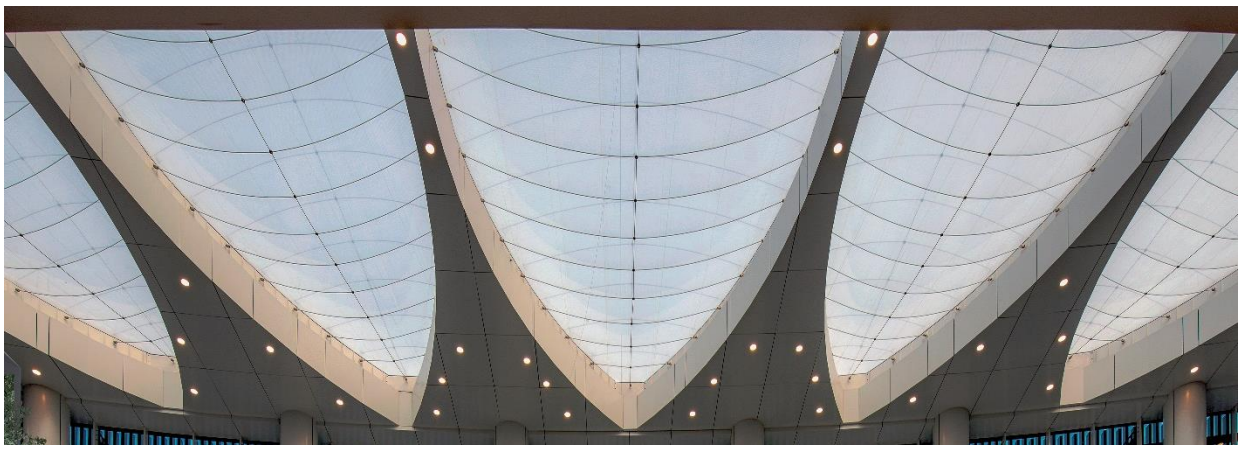
GULF SHADE

RAYTECH©

*The Ultimate Guide for an **ETFE** Skylight System.*

INTRODUCTION



R A Y T E C H is a skylight system that achieves weight savings and provided the advantageous of glass skylight. It is based on ETFE foil designed and fabricated as a cushion filled with air. The joints are laser weld to assure best joining results.

The foil used in RAYTECH is ETFE or Ethylene Tetra Fluoroethylene, is a fluorine-based plastic. ETFE is known to have high resistance against UV radiation and at the same time maintain good strength over a wide range of temperatures. The Low weight of ETFE, approximately 1% of glass weight, makes it the best alternative for glass structures and is the preferred choice where translucency and UV transmission is required.

The ETFE foils can have different print or fritting pattern on the surface as per thermal and optical requirement. The prints help in controlling the optical/ thermal properties of the system such as light transmission, G value, and others. By controlling the print density and area coverage of the print those values changes. The Thermal properties such as the U-Value of the system can be controlled, to meet the desired requirement, by the number of layers and the thickness of the air gaps within the cushion.

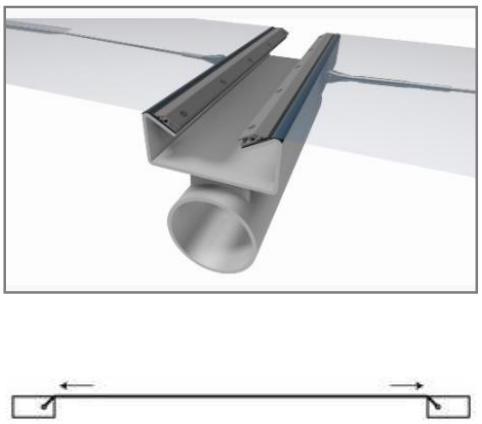
The R A Y T E C H system is supported to the building frame by using a specially designed aluminum extruded profiles. These aluminum profiles are designed to secure the cushion against wind, rain and snow loads.

