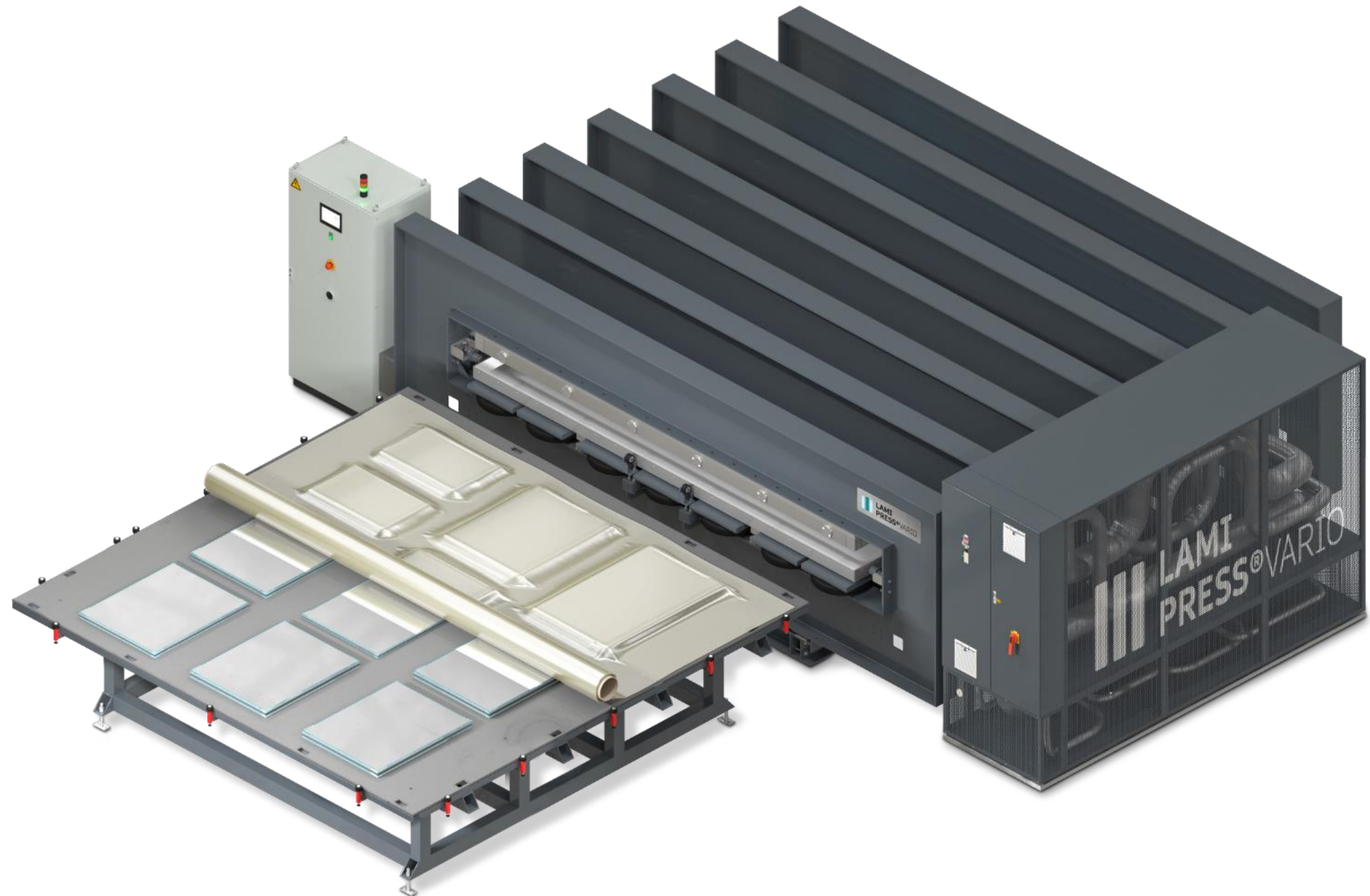




SUMMARY

1. **Functionality**
2. **Variations**
3. **Comparison Overview**
4. **Talking Numbers**

