



1. Introduction

The ENERGY™ Curb mounting system is a lightweight, nonpenetrating, roof-integrated, photovoltaic (PV) mounting system designed to maintain roof integrity and maximize power density.

This application guide describes standard procedures for installing the ENERGY Curb mounting system on TPO single ply membrane roofs and has been prepared for:

- The roofing mechanic
- The solar mechanic

JM recognizes that the success and long-term performance of our mounting system depends upon the personal skill, experience and knowledge of the mechanic performing the application.

How to Use This Guide

This guide is divided into four sections:

1. Introduction
2. Parts List and Required Tools
3. Installation Procedure
 - Step 1 – Array Layout
 - Step 2 – Roof Cleaning
 - Step 3 – TPO Membrane Attachment
 - Step 4 – Peel-and-Stick Tape Attachment
 - Step 5 – PV Module Attachment
 - Step 6 – Wire Duct Attachment

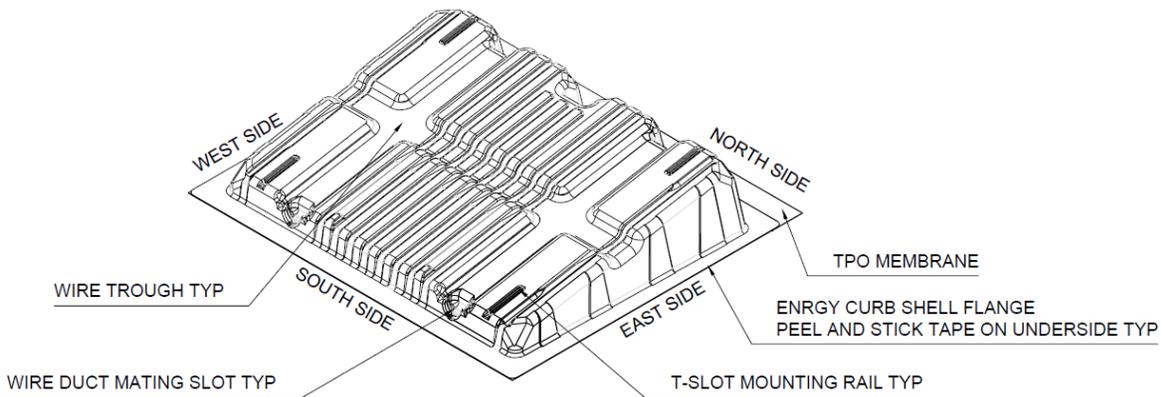
4. Delivery, Storage and Handling

This guide is designed for your convenience. These step-by-step instructions and illustrations should answer your installation questions and help you maintain top-quality craftsmanship when applying the ENERGY Curb mounting system.

2. Parts List and Required Tools

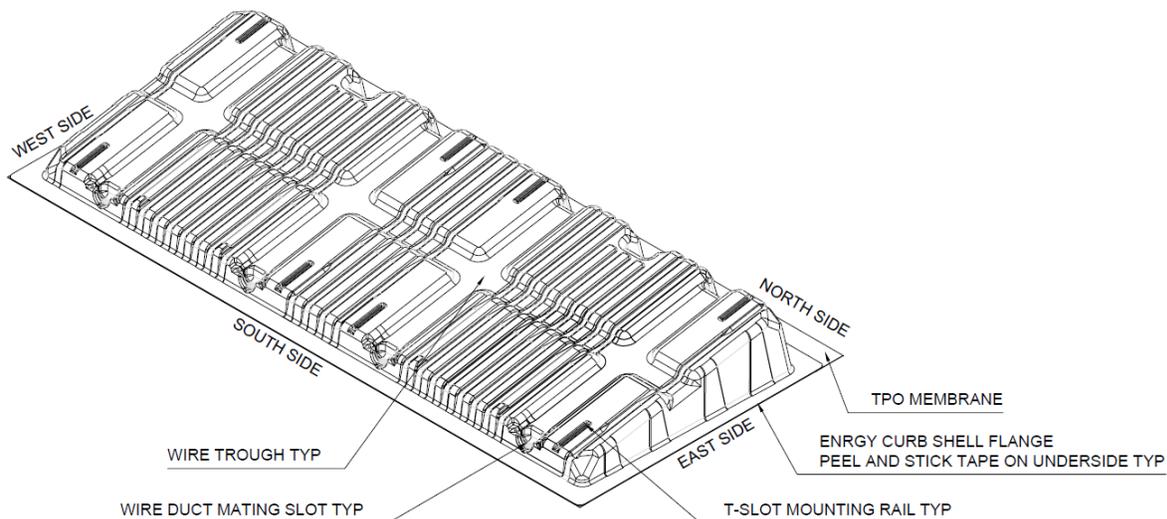
ENRGY Curb TPO 10-01:

