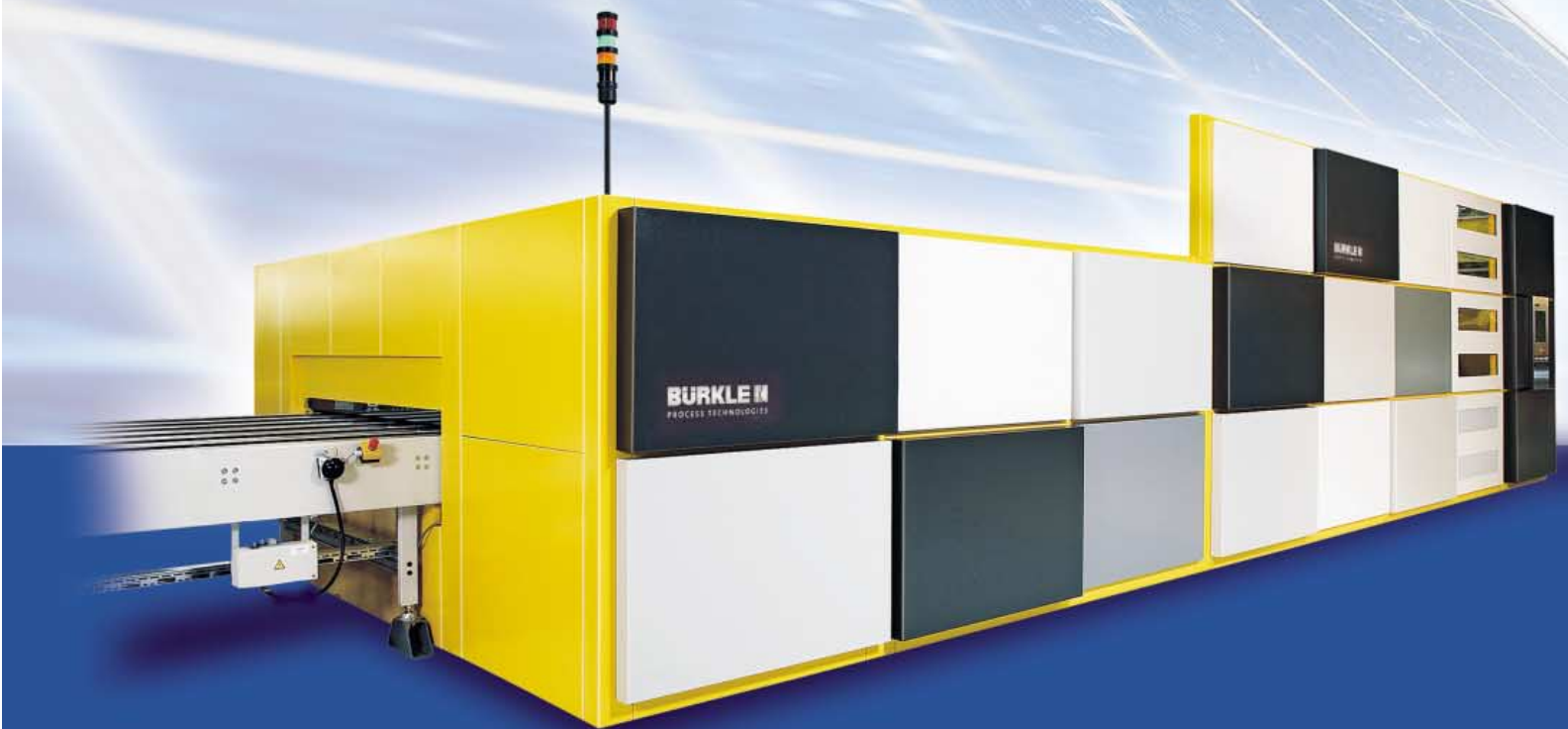


SUN IS RISING.

e.a.sy-Lam<sup>®</sup>  
solutions

## Single-Opening Lamination Technology



**BURKLE**   
PROCESS TECHNOLOGIES



# BÜRKLE PROCESS TECHNOLOGIES

Bürkle's core technologies include Precision Coating and Lamination for a broad group of industry requirements. Located in the city of Freudenstadt in the Black Forest Bürkle has been designing and manufacturing System Solutions for over 90 years.

