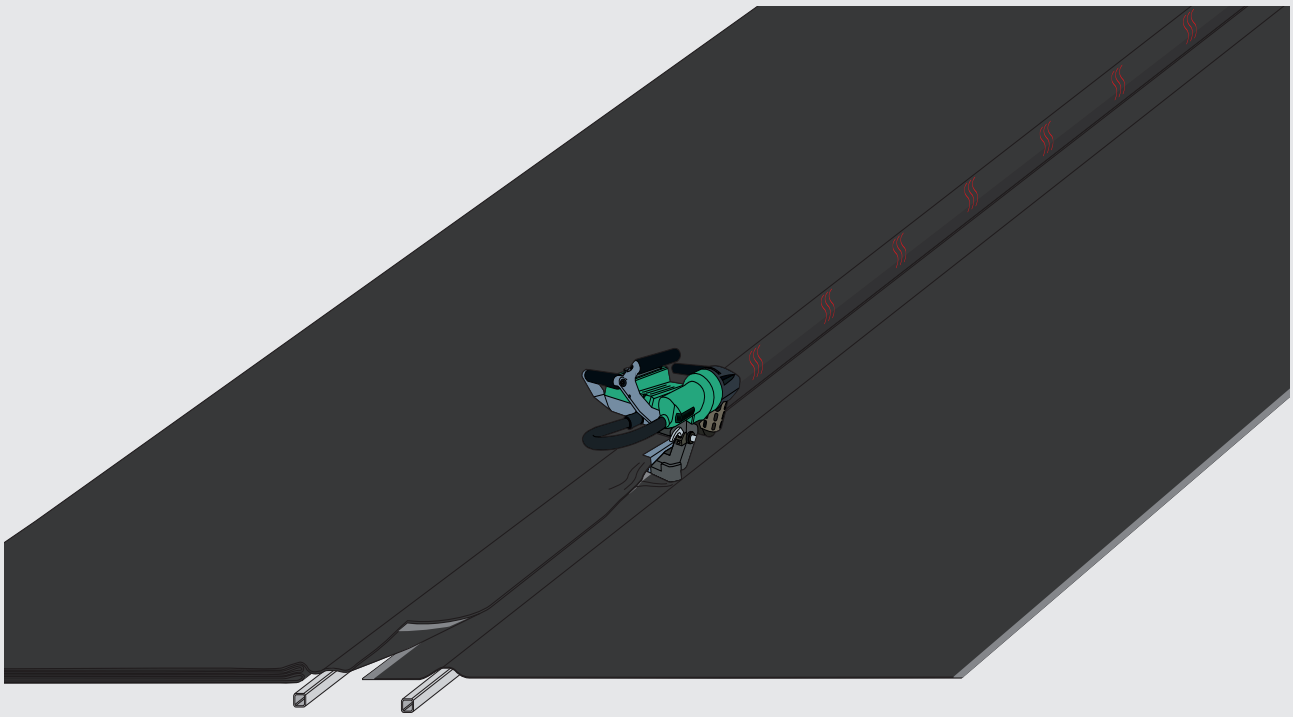
12/2020

Prefabrication Manual

PANELS WITH T-EDGE



A SYSTEM BY SEALECO

Preface

The information in this manual is a guideline to produce prefabricated membranes in a indoor environment. The base for the guideline is many years of practical and design experience obtained by SealEco. Design practice may differ slightly from these specifications and instructions, however the information enclosed should be considered as a general guideline towards the most effective product use and application in a given situation when producing our membranes. Since the handling and installation is beyond our control, SealEco retains no responsibility for these areas. We make every effort to ensure that the information provided in this document is current and accurate. However, errors, misprints, inaccuracies, omissions or other errors may sometimes occur despite our best efforts. SealEco does not warrant that the content of this document including, without limitation, product-/installation descriptions or photographs and illustrations, is accurate or complete. Panels can only be prefabricated after a successful training course. Please contact our technical department.

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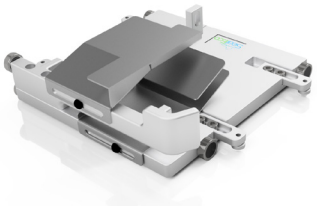
1. Introduction

This manual describes the methods for prefabrication of standard SealEco T-edge EPDM membrane to large panels. The manual constitutes the performance and standard work to be followed by prefabricators approved by SealEco.

2. Tools

Hot-air/wedge Welding Machine	Prefabrication Kit	Hot-air Welding Machine
		
Hot-air Gun + Nozzle 40 mm	Thermobond Splice Strip	Support Strip
		
Hot Melt Sealant	Pressure Roller 50 mm	Pressure Roller 5 mm
		
Guiding Track for Hot-air/wedge Welding Machine	Scissors	Measure Tape, Chalk Line, Mark Pen, Electrical supply (Cables etc.)
		

3. Products

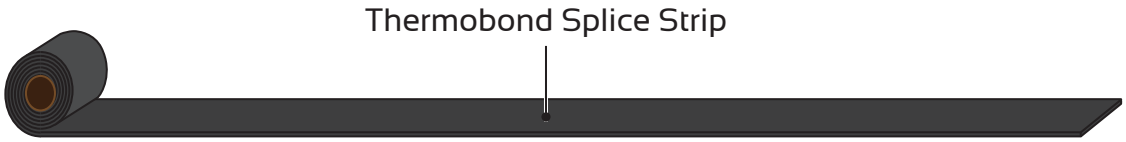
EPDM standard panels with T-edges, Thermobond Splice Strip in width 100 mm and 200 mm, Thermobond Hot Melt Sealant.

3.1 EPDM panel with integrated T-edges, always positioned on the same side of the membrane

Figure 1

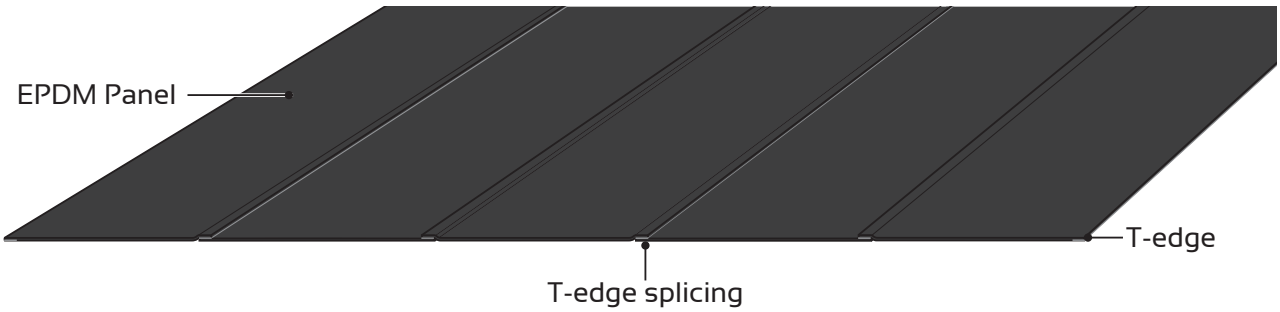
3.2 Thermobond Splice Strip, EPDM membrane fully laminated with Thermobond on one side.

Figure 2



3.3 EPDM standard panel width: 1.70 / 3.36 / 5.02 / 6.68 / 8.34 / 10.00 / 11.66 / 13.32 / 14.98 m x 50 m.

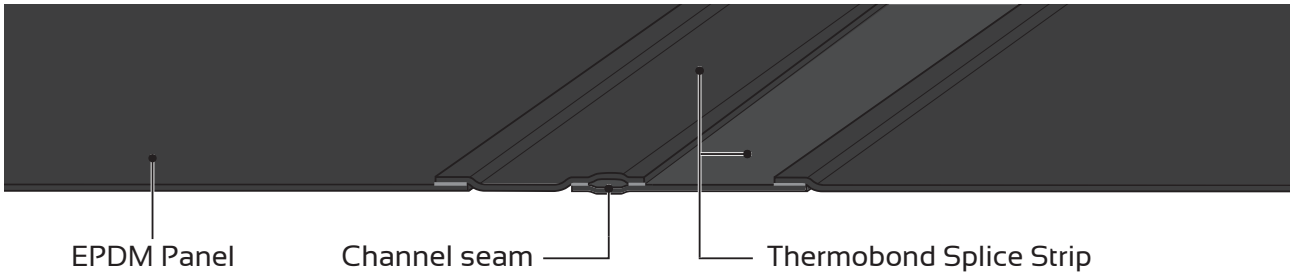
Figure 3



4. Preparation and planning of work

Design each panel and make a panel layout drawing according to project request, utilizing the most beneficial panel width in order to minimize wastage. The design must also take into consideration that T-edge shall be welded to T-edge, although there will be occasions when T-edge shall be welded directly to an EPDM surface, which is allowed. SealEco advices however to weld T-edge to T-edge to increase the efficiency of the welding process. Therefore, it is important that each panel is positioned correctly, meaning T-edge upwards or downwards, when unrolling. The same goes for preparing the end laps of each panel, meaning panel edges that shall be welded to another panel on-site.