- Fixed at 10-degree tilt
- Mounts one PV module
- Includes factory-molded aluminum mounting rails; accommodates ¼" (6 mm) hex bolt
- Includes factory-welded TPO membrane on the north side
- Includes factory-adhered peel-and-stick tape on the west, south and east sides



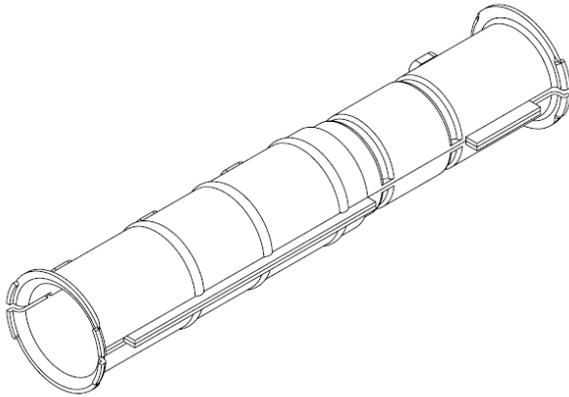
ENRGY Curb TPO 10-02:

- Fixed at 10-degree tilt
- Mounts two PV modules
- Includes factory-molded aluminum mounting rails; accommodates ¼" (6 mm) hex bolt
- Includes factory-welded TPO membrane on the north side
- Includes factory-adhered peel-and-stick tape on the west, south and east sides



Wire Duct Accessory

- Consists of two mating parts
- The Wire Duct comes in two different telescoping lengths:
 - Wire Duct 13: Two pieces mate and telescope from 11" to 15" (27.94 cm to 38.1 cm) long
 - Wire Duct 16: Two pieces mate and telescope from 14" to 18" (35.56 cm to 45.72 cm) long



Hardware Kit

- Bonding, stainless steel, PV module end clamp
- Stainless steel ¼" (6 mm)-20 x 1½" (3.81 cm) hex bolt
- Stainless steel ¼" (6 mm)-20 hex nut
- Stainless steel lock washer



Required Tools

- Machine hot air welder
- Hand-held hot air welder
- 10-lb (4.54 kg) weighted roller
- 7/16" (11 mm) wrench or socket