KEY ADVANTAGES

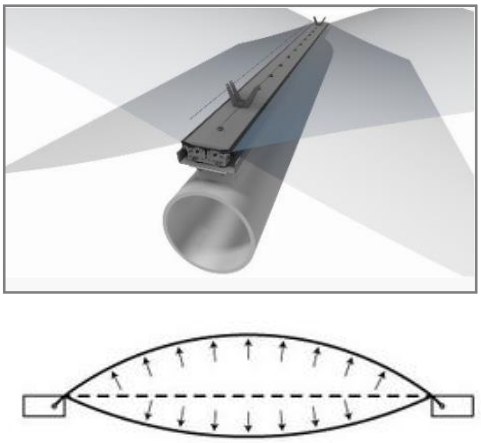
- Thermal Insulation
- Lightweight
- Durable
- Low Maintenance Required
- Self-Cleaning
- Fire Resistant
- Recyclable
- Printable
- Does Not Deteriorate
- Long Lifespan

SYSTEMS

The use of R A Y T E C H skylight system, in the architectural sector is on the rise and can be used in two ways; single layer system supported by a cable net or a pneumatic cushion system made up of multiple layers, between two to four layers. These cushions are pressurized by an air handling unit which maintains the pressure within the cushions through a series of sensors.



Foil - Single Layered Cross Section



Foil – Cushion Cross Section

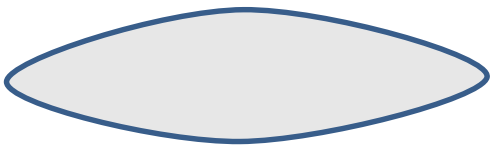
THERMAL INSULATION

The U-Value of the single layer system and a multilayer system is calculated as per DIN 673. The thermal insulation of the multilayer system can be adjusted by changing the number of layers and the air gap thickness which can be as thick as half a meter or more depending on the requirement.

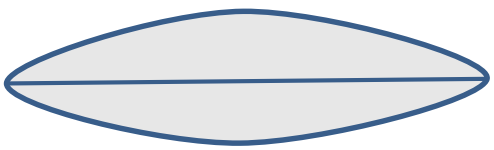
Below are the U-Value of standard single and multilayer ETFE systems:

I. Single Layer, ETFE Foil : **5.8** W / m²K

II. Two-Layers System, ETFE Cushion : **1.6** W / m²K



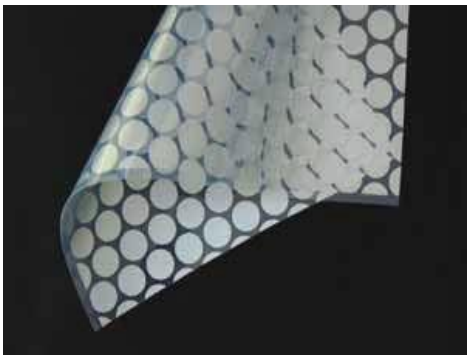
III. Triple-Layers System, ETFE Cushion : **1.1** W / m²K

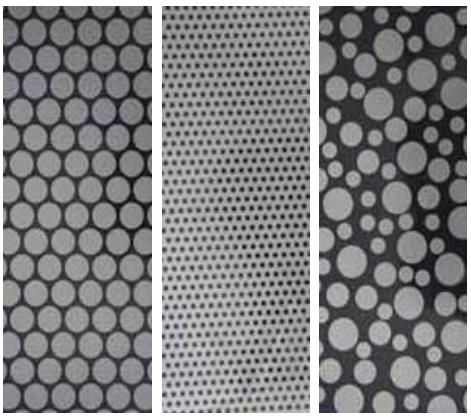


LIGHT TRANSMISSION

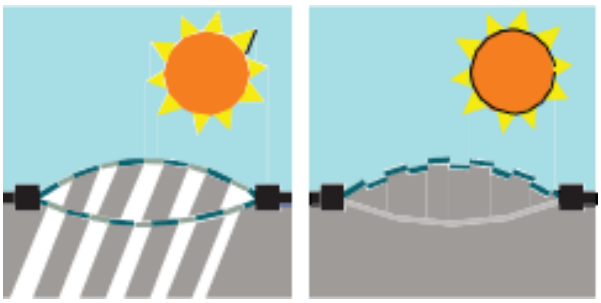
High translucency of the RAYTECH system is 95% to 97% light transmission rate in the visible light region (380 to 780 nm) and 83% to 88% in the ultra violet range (300 to 380 nm). RAYTECH systems provide a sufficient environment where plants and vegetation can thrive.

The solar gain can be control by printing or fritting on the outer layer of the RAYTECH cushions.