Figure 4



Panels that are going to be welded together on-site, must be prepared with a wider pre-applied T-edge for on-site welding. The T-edge for on-site welding consist of the Thermobond Splice Strip in width of 200 mm. Welding on-site is always made T-edge to T-edge. This is also of importance, when planning the design of each panel, meaning T-edge upwards or downwards, when unrolling, since we only want to weld Thermobond to Thermobond.

5. Machine preparations prior welding

5.1 General

To achieve best possible welding result, it is important that the machines are fine-tuned and have the right settings. Temperature, speed and pressure for the actual thickness must be adjusted.
The settings may vary depending on choice of machine, brand, model and surrounding environment.
For more detailed information about each type of machine, please contact SealEco's Application Technician.
Please note, the following settings are only recommendations and each machine and splice needs to be tested by beginning of each shift or if surrounding environment changes drastically, in order to verify that optimal settings are achieved. Keep in mind to allow the splice to cool down before testing.

5.2 Settings

These settings are made during normal indoor climate with a temperature between 10 to 30°C.

5.2.1 Hot-air/wedge Welding Machine, type Leister Twinny T7

- Temperature: 560°C
- Speed: 3.5 - 4.5 m/min; depending on the skills of the prefabricator
- Initial pressure: 130 N
  While operating the machine, the heat will concentrate and pressure will drop. Increase pressure when below 70N.

5.2.2 Hot-air Welding Machine, type Leister Varimat V2

- Temperature: 580°C
- Airflow: 80%
- Speed: 2.7 m/min
- Extra weight: 5.5kg

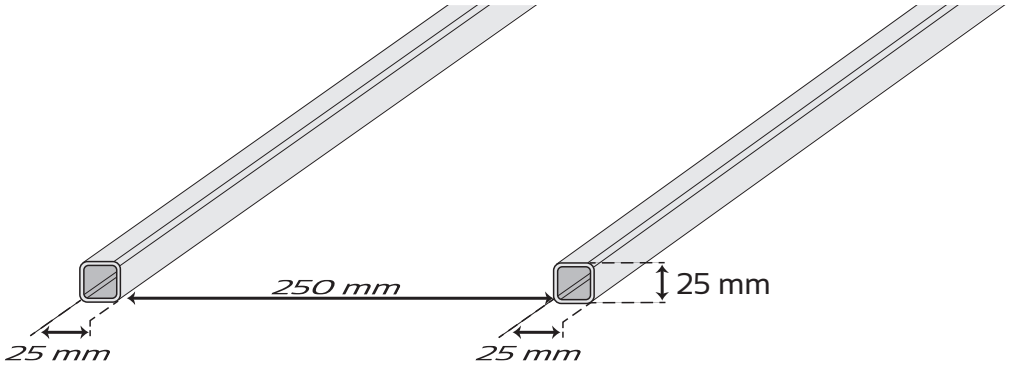
5.2.3 Hot-air Gun, type Leister Triac

- Temperature: 550°C
- Airflow: 100%
- Nozzle width: 40 mm

6. Guiding Track

The Guiding Track is of great importance, since it allows the Hot-air/wedge Welding Machine to run straight and smoothly. There are a lot of different possibilities, when it comes to choosing type of Guiding Track, but the simplest one is made of L- or square shaped metal profiles that are anchored to the floor with a distance in between of 250 mm and a height of 25 mm.

Figure 5



7. General hints during the welding process

Accuracy and planning are the keys to success, if the membrane is positioned straight, flat and with the right overlap, the risk of failure is less, and the operation will be more relaxed. If the membrane is positioned with too large overlap or with too large waves, it could be needed during the welding operation to stretch the membrane in order to allow the Hot-air/wedge Welding Machine to run smoothly.
Visually it could be noticed that the membrane must be stretched slightly, if a larger wave in the membrane is created behind the machine. Waves in the membrane could come from both the upper and the lower membrane and if growing too large, it might end up in the machine to stuck or to separate the membranes with a too small overlap as result. The stretching of the membrane, when machine is welding, can easily be made by pushing the machine slightly backwards, when running.

Figure 6

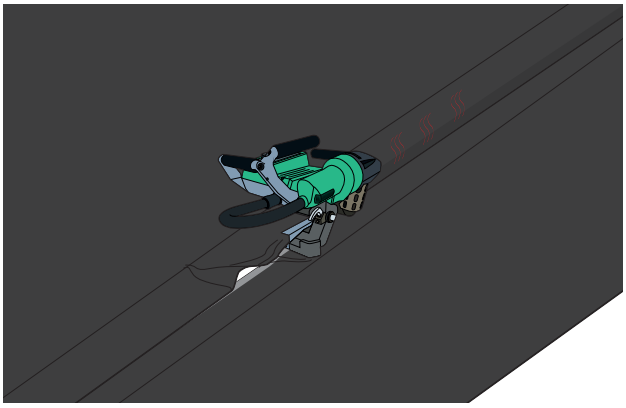
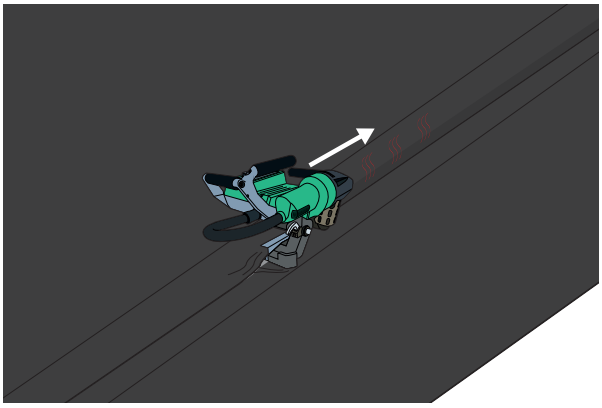
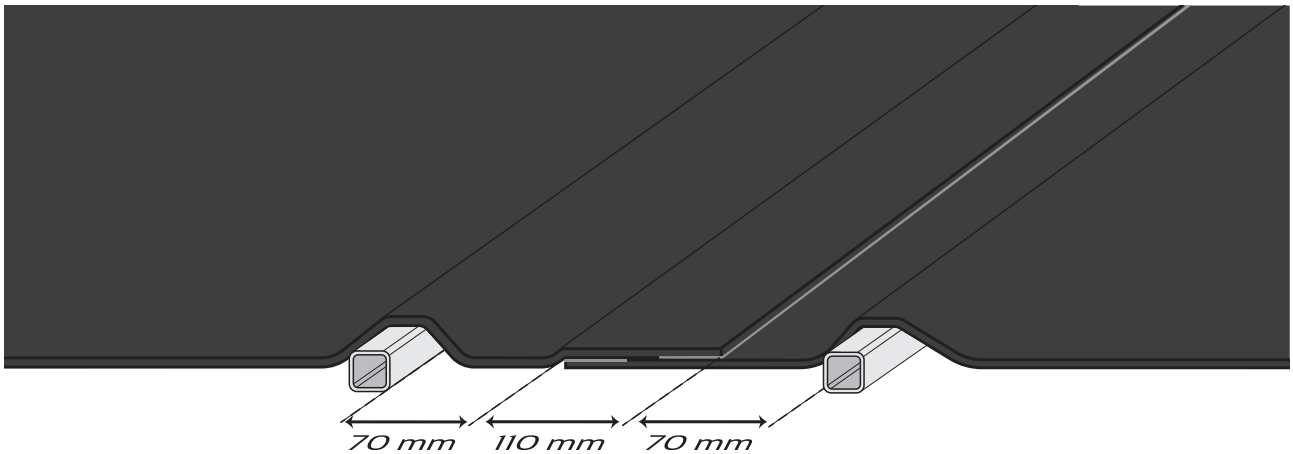


Figure 7



At the start of each splice, it is a risk that the membranes are separating. In order to prevent it happening, it is important that the panels are laying positioned correctly in the Guiding Track and that the panels are slightly stretched along the first 500 mm.
At the end of each splice, it is good to guide the Hot-air/wedge Welding Machine, by steering the membrane by hand and at the same time pull the machine slightly backwards. All this in order to avoid folds or separation of the membranes during the last 500 mm of the splice.