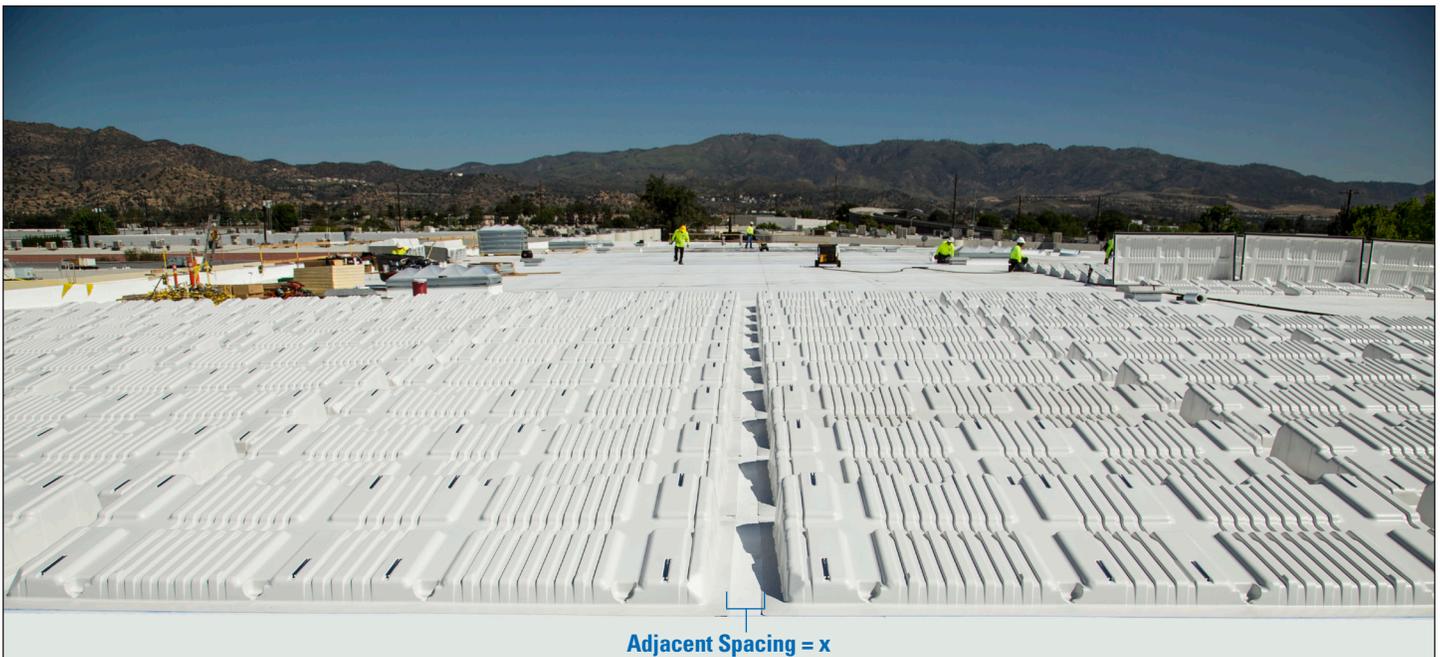
3. Installation Procedure

Step 1 – Array Layout

Utilize design documents provided by a design professional to ensure compliance with all applicable building codes.

Referencing an array layout, mark the installation areas using a chalk line or similar method. Roof areas where hot air welding and application of peel-and-stick tape are to occur should be clearly marked for cleaning.

The spacing between adjacent ENERGY Curb units varies depending on PV module length. For adjacent unit spacing please use the following table (assumes a minimum of ¼" (6 mm) spacing from PV module to PV module).



X Array

The following table and figure can be used to correspond equivalent ENERGY Curb spacing to PV-module-to-PV-module spacing (assumes a 39" (1.0 m) PV module width fixed at a 10-degree tilt). The south side flange of the northern ENERGY Curb can lap over the south curb's TPO membrane to achieve the desired inter-row spacing.

Module Length	ENERGY Curb Adjacent Spacing, X
> 62.5" (1.59 m)	0"
62.5" to 63" (1.59 m to 1.6 m)	0.75" (1.9 cm)
63" to 63.5" (1.6 m to 1.61 m)	1.75" (4.45 cm)
63.5" to 64" (1.61 m to 1.63 m)	2.75" (6.99 cm)
64" to 64.5" (1.63 m to 1.64 m)	3.75" (9.53 cm)
64.5" to 65" (1.64 m to 1.65 m)	4.75" (12.07 cm)
65" to 65.5" (1.65 m to 1.66 m)	5.75" (14.61 cm)
65.5" to 66" (1.66 m to 1.68 m)	6.75" (17.15 cm)



Y Array

The inter-row spacing between ENRGY Curb units varies depending on the latitude/location of the project and the desired unshaded operational window throughout the year. Please consult a design professional for optimal inter-row spacing and shading on your project.

