Phormium

Growth driven. Future proof.

Growth driven. Future proof.

Reference book

info@phormium.com ◆ www.phormium.com

Growth driven. Future proof.

Phormium
Growth driven. Future proof.

Table of contents

WELCOME

Dear reader,

You are holding Phormium's complete technical reference book for climate screens.

Have you ever wondered why screens are needed? Do you sometimes find it hard to choose a certain type of screen for your customers? This book will provide you all the answers. You will find everything you need to know about our company, about our products and also a comparison with other products on the market.

This book can serve as a sales tool with fact sheets, as reference book or even as a training manual for new coworkers.

Of course, our sales team is available to answer any other question you may still have. Please reach out to us through our website or via your sales contact.

Enjoy reading!

The Phormium team

ABOUT PHORMIUM

The Phormium brand in time

1925

Textile company Phormium

The company started by weaving natural jute for packaging. Phormium is the type of flax which is used.

1977

First Phormium screens

Introduction of Phormium in the horticultural sector.

1986

Phormium becomes a part of Low & Bonar

Followed by a complete rebranding, Phormium became part of (Low&) Bonar.

2017

Takeover by IFG

Low & Bonar 's agrotextile division becomes part of IFG.

2018

Re-introduction Phormium

The globally recognized brand for agrotextiles is back.

Phormium
Growth driven. Future proof.

PHORMIUM PLANT BELGIUM

Selling in more than **60** countries

production of all
- climate screens
- biobased ground covers
- mushroom & compost nets
- industrial fabrics

Approx.
200
employees

Active in **niches** with growth

IFG Cresco®

Reinvestment in R&D **>5%**

Focused on significant organic **growth** opportunities

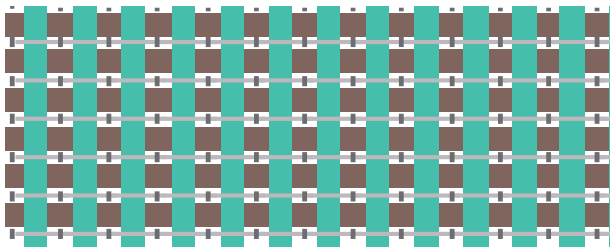
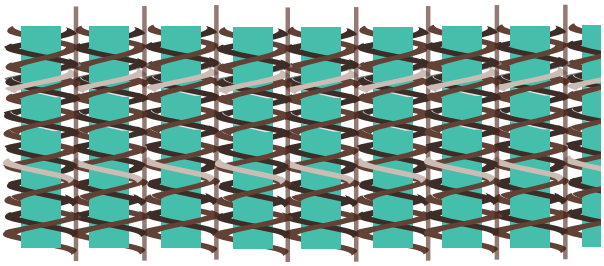
PLC. quoted on **Stockholm Stock Echange**

* part of the IFG/Duroc Group

PHORMIUM'S UNIQUE TECHNOLOGY

Unique technology

Phormium screens are unique because of their **woven technology**.
Compared to knitted screens, this has numerous benefits:

Woven screen	Knitted screen
	
Tapes in two directions: ◆ High dimensional stability over time. ◆ High insulation capacity, even at end-of-life -> **emissivity is up to 2X lower** than in knitted screens.*	Tapes in one direction: ◆ Low dimensional stability: higher chance of twisting tapes during installation and operation. ◆ Lower insulation capacity.
Low shrinkage (max 1%) thanks to thermal fixation of the tapes.	Higher shrinkage
High mechanical properties thanks to HDPE ◆ High **strength**: up to **5X higher** than knitted equivalent -> longer product life. ◆ Long product life: **6 year warranty** (NL).	Reduced product life due to the use of e.g. LDPE ◆ Warranty only 5 years (NL)
Up to **25% more active moisture transport** thanks to acrylic yarns without energy loss.	Low moisture transport due to the use of polyester yarns.
Cooling capacity up to 38% higher in open screens.	Lower cooling capacity due to high amount of yarn crossings.
Darkest blackout on the market.	More light penetration because of open knitted structure.

*As tested by Wageningen University

PHORMIUM'S UNIQUE TECHNOLOGY

Control over the production process

The entire production process takes place in Europe:

- Fully controlled production process from raw materials to finished goods
- Extensive quality control throughout the process
- In-house R&D department and testing lab