Figure 8

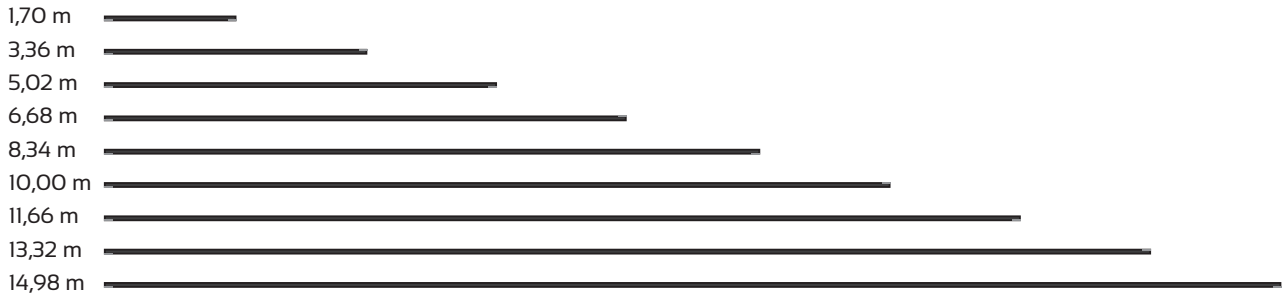


8. Prefab concept with standard panels

4 Note: Example taken is a final panel size of 13.32 m (width) x 50 m (length).

EPDM roll and standard panels are always delivered with T-edges down/down or down/up depending on chosen width, see picture below.

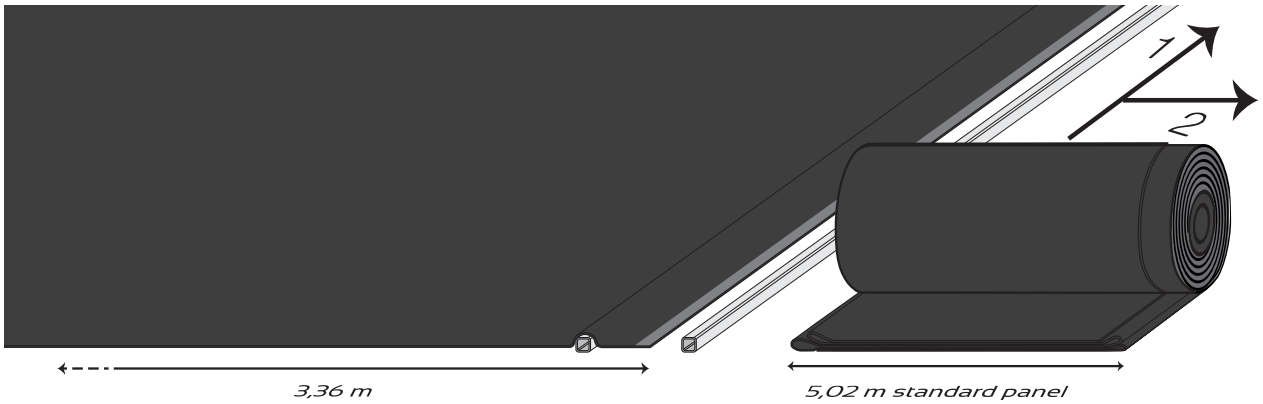
Figure 9



Therefore, it is important to plan how each panel is positioned and how the panel is unrolled, making splicing easy, fast and efficient. The positioning of each panel depends on the T-edges, if it is facing upwards or downwards, when unrolled in the Guiding Track.

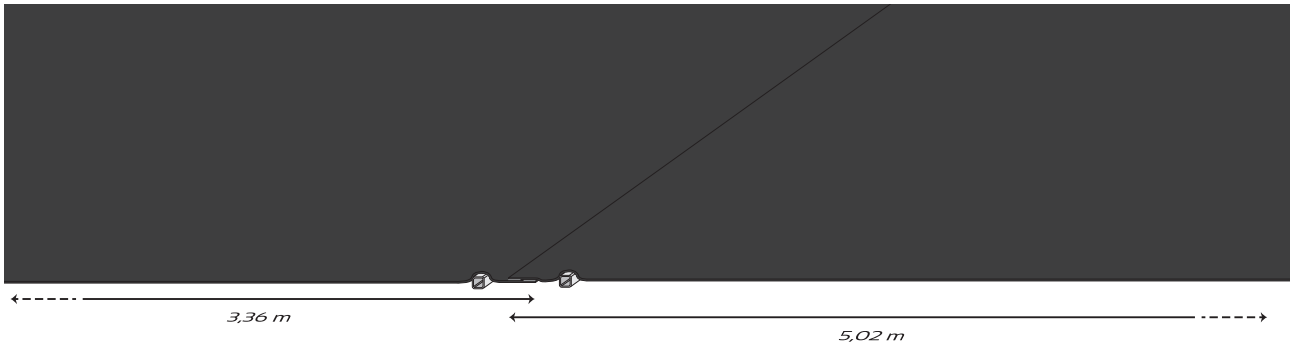
Step 1:
Unroll and position the first panel with the T-edge facing upwards. Place the following panel next to the Guiding Track.

Figure 10



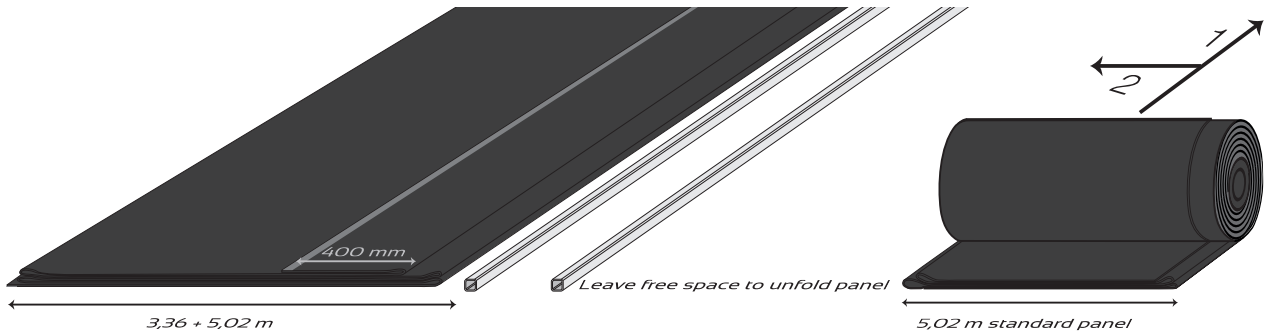
Step 2:
Next panel to be unrolled and positioned with the T-edge facing downwards in the Guiding Track. The overlap shall be 110 mm.
Start welding the panels together.

Figure 11



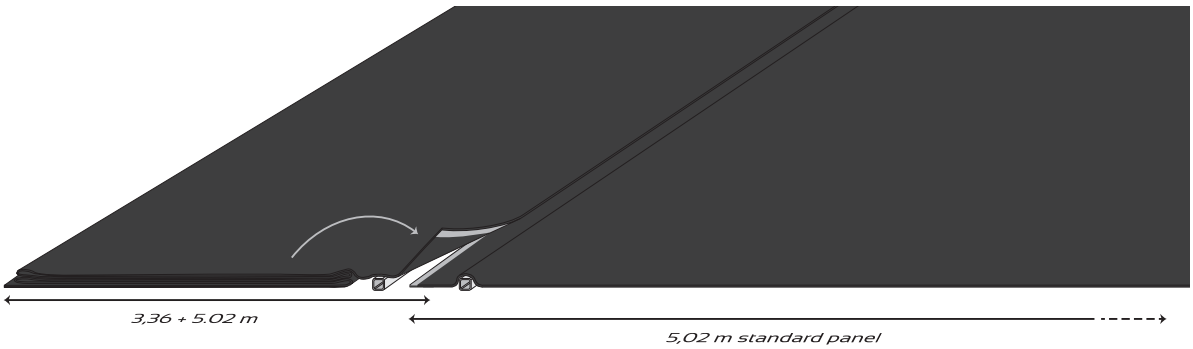
Step 3:
Fold the panel, alternatively move the panel flat to the side in order to free space and be able to use the Guiding Track for a new weld.
The T-edge is now laying in the Guiding Track facing downwards, fold it back 400 mm.
Next panel to be unrolled and positioned with the T-edge facing upwards in the guiding track.

