

# INNOPTEC

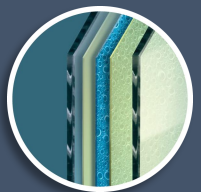
INNOVATIVE OPTICAL TECHNOLOGIES



## SPD FILMS for Glass Lamination

ENGLISH

SPD | Suspended particles device [General specifications - V. [01-02]



# Cut-to-size sheets


## Technical and overall specs


SPD Film | Electro-optical Film for Glass lamination  
Product Specifications for Construction Industry

## ■ Chapter 1

# Construction Parameters

The film consists of **two outer layer of polyester film (PET)**, coated on the inside surfaces with a transparent conductive layer. A layer of **SPD compound** is sandwiched between the two PET film supports.

 Total Thickness
Dark Grade: 390 (+/-10) $\mu\text{m}$
Light Grade: 320 (+/-10) $\mu\text{m}$

 Dimensions:	
Maximum Width of the active area	Up to 1200 or 1500 mm
Length of the active area	as standard from 1000 to 3500 mm

## ■ Chapter 2

# Electro-optical Properties (20°C) – Average values

1. Total Transmittance (VLT)	Light Grade	Switched off: $\leq 10\%$	Switched on: $\geq 60\%$
	Dark Grade	Switched off: $\leq 1\%$	Switched on: $\geq 35\%$



### Response Times

Rise : < 0.5sec, Decay : < 10sec



## Chapter 2

# G-VALUE

Laminated Glass				
	STATE	TVIS(%)	G-VALUE	REMARK
Light Grade SPD (4mm Clear+0.76EVA+SPD+0.76EVA+4mm Clear)	OFF	10	0.43	MEASURED
	110V	62	0.67	
Dark Grade SPD (4mm Clear+0.76EVA+SPD+0.76EVA+4mm Clear)	OFF	2	0.39	
	110V	40	0.55	
	220V	50	0.64	
Light Grade SPD + IR film (4mm Clear+0.38EVA+IR+0.38EVA+SPD+0.76EVA+4mm Clear)	OFF	9	0.3	
	110V	51	0.45	
Light Grade SPD + Double Low-E coated glass (5mmSKN165+0.76EVA+SPD+0.76EVA+4mm Clear)	OFF	8	0.21	
	110V	45	0.33	
Light Grade SPD + Double Low-E coated glass (5mmSKN154+0.76EVA+SPD+0.76EVA+4mm Clear)	OFF	7	0.19	
	110V	36	0.29	
<b>IGU simulation (Light SPD + Double Low-E coated glass)</b>				
Laminated (4mm Clear+0.76EVA+LG SPD+0.76EVA+5mmSKN154)+16Ar+5mm Clear	OFF	6	0.10	SIMULATED
	110V	38	0.24	
Laminated (4mm Clear+0.76EVA+LG SPD+0.76EVA+4mm Clear)+16Ar+5mm PLT-ONE	OFF	7	0.19	
	110V	47	0.38	

## ■ Chapter 3

# Operative ranges



### Operating Voltage

110 Vac (max. 220Vac)

(50 – 60 Hz, sine wave)

Power Consumption: 1-5W/m<sup>2</sup>



### Use Temperature Range

from -20° to +90 °C

## ■ Chapter 4

# Electrical bus bar application

### Standard application

Electrical bus bars are placed along sheet edges of the panels.  
Sketch list of possible bus bar layout is reported on next page.

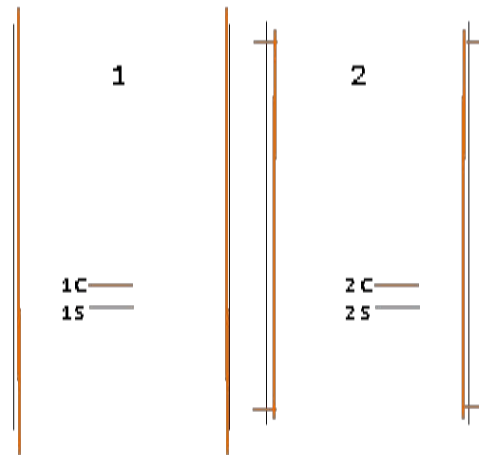
Innoptec will propose you the most appropriate set up in terms of effectiveness and safety.