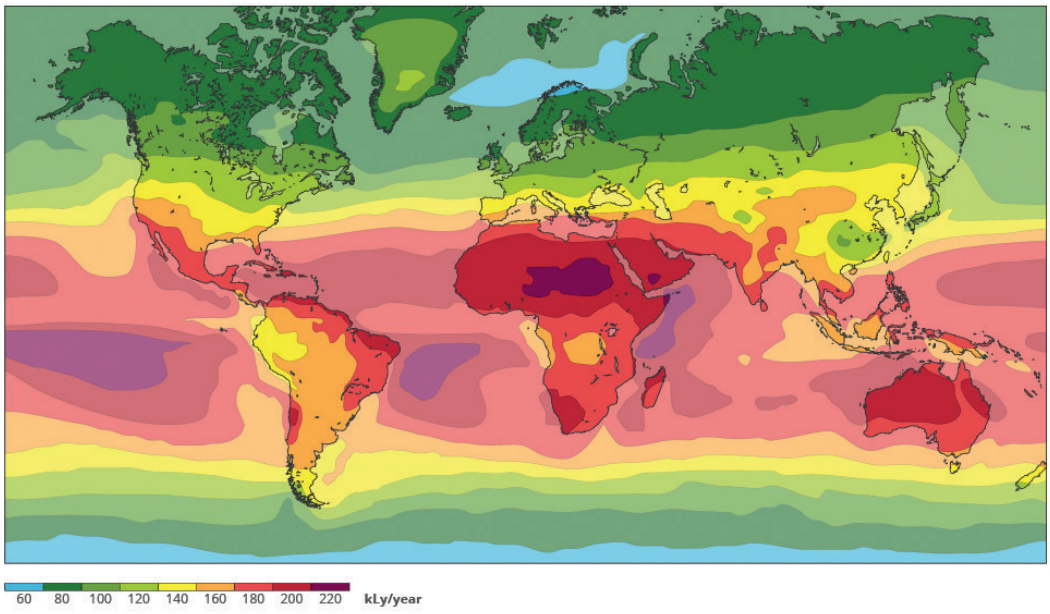
FR behaviour

As safety is one of Phormium's highest priorities, the PhormiTex screens comply to the highest European and North American FR standards. Please check our technical data sheets for more information.

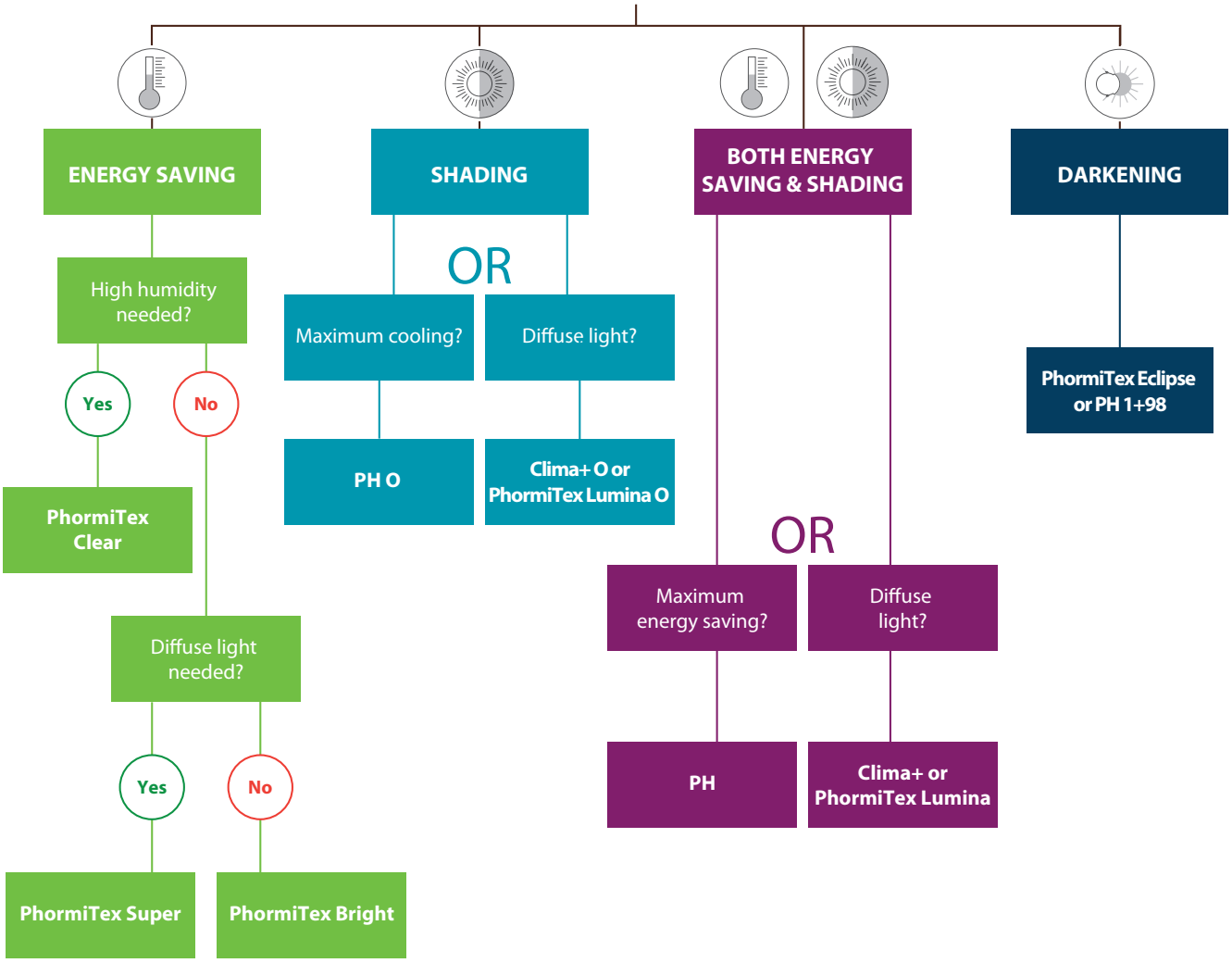
Extensive warranty

- Our warranty is based on the **amount of UV light** (~sunlight) our screens can handle, since UV light is one of the most important factors for degradation.
- The **intensity of UV radiation is measured in kLy** (kilo-Langley), a unit which represents how much UV radiation energy falls on a m^2 per year. On the map below, one can see how much UV radiation normally falls in a certain region of the world.

  E.g. In The Netherlands, the radiation is 100 kLy per year. The warranty for PhormiTex Bright is 600 kLy. This means that PhormiTex Bright has a warranty period of 6 years when installed in The Netherlands.



HOW TO CHOOSE WHICH SCREEN IS REQUIRED?



Phormium
Growth driven. Future proof.