Figure 12



Step 4:
Fold back the T-edge from the left panel. The overlap shall be 110 mm.
Start welding the panels together.

Figure 13

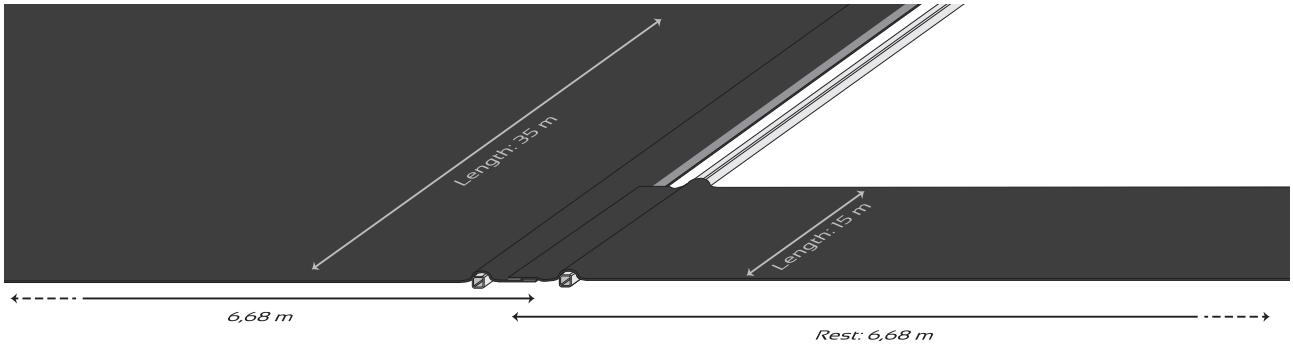


9. Prolongation of panels

4 Example: final panel size 19.96 m (width) x 35 m (length)

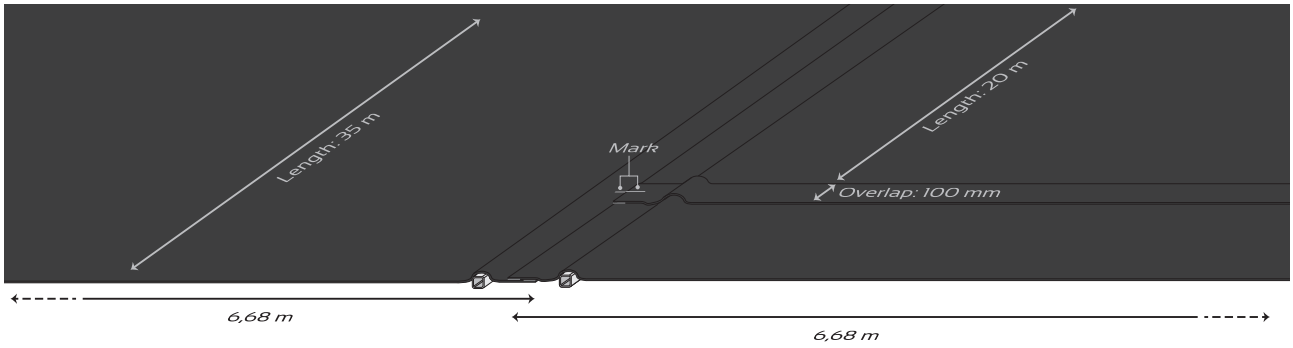
Step 1:
Unroll and position the panel with the T-edge facing upwards in the Guiding Track.
Cut the length to 35 m.
Unroll and position the rest of the panel with the T-edge facing downwards in the Guiding Track.

Figure 14



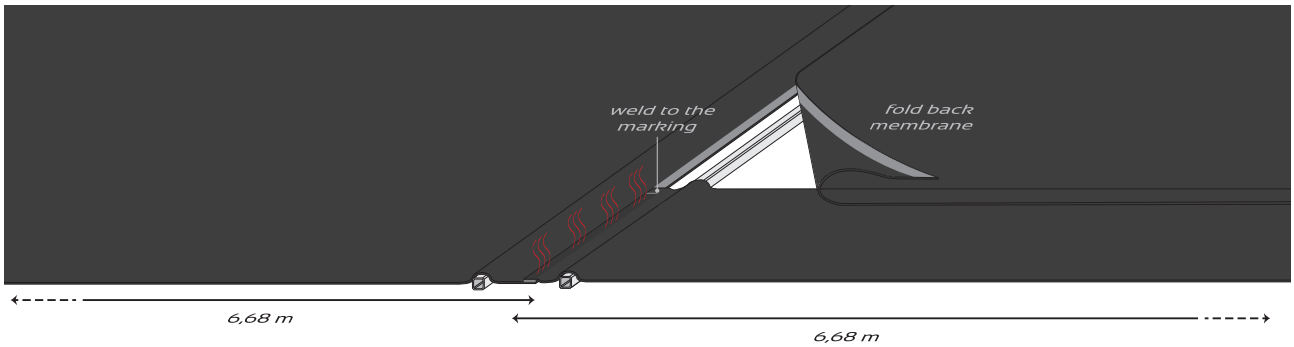
Step 2:
Unroll and position a new panel with the T-edge facing downwards in the Guiding Track.
The panels shall overlap with 100 mm on the transversal (short) side and 110 mm on the long side.
Always unroll and position the panels in right position prior starting any welding. This is important in order to secure enough overlap on the transversal (short) side of the panels. Mark on top of the membrane where the membrane shall be cut to remove excess membrane.

Figure 15



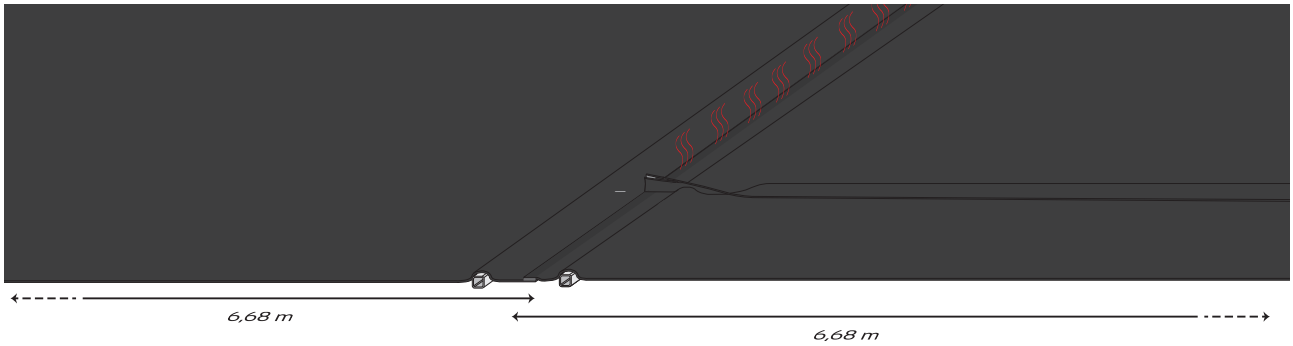
Step 3:
Fold back the corner of the second panel slightly to free some space. Weld to the marking.

Figure 16



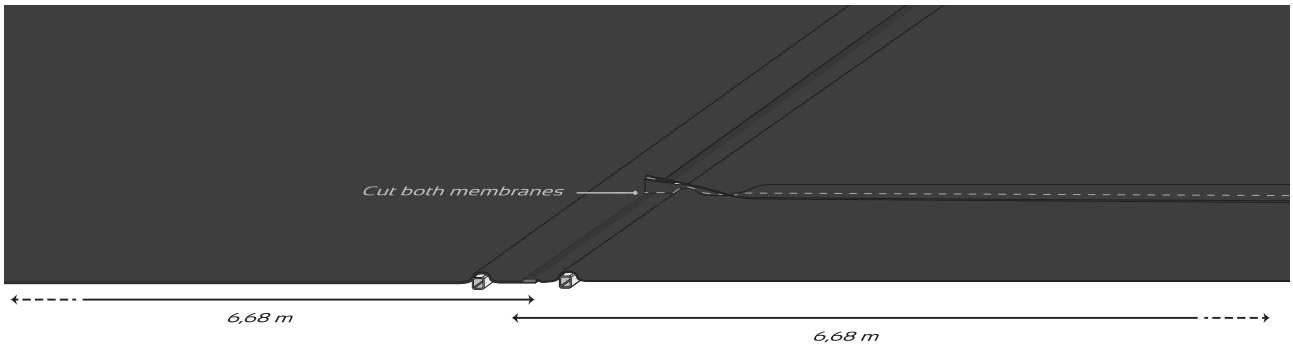
Fold back the corner and start the second weld on the marking.

