BACKER
CALESCO

STARTER KIT
FOIL HEATING INTRODUCTION

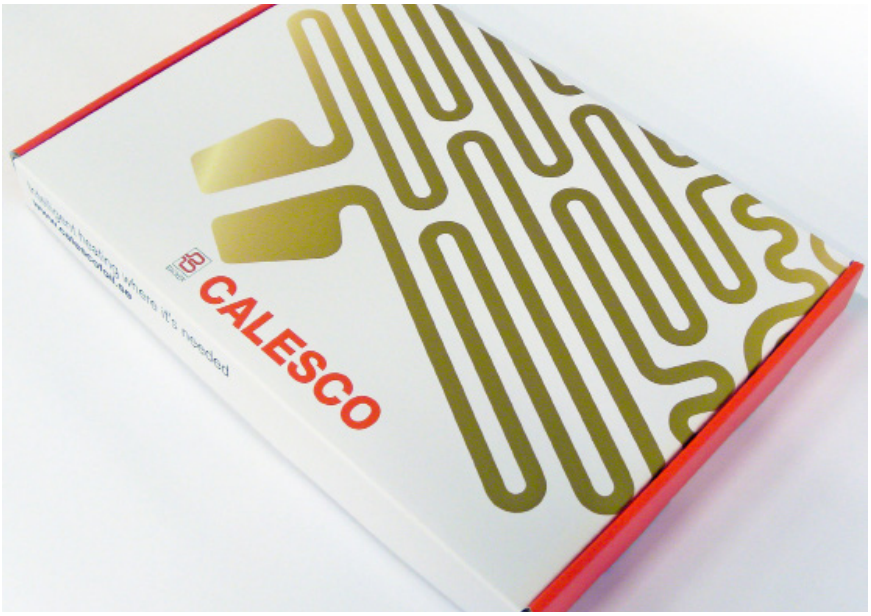
STARTER KIT

7 heaters / 6 different materials

For engineers and R&D dept. that wants to learn more or need heaters for a development project a starter kit is the ideal solution. Here you get an introduction to foil heaters together with data sheets and useful information.

With the starter kit you will get 7 heaters in 6 different materials that you can use for testing and development in order to find the right solution for your application. The heaters can operate under different voltages giving different power. One of the heaters has integrated temperature control and is set to keep 52°C.

Order the starter kit to get started with your project and get to know the different materials to find the best solution.



Materials

- Polyimide
- Silicone
- Mica
- Polyester
- PTC
- PEN

Standard heater selection

Available for immediate delivery

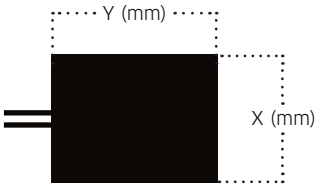
Calesco also has an selection of standard heaters available on stock for immediate delivery to customers. The heaters can operate under different voltages giving different power. The standard heaters can be a good start in the development stage, the heaters are already designed and have the tooling ready.

Our experienced engineers will help you to with finding the right heater if you have any doubts on which one to choose. If you are interested in our standard heater selection and prices please contact us for more information! You can find our selection in page: 12-13.

STARTER KIT

Specifications - For heaters included in the starter kit

Type (form)



Heater specifications

Part No.	X (mm)	Y (mm)	Type	Area (cm^2)	Resistance (Ohm)	Power (W)	Voltage (V)	Material	Other details
PI109366-00	100	100		100	3,64	40	12	Polyimide	-
PI109406-00	50	50		25	3,89	40	12	Polyimide	Integrated temperature control, 52°C
SI109367-00	100	100		100	3,64	40	12	Silicone	-
PM109369-00	100	100		100	10	15	12	PTC	Self regulating
PN109403-00	100	100		100	3,64	40	12	PEN	-
PO109365-00	100	100		100	7,27	20	12	Polyester	-
MI109368-00	100	100		100	5,82	100	24	MICA	-

DESIGN GUIDELINES

Calculation of power

The following information will assist in the design of elements and rough calculation of data. Optimum power and temperature conditions for specific applications are usually determinated experimentally.

The following formula can be used to determine approximately the required rating P (Power) to heat a given material.