OVERVIEW SCREENS

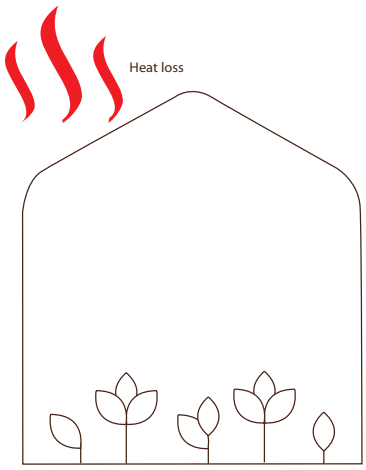
Type	Standard widths (cm)					FR**	Energy saving %	Shading %
ENERGY SAVING SCREENS								
Phormitex Clear	325	*	430	480	530	Yes	47%	11%
Phormitex Bright	325	400	430	480	530	Yes	47%	13%
Phormitex Super	325	*	430	480	530	Yes	47%	15%
OPEN SHADING SCREENS								
PhormiTex Lumina 30 O	325	*	430	480	525	Yes	10%	30%
PhormiTex Lumina 40 O	325	*	430	480	525	Yes	15%	40%
PhormiTex Lumina 50 O	325	*	430	480	525	Yes	20%	50%
PhormiTex Lumina 60 O	325	*	430	480	525	Yes	25%	60%
Clima+ 35 O	325	400	430	480	525	No	10%	35%
Clima+ 45 O	325	*	430	480	525	No	15%	45%
Clima+ 55 O	*	400	430	480	525	No	20%	55%
Clima+ 65 O	*	*	430	*	525	No	25%	65%
PH 55 O	325	*	430	480	*	No	20%	55%
PH 66 O	325	*	430	480	*	No	25%	66%
PH 77 O	325	*	430	480	*	No	30%	77%
CLOSED SHADING SCREENS								
PhormiTex Lumina 30	325	*	430	480	530	Yes	47%	30%
PhormiTex Lumina 40	325	*	430	480	530	Yes	47%	40%
PhormiTex Lumina 50	325	*	430	480	530	Yes	47%	50%
PhormiTex Lumina 60	325	*	430	480	530	Yes	47%	60%
Clima+ 35	*	400	430	*	530	No	47%	35%
Clima+ 45	325	*	430	480	530	No	47%	45%
Clima+ 55	325	400	430	*	530	No	47%	55%
Clima+ 65	325	*	430	*	530	No	47%	65%
PhormiTex 44 (B)	335(B)	*	430(B)	475	525	Yes	50%	44%
PhormiTex 55 (B)	335(B)	400 (B)	430(B)	475	525	Yes	51%	55%
PhormiTex 66 (B)	335(B)	400 (B)	430(B)	475	525	Yes	60%	66%
PhormiTex 77 (B)	335(B)	400 (B)	430(B)	475	525	Yes	63%	77%
PH 44 (B)	335(B)	400 (B)	430(B)	480	530	No	52%	44%
PH 55 (B)	335(B)	400 (B)	430(B)	480	530	No	58%	55%
PH 66 (B)	335(B)	400 (B)	430(B)	480	530	No	63%	66%
PH 77 (B)	335(B)	*	430(B)	480	530	No	68%	77%
BLACK-OUT SCREENS								
PhormiTex Eclipse 98 + 1	325	400	430	480	530	Yes	78%	99,9%
PhormiTex Eclipse 98 + 98	325	400	430	480	530	Yes	91%	99,5%
PH 1	325	400	430	480	530	No	37%	96%
PH 1 + PH 1	325	400	430	480	530	No	60%	99%
PH 98 + PH 1	325	400	430	480	530	No	78%	99,9%
PH 98 + PH 98	325	400	430	480	530	No	91%	99,5%
GABLE SCREENS								
Phormilux outdoor	*	*	230	*	270	No	50%	20%
PHL 20	190	210	230	250	270	No	50%	16%
PhormiTex PHL 20	190	210	230	250	270	Yes	50%	20%
PHL 55	190	*	230	*	*	No	65%	55%
PHL WIT	190	210	230	250	270	No	60%	100%
Gev-Al/Wit	190	210	230	250	270	No	80%	100%
PhormiTex Crystal V	190	210	230	250	270	Yes	50%	14%

* On demand
** Flame Retardant

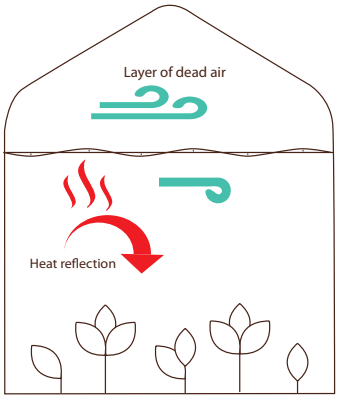
WHY SCREENS?

Conserve energy

Screens save energy by reducing the heat loss surface area, providing an extra insulation barrier and trapping a layer of dead air on both sides of the screen material. If the material contains some aluminum, the infrared part of the heat within the greenhouse will be reflected towards the plants reducing heat loss another few percent. A warm overhead surface slows heat transfer from plants resulting in higher canopy temperature and lower chance of condensation.



Greenhouse without screen



Installing a screen:
- Reducing heat loss surface area
- Adding an insulation barrier
- Creating a layer of dead air on both sides of the screen

Higher canopy temperature

Lower chance of condensation

WHY SCREENS?

Shade or black-out

Screens can avoid excess light on your plants, whether they need a little shading or complete black-out like short-day plants.

Humidity Control

Screens significantly reduce excess humidity, reducing the risk for diseases.

Flexibility

A screen installation gives you flexibility. It's not fixed. You can open and close it whenever you want and as much as you want.