Step 2 – Roof Cleaning

Roof preparation and surface cleaning are extremely important for proper application of the ENRGY Curb system. Roof areas that are to receive the ENRGY Curb units should be clean and clear of all debris. General cleaning of the roof with a push broom or power washer is recommended before the start of any job. Areas where hot air welding and application of peel-and-stick tape are to occur should be cleaned using the following procedures and products:

Clean and remove all dirt and contaminants from the surface of the membrane using JM TPO Membrane Cleaner. Apply cleaner to a clean, natural fiber rag and remove contaminants by using a scrubbing motion. Change rags frequently. Allow the membrane to dry thoroughly prior to hot air welding or application of peel-and-stick tape.

Precautions

Membrane cleaner is extremely flammable and must be kept away from heat, sparks and flame. Use only in well-ventilated areas. Close containers after use. May cause possible skin irritation; use chemically resistant gloves when using this product. Keep out of reach of children.

Refer to the Material Safety Data Sheet prior to using JM TPO Membrane Cleaner. Material Safety Data Sheet is available by calling (800) 922-5922 or on the Web at www.jm.com/roofing.

ENERGY Curb Inter-Row Spacing, Y	PV-Module-to-PV-Module Inter-Row Spacing
0 (Flanges butted to each other)	15.5" (39.37 cm)
1" (2.54 cm)	16.5" (41.91 cm)
2" (5.08 cm)	17.5" (44.45 cm)
4" (10.16 cm)	19.5" (49.53 cm)
6" (15.24 cm)	21.5" (54.61 cm)
8" (20.32 cm)	23.5" (56.69 cm)



Step 3 – TPO Membrane Attachment

Stage and layout the first continuous row of ENRGY Curb units according to the marked areas on the roof. Check that all of the units are aligned and correctly placed before running the machine hot air welder.

The ENRGY Curb installation methods described begin with the south row of the array and progress north to ensure proper spacing for the machine hot air welder. Please contact the JM solar team for alternative methods or sequencing.

Using the machine hot air welder, weld the ENRGY Curb TPO Membrane on the north side of the unit to the top of the roofing system. A hand-held welder is recommended for all corners. Once the north side is completely welded, the units will be fixed to the roofing system.

Refer to the following welding procedures below for recommended methods:

Welding should be performed in temperatures above 50°F (10°C) to ensure high quality welds.

How Hot Air Welding Works

Hot air welding works by applying very hot air to the membrane surfaces, softening and fusing the surfaces together, thereby creating a permanently fused, bonded sheet. One of the major advantages of hot air welding is the fact that the seam comes to full weld strength immediately.

Machine Hot Air Welding

Large, robotic hot air welders are used for high-speed hot air welding of membrane seams. A variable speed control for the electric motor lets you adjust the machine's travel speed along the seam. Movement of the welder along the seam is determined by heat setting based on air temperature.

To hot air weld, dial in the desired temperature and speed and insert the nozzle fully into the 2" (5.08 cm) weld zone, and raise the back wheel to allow the machine to ride on its two drive wheels.

To steer the machine along the seam, use the welder's guide wheel. Watch the guide closely to make sure the machine stays on line.

Surface irregularities can cause the pressure wheel to move slightly away from the seam. If this happens, tap lightly on the machine's upper handle to maintain travel in a straight line. Consult the manufacturer of the hot air welder for specific recommendations.

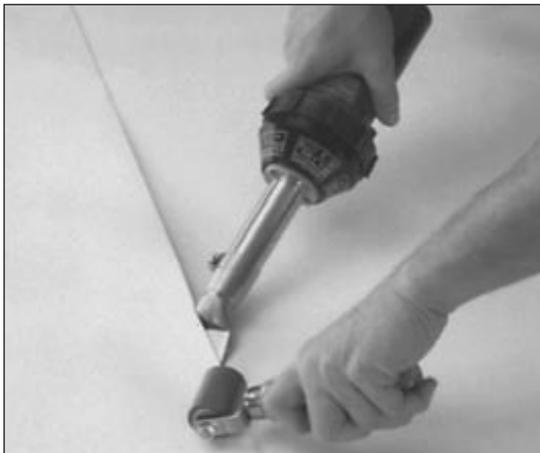
As the hot air nozzle moves along the weld area, a wide drive wheel behind the nozzle applies immediate and uniform pressure to the heated area. The drive wheel presses the heated seam area together. Check all machine hot air-welded seams for voids, and patch with JM TPO Membrane and a hand-held hot air welder. Always run several test welds with the machine each time you begin welding and/or if the machine has been shut down for any length of time.

