panel at seam of finishes
  - Cut out foam using hot knife
  - Install 1x3 boards with adhesive
- Install horizontal furring strips to the InSoFast Studs

Benefits of Solid Backing

Install drywall using standard drywall screws for wood.

It is not necessary to trim the drywall or other sheet goods to land directly on the InSoFast studs. The solid backing of the panels allow the seams to “float” between the studs. Where two sheets meet, apply a bead of adhesive along both sides of the seams to bond to the panels. Remove any excess adhesive immediately.

Drywall can also be installed vertically to eliminate butt seams. This requires the “floating” method mentioned above for the tapered edge seams.

At times, the seams will not be perfectly flush with each other. To avoid temporary bracing of the seam, press the seam down so both sides are flush. Partially drive a drywall screw between the sheets so that the threads act as a wedge. Keep in place until the adhesive has set. See website for more information on drywall and finishes.

Adding Insulation to the Top of the Container Roof

One of the most cost-effective ways to add insulation on top of the container is with conventional roof framing and blown in or batt insulation using a hurricane truss anchor.

For application that utilize metal roofing or pole barn tin, frame up the roof system trusses or rafters up to 8 feet on center with 2x4 purlins. Both of these systems give the ability to add proper overhangs that extend out past the exterior side wall insulation.

Hurricane anchor to attach roof to container.

When using conventional trusses or rafters, layout a 2x4 plate with 2’ o.c. truss or rafter locations. The 2x4 will lay flat on the top of each side of the container and may be notched at the corner blocks.

Pre-fasten all the hurricane anchors to the side of the single 2x4 top plate at all the rafter locations. The hurricane anchor will hang down approximately 1-1/2” below the plate for easy fastening to the side of the steel container.

Set the 2x4 plates with the hurricane straps on the top of the container using PL Premium adhesive. Fasten the hurricane anchors to the side of the container with drill tip self-tapping tech screws at each location. Drop in and fasten conventional roof trusses, rafters or floor joists into the pockets of the hurricane anchors.

Exterior Applications

Siding - Claddings

The InSoFast family of products are very adaptable to virtually any type of cladding. See www.insofast.com for technical details on siding attachment. InSoFast panels have a code compliant rating to support up to 2" thick adhered cultured stone. Refer to the finish manufacturer's installation instructions for fastener size and spacing.

Fastener Selection

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

If a nail gun is used to install the siding, it is only recommended when temperatures are above 50° 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.

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 panels around any penetrations, leaving a 1/4" gap. Fill the gap between the penetrations and the InSoFast panel with a foam sealant.

It is important to apply a continuous bead of foam sealant that seals the top of the wall insulation to the container. This improves performance by eliminating air movement behind a container. Properly detail the roof and siding connection by providing flashing that extends over panels and siding.

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

Architectural Build Outs

The following pictures show how the InSoFast panels can accommodate special architectural details that require boxing out or connecting between multiple types of claddings.

Below 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.

Insulating the Beam along the Bottom of a Container

Container beam locations and style vary with manufacturer. Both of these options below utilize long drill-tip self-tapping screws for steel that fasten through the wood and foam insulation into the steel beam.

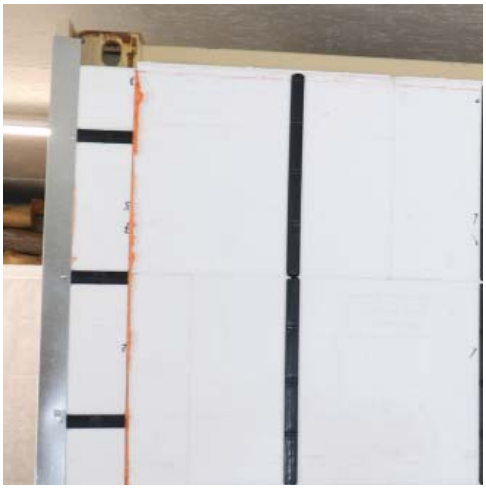
Option one for insulating and furring out the beam.

Option two for insulating and furring out the beam.

Nail or screw on horizontal siding.

Install a metal flashing at the underside of the container to cover any exposed wood foam along the bottom of the container.

Bottom flashing installed over the WRB to cover foam.



Metal flashing installed for added attachment.

Corner Board Installation

For easy attachment at corners, install a metal flashing approximately 1-1/2” wider than the corner board.

The far right photo shows how the 2.0 Flat Panel was applied vertically to the corner beam of the container to provide better attachment for the metal flashing.

