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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.

**Install the LowPro Stud Inserts**

Apply a 3/8" bead of PL Premium 3x Construction Adhesive horizontally across the top 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 first row.

**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 Sheet Foam Between the LowPro Stud Inserts

When LowPro inserts are installed in an alternating pattern, cut the sheet foam in 16” wide panels. If the LowPro is installed in every corrugation, cut the sheet foam in 5” wide panels. Leave a ¼” wide gap to fill with spray foam.

To prepare the surface for the sheet foam, apply a bead of PL Premium 3x near the bottom, in the middle, and at the top of the sheet foam. 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 it is important to seal the insulation system at the top of the wall. Cut the inserts and foam board to allow for a continuous bead of sealant along top edge of the inserts and foam board.
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. Apply additional sheet foam over top of the finished LowPro wall by using plastic capped nails or screws into the LowPro studs. Make sure to mark the stud location as the sheet foam in installed. Only use enough fasteners to hold the sheet foam in place until the siding is installed.

**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.

<table>
<thead>
<tr>
<th>Interior &amp; Exterior Wall Assembly R-Value</th>
<th>Component</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Air Film</td>
<td>.68</td>
<td></td>
</tr>
<tr>
<td>½” Drywall</td>
<td>.45</td>
<td></td>
</tr>
<tr>
<td>CX 44 Panel</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>Container Sidewall</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>LowPro Basic</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>Exterior Air Film</td>
<td>.17</td>
<td></td>
</tr>
<tr>
<td><strong>Assembly R-Value</strong></td>
<td><strong>R-19.3</strong></td>
<td></td>
</tr>
</tbody>
</table>

Add R-Value of Exterior Cladding

**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.
R-Value vs Space - Evaluating your Project’s Insulation Requirements

### LowPro Basic Plus Additional Sheet Foam

<table>
<thead>
<tr>
<th>Container Interior Dimensions</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>7'- 8&quot;</td>
<td></td>
</tr>
</tbody>
</table>

- **Basic LowPro**
  - 7'- 6½" * R-8.3*
  - 7'- 5½" * R-11.6*
  - 7'- 5" * R-13.3*

- **Add R-Value of Additional Foam**
  - + ½" Foam (R-3.3) * R-15.6*
  - + ¾" Foam (R-5) * R-17.3*
  - + 1½" Foam (R-9.8) * R-22.1*

*Assembly Performance Values*

### CX 44 Panel Plus Additional Sheet Foam

<table>
<thead>
<tr>
<th>Container Interior Dimensions</th>
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</tr>
</thead>
<tbody>
<tr>
<td>7'- 8&quot;</td>
<td></td>
</tr>
</tbody>
</table>

- **CX 44**
  - 7'- 4" * R-12.3*
  - 7'- 3" * R-15.6*
  - 7'- 2½" * R-17.3*
  - 7'- 2" * R-18.8*
  - 7'- 1½" * R-20.3*
  - 7'- 1" * R-22.1*

- **Add R-Value of Additional Foam**
  - + ½" Foam (R-3.3) * R-15.6*
  - + ¾" Foam (R-5) * R-17.3*
  - + 1½" Foam (R-9.8) * R-22.1*

*Assembly Performance Values*

### Wood and Steel Framing 16” o.c.

<table>
<thead>
<tr>
<th>Container Interior Dimensions</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>7'- 8&quot;</td>
<td></td>
</tr>
</tbody>
</table>

- **2x4 Framing with R-13 Wall Assembly**
  - R-13 Cavity Insulation
    - 7'- 0¾" * R-7.8**
  - R-19 Cavity Insulation
    - 6'-7" * R-14.81*
  - R-25 Spray Foam
    - 7'- 1" * R-10.3*

**Assembly Performance R-Value* R-10.3

---

\*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.

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### LowPro Basic Wall Assembly R-Value

<table>
<thead>
<tr>
<th>Component</th>
<th>R-Value</th>
</tr>
</thead>
</table>

- **Interior Air Film** 68
- **½" Drywall** 45
- **LowPro Basic** 7.0
- **Container Sidewall** 0
- **Exterior Air Film** 17

**Assembly R-Value* R-8.3

### CX 44 Wall Assembly R-Value

<table>
<thead>
<tr>
<th>Component</th>
<th>R-Value</th>
</tr>
</thead>
</table>

- **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

### 2x4 Framing with R-13 Wall Assembly R-Value

<table>
<thead>
<tr>
<th>Component</th>
<th>Framing R-Value</th>
<th>Cavity R-Value</th>
</tr>
</thead>
</table>

- **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

**Assembly Performance R-Value* R-10.3

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**Steel-framing Performance ANSI/ASHRAE/IESNA Standard 90.1–2007 Table A9.2B**
End Wall - Nose Corner Detail
Install CX 44 side wall panels before the end wall.

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 InSoFast panels, sheet foam, or spray foam.

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 block the panels up in place at the edges. This eliminates a row of bracing on each side.

The blocking is 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 at least seven days. Low temperature or low humidity will increase the cure time needed.

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.

### Ceiling Assembly R-Values

<table>
<thead>
<tr>
<th>InSoFast UX 2.0</th>
<th>InSoFast UX 2.0</th>
<th>InSoFast UX 2.0</th>
<th>InSoFast UX 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-13</td>
<td>R-15</td>
<td>R-30</td>
<td>R-49</td>
</tr>
<tr>
<td>U-Factor 0.092</td>
<td>U-Factor 0.078</td>
<td>U-Factor 0.035</td>
<td>U-Factor 0.025</td>
</tr>
</tbody>
</table>

2x4 framework for additional insulation.
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 EXe 2.5 panel is 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.

First you need to gather all of the critical measurements of the door.

Cutting Panels to Width - Blue
The EXe 2.5 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. Save the scrap pieces off the ends for the PINK area.

Cutting the Panels to Height - Blue
When measuring the bottom panel, include the angled part in the measurement as shown with the BLUE dotted line. Save the scrap to fill in between the panels - GREEN area.

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 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.

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.

Filling between the Panels - GREEN

Using the scrap pieces, cut the foam to the correct height to fit between panels. Cut the pieces down to the proper thickness to cover the exposed rib of the door which is about 1”.

Measure for the thickness needed.

Drill out the foam where the fastener heads are located.

Cut down to the stud face is the usable part.
Cutting Vertical Side Pieces - PINK

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 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.
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.
Electrical Installation

The CX 44 panel has built in horizontal and vertical raceways, meeting the national electrical code for Romex without protection plates.

LowPro is of sufficient depth to conceal ½” conduit.

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. There are no safety issues with running Romex in direct contact with the steel container walls provided it is grounded.

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.
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 1-¼" 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.
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 are rated for up to 2” thick adhered stone or brick. 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 may require a WRB. Tape and seal seams as necessary.

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.
**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 2x can be screwed to horizontal beam with self taping screws for steel.

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

**Corner boards**

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

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

Cold Weather Installation

PL Premium 3x

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.

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.

Interior Installation

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

Interior and Exterior Installation

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

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