



## HEATING SOLUTIONS INTERNATIONAL BV

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### **Radiant heating systems for roofs and gutters**

**The most efficient heating  
solutions at present**

#### **Introduction**

Heating Solutions International has created a new world of roof and gutter heating systems by enhancing the efficiency with more than 35% in comparison with competitive solutions.

More and more often we are faced with long periods of severe wintery conditions including heavy snowfall and frost. It is generally known that heavy snowfall increases the risk of roofs collapsing considerably. Severe frost causes cracks in bitumen, especially when snow is removed manually.

HSI offers you a solution including a smart operating system which controls the energy consumption of the unique amorphous heating ribbons. When the system is switched on, the amorphous heating ribbons will not only reduce snow and icing on roofs but also reduce the risk of a hazardous roof pressure, frozen gutters, falling ice lumps and icicles. In short: the wintery conditions become controllable.

The total system, consisting of custom made prepared heating ribbons, connection cables, sensors, a control unit and software can be applied on all roof types. Smaller heating ribbons are available for gutters.

For a short video impression about roof Heating solutions see:

<https://www.youtube.com/user/HSIBV2010/>.



### **System description**

Our advanced heating system consists of heating ribbons, connection cables, sensors for the detection and registration of moisture in combination with the outdoor temperature, a control unit and software.

The heating ribbons will be attached to the roof surface or will be embedded in the roof insulation. All heating ribbons are provided with connection cables to connect the heating ribbons to the control unit. The heating ribbons will be protected against earth leakage currents and short-circuit currents.

The control will contain a snow- and ice detection set including two sensors (for moisture and ambient temperature) to be mounted onto a roof of gutter. The system will be automatically engaged and disengaged based on the preset settings of the snow and ice detection unit. Manual or remote system operation are also possible.

### **Various references**

#### **1. Roof heating on a restaurant**

This image shows the application of a roof heating system to prevent snow from sliding down onto the south facing entrance of the restaurant underneath.



#### **2. Roof/ gutter heating**

This image shows the application of a heating ribbon in a gutter. The 33mm ribbons are fixed and the effect of the radiant heat comprises a width of approx. 20 cm. This is a unique effect and unmatched by any other gutter heating product. Furthermore this application only requires a minimum power supply: 9.2 Watt/meter.



As an alternative additional to the 33 mm heating ribbons, smaller ribbons are available.



### 3. Partial roof heating

This image shows the application of a heating system on the roof of an existing building next to a newly constructed high-rise building. An ideal spot for snow to accumulate, resulting in an increased roof pressure. The decision between reinforcing the low structure roof and installing a roof heating system was easily made in view of the considerably lower costs for the latter option!



#### Why HSI heating solutions: the advantages of HSI's radiant heating systems

With HSI's radiant heating technology it is feasible to achieve at least a 35% lower energy consumption in comparison to traditional heating systems like liquid or electricity.

The main distinctiveness of HSI's radiant heating system is the unique method of heat production which is generated by an amorphous metal glass ribbon. The ribbons enable an optimal heat – combined with an intelligent control unit – leading to the most efficient heating system worldwide ensuring deicing of roofs and gutters.

#### Characteristics of our amorphous metal glass heating ribbons

Due to the shape of the amorphous heating element the structure of the total heating ribbon is different. Some competitors have already copied the unique patented structure of the HSI heating ribbon into their own wire ribbon. Although both heating ribbons show a similar exterior design there is a huge difference in efficiency and effectiveness in both ribbons.

Below images show the difference in structure of both heating ribbons and also the difference when using an IR camera. They show the heat output of both systems while these are powered with the same wattage.

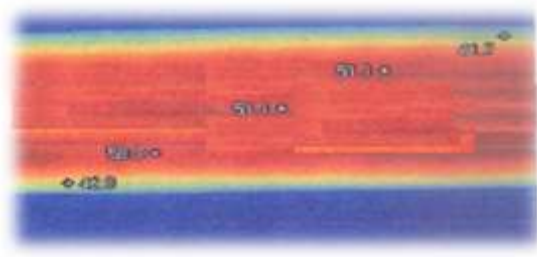
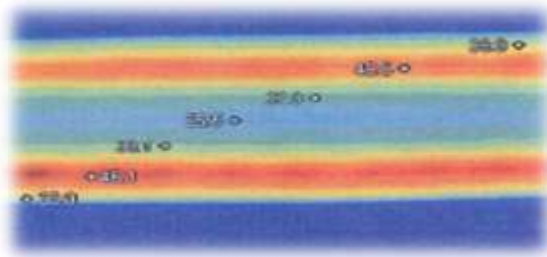


Copper wire heating ribbon



Amorphous metal glass heating ribbon

The images below visualize the difference between both technologies (IR camera).



### **Design of the amorphous metal glass ribbon**

Due to the structure of the amorphous ribbon the energy will be turned into radiant immediately. There is no loss of energy by heating up the material itself. This ensures the difference in performance as shown in above images.



### **Combination with a high performance Control Unit**

The heating ribbons will be connected to an operating system which will manage the energy consumption in the most efficient way. Modulating and heating cyclically based on the environmental requirements. The system is able to define the optimal way of energy consumption based on the climatic/weather conditions. This also results in substantial savings on energy costs compared to traditional hydronic/water based or electrical systems.

In addition, to enhance the control unit for business critical applications, it can be extended with a UPS and warning system, ensuring the system's reliability, continuity and safety. In case the central electricity supply is disrupted, the power supply will be taken over by the UPS system and the operator is informed.



### **Required amperage (energy connection) and power consumption**

HSI will provide the required amperage based on the amount of heating ribbons. Special software enables the use of a heating cycle, which reduces the maximum peak power required.

**For external research into the efficiency of our heating systems see annex 1 of this exhibit.**



## Annex

### External research conclusions

#### Landstra Engineering

Calculations show that a better temperature distribution in the floor is obtained. At the surface, the temperature variation is 23% smaller than with other systems.



#### Sintef (Norwegian TNO/ TÜV):

- The chosen thin and relatively broad amorphous ribbons and their internal structure are beneficial compared to the conventional electric wires.
- The chosen DC technologies enable the possibility to supply more power to the ribbons than AC.



#### Prof. Dr Mark Geller

Hermon Laboratories Israël / Amorphous Competence Center. If the ribbons are situated between 4 cm to 2.5 cm from the surface the warm up time of the ribbons is twice as fast then the wire and when the ribbons are situated less than 2.5 cm from the surface the warm up time could became 4 times faster than traditional copper wires or liquid heating systems.



#### SGS Intron / Hogeschool Zuyd

The amorphous ribbon generates highly efficient IR radiation. This results in a 35% less energy consumption. In conjunction with renewable energy generation a big step in achieving sustainability objectives can be realized.