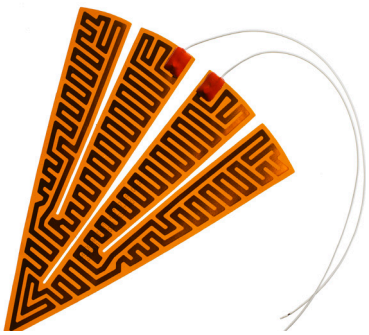
$$P = \frac{\text{Weight of material (g) x Spec.heat (Ws/g °C) x temp. rise °C}}{\text{Time sec}} \quad W$$

Technical specification

Spec. heat and density of common materials:

Material	Spec. heat Ws/g	Density g/cm³)
Aluminum	0.90	2.7
Copper	0.39	8.9
Stainless steel	0.50	8.0
Iron	0.46	7.8
Water	4.18	1.0

Product photo



Temperature control

In conjunction with CALESCO foil heating elements it is usually necessary to arrange some form of control to ensure that the desired temperature is maintained.

This can be achieved with electromechanical thermostats of bimetallic type where temperatures and surface ratings are low, while electronic thermostats are prefered where temperatures and surface loads are high.

We can fit thermostats, temperature fuses and sensors of the thermoelement type, thermistors and resistance sensors directly to element in accordance with customer specifications.

Electrical insulation and leakage current

When a foil element is fitted on or in contact with a metal, surface leakage current must be taken into account. The basic standard for heating appliances is laid down in the rules IEC 335-1, on which various national standards are based.

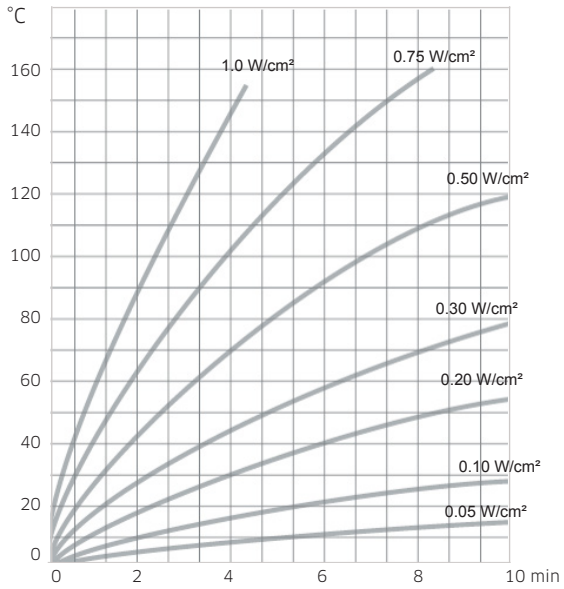
The maximum level of leakage current for Class I (earthed) appliances is 0.75 mA/kW while for Class II (double-insulated) appliances it is 0.25 mA/kW. Medical appliances are subjected to special leakage current restrictions as per IEC 601.

Temperature curves and required power

The diagrams below show temperature rise as a function of time for certain applications and various types of element with different surface rating. Surface rating is defined as the total power divided by the effective area of one side of the element.

Optimum power and temperature conditions for specific applications are usually determinated experimentally.

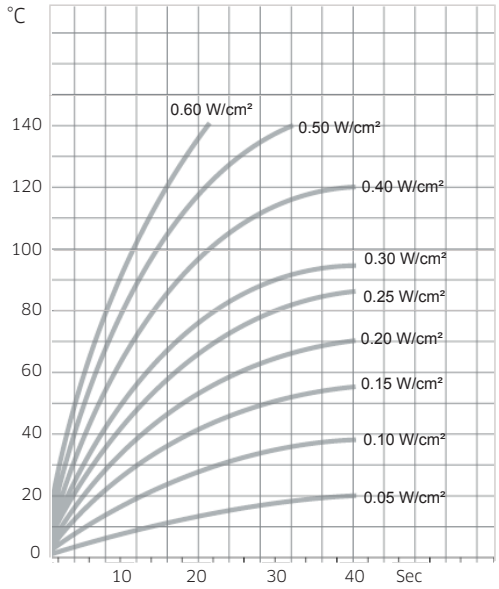
Temperature rise for element mounted on aluminium



Watt density W/cm²	0.05	0.10	0.20	0.30	0.50
Final temp. rise °C	25	45	80	105	160

Foil element mounted on an aluminium plate, 215x155x5 mm, with adhesive and suspended horizontally in free air.

Temperature rise for element alone



Watt density W/cm²	0.05	0.10	0.15	0.20	0.25	0.30	0.40	0.50	0.60
Final temp. rise °C	25	45	60	80	90	105	130	160	175

Foil element, 210x150 mm, suspended horizontally in free air.