With either this method or the method below, perform a 4' or 5' (1.22 m or 1.52 m) test weld before beginning each day's application and any time the hot air welder has been turned off for any length of time. This checks peel strength, consistency, weld width, etc., and allows for welder adjustments.

Hand-held Hot Air Welding

A hand-held hot air welder is especially useful when welding membrane corners. Hand-held hot air welders are also used to weld membrane sections together.

First, adjust the temperature of the hot air welder to produce a shiny membrane surface without burning the membrane. Fully insert the tip of the hot air welder into the seam, moving it slowly backwards. As the membrane softens, press the membrane surfaces together with a roller from the inside edge to the outside edge of the seam. Take care to produce a continuous weld with no air pockets.



Repairing Scorched Membranes

If the membrane surface is overheated, a good weld cannot be achieved. The burned or discolored membrane must be patched.

To repair a burned section, cut away the damaged material at least 1" (2.54 cm) beyond the burned edges. Patches should be cut to extend at least 3" (7.62 cm) beyond all damaged edges. Allow for a minimum 1½" (3.81 cm) weld width on all sides.

Center the patch over the cut area and weld to the membrane, using normal welding procedures. Cut all patches in a square or rectangular shape with round corners for a neat, finished roof appearance.



Testing Seams

Hot air-welded seams may be tested as soon as the seams cool. After welding, carefully test every seam along its entire length. Do this by running a blunted scratch awl, cotter key puller, or other round tipped, blunted tool along the seam edge while applying firm, steady pressure. It is imperative to avoid scoring the membrane that has just been welded. Any penetration of the probe into the seam indicates a void in the weld, which must be patched. Continuous seam probing will tend to sharpen the tip of the probe, so it is important to blunt the tip of the probe regularly.

Test all welded seams for integrity and continuity before the end of each work day. In addition to probing, take seam samples to verify seam quality as necessary.

Cut the samples across the seam 6" (15.24 cm) on each side of the seam and 2" (5.08 cm) wide. Peel these samples by hand to test seam strength. Good seams will be virtually impossible to peel and should delaminate the JM TPO film from the reinforcing scrim. Cut and test a minimum of three seam samples each day—in the morning, at noon and at day's end. Take additional test cuts when weather conditions change or after work interruptions when the machine hot air welder has been shut off.

Step 4 – Peel-and-Stick Tape Attachment

Using the welded north side of the ENERGY Curb as a hinge, expose the underside of the unit by lifting the south side. Peel-and-stick tape is factory applied on the underside of the east, west and south side flanges. Remove the release liner on the tape to expose the adhesive.



Carefully lower the ENERGY Curb unit back into position on the roofing surface and use a 10 lb (4.54 kg) weighted roller to apply pressure to the topside of the flanges.



ENERGY Curbs in the field or north row of an array may overlap the neighboring south curb's TPO membrane depending on the inter-row spacing. Ensure the top surface of the ENERGY Curb's TPO membrane is properly cleaned before the peel-and-stick tape is overlapped. Tape application should be performed in temperatures above 50°F (10°C) to ensure best results.

Step 5 – PV Module Attachment

Module stops are standard on all ENERGY Curb units and are located on the south edge of the curb. PV modules can be temporarily held in place by the module stops to assist with cable connections and organization before the bonding module end clamps are installed.



Bonding module end clamps are manufactured with mechanisms that electrically bond the PV module frame and the T-slot mounting rail. The end clamps pierce the anodized layer of the PV module frame and provide a tight connection bonding the dead metals.

