# *Sunstrip™* Solar Fins

Aluminum/Copper Fin
Technical Specifications

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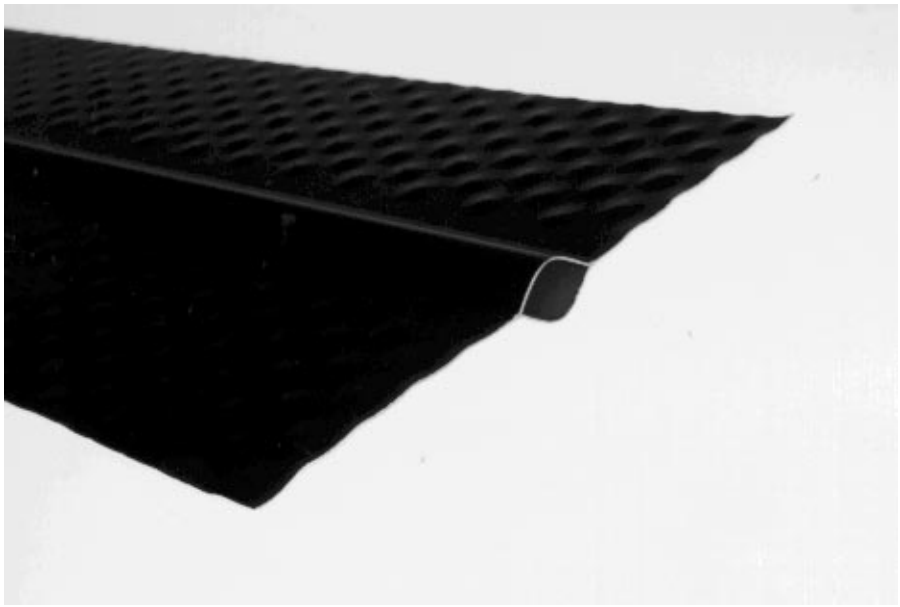
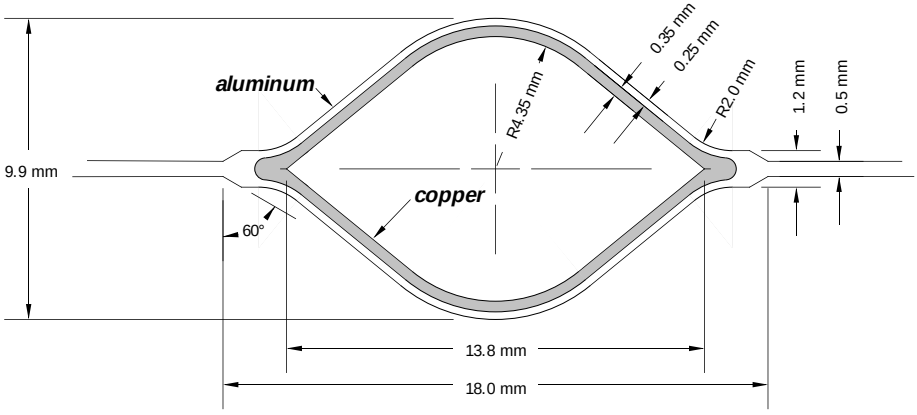
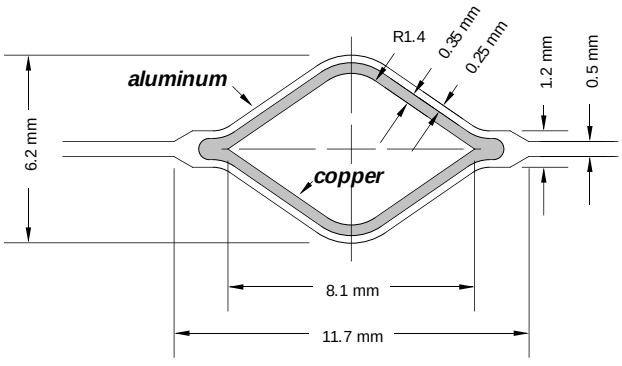





**Sunstip™ SS146/12 cross section (scale 4:1)**




**Sunstip™ SS146/8 cross section (scale 4:1)**

## A. General Information

### 1.0 Product Description

After more than a decade of research, the Sunstrip™ solar fin has emerged as one of the most innovative developments in solar technology. The fin's metallurgically-bonded aluminum completely surrounds a rhombic copper tube waterway. The corrosion resistance of the copper combined with the light weight and high thermal conductivity of aluminum produces the optimal finned tube. Sunstrip™ solar fins are available in either 8 mm or 12 mm nominal diameter waterways.