Technical and overall specs

# Busbar sketch list 1/3

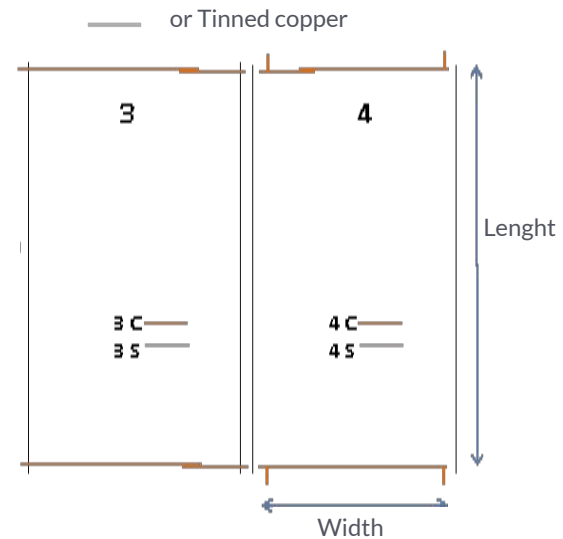
Busbars can be realized in two different tape colors

On both long edges  
Max lenght =  
5000 mm



Copper

On both short  
edges  
Max lenght =  
3200 mm

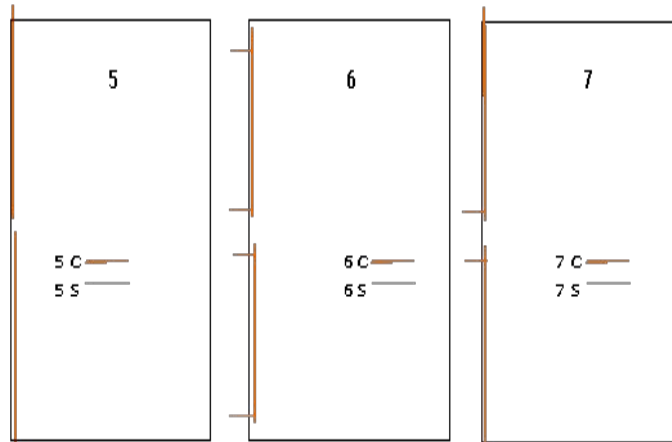




Technical and overall specs

# Busbar sketch list 2/3

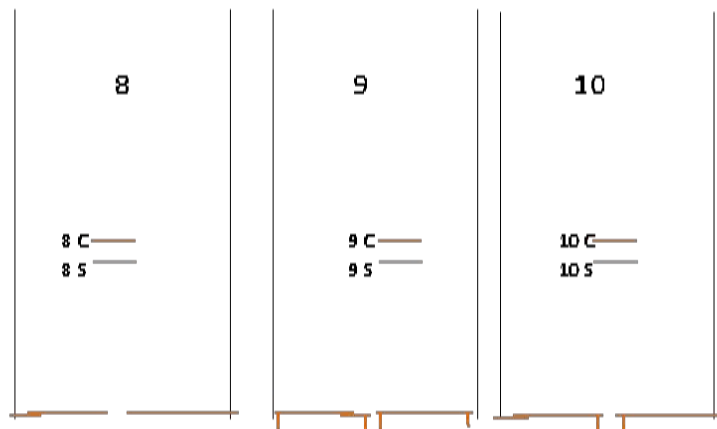
On one long edge  
Max lenght = 2700  
mm