Light reflection

A screen can be used to reflect the assimilation lights. This increases the amount of light and reduces light pollution.

Reduced Insurance Premium

A little-known benefit of screens; they may get you a break on your insurance. Fire-rated products, which resist or lower the risk of fire, are an appealing add-on for many insurance adjustors analyzing a greenhouse business. You put it in for energy savings, but it's worth asking if you can get additional benefits in another area!

Keep Workers Happy

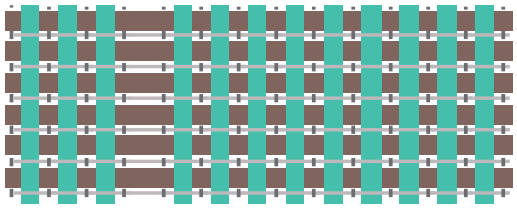
Worker comfort takes on new emphasis. Screens can help exponentially. Using high-diffusion screens can decrease interior greenhouse temperatures by 5 °C almost immediately.

ENERGY SAVING

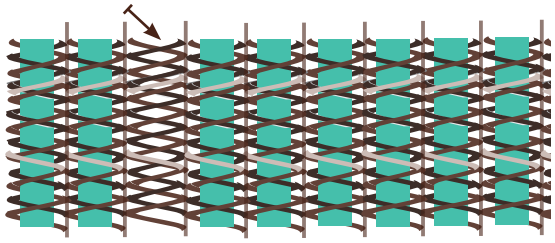
Why Phormium?

Energy saving

Due to the unique woven technology, the screen remains closed over time. Even if a tape would twist or be removed, Phormiums screens remain closed. In a knitted screen, an opening is created.



Phormium's energy saving screens



Knitted fabric

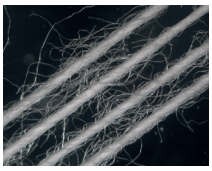
The unique woven 2-dimensional structure results in a high energy saving capacity during the full life cycle of the screen.

If a screen is not completely closed (e.g by twisted tapes in a knitted screen), one creates a chimney effect in the greenhouse which leads to energy loss and an unstable climate.

> 4% opening -> screen has no longer energy saving effect.

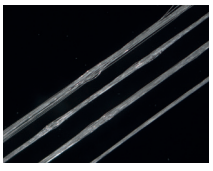
Optimal humidity transfer

- High humidity transfer: maximal humidity transport combined with minimal energy loss
  - The screens **PhormiTex Bright** or **PhormiTex Super** have a network of acrylic yarns which enable a constant moisture transport through the screen.



Yarns in a woven screen

In woven screens, a voluminous yarn can be used to maximize humidity transport, while minimizing convection through the screen.



Yarns in a conventional screen

In a knitted screen, a strong, thin yarn has to be used.

- Low humidity transfer:
  - **PhormiTex Clear** allows you to create a humid climate for young plants or to fully steer the climate if one has other dehumidification options.

ENERGY SAVING

Strength

Phormium uses ao. HDPE (High Density Poly-Ethylene) for its tapes. HDPE is 2X stronger than the LDPE used in conventional screens.

PhormiTex Bright	Knitted alternative
Tensile strength: 10.69 kN/m	Tensile strength: 5.12 kN/m

What type of energy screen to choose?

Transparent screens: maximum screening hours

With a transparent screen, one chooses for maximum screening hours. A transparent screen allows using the screen with a minimal loss of sunlight. One can keep the screen closed in the morning or during cold days.

Night screen: High amount of alu -> high energy saving during the night!

Choose maximum insulation by utilizing a 'night screen', a highly insulating screen, which is (mainly) used during the night.
Pick the screen with the highest energy saving capacity (e.g. PhormiTex 77 or PH 77) to save the maximum amount of energy during the night and open it soon after sunrise. (See section about closed shading screens).

Next generation growing: saving energy while obtaining optimal yields

- A homogenuous climate is key to optimizing production.
- One can grow at a higher Relative Humidity (RH) with a lower use of energy -> the risk of condensation on the plant decreases.
- When growing at a higher RH, control of humidity is important. Thanks to Phormium's screens, humidity is transported through the screen and condensates against the greenhouse cover/roof. One can even increase the humidity transport by opening the windows (and keeping the screens closed).
- The climate needs to be active and to stimulate plant evaporation for the plant to grow.

Recommended gable screen

Phormium offers reinforced gable screens PhormiTex Crystal V, PhormiTex PHL 20, PHL 20.

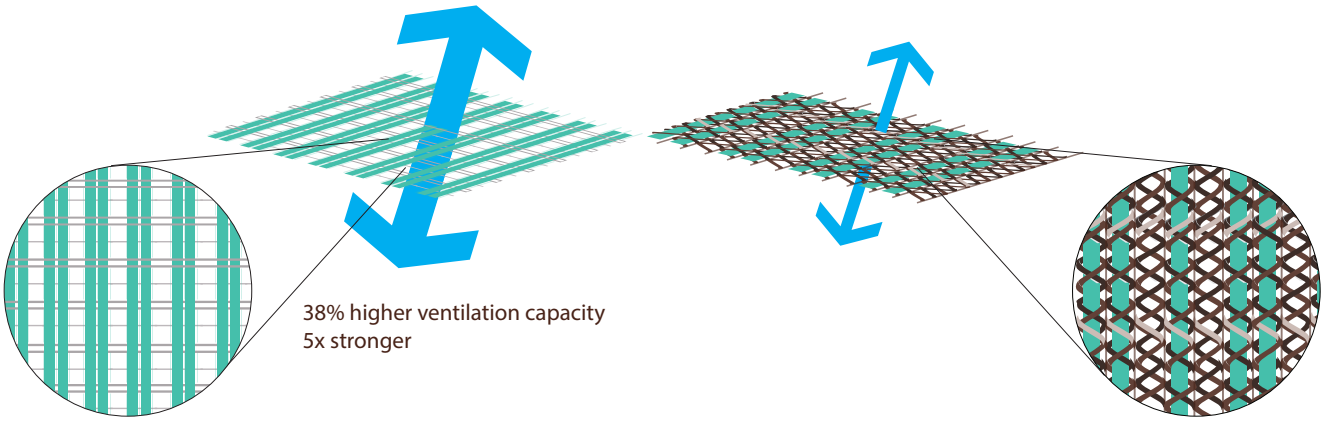
PHORMIUM SCREENS:

- Durable & strong
- Superior energy saving
- Optimal humidity transport
- Guaranteed European quality

OPEN SHADING SCREENS

Why Phormium open screens?

Maximal cooling - Superior strength



PhormiTex Lumina 40 O	Knitted alternative, 40% shading
Air permeability: 3872 l/m^2*s	Air permeability: 2390 l/m^2*s
Tensile strength: 15.03 kN/m	Tensile strength: 2.94 kN/m

OPEN SHADING SCREENS

Aluminum vs Diffuse screens

Diffuse screens

- Shade the light away -> avoids burning the top of the plants.
- Light is spread evenly -> high and constant yields over the complete area.

Wageningen University (Hemming et al., 2008) has shown that diffuse light ensures a better distribution of light with cucumbers.

- Less light reaching the top -> less light saturation
- Lower temperature at the top -> ensures better photosynthesis
- More light goes to the lower leaves

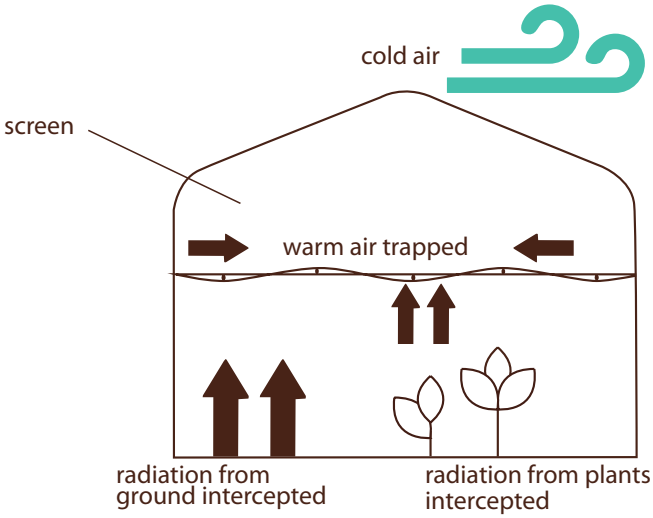
This can generate 10% more production

Similar research with tomatoes has shown 9% higher crop yield in the diffuse compartments of the greenhouse (compared to the non-diffuse areas).

Diffuse screens decrease the bud temperature and the number of burned leaves with roses (Kempkes et al., 2012).

Aluminum screens

- Shade the sunlight away -> maximum cooling effect due to its highly reflective aluminum tapes.
- Cold nights/clear skies -> reduce the radiation heat losses which would cause condensation on the top of the plants. This also helps to prevent frost damage in cold crops.



Recommended gable screen

Phormium recommends installing PHL 55.

PHORMIUM SCREENS:

- Durable & strong
- Maximal cooling
- Guaranteed European quality

CLOSED SHADING SCREENS

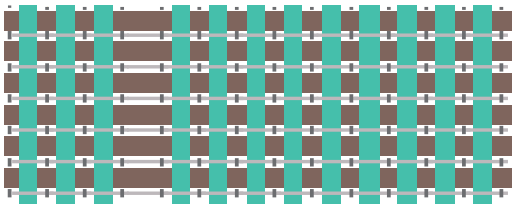
Why Phormium's combi-screens?

The perfect all-in-one screen

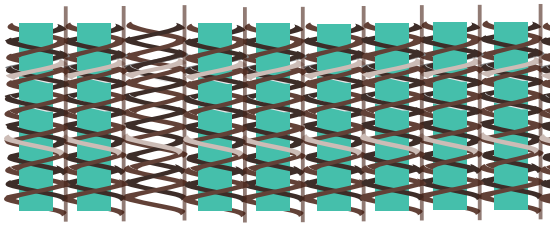
One single screen can be used for both shading and energy saving.

Energy saving

Due to the unique woven technology, the screen remains closed over time. The images below exhibit that, even if you would remove a tape, Phormiums screens remain closed. In a knitted screen, an opening is created.



Phormium's energy saving screens

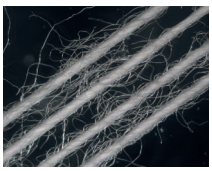


Knitted fabric

The unique woven 2-dimensional structure results in a high energy saving capacity; even at the end of product life.

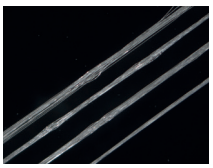
Optimal humidity transfer

- The acrylic yarns guarantee a high humidity transport when the screens are closed.
  - This reduces the disease burden and falling drops on the plants.



Yarns in a woven screen

In woven screens, a voluminous yarn can be used to maximize humidity transport, while minimizing convection through the screen.



Yarns in a conventional screen

In a knitted screen, a strong, thin yarn has to be used.