Figure 17



Move the panel slightly to the side (direction right) to avoid the Guiding Track and get a smooth surface underneath the membrane. Position it straight and flat. Mark on top of the membrane and cut through both layers to remove excess material, after the cutting it should not be any overlap anymore, membrane shall be laying edge to edge.

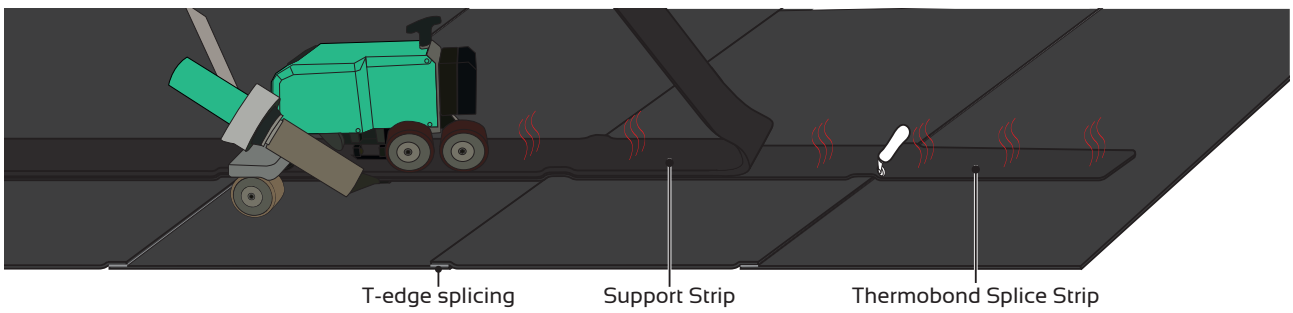
Figure 18



Mark again on top of the membrane a straight line 50 mm from the edge on one of the panels.
Unroll and position the Thermobond Splice Strip in width of 100 mm along the marked line. Cut the length to get an overlap of 60 mm on each side.
Unroll and position the Support Strip on top of the Thermobond Splice Strip. The use of the Support Strip makes it easier to weld avoiding movements of the Thermobond Splice Strip and waves/folds in the membrane underneath. It is important that the edge of the Support Strip is following the edge of the Thermobond Splice Strip on the welding side. The Hot-air Welding Machine is then positioned on top of the Support Strip.

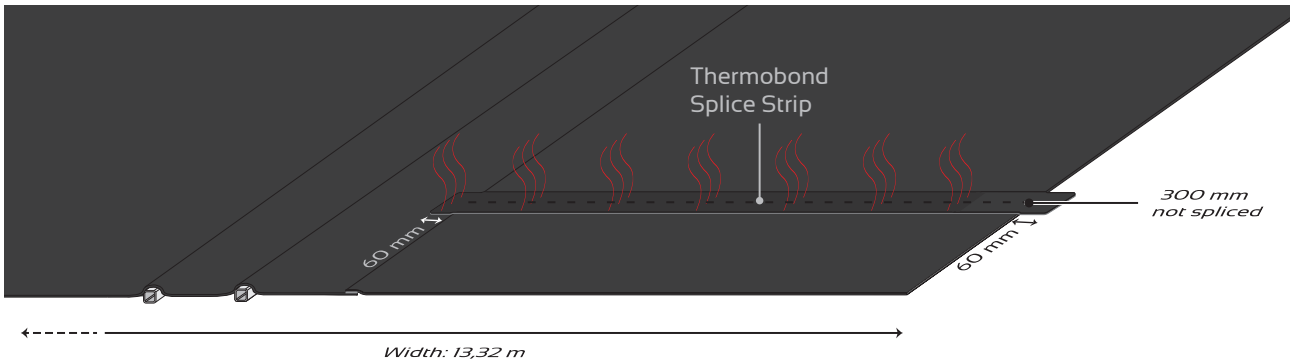
When the Hot-air Welding Machine is running over a splice overlap or any level differences, it is important to use the narrow Pressure Roller 5 mm, lift the Support Strip slighly and push firmly the Thermobond Splice Strip from above in order to seal the T-splices properly.

Figure 19



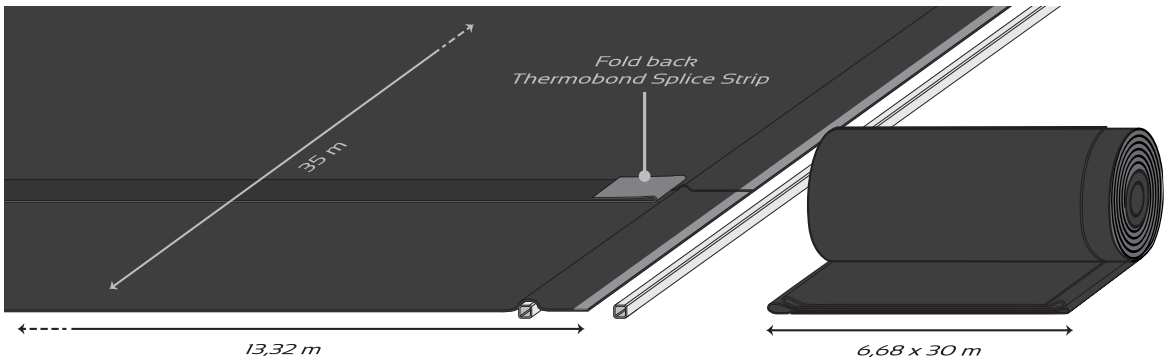
Do not weld the last 300 mm of the Thermobond Splice Strip on the right side of the panels, unless you not finished the complete panel. See the next figure.

Figure 20



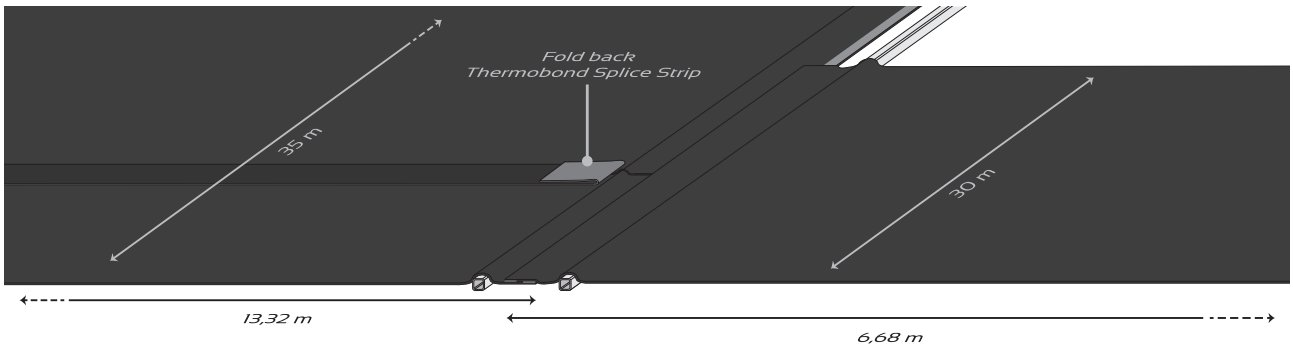
Step 4:
Pull back the panel and position the T-edge upwards in the Guiding Track.
Fold back the end of the Thermobond Splice Strip in order to free space for welding a new panel.

Figure 21



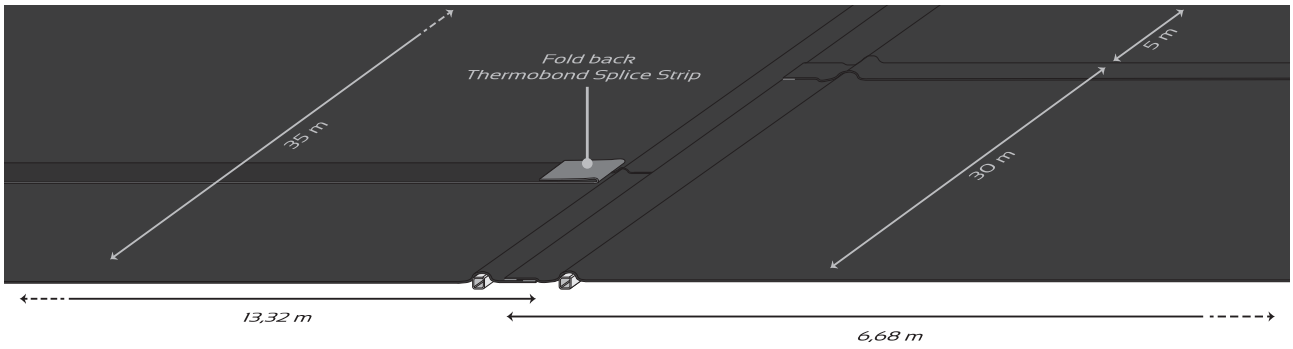
Unroll and position the rest of the panel with an overlap of 110 mm and the T-edge facing downwards.