1 FUNCTIONALITY



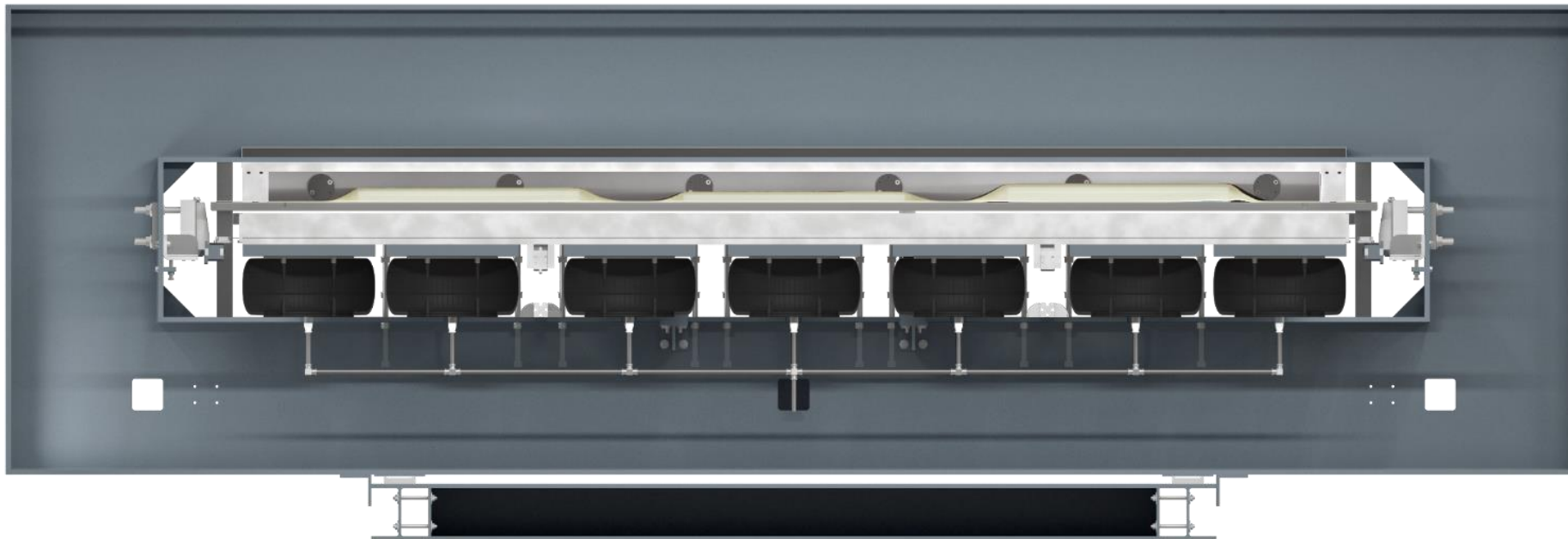
1.1 BUILD-UP

- **Aluminum plate** (Heating Plate) stationary inside the machine
- **Heating- and Cooling System** temperates the aluminum plate inside the laminator
- Glass Packages are getting prepared on the **transfer plate**
- Transfer plate is being manouvered into the machine over a **rolling table**
- **Bellow System** pushes the heating plate as well as the transfer plate into a **Passepartout**
- **Silicon matt** seperates the process room
- H-Formed **Steel Beams** which control the pressure in the process room (patented)
- With the **control panel**, the heat, pressure and vacuum can be regulated to need

1.2 PROCESS ROOM



- The LamiPress®
opened



- The LamiPress®
closed

1.3 CYCLE

1. **Preparation of Glass Packages**
2. **Belay of the Transfer Plate**
3. **Covering with Silicon Mat**
4. **Transfer Plate into the Laminator**
5. **Programing the Parameters (Pressure, Vacuum, Temperature)**
6. **Pneumatic elevating of the Bellow System**
7. **Lamination Process**
8. **Cooling of the laminated Glass In- or Outside of the machine**
9. **Post Processing (if needed)**