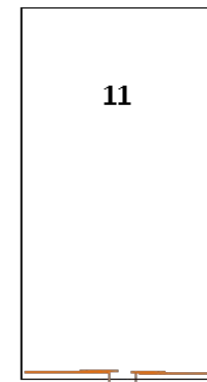
Technical and overall specs

## Busbar sketch list 3/3

On one short edge  
Max lenght = 2700  
mm



For A3/A4  
samples



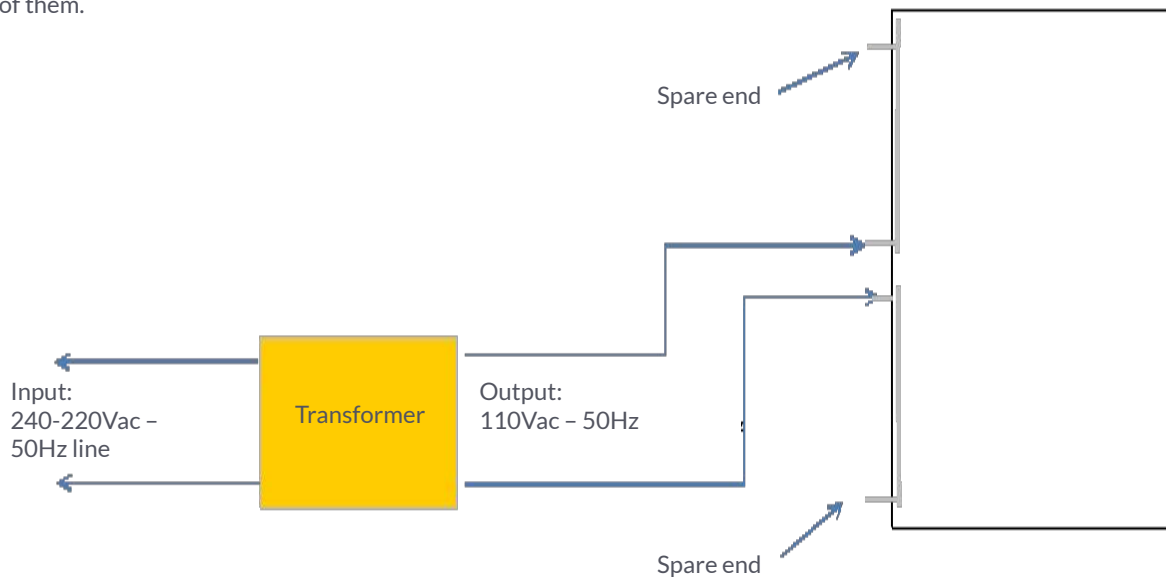
**Note:**

- Copper busbar tape on long edges of nHS film could be subjected to light wavy effect after glass lamination in oven.

Technical and overall specs

# Wiring diagram examples 1/2

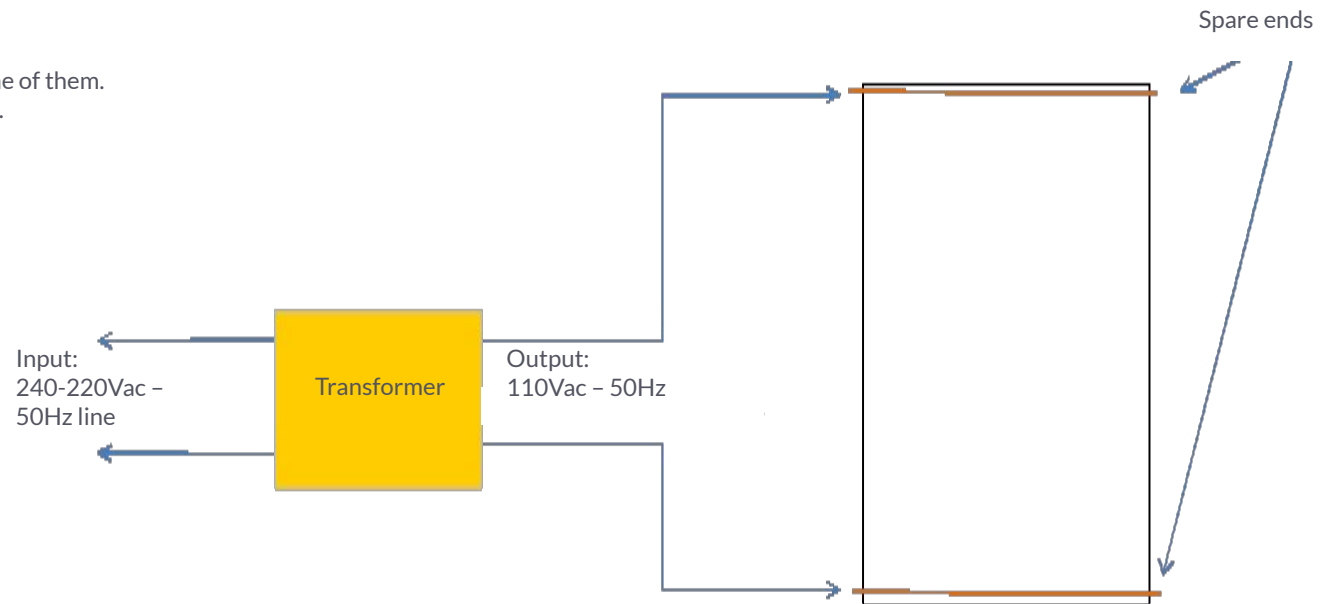
Each busbar has two ends.  
Wire can be joined on only on one of them.  
The other one end is a spare end.