### 1.1 Options:

Sunstrip™ solar fins are available with highly selective Anodic–Cobalt™ or semi-selective black paint surface finishes; 12 mm (1/2") or 8 mm (1/4") copper waterway; cut and inflated to your specified length or coil form.

### 1.2 Dimensions:

**SS146/12:**
Fin width: 143 mm (5.63")
Waterway: 12 mm (1/2") nominal
Area:
Fin thickness: 0.5 mm (.02")

**SS146/8:**
Fin width: 143 mm (5.63")
Waterway: 8 mm (1/4") nominal
Area:
Fin thickness: 0.5 mm (.02")

### 1.3 Weight:

| | |
|---|---|
| SS146/12 | 1.5 kg/m$^2$ (0.31 lb/ft$^2$) |
| SS146/8 | 1.5kg/m$^2$ (0.31 lb/ft$^2$) |

### 2.0 Product Use

### 2.1 Product Applications:

Residential and commercial domestic water, process hot water, space heating, pool heating

### 2.2 Geographic and Climatic Limitations:

None.

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**3.0 Manufacturer's Experience**
Thermo Dynamics Ltd. (TDL) is a Canadian company engaged in the research, development, production, distribution and installation of solar thermal equipment. The company has been involved in the solar industry since 1981 and operates from its head office and factory in Dartmouth, Nova Scotia, Canada, sister city of Halifax situated on the Atlantic coast. The company's specialization is the glazed liquid-flat-plate (LFP) collectors with metal absorbers. TDL is a fully integrated solar thermal company with the ability to convert raw aluminum and copper into a high technology solar water heating system.

Thermo Dynamics Ltd., as a world leader in solar technology, manufactures and markets solar heating equipment from complete systems to basic selective components for O.E.M.'s licensees, dealers and distributors throughout North America, Europe, Africa, New Zealand, as well as 10 other countries around the world.

**3.2 Production:**
10,000 $m^2$ per year for the SS146/12 and SS146/8 Sunstrip™ solar fin.

Production capacity is more than 400,000 $m^2$ per year.

## B. Sunstrip™ Solar Fins

**1.0 General Description:**
Two strips of aluminum metallurgically bonded to a single copper tube.

**1.1 Generic/Trade Names:**
Sunstrip™ solar fins
MICRO-FLO® for SS146/8

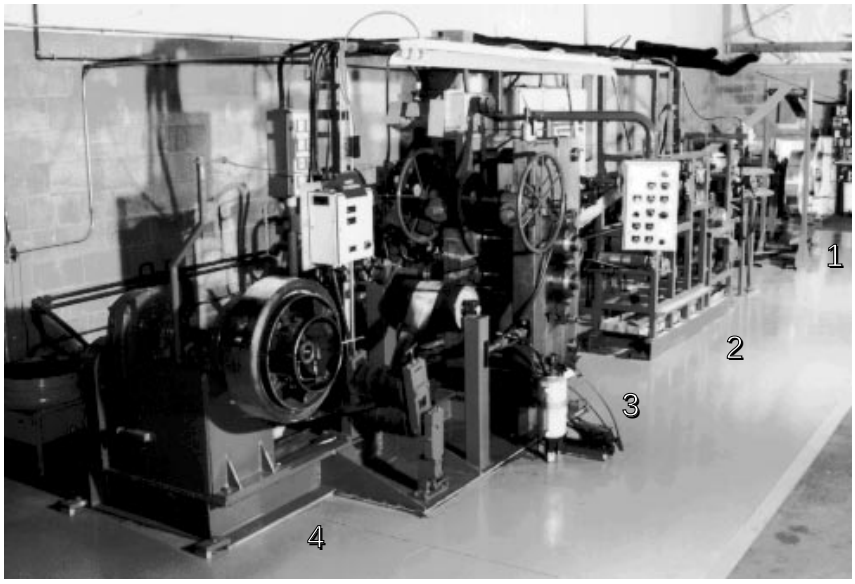
**12. Chemical Composition:**
Aluminum: 1350
Copper: 99.9% pure

**1.3 Physical Treatment:**
None

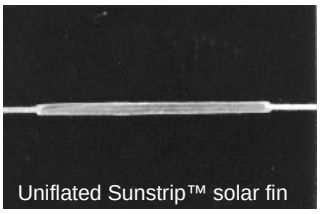
**1.4 Physical properties:**
Average weight: 1.5 kg/$m^2$ (0.31 lb/$ft^2$)
High burst pressure: 6.0 MPa (870 psi) for SS146/12
High burst pressure: 20 MPa (2900 psi) for SS146/8
Fin is automatically tested to 250 psi for SS146/12
1100 psi for 146/8.