Focussed on markets requiring precision and reliable manufacturing equipment Bürkle has served major markets including the wood based panel industry for finishing and lamination systems, the printed circuit board industry, plastic card industry, photovoltaic industry, building and automotive industries.

From low volume production to high volume applications Bürkle has experienced design teams available to provide standalone machines or

complete custom system solutions. Reliable and predictable process control is one of the distinguishing features of Bürkle's design.

As an internationally focused company Bürkle systems are found globally. Distribution and service centers are located in all major countries of the world.

## e.a.sy solutions – economic applications, systems and technologies

Bürkle's customers rely on highly sophisticated and future oriented technologies. Bürkle's machines, lines and systems are the solution for economic applications and technologies.

From the planning to the development and design to installation and start-up of a line Bürkle has one goal: it must be e.a.sy!

Bürkle's machines, lines and systems are designed to provide a high return on the customer's investment enabling predictable processes with a high level of process control.

Bürkle's e.a.sy service is based on highly skilled and trained service technicians, a service hotline and state of the art diagnostic systems as well as remote support capabilities.



economic application  
systems by BÜRKLE

# BÜRKLE INNOVATION CENTER

Bürkle's Innovation Center provides the capability to test lamination and coating processes for recipe development and operational feasibility tests for existing and potential customers as well as material suppliers.

## Your Application – Bürkle's Systems and Solutions

Bürkle's experienced process engineers, technicians and researchers develop new processes, test new materials and provide assistance to solve your lamination or coating challenge. This enables you to develop the best process for your application and production.

Examples of new applications and processes include our proven split "Ypsolar® Lamination Process" for glass-glass modules using a membrane lamination step followed by a flat press for final lamination and a cooling step. Other new developments have



included the "SL-Short Lamination Process" reducing the lamination cycle time for crystalline glass-backsheet modules by nearly 50%. Both processes have been developed by Bürkle and are just two examples for the Power of Innovation at Bürkle.

Quality improvement of your product, faster processes and higher production capacities combined with a higher level of process control and reliable and reproducible processes are the advantages and characteristics of Bürkle's Single-Opening Lamination Lines e.a.sy-Lam and Bürkle's Multi-Opening Lamination Lines Ypsator® as well as Bürkle's Coating Lines e.a.sy-Coater.

## Bürkle Process Technologies

See for yourself how Bürkle's lamination and coating experience can benefit your manufacturing process improving reliability and quality.



Multi-Opening Lab Laminator for test purposes at Innovation Center



"Bürkle's Innovation Center in Freudenstadt, Germany"



SUN IS RISING.

**e.a.sy-Lam**  
solutions

From the Pioneer of the Short Lamination Technology

## Single-Opening Lamination Line e.a.sy-Lam



### Advantages of Single-Opening Lamination Line e.a.sy-Lam

- Robust and reliable system design for 24/7 operation.
- High yield and high equipment utilization.
- Predictable and reproducible process.
- High level of process control.
- Controlled and uniform heating and pressure application.
- Overpressure possibility to enable shorter process times (SL Process Technology).
- Thermal oil heating in combination with steel heating platens provides uniform temperature accuracy of  $\pm 2^\circ\text{C}$ .
- Dry-running vacuum pumps with short evacuation times.
- Spring-loaded lifting pins to hold off modules during transportation and evacuation in step 1.
- Fast replacement of membrane under heated operating conditions.
- Active cooling under pressure or fan cooling.
- Maintenance friendly and good accessibility.
- High sophisticated process visualization and control system.