Technical and overall specs

# Wiring diagram examples 2/2

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Wire can be joined on only on one of them.  
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# Technical and overall specs 1/3

**Innoptec** manufactures a LPF/SPD electro-optical film to be used in the architectural field. Please refer to Innoptec for advice in case of exterior use;  
All film is preliminary electrically tested before shipment.

## ■ 1\_Product supply conditions

Innoptec carries sufficient inventory for quick deliveries. Sheets with smaller width with respect to above standards, could have slightly higher quotation.

### Quality release limits

Inspection conditions:

- **Distance** = 1 m - perpendicular view
- **Back Lighting:** 300 – 500 Lux / white light (400-700 nm)
- **Inspection time:** 10 seconds per sqm.

Single spots smaller than 1 mm are considered acceptable.

Other optical non uniformities are not considered defective if they result invisible at above inspecting conditions.

### Electrical connections

(bus bars) are obtained by cutting sheets to the right size and subsequent bus bars application. The price of this work is included in the invoiced surface. Sheets cut to particular rectangular or other shapes , with or without bus-bars, can also be supplied on request, at a case by case pricing.

### Voltage Drivers/Transformers

The Innoptec SPD film works at 110Vac/50Hz.

We can supply many transformers based on the square meters required (to be referred to EU area, made according European standards (CE) and to be used where the voltage line is 220-230Vac-50Hz sine wave).

Different voltage driving solutions are also available on request (remote control – dimming - etc.).



with negative SPD available on request.

### SPD | Suspended particles device [General specifications - V. 01-02]

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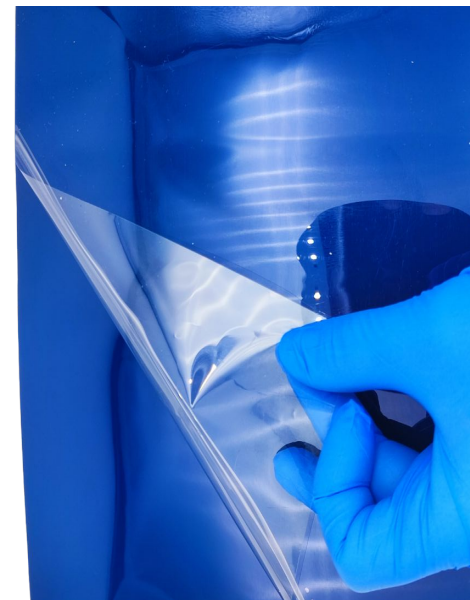
### Note

1. Voltage Stabilizer (UPS systems): All the voltage systems must be protected with an UPS system in order to avoid sudden voltage variations.

# Technical and overall specs 2/3

## ■ 2\_Notes for processing and manipulation

- Masking film removal should be made with care and in dust-free environment.
- Gently remove the masking film using powder-free gloves.
-  **Note:** Do not remove the transparent protective tape present on the copper of the busbars applied to the film.
- **Max temperature for glass lamination is 110°C for 60 minutes.**
- Allowed interlayers for glass laminating process are PU or EVA or Ionomeric sheets. PVB is to be used after preliminary validation test.





# Technical and overall specs 3/3

## 3\_Warranty

- **After lamination:** In case of demonstrated failure of Innoptec Switchable film after lamination, latest within two years from delivery date, the maximum compensation will be free of charge replacement of the area of lost film. Black spots (caused by short circuit) appearing after lamination will not be considered Innoptec failure, as film is 100% electrically controlled before shipment. Innoptec warns laminators to use adhesive interlayers not containing migrating plasticizers as they may cause the film to become clear and therefore not anymore capable of switching. PVB is to be used after preliminary validation test.
- **After installation:** Considering that framing, installation, on site electrical wiring are not under its control, Innoptec is in principle not available to consider warranty on Product framed and/or or installed in the field.
- Unproper framing may pinch the laminate, bend it due to not planar frames, causing switchable film detachments or delaminations. Innoptec furthermore wants to stress that Buyer should inform customers not to use adhesives and sealants containing migrating, low molecular weight components (like plasticizers, liquid stabilizers, residual solvents, monomers) and to avoid contacts with oils and greases as they will, sometime after lamination or laminated glass sealing, damage the liquid crystal compound, resulting in clear spots and loss of switching capability in the damaged area.
- Oily wood frames should be protected by a reactive paint (Polyurethane or Epoxy) to prevent oils or rosins to migrate into the switchable film.