CLOSED SHADING SCREENS

Aluminum vs Diffuse screens

Diffuse screens

- Shade the light away -> avoids burning the top of the plants.
- Light is spread evenly -> high and constant yields over the complete area.

University of Wageninen (Hemming et al., 2008) has shown that diffuse light ensures a better distribution of light with cucumbers.

- Less light reaching the top -> less light saturation
- Lower temperature at the top -> ensures better photosynthesis
- More light goes to the lower leaves

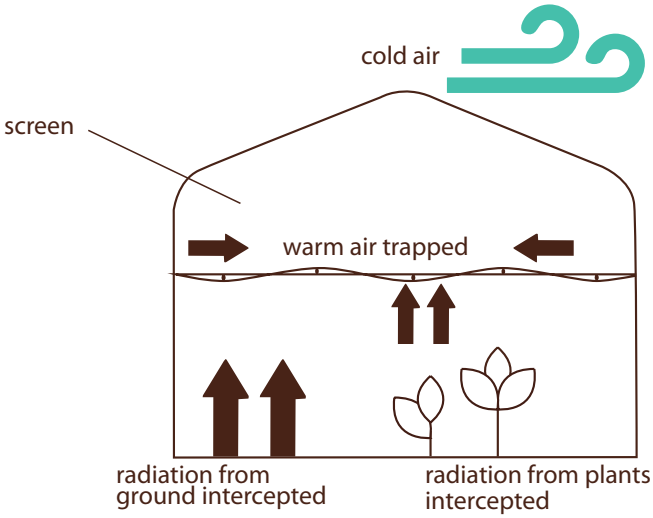
This can generate 10% more production

Similar research with tomatoes has shown 9% higher crop yield in the diffuse compartments of the greenhouse (compared to the non-diffuse areas).

Diffuse screens decrease the bud temperature and the number of burned leaves with roses (Kempkes et al., 2012).

Aluminum screens

- Shade the sunlight away -> maximum cooling effect due to its highly reflective aluminum tapes.
- Cold nights/clear skies -> reduce the radiation heat losses which would cause condensation on the top of the plants. (So called **night screens**).



Recommended gable screen

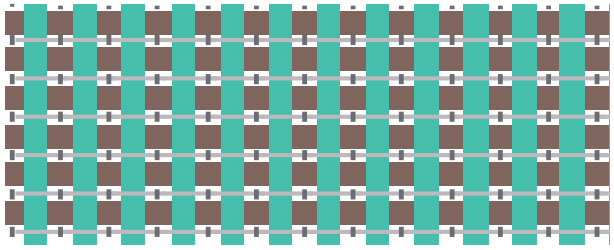
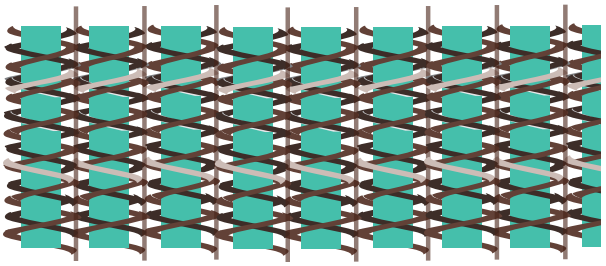
Phormium recommends installing PHL 55.

PHORMIUM SCREENS:

- Durable & strong
- Superior Energy saving
- Optimal Humidity transport
- Guaranteed European quality

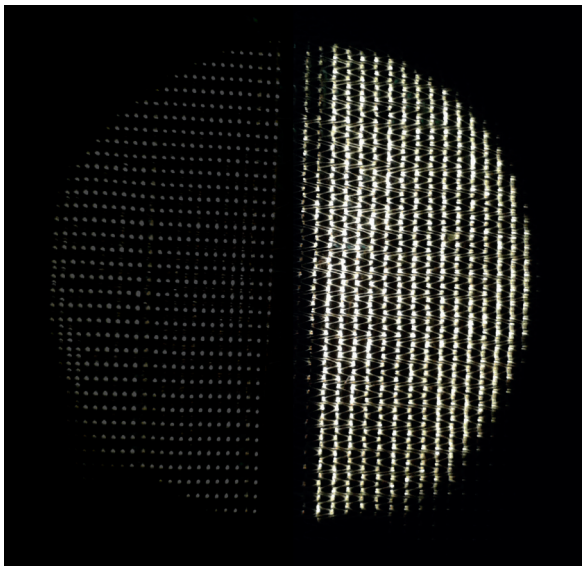
BLACK OUT SCREENS

Why Phormium?

Woven screen	Knitted screen
	
Tapes in two directions: ◆ High dimensional stability ◆ High insulation capacity, even at end-of-life High strength: **4X stronger** than knitted alternative	Tapes in one direction: ◆ Low dimensional stability: higher chance of twisting tapes during installation and operation ◆ Lower insulation capacity ◆ Lower strength
Low shrinkage (max 1%) thanks to thermal fixation of the tapes.	Higher shrinkage
Long product life: **6 year warranty** (NL)	Warranty only 5 years (NL)
High moisture transport thanks to acrylic yarns.	Low moisture transport due to the use of polyester yarns.

BLACK OUT SCREENS

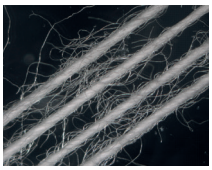
Ultimate darkening



Light penetration through a PhormiTex Eclipse 98 (left) and its knitted alternative

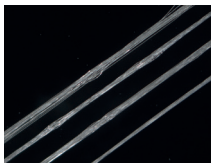
Optimal humidity transfer

- In all closed Phormium screens a network of acrylic yarns allow humidity transport without losing warmth.