Benefits

- Space saver
- Optimized heat distribution
- High/Low wattage
- Custom design
- Cost efficient

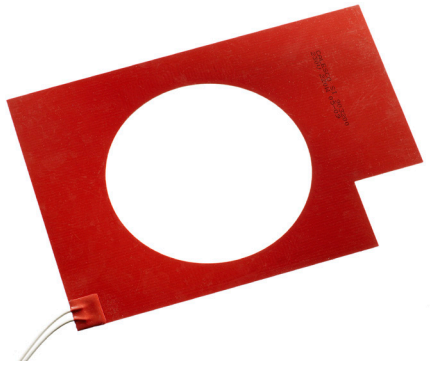
SILICONE HEATERS

BACKER CALESCO

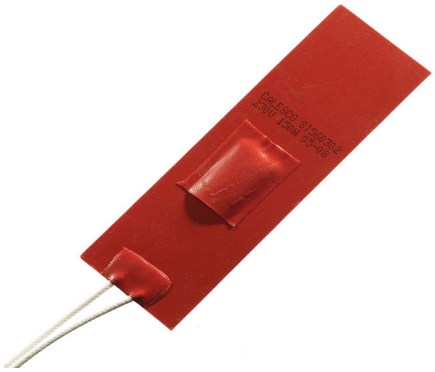
Description

Silicon rubber is a rugged, flexible material with excellent temperature properties. They can be used in both high and low temperature applications.

Fiberglass-reinforced silicone rubber gives your heater dimension stability without sacrificing flexibility.



Product photo



Technical specification

Max element temp.	235 °C (457 °F)
Min. element temp.	-50 °C (-58 °F)
Dielectric strength at 20°C AS per ASTM KV/mm	21- 23
Thermal conductivity at 100 °C W/(m•K)	0.24
Moisture absorption as per ASTM D-570-63. (24h immersion at 23°C)	0.1 %
Waterproof as per IEC 335-1 sect. 15-16	yes
Constant of dielectricity at 25°C, 50Hz	2.9-3.6
Bending radius, min	3 mm
Max. element width	610 mm
Power density	1,3 W/cm²
Resistance tolerance	As standard, ±5% of nominal. Tolerance down to ±2% avaliable
Rated voltage	Up to 1000 V AC/DC single or 3 phase
Approvals/Standards	ETL (UL, V0, HB)

Benefits & Fields of Application

BENEFITS

- Can be factory vulcanized to metal parts
- PSA assembly
- Low gas permeability

FIELDS OF APPLICATION

- Food service equipment
- Freeze protection and condensation prevention for instrumentation and equipment
- Medical respirators
- Ultrasonic cleaners

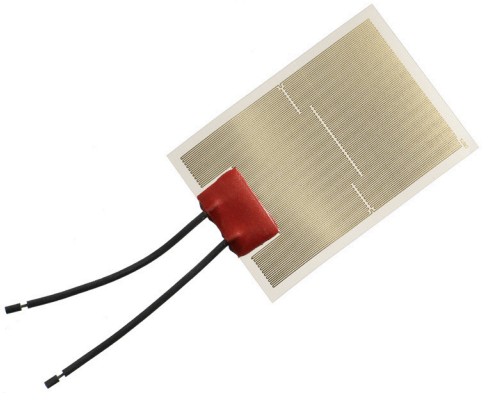
Application photo

POLYESTER HEATERS

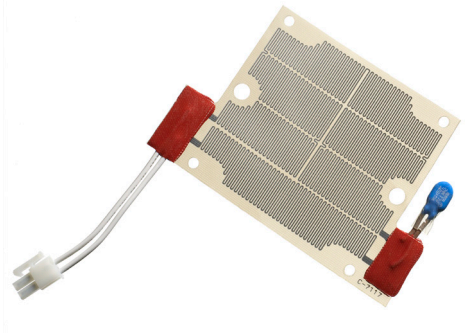
BACKER CALESCO

Description

The etched heating element has superior heat transfer and exceptionally uniform heat output, which results in a faster warm-up cycle and longer life. Use this heater to cover large areas with even heat, for flat or gently curved surfaces. Etched foil polyester heaters can be designed and fabricated in many types of configurations to fit the size and shape required in your application.