### Usable neutral sealant

Among neutral sealants Innoptec customers experienced good results by using:

- Alcosil by Zucchini
- 791T by Dow Corning

Sealant for insulating glass unit: Dow Corning 3793 Black




### ALCOSIL (by Zucchini) - 791T (by Dow Corning)


Low modulus neutral silicone sealants. High movement accommodation and good adhesion onto most of building materials, glass, metals, painted surfaces, marble, clean concrete. Excellent weather resistance as well as to sunlight in a wide temperature range.


- **Applications:** Suitable for glazing windows, skylights, curtainwalls, for perimeter joints of door and window frames made of metal, PVC and wood
- **Packaging:** Cartridge 310 ml
- **Colours:** Translucent - White



## ■ Safety Information

 **IMPORTANT:** Please read these instructions fully before installing or operating

 **IMPORTANT:** Installation must be made by qualified personnel.

 **IMPORTANT:** Innoptec liquid crystal film must be driven with CE marked transformers with a maximum output voltage of 60Vac.  
All Innoptec transformers have the following safety features:



- Short-circuit and Overload protection
- Insulation **Class II**
- **CE Mark**
  - 2006/95/CE – (LVD) LOW VOLTAGE DIRECTIVE of 12/12/2006
  - 2004/108/CE – (EMC) ELECTRO MAGNETIC COMPATIBILITY
  - 2006/42/CE – MACHINE SAFETY

Furthermore, they comply with the following directives:

- EN 61558-1 Safety of transformers, reactors, power supply units and combinations.
- EN 61558-2-4 Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers for general applications.
- Wiring and electrical connections must be made by qualified personnel according the local regulations.
- Periodically check the good condition of the cables and connections.
- Use only neutral silicone sealants.
- Keep a safety distance of 2-3mm from the edge of the film to the edge of glass.
- Do not use water or liquids with solvent on the liquid crystal film.
- Before cleaning, unplug main power of transformer.
- We recommend placing the electrical connections on the upper side of the glass.
- Be sure that the INPUT voltage correspond exactly to the specifications given on the supplied power supply units.
- Provide appropriate ventilation to power supply units.

# Warnings and general disclaimer

Above indications represent the best result of **Innoptec** experience in the field of its Switchable film use and of Innoptec lab experimental activity. It is not Innoptec responsibility to decide the film processing conditions and final use practices and setup in order to obtain the best result. Anyhow Innoptec is available to make its experience available to customers facing specific cases and problems.

Furthemore is Buyer responsibility to check whether the use of the Switchable film abides by any safety regulation prevailing in any country where it will be installed alone or in combination with other materials. It is also Buyer responsibility to ascertain whether the application or design of final goods containing the Innoptec Switchable film may infringe third parties rights covered by patents, trademarks and any other type of intellectual property.

By signing order confirmations Buyers of **Innoptec** film keep the same harmless of possible claims and indemnification requests raised by persons or organizations in connection of above Buyer responsibilities.

## On receiving the film:

1. Inspect carefully the packages before accepting them: if there is a damage, even if it appears as a minor scratch, or detached tapes, or lack of label and/or accompanying documents, refuse the delivery or accept it with reserve to ask for damages. Take good quality pictures. In case of delivery refusal drop immediately the claim with the forwarder. Report the case, with pictures, to Innoptec within the same dates as above.
2. If delivery has been accepted, open carefully and check for internal damages: in case of damages to the goods, send immediately a fax or email with good quality pictures to the forwarder with reference to the acceptance reserve. All claims have to be completed latest within one week after refusal or accepted delivery.
3. Innoptec will not accept any claim for any damages to the film after masking film removal.

**E-Mail: [info@innoptec.it](mailto:info@innoptec.it)**



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**ENGLISH**

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