Vertical Siding

Installing vertical siding is no different than conventional framed walls. It is necessary to fasten wood furring strips horizontally over the InSoFast panels.

Raw steel was added on lower part of wall.

Vertical siding is nailed to wood furring strips.

Finished corner.

Adding Insulation for Higher R-Values

To obtain higher R-Values, additional sheet foam can be use over any of the InSo-Fast Systems.

LowPro Plus with 4' x 8' sheet foam

Adding Sheet Foam for more R-Value

Sheet foam with a thickness of up to 1-1/2" can be easily tacked in place before installing finishes. When the foam exceed 1-1/2", building codes require that the drywall or siding be fastened directly to furring strips. Furring strips are applied over the foam board with #9 or larger coarse thread screws that penetrate a minimum of 1/2" into the face of the InSoFast stud. The drywall or siding is then attached directly to the furring strips. See the image at bottom middle.

Fasten additional sheet foam over top of the finished InSoFast wall assembly using plastic foam board washers and screws into the InSoFast studs. Allow the adhesive of the assembly to set up before continuing with additional sheet foam. Make sure to mark the stud location as the sheet foam is being installed to make installing drywall or siding easier. Only use enough fasteners to hold the sheet foam in place until the interior finishes or siding is attached through the sheet foam to the InSoFast studs.

LowPro Plus Method #2

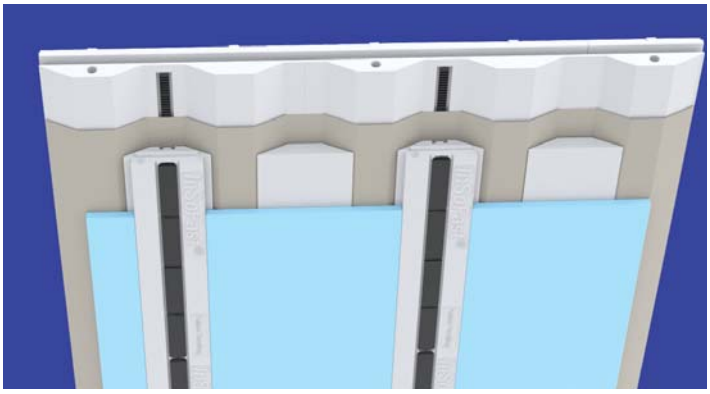
Alternate Method for LowPro

Instead of using multiple layers of foam, this method uses a single 16" wide piece of 1-1/2" foam between the LowPro stud inserts instead of the 3/4" sheet foam. Then strips of ¾" foam are installed on top of the LowPro Insert. There is no need to mark stud locations as they are centered between the strips.

Use spray foam to seal all of the gaps.

Calculations for Interior and Exterior R-Value

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



Interior and Exterior Side Walls

Rain Screen Assemblies for Exterior Applications

For applications requiring rain screen, wood furring strips can be 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

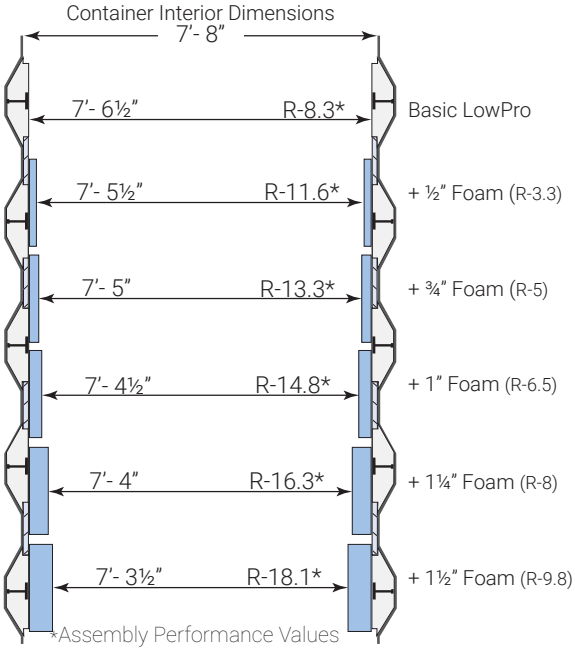
Interior & Exterior Wall Assembly R-Value	
Component	R-Value
Interior Air Film	.68
1/2" Drywall	.45
CX 44 Panel	11.0
Container Sidewall	0
LowPro Basic	7.0
Exterior Air Film	.17
Assembly R-Value*	R-19.3
Add R-Value of Exterior Cladding	

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
½" 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	