Yarns in a woven screen

In woven screens, a voluminous yarn can be used to maximize humidity transport, while minimizing convection through the screen.



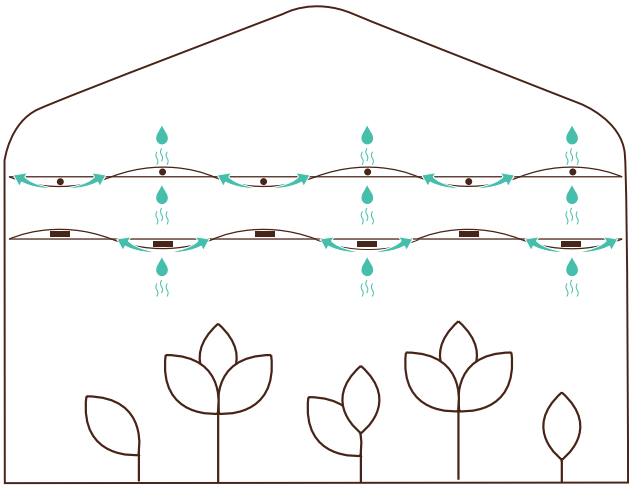
Yarns in a conventional screen

In a knitted screen, a strong, thin yarn has to be used.

Active Humidity Control with PhormiTex Eclipse Dry

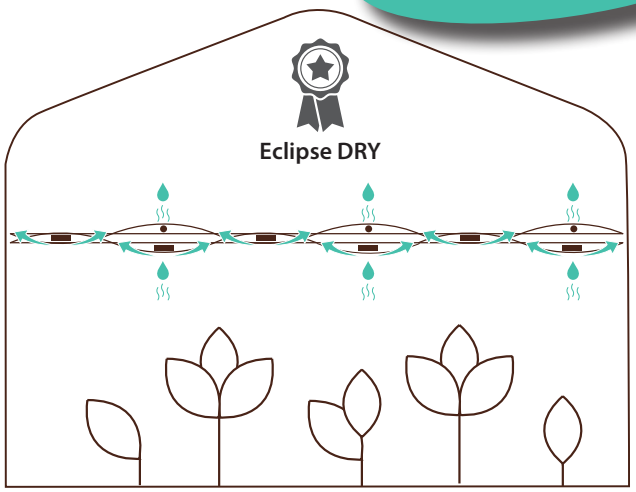
To answer the request for high humidity transport without energy loss; Phormium's Research Center has developed PhormiTex Eclipse Dry: a 3D woven darkening screen with **active humidity control**.

New development



DOUBLE SCREEN

contact zone between screens: 20%
dead zone between screens: 80%
--> minimal moisture transport



3D SCREEN

100% connected
no dead zones
--> Active Humidity Control

Benefits

- Active humidity control
- Ease of installation: two screens are woven into 1 3D fabric -> no sliding of screens
- No energy loss
- Darkest black

Phormium
Growth driven. Future proof.

BLACK OUT SCREENS

Aluminum screens

- Benefits of aluminum facing the sun: cooling effect
- Benefits of aluminum facing the plants:
  - Insulation
  - Heat and light reflection

What type of screen to choose

PhormiTex Eclipse 1+1: Best value for money on the market
PhormiTex Eclipse 1+1+White: Best value for money with light reflection
PhormiTex Eclipse 98+1: The world's most preferred black-out system
PhormiTex Eclipse 98+98: Complete black-out + maximum energy saving + reflection of assimilation light
PhormiTex Eclipse Dry +1: The world's darkest screen: The preferred cannabis screen
PhormiTex Eclipse Dry + White: The preferred cannabis screen with light reflection

* Non FR options are available

Recommended gable screen

Phormium recommends installing PHL White or Gev Al/White.

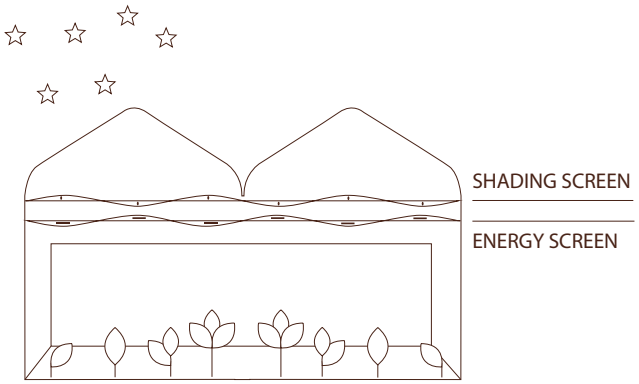
PHORMIUM SCREENS:

- Durable & strong
- Maximum darkening
- Active Humidity control
- Guaranteed European quality