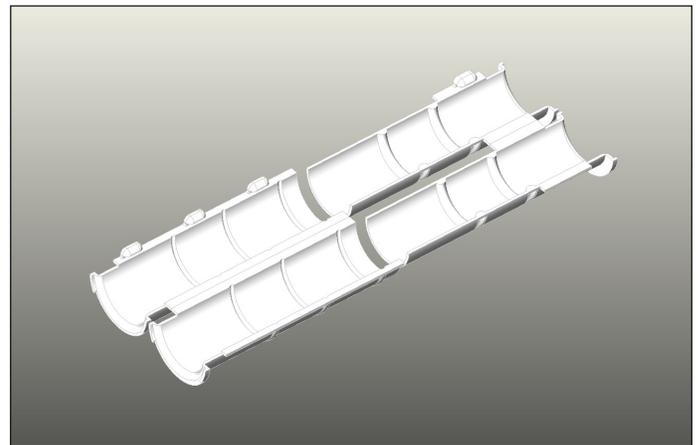
To increase ease of installation, it is recommended to preassemble the bonding module end clamps and mounting hardware. Insert a hex bolt up through the hole in the foot of the end clamp, with the bolt head under the clamp. Slide a lock washer onto the bolt and screw on a nut. Only use a few turns to screw the nut. To install the end clamp, hold the preassembled hardware with the bolt head extending below the end clamp. Insert the bolt head into the end of a T-slot and slide the assembly snug up against the module frame. Finger-tighten the nut. Repeat at the other three (3) T-slots. When all clamps are in place and the module position is finalized, tighten each nut.



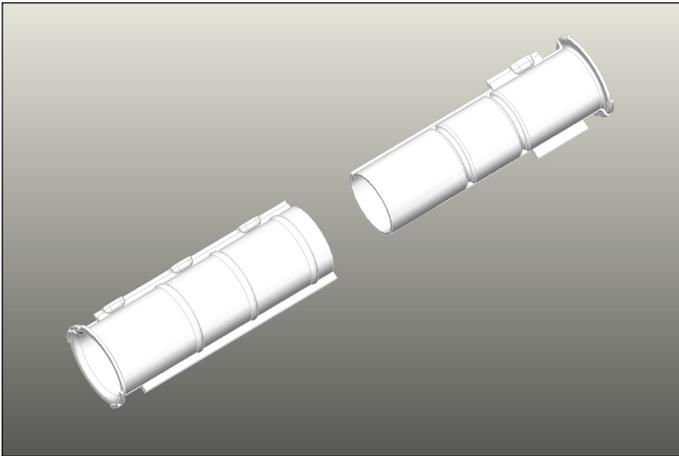
Step 6 – Wire Duct Attachment

The Wire Duct is an ENRGY Curb accessory used for inter-row wire management and protection. The Wire Duct is shipped in two components that must be folded and connected together before installation to the ENRGY Curbs.

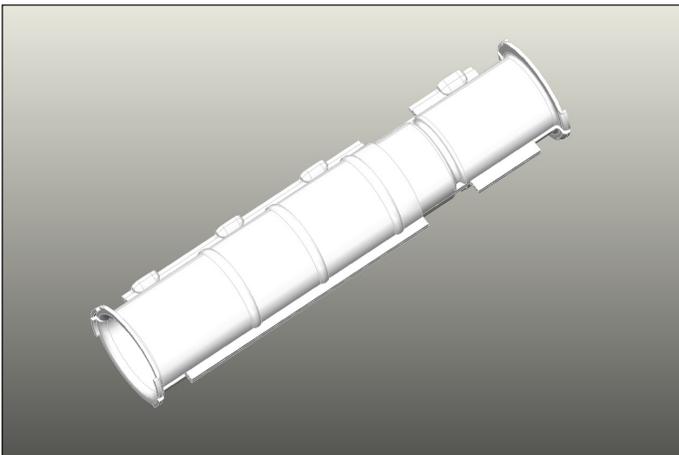
There are two sizes available to accommodate varying inter-row spacing, the Wire Duct 13 and the Wire Duct 16. The Wire Duct 13 has a telescoping range of 11" to 15" (27.94 cm to 38.1 cm) and the Wire Duct 16 has a telescoping range of 14" to 18" (35.56 cm to 45.72 cm) The Wire Duct 13 can handle ENRGY Curb inter-row spacing of 0" to 4" (0 cm to 10.16 cm) and the Wire Duct 15 can handle ENRGY Curb inter-row spacing of 4" to 8" (10.16 cm to 20.32 cm) (Refer to array layout steps for proper inter-row spacing.)