Product photo



Technical specification

Max element temp.	130 °C (266°F)
Min. element temp.	-60°C (-76°F)
Dielectric strength at 20°C AS per ASTM KV/mm	175
Thermal conductivity at 100 °C W/(m•K)	0.16
Moisture absorption as per ASTM D-570-63. (24h immersion at 23°C)	0.8%
Waterproof as per IEC 335-1 sect. 15-16	yes
Constant of dielectricity at 25°C, 50Hz	3.3
Bending radius, min	1 mm
Max. element width	610 mm
Power density	0,6 W/cm²
Resistance tolerance	As standard, ±5% of nominal. Tolerance down to ±2% avaliable
Rated voltage	Up to 1000 V AC/DC single or 3 phase

Benefits & Fields of Application

BENEFITS

- Low wattage
- Distributed wattage
- Edge loss compensation
- Very small sizes of heaters can be precizely manufactured
- Economical mass production
- Accurate reproduction of complex circuits

FIELDS OF APPLICATION

- Bathroom mirror heater
- De-icing equipment
- Rear view mirror
- Hand grip heater

Application photo

POLYIMIDE HEATERS

Description

Polyimide is a thin, semitransparent material with excellent dielectric strength. It is also resistant to most chemicals, acid and basis. The temperature range is between as low as -271°C (liquid helium) and as high as 200°C. If requested we have the possibility to add components such as thermistors, sensors and IC circuits, by soldering them to the element.

Product photo

Technical specification

Max element temp.	200 °C (392 °F)
Min. element temp.	-271 °C (-456 °F)
Dielectric strength at 20°C AS per ASTM KV/mm	205
Thermal conductivity at 100 °C W/(m•K)	0.12
Moisture absorption as per ASTM D-570-63. (24h immersion at 23°C)	2.8 %
Waterproof as per IEC 335-1 sect. 15-16	No
Constant of dielectricity at 25°C, 50Hz	3.5
Bending radius, min	1 mm
Max. element width	610 mm
Power density	1,3 W/cm²
Resistance tolerance	As standard, ±5% of nominal. Tolerance down to ±2% avaliable
Rated voltage	Up to 1000 V AC/DC single or 3 phase

Benefits & Fields of Application

BENEFITS

- High and low temperature range
- Excellent dielectric strength
- Good chemical resistance
- Soldered components possible

FIELDS OF APPLICATION

- Military/areospace, where low outgassing properties are required
- Medical diagnostic instruments, where autoclave cleaning or sterilization is needed
- Photographic equipment
- LCD displays
- Laboratory research

Application photo

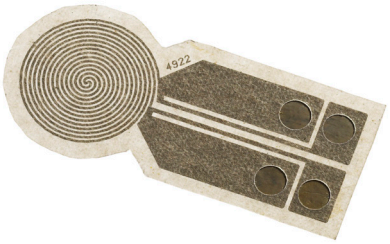
MICA HEATERS

Description

The Mica heaters are etched foil elements, sandwiched between layers of mica. The heater can be rigid or soft in order to fit the application.

In all cases the mica heater need uniform mecanical clamping to give the best longterm performance.

Product photo



Technical specification

Max element temp.	600°C (1112°F)
Min. element temp.	-150°C (-238°F)
Dielectric strength at 20°C AS per ASTM KV/mm	>25
Thermal conductivity at 100 °C W/(m•K)	0.30
Moisture absorption as per ASTM D-570-63. (24h immersion at 23°C)	<1%
Waterproof as per IEC 335-1 sect. 15-16	NA
Constant of dielectricity at 25°C, 50Hz	4-5.5
Bending radius, min	NA
Max. element width	900 mm
Power density	5 W/cm² (depending on application)
Resistance tolerance	As standard, ±5% of nominal. Tolerance down to ±2% avaliable
Rated voltage	Up to 1000 V AC/DC single or 3 phase
Other	Thickness min. 0,1 mm