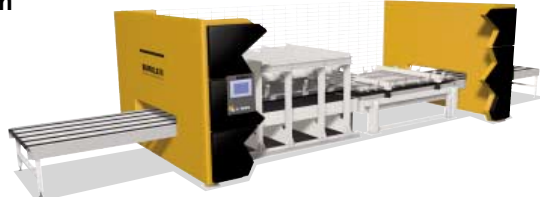




**e.a.sy**  
solutions

economic application  
systems by **BÜRKLE**



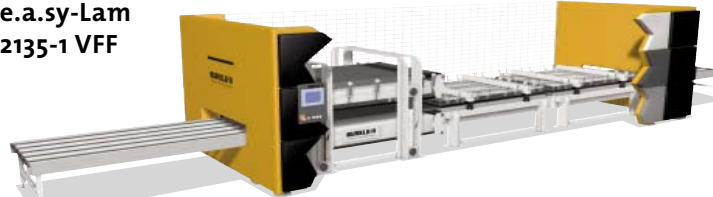

## Single-Opening Lamination Line e.a.sy-Lam

For Glass-Backsheet Modules

Lamination Systems	Number of Lamination Steps	Useful Lamination Area	Typical Cycle Time	Approx. Yearly Production Capacity	Type of Cooling
<b>e.a.sy-Lam 2141-1 SL</b> 	1 Lamination Step	2100 x 4100 mm (4 x 60 cell modules or 4 x 72 cell modules)	< 9 min.	up to ~ 60 MWp**	Cooling Platen or Fan Cooling
<b>e.a.sy-Lam 2135-1 SL light</b> 	1 Lamination Step	2100 x 3500 mm (4 x 60 cell modules or 3 x 72 cell modules per cycle)	< 12 min.	up to ~ 38 MWp**	Cooling Platen or Fan Cooling
<b>e.a.sy-Lam 2141-1 SL light</b> 	1 Lamination Step	2100 x 4100 mm (4 x 60 cell modules or 4 x 72 cell modules per cycle)	< 12 min.	up to ~ 45 MWp**	Cooling Platen or Fan Cooling
<b>e.a.sy-Lam 2135-1 VVV</b> 	2 Lamination Steps (split lamination process for glass-backsheet modules)	2100 x 3500 mm (4 x 60 cell modules or 3 x 72 cell modules per cycle)	< 8 min.	up to ~ 58 MWp**	Cooling Platen or Fan Cooling
<b>e.a.sy-Lam 2141-1 VVV</b> 	2 Lamination Steps (split lamination process for glass-backsheet modules)	2100 x 4100 mm (4 x 60 cell modules or 4 x 72 cell modules per cycle)	< 8 min.	up to ~ 68 MWp**	Cooling Platen or Fan Cooling

## Single-Opening Lamination Line e.a.sy-Lam

For Glass-Glass Modules and  
Glass-Backsheet Modules

Lamination Systems	Number of Lamination Steps	Useful Lamination Area	Typical Cycle Time	Approx. Yearly Production Capacity	Type of Cooling
<b>e.a.sy-Lam 2135-1 VFF</b> 	2 Lamination Steps (split lamination process for glass-glass modules and glass-backsheet modules)	2100 x 3500 mm (4 x 60 cell modules or 3 x 72 cell modules per cycle)	< 12 min.* (for glass- glass modules) < 8 min. (for glass- backsheet modules)	up to ~ 38 MWp** up to ~ 58 MWp**	Cooling Platen or Fan Cooling
<b>e.a.sy-Lam 2141-1 VFF</b> 	2 Lamination Steps (split lamination process for glass-glass modules and glass-backsheet modules)	2100 x 4100 mm (4 x 60 cell modules or 4 x 72 cell modules per cycle)	< 12 min.* (for glass- glass modules) < 8 min. (for glass- backsheet modules)	up to ~ 45 MWp** up to ~ 68 MWp**	Cooling Platen or Fan Cooling

\* depending on bill of material and atmospheric pressure

\*\* based on 8000 hrs. working time, assumed module power of 240 Wp (60 cells) or 285 Wp (72 cells)