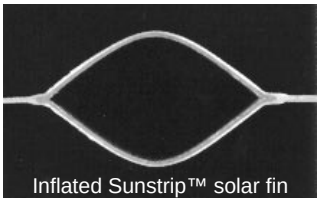
**1.5 Mechanical Strength:**
For Sunstrip™, featuring the aluminum substrate, with a tube of open area 50 $mm^2$ (.078 $in^2$), the static burst pressure is 6.0 MPa (870 psi). More importantly, when cycled between 21 kPa (3 psi) and 690 kPa (100 psi), the fatigue life is at least 200,000 cycles. In addition, temperature cycling from 10°C (50°F) and 150°C (302°F) for 60,000 cycles results in absolutely no reduction of the static burst pressure.

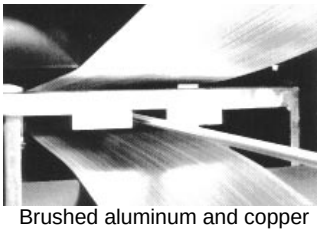
In production, all Sunstrip™ material is subjected to a combined pressure leak test during the inflation process of the tube - following the rolling mill operation.




**Sunstrip™ Rolling Mill:** 1, aluminum and copper uncoilers; 2, aluminum and copper scratch brushing station; 3, high pressure steel rolls for bonding; 4, Sunstrip™ fin recoiler.


Uniflated Sunstrip™ solar fin


Inflated Sunstrip™ solar fin


Brushed aluminum and copper before roll bonding process

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## C. Sunstrip™ Production

### 1.0 General

Sunstrip™ is produced by metallurgically bonding two strips of aluminum to a single copper tube which acts as a waterway. The Sunstrip™ rolling process involves four stages. First, the raw aluminum and copper are uncoiled, second the aluminum and copper are scratch brushed, third, the aluminum and copper are bonded together through high pressure steel rolls, and finally, the fin is coiled.

### 1.1 Uncoilers

Two 600 kg (1322 lb) coils of aluminum and one 150 kg (330 lb) of copper tube are loaded onto uncoilers. The uncoilers have brakes which allow tension to be maintained.

### 1.2 Brushing Station

The raw aluminum strips are scratched brushed over the entire width to eliminate surface contaminants and expose a large amount of underlying virgin material. The copper tube is scratch brushed on two sides, then flattened, and then scratch brushed on the top and bottom. This ensures that all mating surfaces between the copper and aluminum are contaminant free.

### 1.3 Roll Bonding

The scratch brushed aluminum and flattened copper tube are guided between two steel rolls which apply a very high pressure to the materials. This metallurgically bonds the materials together to form a strip of variable thickness.

### 1.4 Recoiler

The bonded strip exists the steel rolls and is coiled. The finished coils can be up to 520 linear meters (1,706 ft).

### 2.0 Sunstrip™ Availability

### 2.1 Coil form

The finished Sunstrip™ is available in coil form up to 520 linear meters (1,706 ft). The coils are palleted 8 high. Each coil of Sunstrip™ is 75 $m^2$ (807 $ft^2$). The customer can uncoil and inflate fin to their required lengths.

### 2.2 Inflation machine

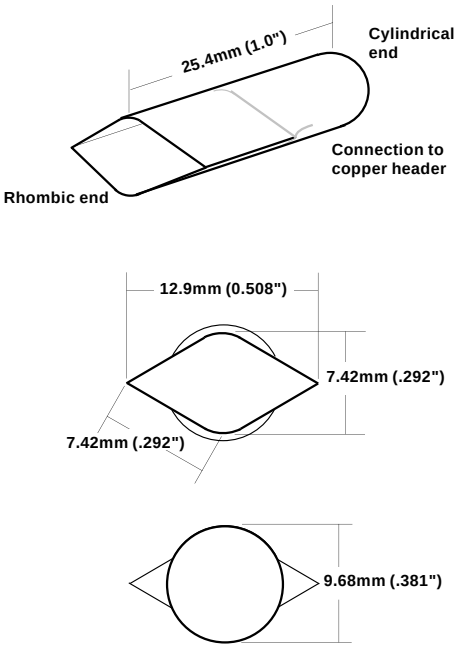
The coils of Sunstrip™ are loaded onto an uncoiler. The strip is automatically fed, inflated, and cut to length. This process is used for the SS146/12 fin only. Fin lengths available up to 5 m (16 ft).