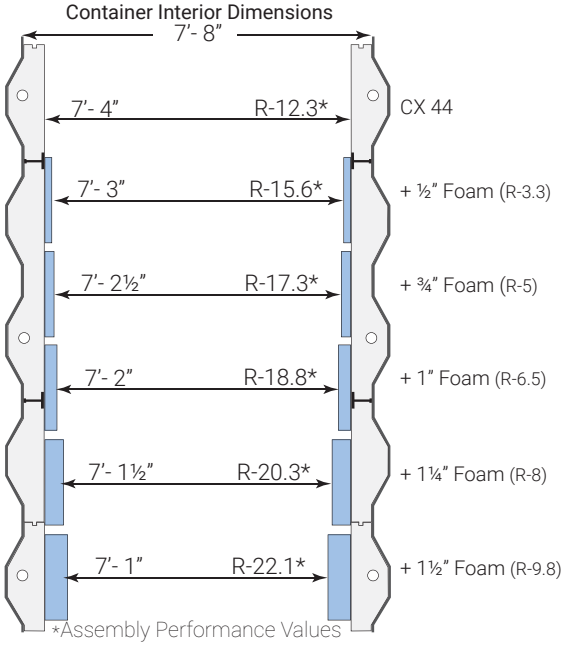
Sheet foam R-Values vary by manufacturer. Examples shown use polyiso foam. Verify manufacturer's specifications.

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 or 2.0 Flat Panels with Inserts

CX 44

CX 44 Plus



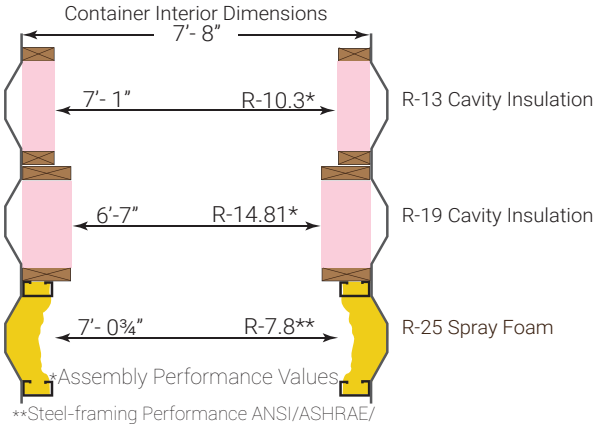
CX 44 Wall Assembly R-Value	
Component	R-Value
Interior Air Film	.68
½" Drywall	.45
CX 44 Panel	11.0
Container Sidewall	0
Exterior Air Film	.17
Assembly R-Value*	R-12.3
Add R-Value of Additional Foam	

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.

Wood and Steel Framing 16" o.c.

Wood Framing



**Steel-framing Performance ANSI/ASHRAE/ IESNA Standard 90.1-2007 Table A9.2B

2x4 Framing with R-13 Wall Assembly R-Value		
Component	Framing R-Value	Cavity R-Value
Interior Air Film	.68	.68
½" 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

Shipping Container Insulation Bundle Parts

Insulating a shipping container utilizes many different InSoFast Panels and Inserts. This information helps to sort out the boxes that have been received. InSoFast has products are used across the construction industry in many different applications and may be labeled differently.

Side Wall Options

CX-44 Bundle: CON-SWCX

=

● CX-44 Panel

● Side Wall Bundles: CX-44		
Container Size	One Side Wall	Two Side Walls
20' Standard	4.5*	9
20' High Cube	5	10
40' Standard	9	18
40' High Cube	10	20

* Half boxes are not available - estimating purposes only

Flat Panels over Inserts Bundle: CON-SWUX

=

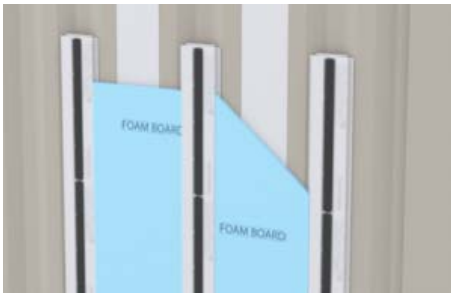
● 2.0 Flat Panel

+

● Side Wall Inserts

Flat Panels + Side Wall Inserts		
Container Size	One Side Wall	Two Side Walls
20' Standard	● 4 + ● 2	● 8 + ● 3
20' High Cube	● 5 + ● 2	● 9 + ● 4
40' Standard	● 8 + ● 3	● 16 + ● 6
40' High Cube	● 9 + ● 4	● 18 + ● 7