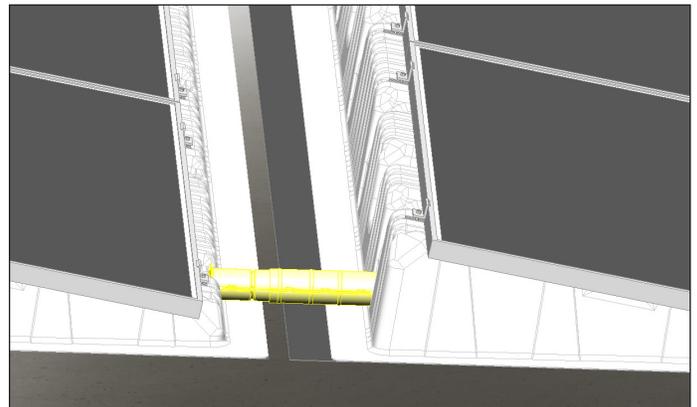
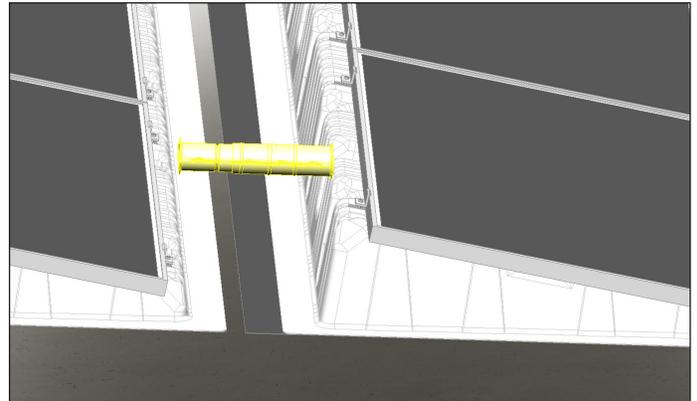
Take each wire duct component and fold along the hinge or connected edge. Fold until each locking mechanism snaps and engages into place. The locking mechanisms are meant for single use and should not be disconnected once engaged.



Take the two engaged Wire Duct components and connect them together by placing one unit inside the other in a telescoping fashion. Adjust the completed Wire Duct assembly to the appropriate length according to the inter-row spacing for the array.



There are two mating slots on every ENRGY Curb 10-01 and four mating slots on every ENRGY Curb 10-02 that can be utilized. Place the Wire Duct assembly into the mating slots on the south and north edges of the ENRGY Curbs where inter-row wiring is required. Wire Ducts may not be required at all mating slots; please refer to the approved design documents for your wiring layout.



Wire Ducts that are preassembled, as outlined above, will require PV module and source circuit wiring to be connected and run through the completed Wire Duct assembly. Wire Ducts can also be assembled after PV module and source circuit wiring have been connected. This will require the Wire Ducts to be folded and assembled around the completed wire runs and then placed into the mating slots on the ENRGY Curbs.

Ensure that the Wire Duct mating slots on the ENRGY Curbs are aligned during the array layout and attachment steps of the installation.