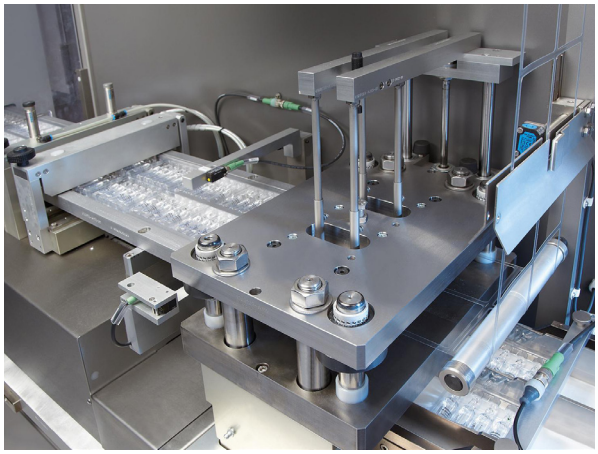
Benefits & Fields of Application

BENEFITS

- High power destiny
- Possibility to be used assembled in open air
- High working temperatures
- Fast warm up

FIELDS OF APPLICATION

- Packing, strapping and sealing equipment
- Food service appliances
- DNA analyse
- Semiconductor industry
- Radiators, heating panels



Application photo

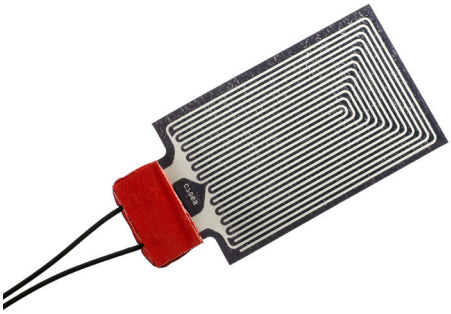
PRINTED POLYMER HEATERS
PTC

BACKER CALESCO

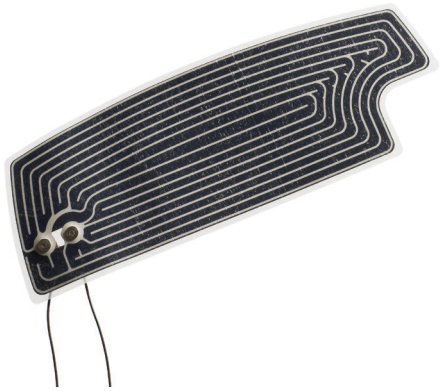
Description

Printed Polymer heaters are based on low resistance printed silver as electrode. The heat is generated by a number of parallel connected polymer resistors with PTC characteristics (Positive Temperature Coefficient).

In most cases the polymer resistor is covering the heater completely and hence gives a very even temperature distribution. The PTC effect makes the heater self limiting and therefore hot and cold spots are avoided as the power is generated were you need it. The polymer heater is also very corrosion resistance compared to metal heaters.



Product photo



Technical specification

Max element temp.	70 °C (158°F)
Min. element temp.	-50°C (-58°F)
Dielectric strength at 20°C AS per ASTM KV/mm	175
Thermal conductivity at 100 °C W/(m•K)	0.16
Moisture absorption as per ASTM D-570-63. (24h immersion at 23°C)	0.8 %
Constant of dielectricity at 25°C, 50Hz	3.3 (PET)
Power density at -40°C	0.3 W/cm²
Resistance tolerance	±20%
Rated voltage	800 V
Other	Possible substrates: PET

Benefits & Fields of Application

BENEFITS

- Self regulation
- Robust design insensitive to small damages
- Corrosion resistant
- Cost effective at low power and high voltage

FIELDS OF APPLICATION

- Rear view & wing mirror heaters
- Lens heaters
- Waterbed heaters
- Low temperature applications
- De-icing

Application photo

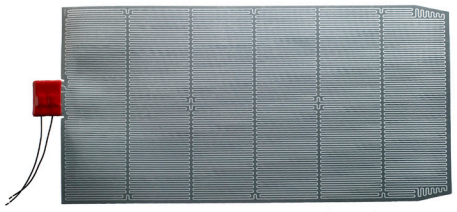
PEN HEATERS

BACKER CALESCO

Description

PEN is a heater similar to PET but with much better properties.
PEN is a little more expensive than PET, but have higher chemical, thermal, mechanical and electrical properties.
The material is common used in electronic devices.