Section of Standard Patterns



G-VALUE (SOLAR HEAT GAIN)

G -Value, also known SHGC, is a coefficient used to measure the transmittance of solar gain through the cushion. It represents the solar transmissions of radiation into space below the cushion.

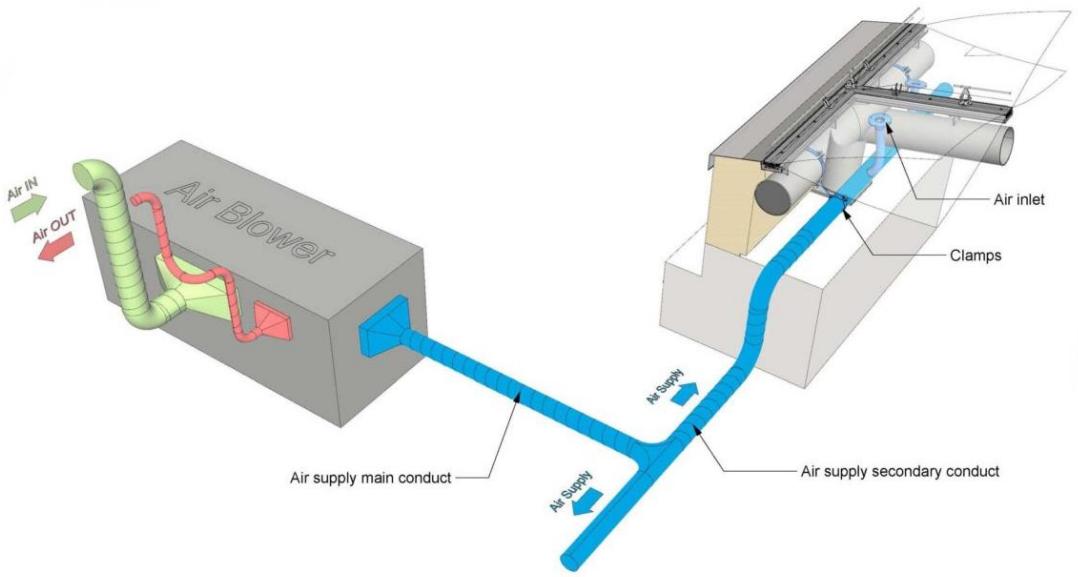
G-Value of near **1.0** is full radiation transmission through the cushion, while **0.0** represents a non transmittance of the solar radiation.

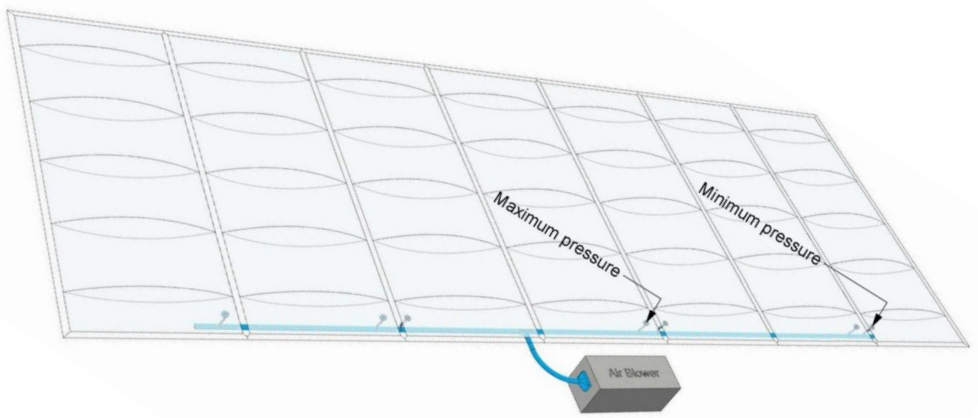
There are multiple ways of treating the ETFE foils in order to control the G-value or SHGC of the system. These ways include adding print or frit pattern on the top layer of the system, adjusting the print density, area coverage , using specially designed foils for reducing solar gain.

AIR HANDLING UNIT

The multilayer cushions requires to be under a constant pressure, depending on the design, to attain its design shape and attain structural stability and be able to withstand weather conditions such as wind, rain and snow. The cushions need to be maintained at the design pressure which is done by special air handling unit (AHU). The entire roof system with multiple ETFE cushions can be connected to 1 or multiple of these AHUs.