4. Delivery, Storage and Handling

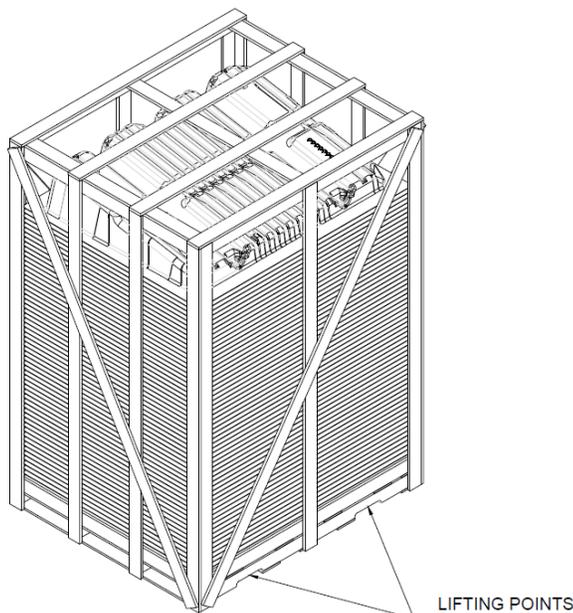
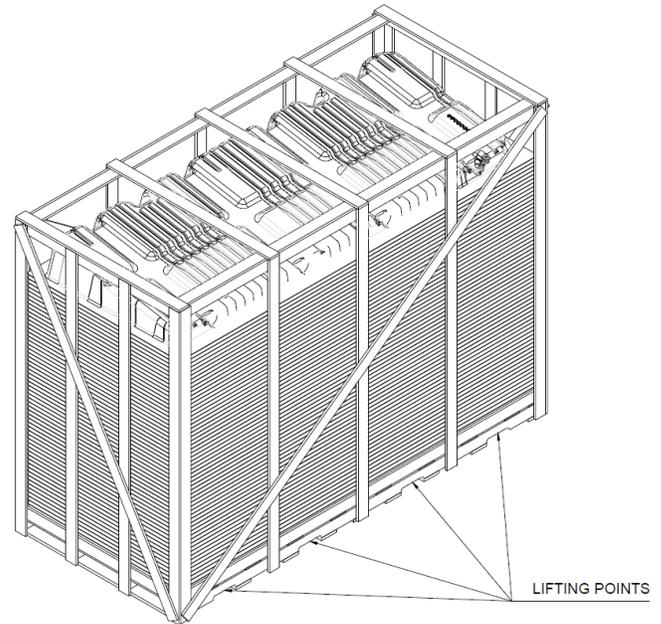
ENERGY Curb units are nested together and crated on wooden pallets. Crates are delivered on flatbed trucks for easy access and unloading. Crates can be lifted to the roof with a forklift, or by crane with lifting straps using the lifting points shown in the illustrations. Care must be taken to ensure the straps do not damage the crate or ENERGY Curb units.

Plywood should be used on the roof for loading and storage areas to support the crates and protect the roofing system. Roof carts with inflatable rubber wheels should be used to transport crates to installation areas on the roof.

ENERGY Curb units are lightweight and can be handled by one to two persons. Unattended units should be secured from wind.

ENERGY Curb TPO 10-01 Pallets

- Maximum of 60 units per pallet
- Dimensions: 4.9' W x 5.9' L x 8' H
(1.49 m W x 1.81 m L x 2.44 m H)
- Weight: 1,140 lb (517.1 kg)



ENERGY Curb TPO 10-02 Pallets

- Maximum of 60 units per pallet
- Dimensions: 4.9' W x 10.9' L x 8' H
(1.49 m W x 3.32 m L x 2.44 m H)
- Weight: 2,150 lb (975.22 kg)

Wire Duct Accessory

- Maximum of 30 units per box
- Dimensions: 28" W x 19" L x 24" H
(71 cm W x 48 cm L x 61 cm H)
- Weight:
 - Wire Duct 13: 28 lb (12.7 kg)
 - Wire Duct 16: 34 lb (15.42 kg)

Hardware Kit

- Bolts: 1.25" x 1/4-20, fully threaded, 316, 308, 18-8 SS
- Nuts: Hex 1/4-20, 316, 308, 18-8 SS
- Washers: 1/4 flat lock, external tooth, 316, 308, 18-8 SS