Product photo



Technical specification

Max element temp.	160°C (320 °F)
Min. element temp.	-60 °C (-76 °F)
Dielectric strength at 20°C AS per ASTM KV/mm	160
Thermal conductivity at 100 °C W/(m•K)	0.16
Moisture absorption as per ASTM D-570-63. (24h immersion at 23°C)	0.8 %
Waterproof as per IEC 335-1 sect. 15-16	yes
Constant of dielectricity at 25°C, 50Hz	3.2
Bending radius, min	1 mm
Max. element width	610 mm
Power density	1 W/cm² (depending on application)
Resistance tolerance	As standard, ±10% of nominal.Tolerance down to ±2% available
Rated voltage	Up to 1000 V AC/DC single or 3 phase

Benefits & Fields of Application

BENEFITS

- Possible to waveflow solder with leadfree solder
- Higher temp possible compared to PET
- Good chemical resistance
- Higher mechanical strength with 3 approx 30% compared to PET

FIELDS OF APPLICATION

- Bathroom mirror heaters
- Radiators
- DNA Analysis
- High power standard elements (more cost effective compared to polyimide elements)

Application photo

STOCK FLEXIBLE FOIL HEATERS

BACKER CALESCO

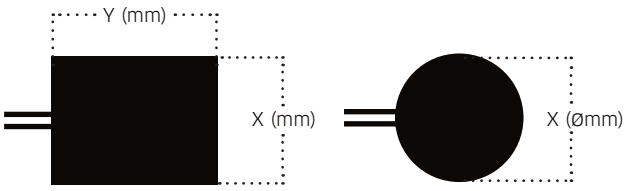
Description

Calesco has a selection of heaters available on stock for immediate delivery to customers. The heaters are designed to a certain resistance and can be operated under different voltages to give different power as shown in the tables below. The heaters can be incorporated directly into a heating application, if the performance is right, or be used as a test heater to figure out the appropriate surface power for the specific application before ordering a tailor made heater.

Note: At surface power over ca 0,4/cm² the heater requires good contact with a suitable heat sink.

Specification for each heater type can be found in the corresponding data sheet.

Type (form)



>> Silicone

Silicon rubber is a rugged, flexible material with excellent temperature properties, max 235°C. Fiberglass-reinforced silicone rubber gives your heater dimension stability without sacrificing flexibility. The silicone heater is chemical resistant and can be cold laminated with adhesive to various surfaces.

						12V	24V	48V	110V	230V	400V
Part No.	X (mm)	Y (mm)	Type	Area (cm²)	Resistance (Ohm)	Power (W)	Power (W)	Power (W)	Power (W)	Power (W)	Power (W)
SI102985-00	25	50		12.5	56.9	2.5	10.1	40.5	-	-	-
SI102987-00	50	50		25	28.8	5.0	20.0	80.0	-	-	-
SI102989-00	50	100		50	14.4	10.0	40.0	160.0	-	-	-
SI102991-00	95	110		100	151	-	-	15.3	80.0	350.3	-
SI102993-00	95	200		200	75.5	-	-	30.5	160.3	700.7	-
SI102995-00	95	200		200	331	-	-	-	36.6	159.8	483.4
SI102997-00	190	200		400	37.8	-	-	61.0	320.1	1399.5	-
SI102999-00	190	200		400	165	-	-	-	73.3	320.6	969.7
SI103001-00	190	300		600	110	-	-	-	110.0	480.9	1454.5
SI103003-00	ø 50	-		20	18.9	7.6	30.5	-	-	-	-
SI103005-00	ø 70	-		38	19.2	7.5	30.0	120.0	-	-	-
SI103007-00	ø 100	-		79	9	16.0	64.0	256.0	-	-	-
SI103009-00	ø 150	-		177	16.5	-	34.9	139.6	733.3	-	-
SI103011-00	ø 200	-		314	211.6	-	-	-	57.2	250.0	756.1

STOCK FLEXIBLE FOIL HEATERS

BACKER CALESCO

>> Polyimide

Polyimide is a thin, semi-transparent material with excellent dielectric strength. It is also resistant to most chemical acids and basis. Temperature range as low as -271°C (liquid helium) and as high as 200°C.

						1,5V	3V	4,5V	6V	9V	12V	24V	48V
Part No.	X (mm)	Y (mm)	Type	Area (cm^2)	Resistance (Ohm)	Power (W)	Power (W)	Power (W)	Power (W)	Power (W)	Power (W)	Power (W)	Power (W)
PI102831-00	25	50		12.5	1.9	1.2	4.7	10.7	18.9	-	-	-	-
PI102833-00	50	50		25	3.6	0.6	2.5	5.6	10.0	22.5	40.0	-	-
PI102835-00	50	100		50	1.8	1.3	5.0	11.3	20.0	45.0	80.0	-	-
PI102837-00	100	100		100	3.6	-	2.5	5.6	10.0	22.5	40.0	160.0	-
PI102839-00	100	200		200	1.8	-	5.0	11.3	20.0	45.0	80.0	320.0	-
PI102841-00	195	200		400	3.6	-	-	-	10.0	22.5	40.0	160.0	640.0
PI102843-00	195	300		600	2.4	-	-	-	15.0	33.8	60.0	240.0	960.0