The AHU supplies clean dehumidified air for ETFE cushions through a series of filter, dehumidifier and air blowers. The control panel is equipped with a programmable controller which controls the air flow and maintains the pressure inside the ETFE cushions through the feedback from the sensors.





The machine includes two variable speed fans which work alternatively at different speeds depending on the pressure inside the cushions. In case of an emergency, both fans work together at full capacity. In case of failure of either of fans, one fan is always standby to maintain the preset pressure.

POWER LOSS

In the unlikely event of a power loss, the cushions will maintain the shape and minimum required pressure for 2 to 5 hours before deflating, depending on the weather conditions. Once the cushions are deflated, they are under the risk of getting damaged specially during harsh environmental condition.

MAINTENANCE

The smooth surface of the ETFE foils in the R A Y T E C H system does not allow any major dirt accumulation on the surface and the rain washes away dust and other debris if found. Further the ETFE foils has an anti dust property which is favorable in desert climate. Cleaning of the cushion can be done as easy as spraying it with water and wiping it with clean cloth if needed.

REPAIR & REPLACEMENT

One of the outstanding characteristics of R A Y T E C H system is its exceptional tear resistance, lack of notch weakness and stress crack concentration. Minor damages such as puncture holes or straight cuts can be easily repaired at site by trained professionals. To repair these damages, a special ETFE tape is cut as per requirement and applied on damaged area to block any air leakage.

In case of severe damage to the cushion, where the whole cushion needs to be replaced, the individual damaged cushion can be removed and replaced with a new cushion by trained professionals without disturbing the adjacent cushions.

CUSHION DIMENSIONS

Wind and snow load on the cushion and the orientation of the cushion generally affect the size of the cushion. As a general design guideline, rectangular cushions can go up to 4.5 min width, and can go as long as required in the other direction. Larger cushion can also be manufactured noting that they are reinforced by cable net both internally and externally.

LIFE EXPECTANCY

ETFE foil has an excellent life expectancy as it is unaffected by UV light, atmospheric pollution and other forms of environmental weathering.

While no ETFE structures have been in place for long enough to gain a true understanding of the full life cycle of the foil, the material has been extensively researched and tested in a laboratory environment and out in the field.

These tests have concluded that no degradation or loss of strength has occurred and there is no sign that the material will become brittle or discolor over time. As a result, it is anticipated that the material has a life expectancy in excess of 50 years.

FIRE PERFORMANCE

With a melting point of approximately 270 ºC, the ETFE foil is considered to be self-extinguishing. In the event of a fire, ETFE film neither promotes spread of fire nor any formation of flaming particles or droplets. If hot gases or flames come into contact with ETFE cladding forming part of the building envelope it will melt and shrink back from the area affected allowing hot gases and smoke to be vented from the building.

ETFE foil has been comprehensively tested. This is a selection of the fire results:

DIN 4102	**Class B1**
EN 13501-1	**Class B-s1,d0**
NFP 92-505	**M2**
NFPA 701	**Pass**

For more information on specific fire tests, please contact Gulf Shade.

ACOUSTIC PERFORMANCE

ETFE foil roofing, whether single layer or cushion, is acoustically transparent and thus has no effect on the acoustics of the space.

The reverberation time is the amount of time it takes for a sound wave to dissipate. The shorter the reverberation time, the better. Because ETFE is a low mass, soft material, its reverberation time is shorter than that of all other materials such as glass, masonry blocks, and so on. It is considered transparent to sound waves and thus has no echo. Having echo is a bad quality for internally generated sounds.

The rain-generated sound reaches **50** to **60 dB**, which is within the range of normal conversation and public places.

BIRDS & BIRD WIRE

Bird protection wires are provided with RAYTECH skylight cushion system. This prevent the birds form nesting and keeps the cushion roof birds free.

RAINWATER & DRAINAGE

To avoid any ponding of water on the RAYTECH system has a curvature. This curvature allows the rain water to naturally flow to the perimeter where it can be collected in the main drain gutter. The water is further discharged to the outlet from the drain gutter.

PRODUCTION

Gulf Shade has an in-house production facility of 1600 m2 with 3 independent ETFE production lines. With the available facility we can fabricate up to 120,000 m2 of ETFE every year.

ETFE foils of different thickness comes from selected suppliers ensuring the quality standards set by the company are met. Once the design pattern has been received by the production department from the engineering department, the panels are cut as per the design measurements by high tech CNC plotter cutter, ensuring minimum to zero deviation from the design.