1.4 LAMINATION PROCESS

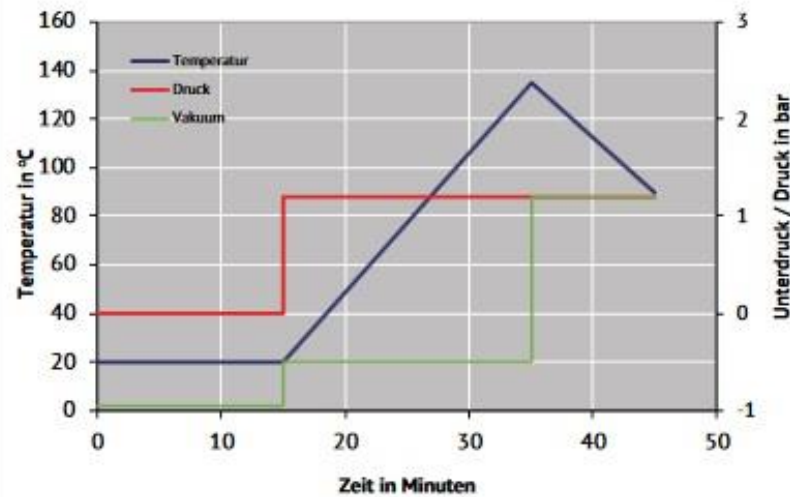
Vacuum Phase: Extract air at room temperature – close to an absolute vacuum - ca. 15 – 30 Min

Heating Phase: Heating curve with or without fusing point – reduce vacuum – add pressure

Cooling Phase: By Pass - To 60°C inside the laminator – Afterwards with fans outside