>> Micanite

The Mica heaters are an etched foil element, sandwiched between layers of mica. Mica material creates a fairly rigid heater, but is also able to handle extreme temperatures. For use at lower temperatures (below 100°C), it works perfect as a stand-alone heater. However, higher temperatures require proper support and even pressure to provide good heat transfer. For example, it can be uniformly clamped between two metal plates.

						12V	24V	48V	110V	230V	400V
Part No.	X (mm)	Y (mm)	Type	Area (cm^2)	Resistance (Ohm)	Power (W)	Power (W)	Power (W)	Power (W)	Power (W)	Power (W)
MI102981-01	100	100		100	353.0	-	-	6.5	34.3	149.9	453.3
MI102983-01	180	200		400	88.2	-	-	26.1	137.2	599.8	1814.1

ASSEMBLY INSTRUCTIONS

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1. Adhesive

If the release paper does not come off, or tears, the element should NOT be used. If this happens the element must be scrapped. There can be small bubbles or wrinkles in release liner, making the surface of the adhesive look slightly different (stains, marks…). This is only visual effect and does not impact the adhesion.

- Surface tension should be above 38 Dynes/cm². If surface energy is below 38 Dynes/cm² we recommend cleaning with alcohol, isopropanol or corona treatment.
- The maximum adhesion is reached 72 h after assembly. Any usage or testing of performance is therefore made more than 24 h after assembly.

2. Packaging & Storage

Change of packaging is not recommended, since it can create creases, folds and terminal damage if heaters are not handled with care. If however repackaging the parts for production reasons is done, heaters should be placed flat.

Optimal Storage for heaters is at a temperature of 21°C, with 50% RH

Life time of heaters:
If stored in closed cartons, in optimal conditions as above, storage time of heaters can be at least 36 months without any damage. If heater exceeds this time limit, we recommend a pull-force test of the heater on a sub-assembly to verify adhesion. Our experience shows that the adhesive is still performing as in initial conditions.

Warranty time:
Standard warranty time is 24 months from deliver date, unless specific agreements.

3. Assembling recommendations

How to proceed:

It is of utmost importance that proper training exists for the team members assembling the heater sub assembly.

- Remove release liner on the first side to be mounted
- Avoid touching the surface of adhesive with hands or clothes
- Position element to surface, press smoothly to avoid creation of air pockets or air bubbles (can cause over heating and lower adhesion performance)
- Remove release liner on second side of elements, if applicable
- Avoid touching surface of adhesive with hands or clothes
- Press sub-assembly in appropriate fixture, with an evenly distributed force over the whole surface of glass and back plate, if applicable
- Force on element should be approximately 1km/cm², for min 10 seconds

If heater is misplaced or miss-aligned during assembling:

- DO NOT CUT heater to allow air out of assembly
- DO NOT try to re-assemble, due to risk of circuit damage (heater is to be scrapped)
- DO NOT cut around the part (circuit will be damaged)

4. Curing time after assembly

All adhesives used today by Backer are pressure sensitive adhesives, and need activation and polymerization to reach their full performance, we recommend to let the heater cure for 24 hours at RT. We strongly advice not to perform any pull test on glass during the first hour of assebly, this can cause a stoppage in the curing process of the adhesives and create later openings.

5. Testing after assembling

No testing of the adhesion should be performed until the assembly has cured for at least for 24 hours. Full curing is achieved after 72 hours. This guideline is provided for your information, it is not exhaustive, and can be modified at any time by our company.

6. Important recommendations

The information provided in this document is correct to the best of our knowledge.
Each product we manufacture has been developed carefully. However, experience has shown that for each product and application, the requirements may differ from case to case. We therefore recommend that you carry out your own test to verify that the mounting is done to provide best results. All information is given in good faith, based on tests, but without guarantee.

Backer AB / Div. Calesco
Västra Åvägen 11
SE-734 51 Kolbäck, Sweden
Tel: +46 (0) 220 453 00
backercalesco.com

EVERYDAY · EVERYWHERE

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