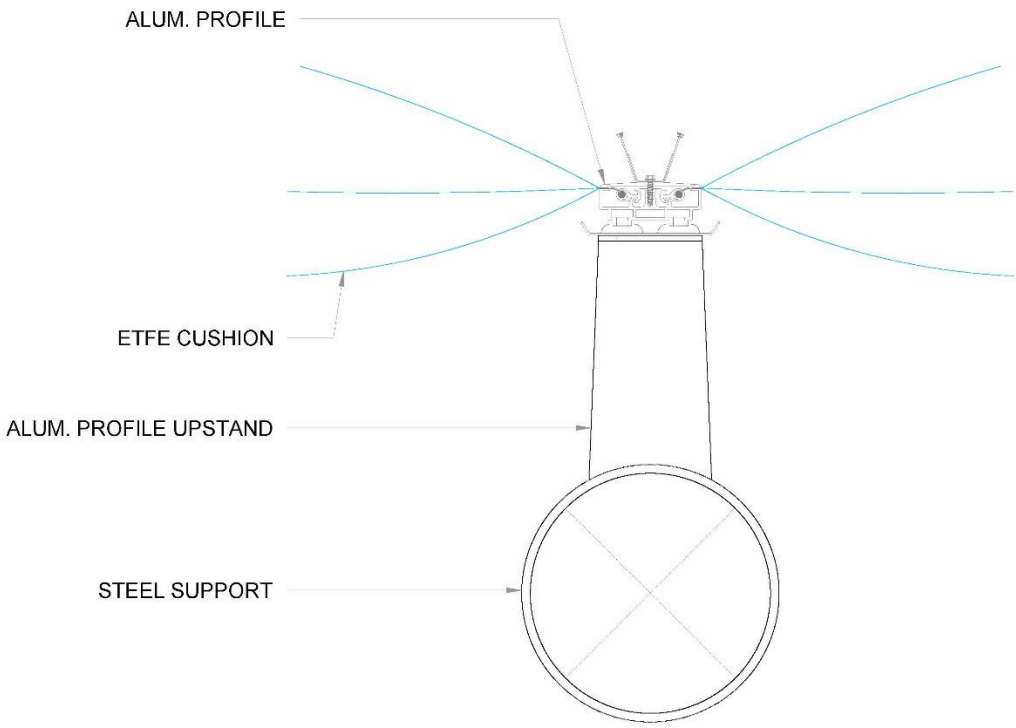
The cut panels are then forwarded to the welding area where the panels are welded together by special laser welding machines to form the final shape. Once the welding is completed and all the panels and layers are jointed together, the completed cushion goes under quality inspection where the cushion is inspected for any defects such as damaged joints, puncture, abnormal marks, etc.

After the completion of the quality inspection and receiving clearance from the QA/QC department, the cushion is cleaned and packed into wooden box and is ready to be delivered to site.