## Bürkle's "SL" Short Lamination Process Technology

### The SL Process Technology for Glass-Backsheet Modules

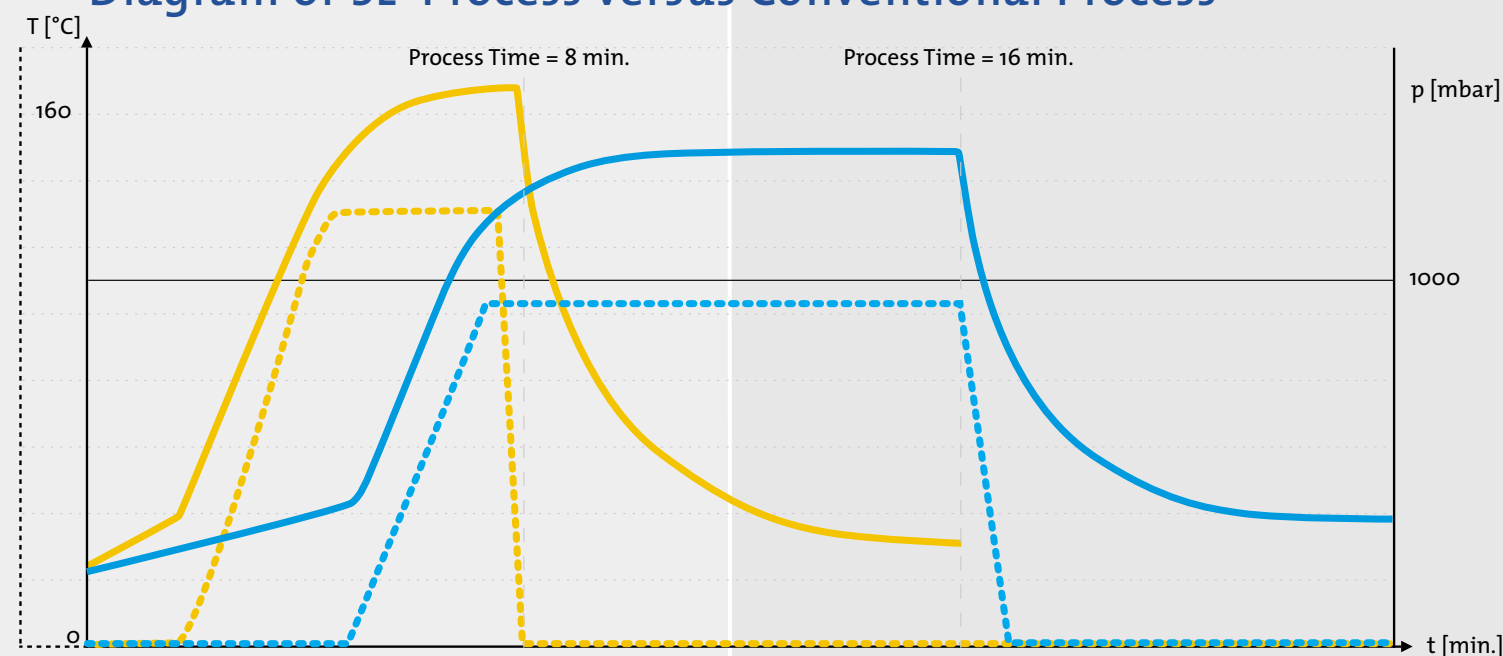
#### The Short Lamination Process Technology:

- Reduction of evacuation time (approx. 50 % of typical evacuation time).
- Higher operating temperature allows increase of cross linking speed (e. g. 10°C higher operating temperature will double the cross linking speed).
- Higher pressure (> atmospheric pressure) avoids emerging of gasses out of the material and thus avoids formation of bubbles.
- Dedicated process recipe.

#### Advantages of the SL Process:

- Short cycle times and high production capacity with one lamination step.
- No shrinkage of backsheets caused by pressureless transfer in an incomplete lamination status (as with split lamination process).
- Cooling under pressure.