Figure 22



Unroll and position the last piece of panel in order to secure enough overlap between the panels prior starting to weld.

Figure 23

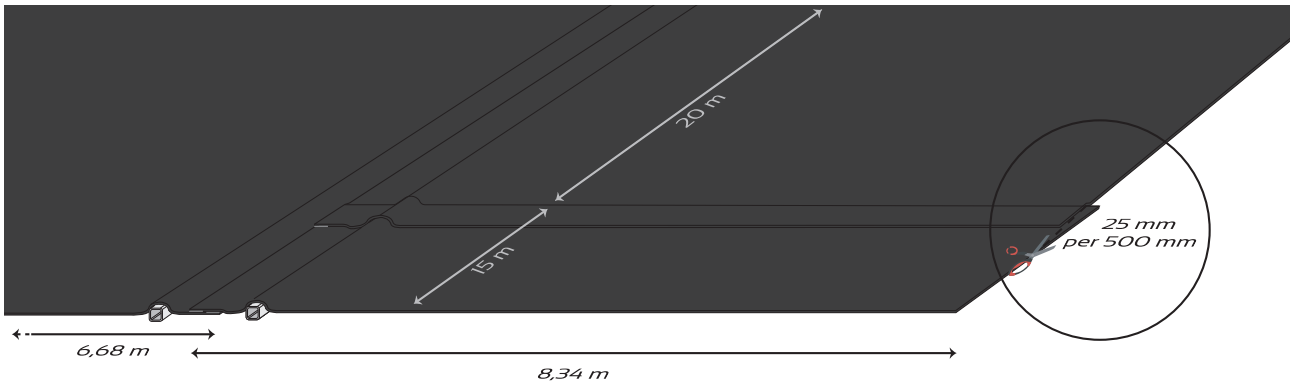


Fold back the Thermobond Splice Strip and weld the end by hand.
Repeat the previous procedure prolonging the panel.

10. Width variations between panels

If the width between two panels does not match 100%, cut away excess material and for a minor part weld Thermobond directly to EPDM. At most 25 mm could be cut away on a length of 500 mm. Cut in a smooth and straight line.
When welding a panel to a panel with cut edge, pay extra attention and give the machine a helping hand.

Figure 24

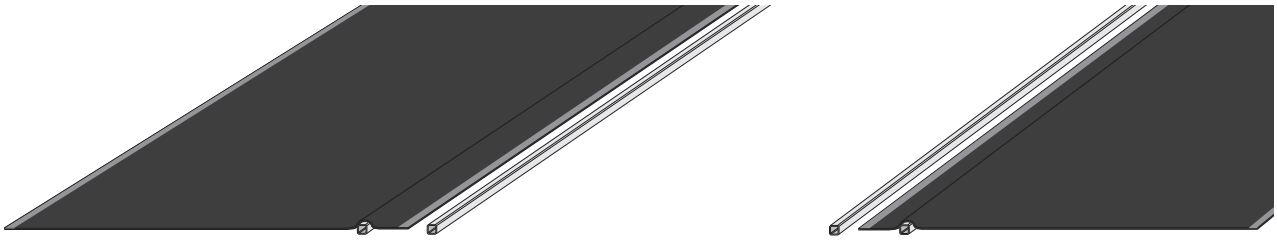


11. Prefab Concept with rolls in width 1.70m

4 Note: Example: final panel size 8,34m (width) x 50m (length)

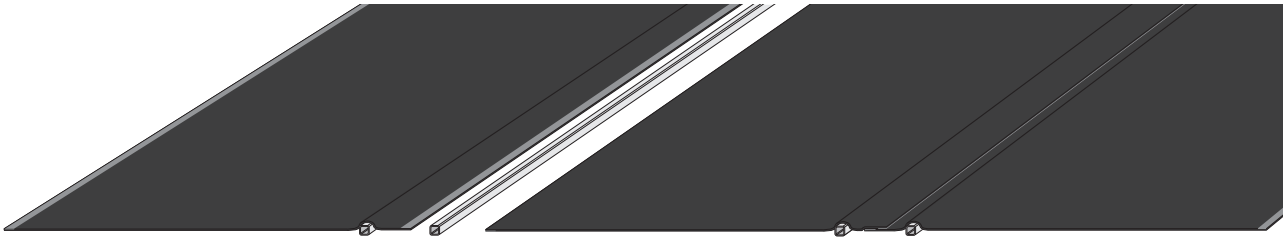
It is an option to use two guiding tracks, but not necessary. Two tracks are more efficient and less labor intensive, since you must move the membrane less.
Unroll and position the first 1.70 m rolls with the T-edge facing upwards in the Guiding Tracks.

Figure 25



Unroll and position one more 1.70 m roll in between the previous two membranes, with the T-edge facing downwards in the Guiding Track on the right side.
The overlap shall be 110 mm.
Start welding.

Figure 26

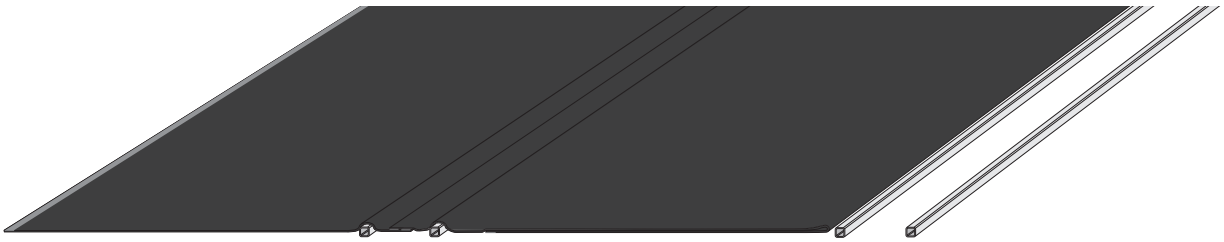


At the start of each splice, it is a risk that the membranes are separating. In order to prevent it happening, it is important that the membranes are laying positioned correctly in the Guiding Track and that the membranes are slightly stretched during the first 500 mm.

At the end of each splice, it is good to give the Hot-air/wedge Welding Machine help by steering the membrane by hand and at the same time pull the machine slightly. All this in order to avoid folds or separation of the membranes during the last 500 mm of the splice.

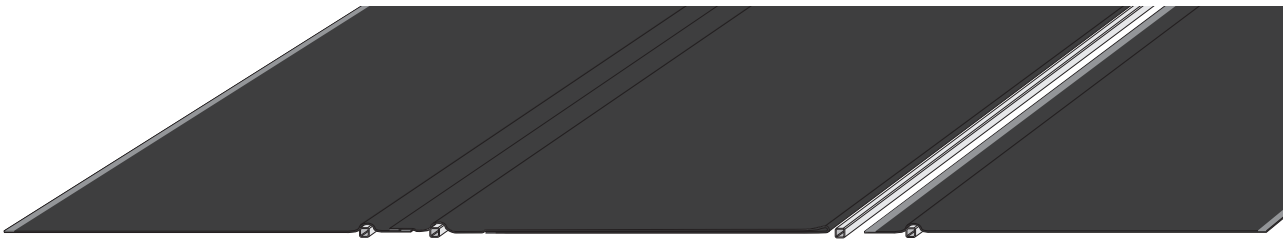
Fold the right panel to the Guiding Track on the left side with the T-edge facing downwards.
The overlap shall be 110 mm.
Start welding.

Figure 27



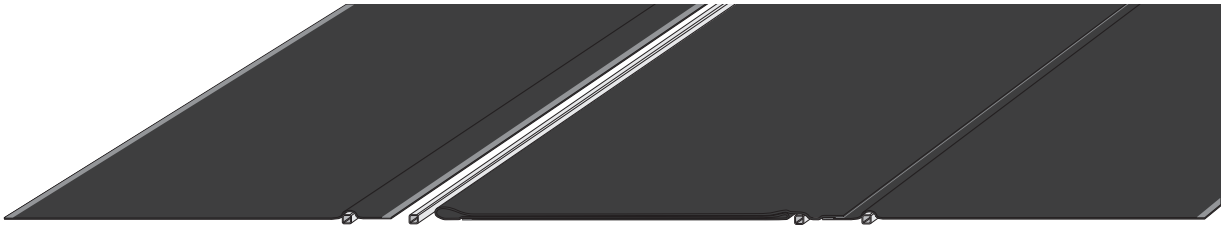
Unroll and position a new 1.70 m roll with the T-edge facing upwards in the Guiding Track on the right side.
Fold the left membrane to the guiding track on the right side with the T-edge facing downwards.
The overlap shall be 110 mm.