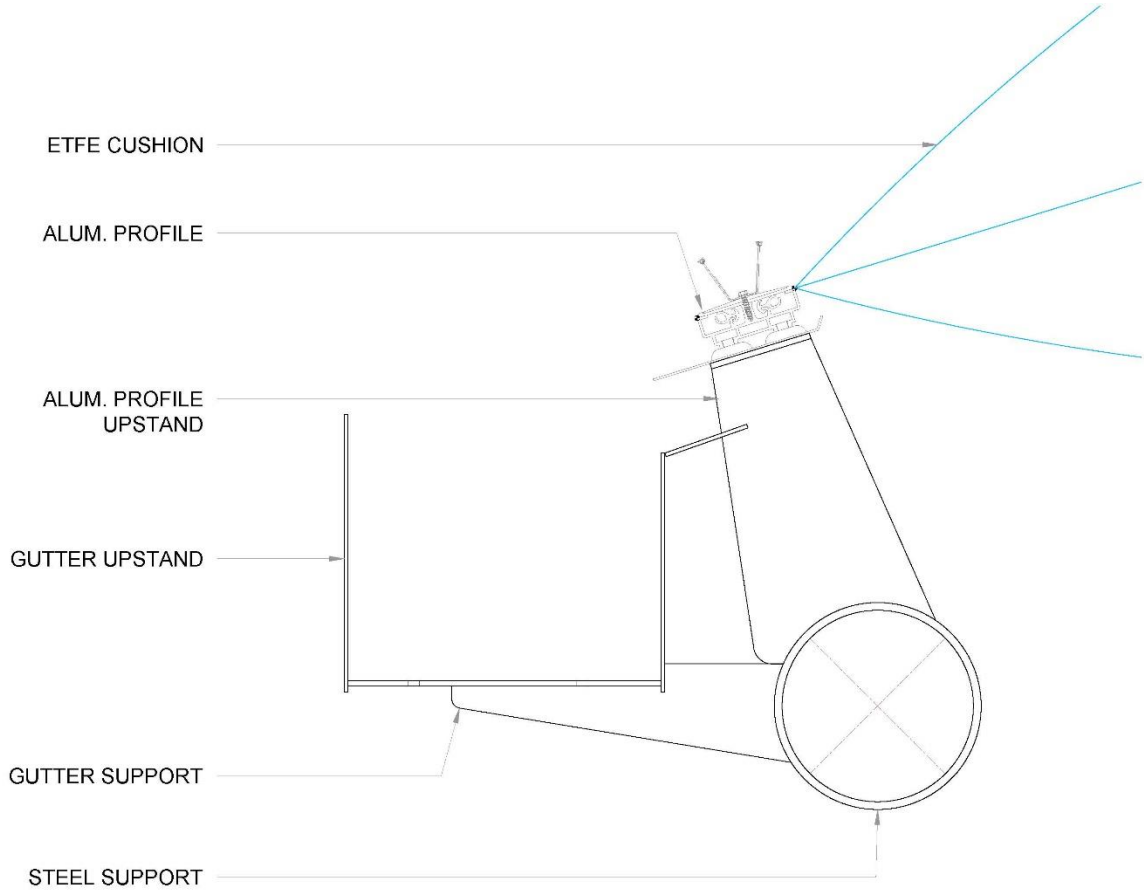
ENVIRONMENTAL CREDENTIALS

ETFE can be easily recycled, however, due to its remarkable properties such as UV resistance, weather resistance and pollution resistance, the ETFE foils have a very long life which is estimated up to 50 years, making the need for recycling small. ETEF suppliers can easily recycle the excess material that is left behind during the production of the cushions. While on the other hand, the aluminum extrusion frames also have a long life and can be recycled when they reach the end of their life.