## Diagram of SL Process versus Conventional Process



#### SL Lamination Process

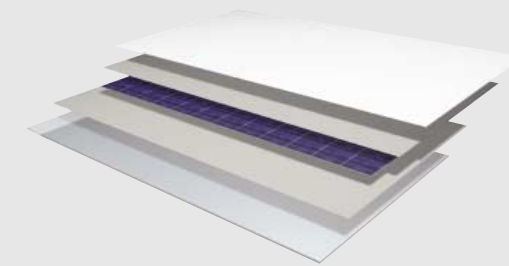
- Module Temperature
- Pressure

#### Conventional Lamination Process

- Module Temperature
- Pressure

## Single-Opening Lamination Line e.a.sy-Lam SL

### For Glass-Backsheet Modules



### 1 Step SL Lamination Process with Cooling



Technical Data	e.a.sy-Lam 2141-1 SL
Useful lamination area [mm]	2100 x 4100
Number of modules per cycle	4 x 60 cells or 4 x 72 cells
Assumed cycle time* [min.]	< 9
Capacity of Laminator** for glass-backsheet modules [MWp]	58
Number of lamination steps	1
Operating temperature max. [°C]	180
Heating medium	Thermal oil in combination with steel heating platens
Number of heating units	1
Temperature accuracy [°C]	< ± 2
Specific pressure in Step 1 [N/cm²]	0,5–19
Final vacuum pressure in Step 1 [mbar]	< 1
Evacuation time to 1 mbar in Step 1 [sec.]	< 60
Cooling unit	optional
Cooling	cooling platen or fan cooling
* depending on bill of material and atmospheric pressure	
** based on 8000 hrs. working time and a module power of 240 / 285 Wp	

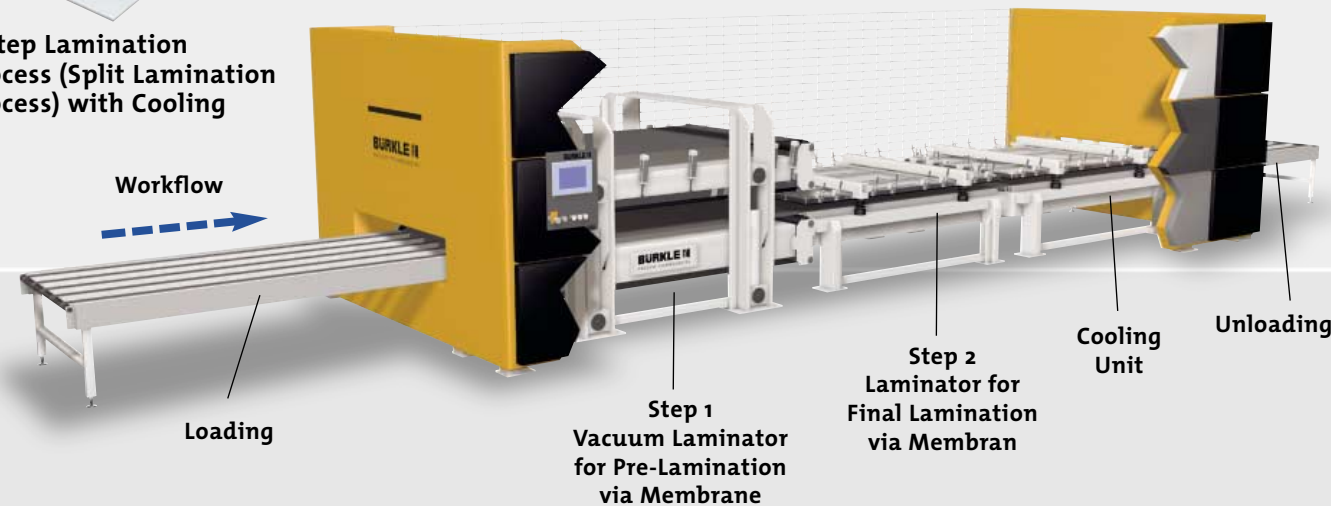
## Single-Opening Lamination Line e.a.sy-Lam SL light