MULTIPLE SCREEN INSTALLATIONS: OPTIMAL CLIMATE CONTROL

Cold nights

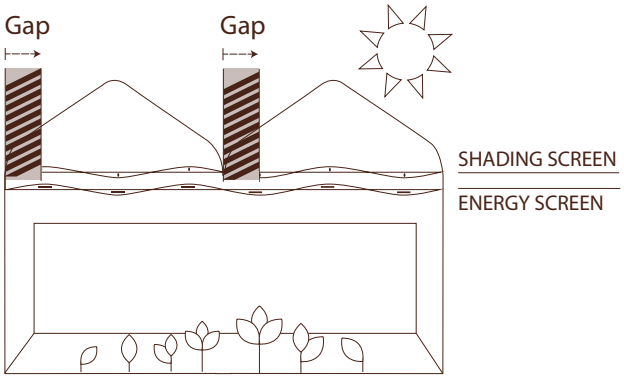
Use both screens during cold nights



Mornings

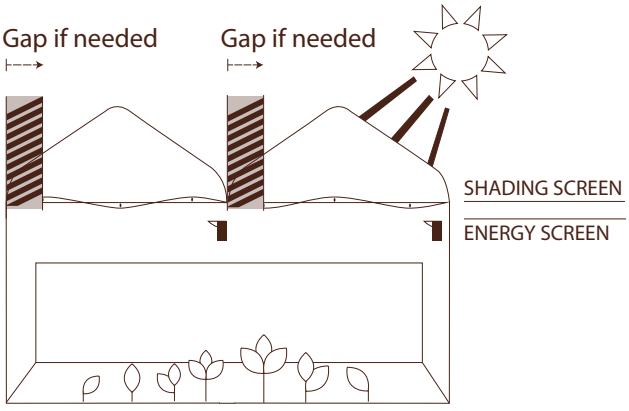
Use a transparent screen in the morning: start by opening the shading screen with a small gap in order to avoid cold on the plants.

Once the shading screen is fully opened, the transparent screen should stay fully closed as long as possible to avoid energy losses.



Warm days

Shading during sunny days while allowing maximal cooling.



PHORMIUM CONSULTANCY CENTER

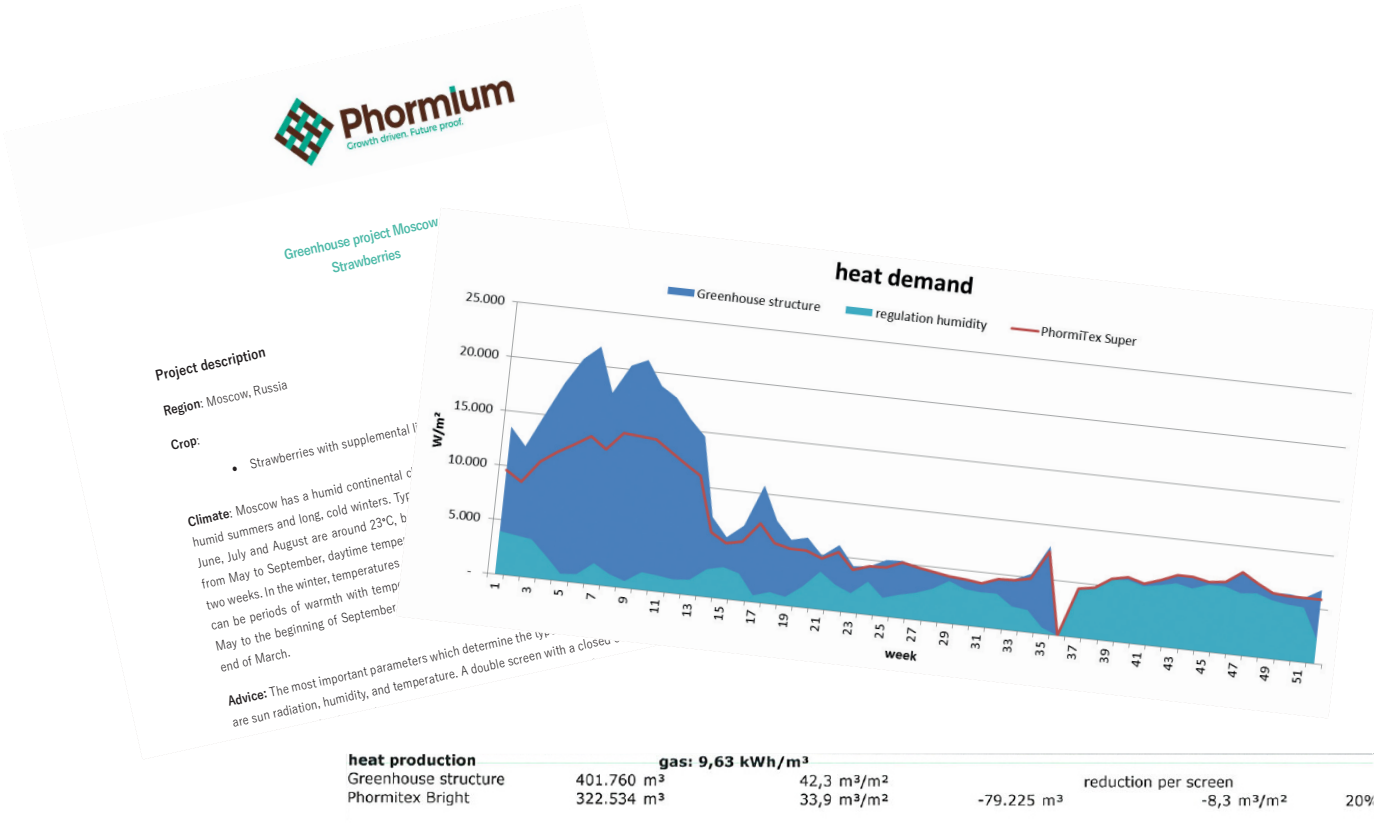
Screen advice

We offer comprehensive free screen advice tailored to your specific project. Our team will work closely with you to understand your requirements. We can recommend the best solution(s) for your specific project and supply the technical specifications necessary for your customized system.

On our website (www.phormium.com/en/screen-advice) you can fill out a form to collect all necessary information so we can provide a detailed and tailored advice.

Modelling energy saving and screening hours

Together with DLV Glas & Energy, Phormium developed an application to model energy saving and screening hours for a specific project.



Growth driven. Future proof.

Growth driven. Future proof.