Figure 28



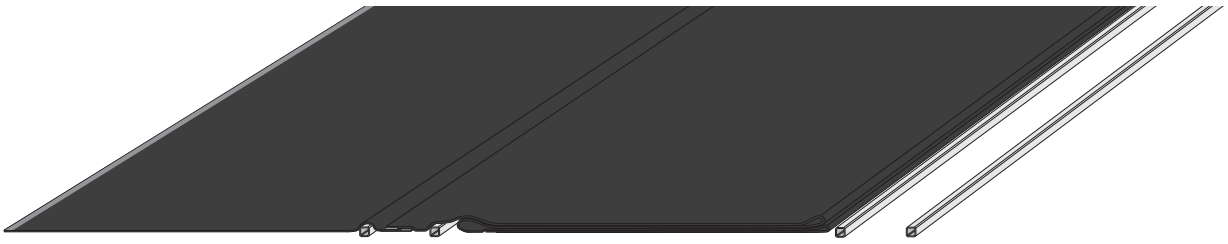
Unroll and position a new 1.70 m roll with the T-edge facing upwards in the Guiding Track on the left side.
Start splicing both membranes in the Guiding Track on the right side.

Figure 29



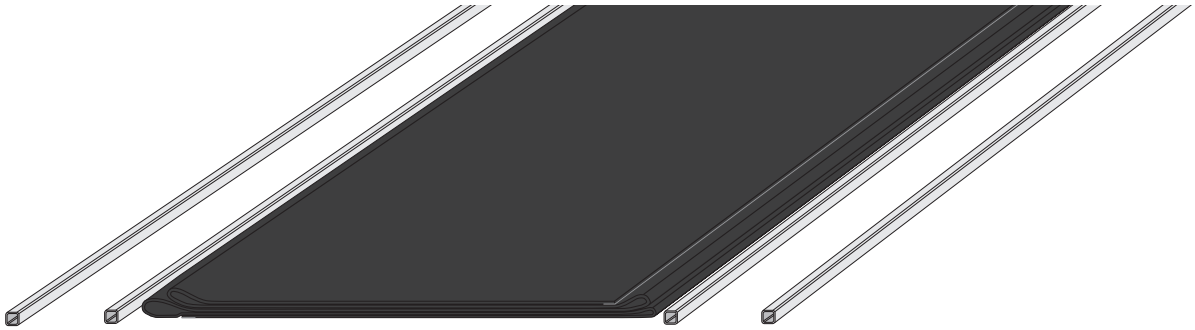
Fold the right membrane to the Guiding Track on the left side with the T-edge facing downwards.
The overlap shall be 110 mm.
Start splicing both membranes in the Guiding Track on the left side.

Figure 30



Finally, fold the left membrane to the right side, so that the whole membrane is positioned between the two Guiding Tracks.
Roll up the membrane. The 8.34 m x 50 m panel is finished.

Figure 31



12. Preparing prefabricated panels with wide T-edge for on-site welding

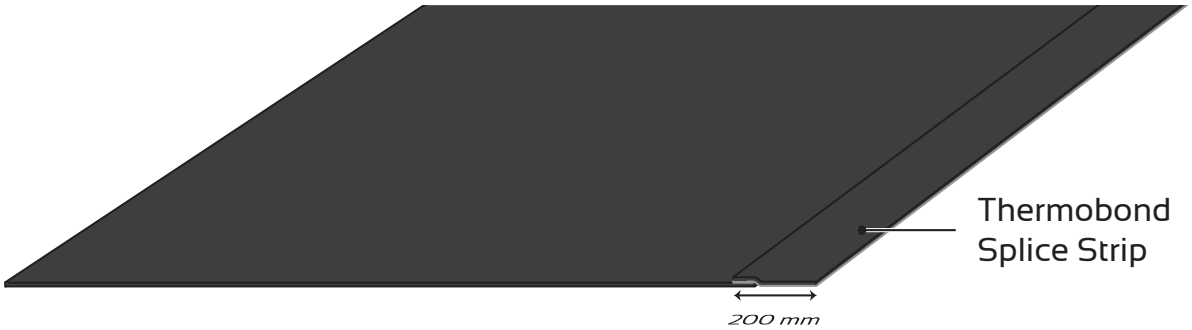
Panels that are going to be welded together on-site, must be prepared with a wider pre-applied T-edge for on-site welding. The T-edge for on-site welding consist of the Thermobond Splice Strip in width 200 mm. Welding on-site is always made T-edge to T-edge and Thermobond to Thermobond.

Mark on top of the membrane a straight line 50 mm from the edge of the panel.

Figure 32

Unroll and position the Thermobond Splice Strip in width of 200 mm along the marked line.

Figure 33

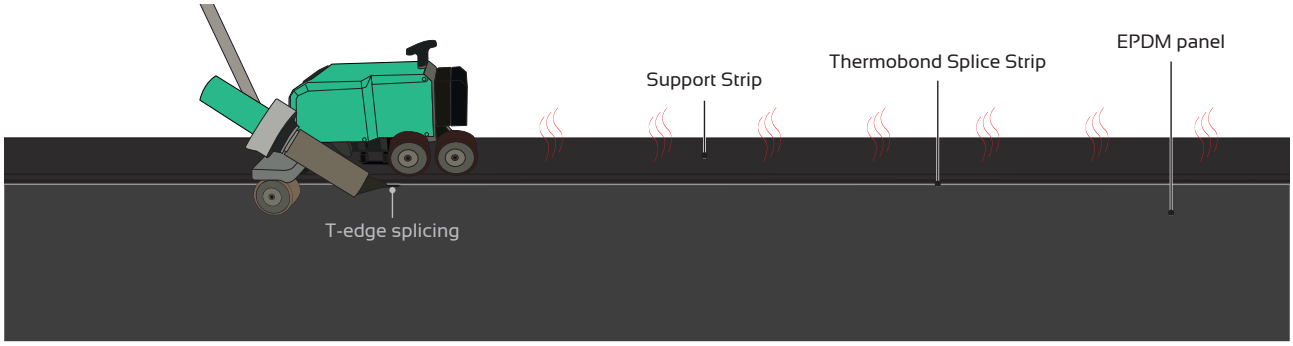


Unroll and position the Support Strip on top of the Thermobond Splice Strip. The use of the Support Strip makes it easier to weld avoiding movements of the Thermobond Splice Strip and waves/folds in the membrane underneath. It is important that the edge of the Support Strip is following the edge of the Thermobond Splice Strip on the welding side.