For Glass-Backsheet Modules

1 Step SL Light Lamination Process with Cooling



2 Step Lamination Process (Split Lamination Process) with Cooling



Technical Data e.a.sy-Lam	2135-1 SL light	2141-1 SL light	2135-1 VVV	2141-1 VVV
Useful lamination area [mm]	2100 x 3500	2100 x 4100	2100 x 3500	2100 x 4100
Number of modules per cycle	4 x 60 cells or 3 x 72 cells	4 x 60 cells or 4 x 72 cells	4 x 60 cells or 3 x 60 cells	4 x 60 cells or 4 x 72 cells
Assumed cycle time* [min.]	< 12	< 12	< 8	< 8
Capacity of Laminator** for glass-backsheet modules [MWp]	38	45	58	68
Number of lamination steps	1	1	2	2
Operating temperature max. [°C]	180	180	180	180
Heating medium	Thermal oil in combination with steel heating platens			
Number of heating units	1	1	2 (1 per step)	2 (1 per step)
Temperature accuracy [°C]	< ± 2	< ± 2	< ± 2	< ± 2
Specific pressure in Step 1 [N/cm²]	0,5–12	0,5–12	0,5–12	0,5–12
Final vacuum pressure in Step 1 [mbar]	< 1	< 1	< 1	< 1
Evacuation time to 1 mbar in Step 1 [sec.]	< 60	< 60	< 60	< 60
Specific pressure in Step 2 [N/cm²]	N/A	N/A	up to 10	up to 10
Cooling unit	optional	optional	optional	optional
Cooling	cooling platen or fan cooling	cooling platen or fan cooling	cooling platen or fan cooling	cooling platen or fan cooling

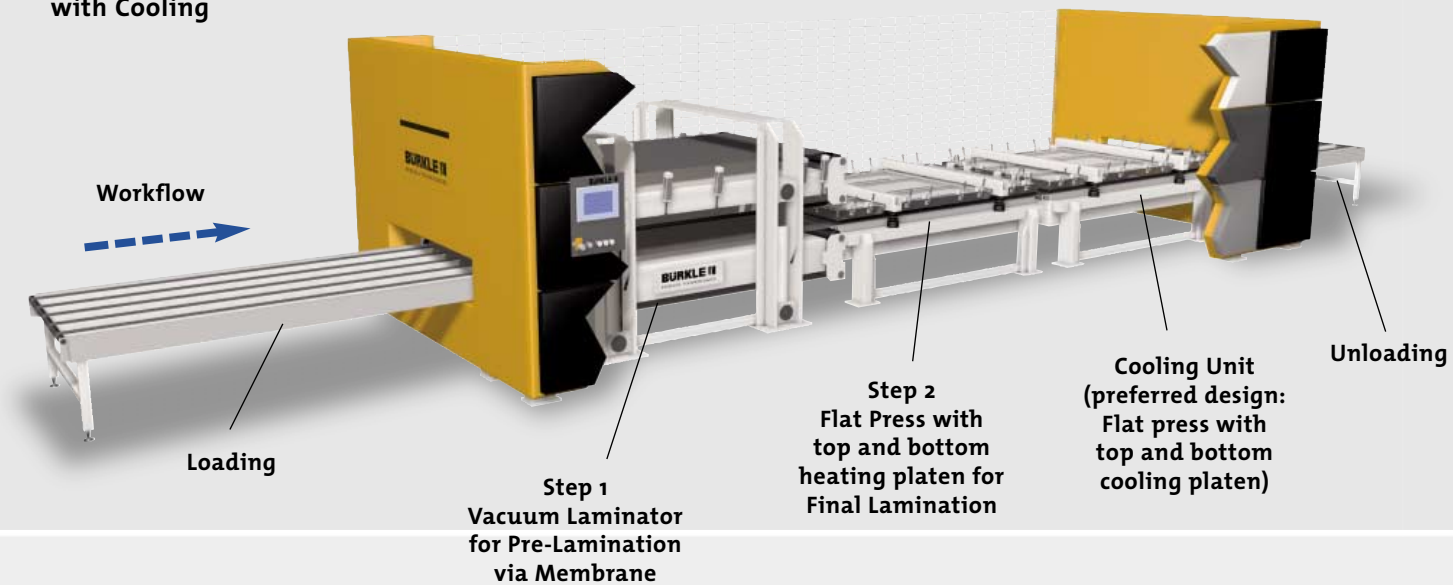
\* depending on bill of material and atmospheric pressure