### 2.3 Sunstrip™ FAKIR

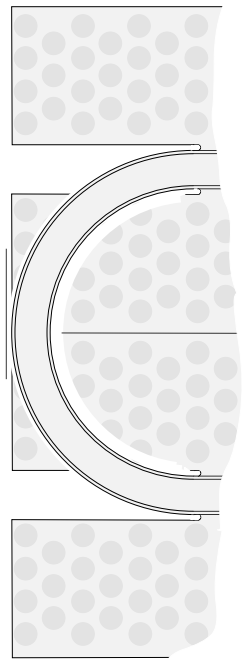
The SS146/8 Sunstrip™ fin is used for the MICRO-FLO® absorbers. The coils are loaded onto an uncoiler, and then fed into the FAKIR which inflates, punches, and bends the fin into a serpentine absorber. This process is used for the SS146/8 fin only. Absorber lengths are available from 1 m (3.3 ft) to 4 m (13 ft).

**Sunstrip™ inflation machine**
**Operation: uncoil, inflate and cut SS146/12 fin**

**Sunstrip™ FAKIR**
**Operation: uncoil, punch, inflate, and bend SS146/8 fin into serpentine absorbers**




**Round - Rhombic nipple (Type L copper, 3/8" nominal) for connection of SS146/12 Sunstrip™ fin to copper headers. Grid solar collectors**



**Typical U-bend of a serpentine absorber, made from SS146/8 Sunstrip™.**

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## D. Optical Performance

**1.0 General**
Sunstrip™ solar fins are available in bare aluminum, highly selective Anodic-Cobalt™, and semi selective black paint surfaces.

**2.0 Anodic-Cobalt™ selective surface**

**2.1 General**
This surface is formed by creating a thin layer of aluminum oxide (0.5 to 1.0 υm) on the surface of the Sunstrip™ solar fin and then embedding cobalt in this layer. The anodizing process, which forms the layer of aluminum oxide, is a process used world wide to protect and prevent it from weathering.

**2.2 Appearance**
The cobalt deposited in the aluminum oxide layer gives the surface the characteristic black/green/purple colour.

**2.3 Spectral Properties**
The Anodic-Cobalt™ selective surface has excellent spectral properties. Testing at the University of Waterloo, Ontario, Canada yielded the following results:
absorptivity $\alpha$ = 92%
emissivity $\varepsilon$ = 15%

**2.4 Durability**
The Anodic-Cobalt™ surface is very durable particularly at high temperatures.

**2.5 Availability**
The Anodic-Cobalt™ surface can be applied to solar fins as long as 2.75 m (9 ft).

**3.0 Semi-selective black paint**

**3.1 General**
The semi selective black paint is applied in a atomizing spraying process.

**3.1 Appearance**
The painted surface is flat black in colour.

**3.2 Spectral Properties**
The spectral properties of the semi-selective black painted surface are:
absorptivity $\alpha$ = 94%
emissivity $\varepsilon$ = 28%

**3.3 Durability**
The black painted surface is very durable especially in humid conditions

**3.4 Availability**
The black paint surface can be applied to solar fins as long as 5 m (16 ft).

## E. Thermal & Hydraulic Performance

**1.0 General**
Good thermal performance due to good metallurgical bonding and high conductivity of aluminum and copper.

**1.1 Fin efficiency**
Good metallurgical bonding, highly conductive metals, and superior surface treatments contribute to the high fin efficiency of Sunstrip™ Solar Fins. Graph below shows fin efficiency versus fin width.

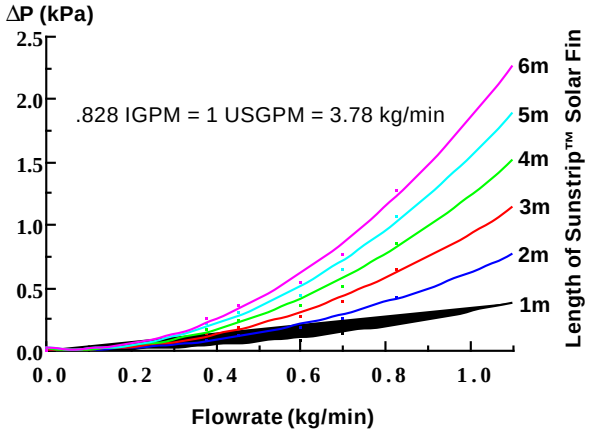
**2.0 Hydraulic performance**
Graph indicates the pressure drop through Sunstrip™ SS146/12 for various lengths of fin.

## F. Maintenance and Warranty

**1.0 Maintenance**
Once installed, Sunstrip™ solar fins are maintenance free. Anodic-Cobalt™ or painted surface should not be directly exposed to high humidity. In collector design, suitable air flow through the collector should be considered to maintain less than 95% relative humidity.

**2.0 Warranty**
Sunstrip™ fins are warranted for 10 years. The manufacturer may repair or replace the fins as required at his discretion.

**Pressure drop versus Flow rate, SS146/12 Sunstrip™**




**Fin Efficiency versus Fin Width**