Figure 34

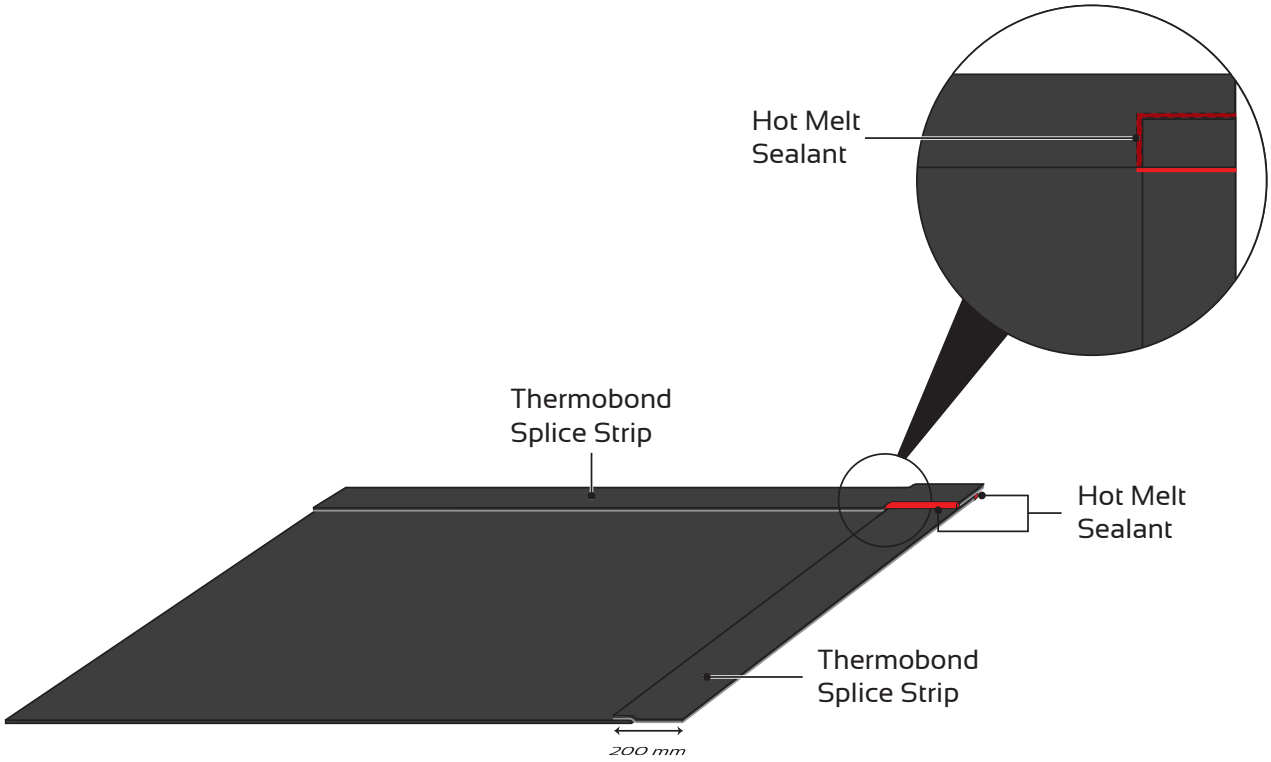
The Hot-air Welding Machine is then positioned on top of the Support Strip.

Figure 35



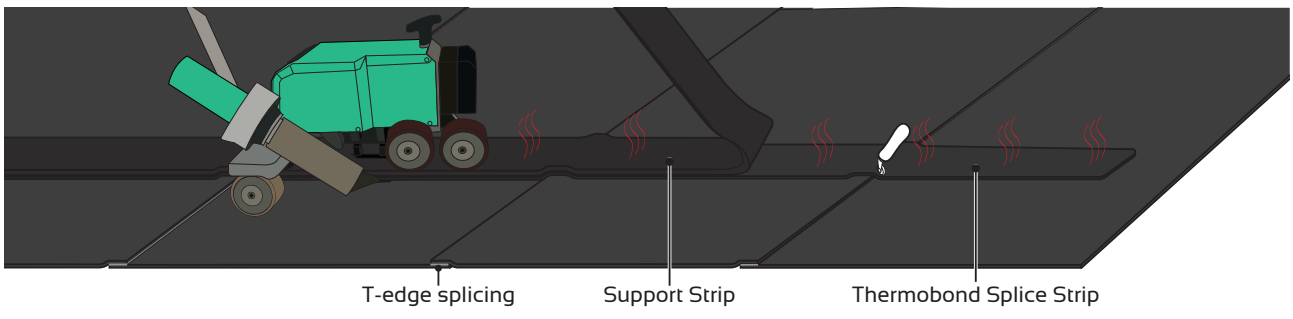
If Thermobond Splice Strip is needed transversal (short) side of the panel, repeat previous procedure and pay extra attention to the T-splices.
T-splices between two Thermobond Splice Strips must be sealed and treated properly with additional Hot Melt Sealant applied and welded by hand.

Figure 36



When the Hot-air Welding Machine is running over a splice overlap or any level differences, it is important to use the narrow Pressure Roller 5 mm, lift the Support Strip slightly and push firmly the Thermobond Splice Strip from above in order to seal the T-splice properly.

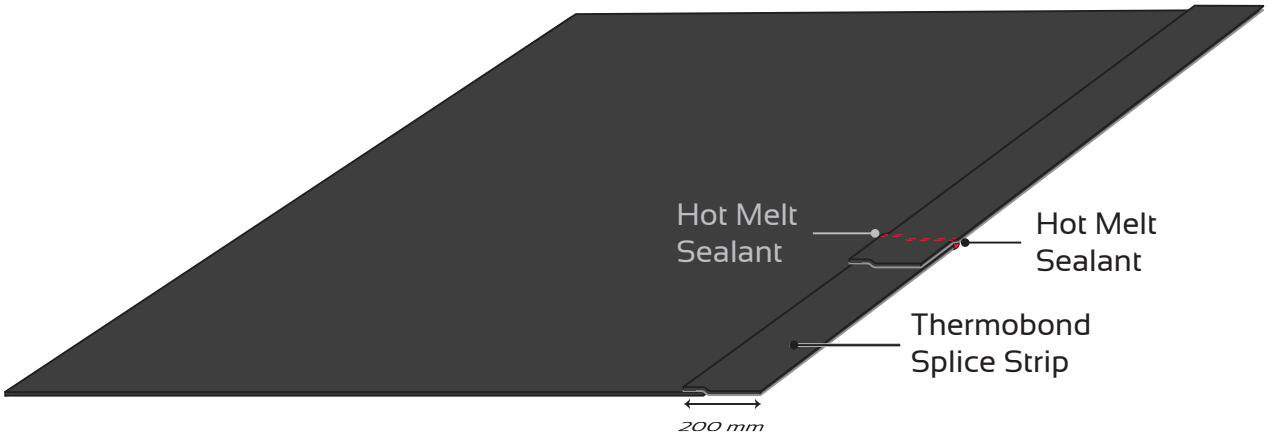
Figure 37



13. Prolongation of a Thermobond Splice Strip

Unroll and position a new Thermobond Splice Strip with an overlap of 60 mm to the other Thermobond Splice Strip.
Cut corners on both strips rounded with scissor.
T-splices between two Thermobond Splice Strips must be sealed and treated properly with additional Hot Melt Sealant applied and welded by hand.

Figure 38



14. Quality control

14.1 Non-destructive testing

There are different ways of controlling the prefabricated splices without destroying the membrane. Visual controls, mechanical point pressure from blunt object along the splice, vacuum testing, air lance etc., which all can be used as quality control of the splice, individually or combination of it and it is up to the prefabricator to choose way of how to control their own workmanship.
We will describe the air lance continuity test. The air lance equipment and procedures are generally outlined in ASTM D 4437 and as follows:

- Air lance test equipment is a compressed air source that continuously delivers an exit pressure of a minimum 350 kPa (3.5 bar) thru a hand held lance with a nozzle diameter of 4.75 mm.
- The nozzle opening shall be directed to the edge of the splice and held a maximum 25 mm away from the edge.
- The testing speed shall not exceed 12 m/min.
- Any defect that is identified by a distinct change in sound shall be marked for repair. The panel as such shall also be controlled visually and approved before packaging.

14.2 Destructive testing

A destructive splice testing shall be performed at the beginning of every working shift or when the splice conditions for some reason changes. The splice must have cooled down to approx. 20 C° before testing.

- Cut a sample of minimum 300 x 300 mm with the splice located in the center of the sample.
- Pull the sample so that the splice is tested by shear force.
- The break of the sample shall always occur in the membrane beside the splice.

Typical values while testing the splice in a tensiometer at 500 mm/min are: splice shear 6.0 N/mm and splice peel 2.0 N/mm. A shear test should always give a break in the membrane and not an adhesion break.

15. Package and transport

Prefabricated panels can either be folded into a package and put on a pallet alternatively be folded and rolled around a pipe or tube. Regardless the methods that are being used the package shall be wrapped with some kind of protection material to prevent contamination, oxidation and mechanical damages during transportation. Project name, panel identification no. and unfolding/unrolling instructions are also important documentation that might be of importance during delivery.

16. Defects and repairs

From experience we know that most of the damages occur due to careless handling of the material. If damages does occur these can be repaired with Thermobond Splice Strip.

- Measure and mark out the size of the repair patch needed. The patch of the Thermobond Splice Strip must be at least 50 mm larger than the actual damage in all directions. The corners of the patch shall be cut rounded.
- Splice the patch of Thermobond Splice Strip using a Hot Air Gun and a silicone pressure roller.

If the material has been exposed to sun for more than few hours before repairing, the membrane must be grinded before splicing. Always remove all possible oxidisation by grinding prior any welding. This can also be the case if material has been lying in the open indoors for a longer period of time. If uncertainty, are at hand a test splice shall be performed followed by a destructive splice testing as described above. Note that the membrane must be completely dry before repairing.