\*\*based on 8000 hrs. working time and a module power of 240 / 285 Wp

## Single-Opening Lamination Line e.a.sy-Lam VFF

For Glass-Glass Modules and Glass-Backsheet Modules

2 Step Lamination Process (Split Lamination Process) with Cooling



Technical Data	e.a.sy-Lam 2135 VFF	e.a.sy-Lam 2141 VFF
Useful lamination area [mm]	2100 x 3500	2100 x 4100
Number of modules per cycle	4 x 60 cells or 3 x 72 cells	4 x 60 cells or 4 x 72 cells
Assumed cycle time* for glass-glass modules [min.]	< 12	< 12
Assumed cycle time* for glass-backsheet modules [min.]	< 8	< 8
Capacity of Laminator** for glass-glass modules [MWp]	38	45
Capacity of Laminator** for glass-backsheet modules [MWp]	58	68
Number of lamination steps	2	2
Operating temperature max. [°C]	180	180
Heating medium	Thermal oil in combination with steel heating platens	Thermal oil in combination with steel heating platens
Number of heating units	2 (1 per step)	2 (1 per step)
Temperature accuracy [°C]	< ± 2	< ± 2
Specific pressure in Step 1 [N/cm²]	0,5–12	0,5–12
Final vacuum pressure in Step 1 [mbar]	< 1	< 1
Evacuation time to 1 mbar in Step 1 [sec.]	< 60	< 60
Specific pressure in Step 2 [N/cm²]	up to 10	up to 10
Cooling unit	optional	optional
Cooling	cooling platen or fan cooling	cooling platen or fan cooling

\* depending on bill of material and atmospheric pressure

\*\* based on 8000 hrs. working time and a module power of 240 / 285 Wp

# BÜRKLE WORLDWIDE



## ► Headquarters Robert Bürkle GmbH

Stuttgarter Straße 123  
72250 Freudenstadt / Germany  
Phone +49 (0) 74 41 / 58-0  
Fax +49 (0) 74 41 / 78 13  
[www.buerkle-gmbh.de](http://www.buerkle-gmbh.de)  
[buerkle@buerkle-gmbh.de](mailto:buerkle@buerkle-gmbh.de)

## ► Bürkle North America, Inc.

12802 Valley View Street  
Suite 12  
Garden Grove, CA 92845 / USA  
Phone +1-714-379-5090  
Fax +1-714-379-5092  
[www.burkleusa.com](http://www.burkleusa.com)  
[buerkleusa@buerkle-gmbh.de](mailto:buerkleusa@buerkle-gmbh.de)

## ► Bürkle Machinery (Shanghai) Co., Ltd.

Building 5 & 6, No. 2715, Ledu Road (W)  
Songjiang District  
201614 Shanghai / China  
Phone +86-21-57 85-02 88  
Fax +86-21-57 85-02 58  
[www.burkle-shanghai.com](http://www.burkle-shanghai.com)  
[buerkleasia@buerkle-gmbh.de](mailto:buerkleasia@buerkle-gmbh.de)

## ► Bürkle Taiwan

1F, No. 196, Minfu 9th St.  
33049 Taoyuan City  
Taoyuan County / Taiwan  
Phone +886-3-316 04 30  
Fax +886-3-316 04 31  
[buerkletaiwan@buerkle-gmbh.de](mailto:buerkletaiwan@buerkle-gmbh.de)

[www.easy-lam.com](http://www.easy-lam.com)

**BÜRKLE**   
PROCESS TECHNOLOGIES