TYPICAL CONNECTION DETAILS

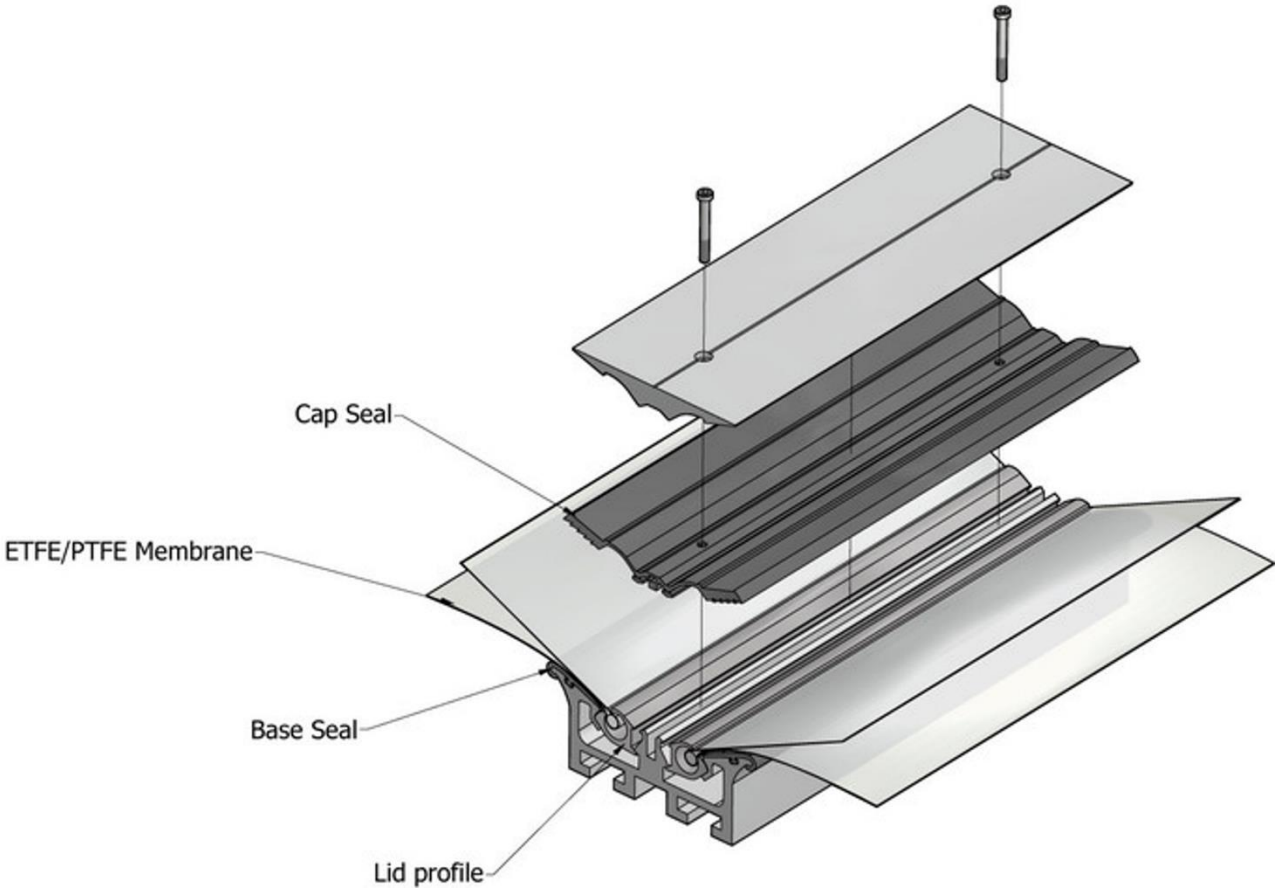


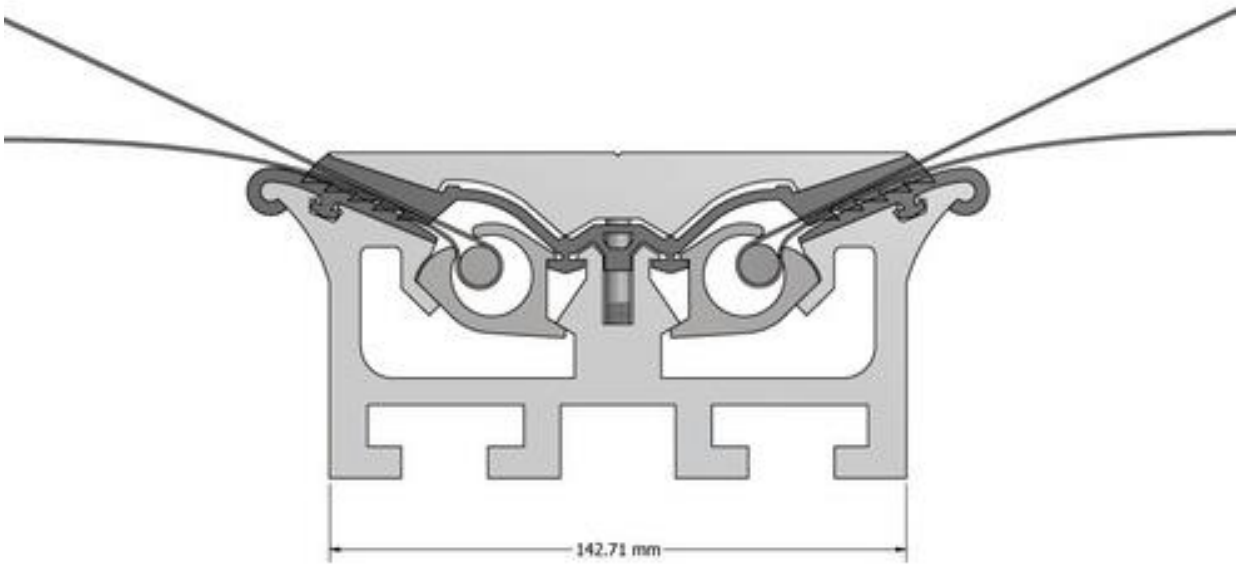
Details Between Two Cushions



Details At The End of Cushion

ALUMINUM PROFILE DETAILS





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