LowPro Insert Bundle: CON-SWLP



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● LowPro Inserts Qty:46

⛀ LowPro Inserts Qty:15

+

● Side Wall Inserts

LowPro SW Inserts + Side Wall Inserts		
Container Size	One Side Wall	Two Side Walls
20' Standard	● 1 + ● 1	● 2 + ● 2
20' High Cube	● 1+ ⛀ 1+ ● 1	● 2 + ● 2
40' Standard	● 2 + ● 2	● 4 + ● 3
40' High Cube	● 2+ ⛀ 1+ ● 2	● 4+ ⛀ 1+ ● 3

Swing Doors

Swing Door Bundle: CONDOOR

=

● 2.5 Flat Panel RW

Swing Doors	One Door	Two Doors
2.5 Panels ●	1	2

End Wall Options

End Wall Bundle: CON-EW

=

2.0 Flat Panel

+

End Wall Inserts

End Wall Bundle	Standard	High Cube
End Wall Inserts	1	1
2.0 Flat Panels	2	2

LowPro End Wall Kit: CX-LPEW

=

LowPro End Wall Kit

LowPro End Wall	Standard	High Cube
End Wall Kit	1	1

Ceiling

Ceiling Bundle: CONCEIL

=

2.0 Flat Panel

+

Ceiling Inserts

Ceiling Bundle	20’	40’
Ceiling Inserts	1	2
2.0 Flat Panels	4	8

Floor

Floor Bundle: CONFLOOR

=

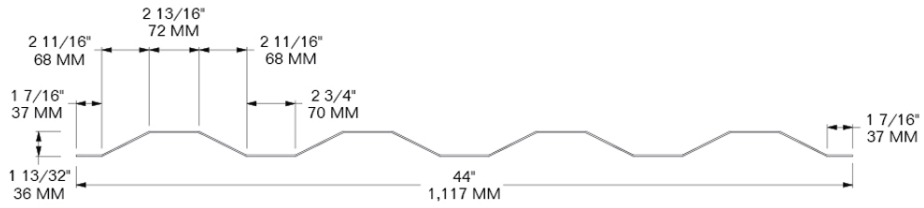
2.0 Flat Panel

Floor Bundle	20’	40’
2.0 Flat Panels	4	8

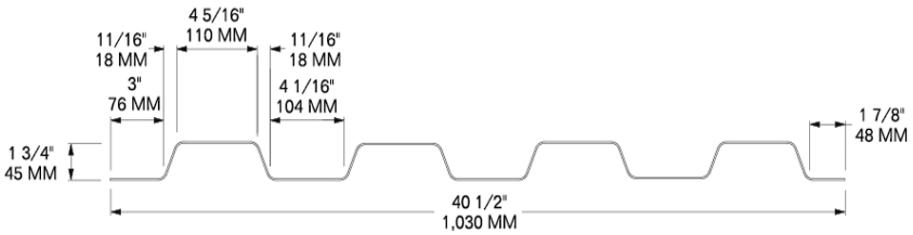
Container Specifications

The InSoFast family of products are designed to fit most shipping containers. Containers typically have three different types of corrugations: side wall, end wall, and ceiling. Refer to the container diagrams below to determine if the InSoFast products will fit your container's corrugations. Older or modified containers may have different corrugation sizes.

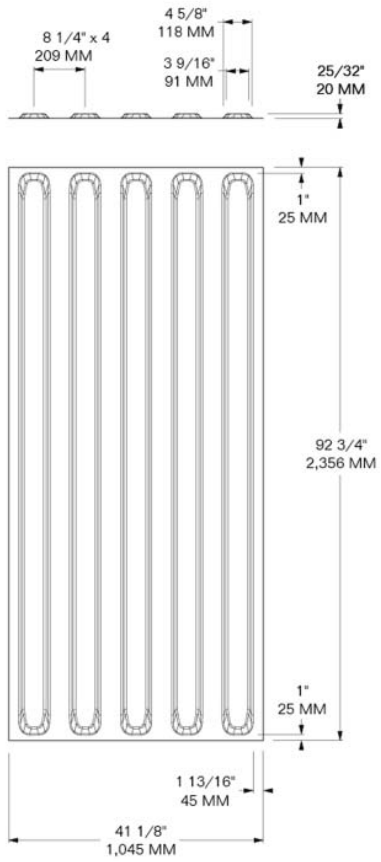
CX 44, LowPro SW, and Side Wall Inserts are design to fit this side wall corrugation



LowPro EW and End Wall Inserts are designed to fit this end wall corrugation



Ceiling Inserts are designed to fit this ceiling corrugation



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Made in USA · US Patent No. 8,635,824 · CA Patent No. 2,761,810 · US & Foreign Patent Pending