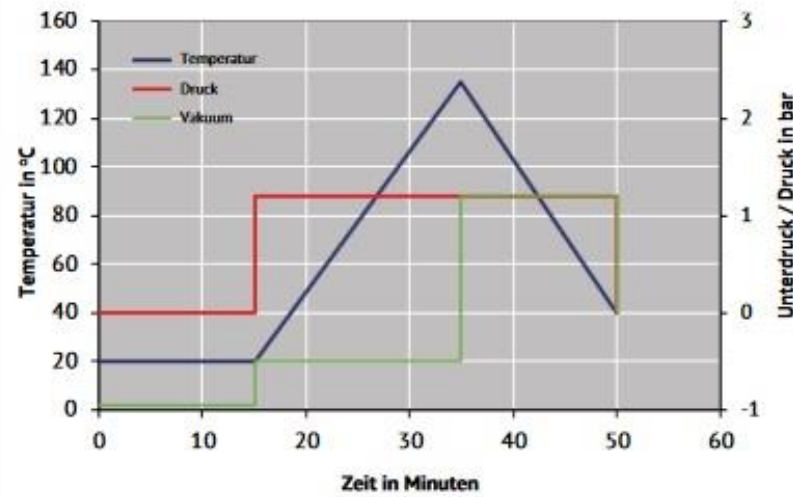
C PROZESS SENTRY

Verbundprozess für Float 4 mm / 0,76 mm Sentry / Float 4 mm



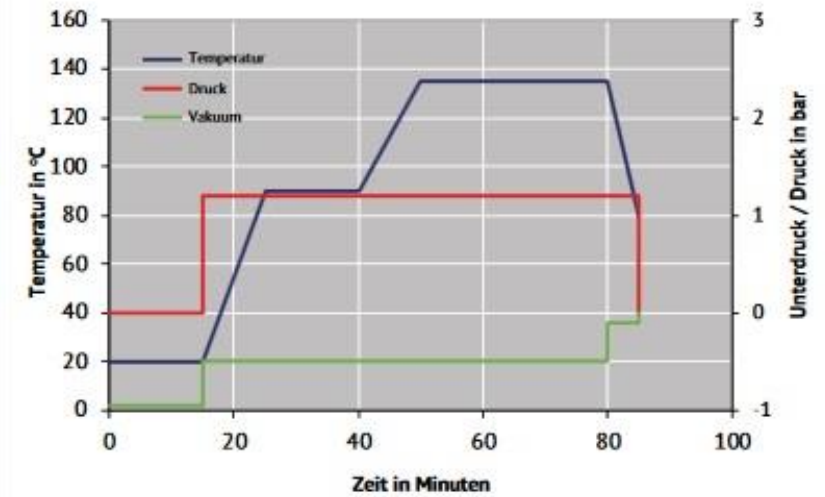
A PROZESS PVB

Verbundprozess für Float 4 mm / 0,76 mm PVB / Float 4 mm

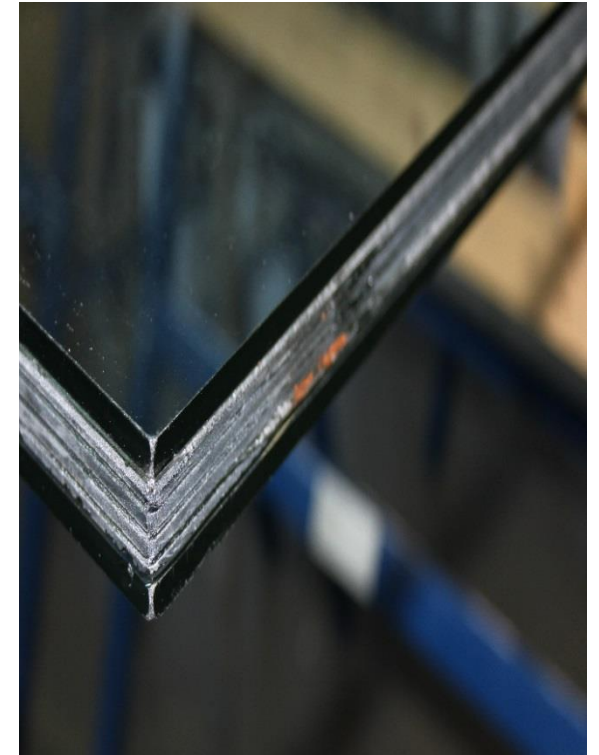


B PROZESS EVA

Verbundprozess für Float 4 mm / 0,76 mm EVA / Float 4 mm

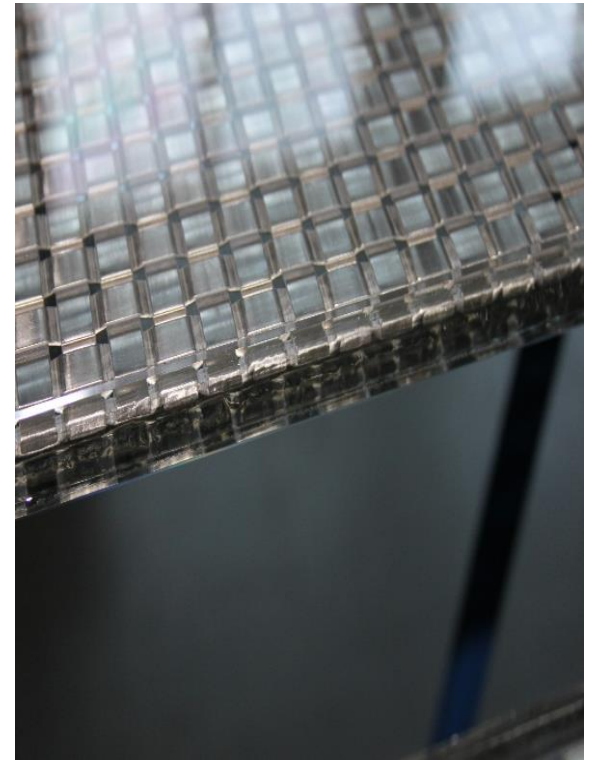


1.5 PRODUCTS OUT OF THE LAMIPRESS®



- Safety Glass out of Toughened Glass, Partially Tempered Glass, Thinglass, Structure- and Extraordinary Glass, with PVB, SentryGlass®, EVA, TPU
- Switchable Glass, Firesafety Glass, Break- and Bulletresistant, or combined

1.5 PRODUCTS OUT OF THE LAMIPRESS®

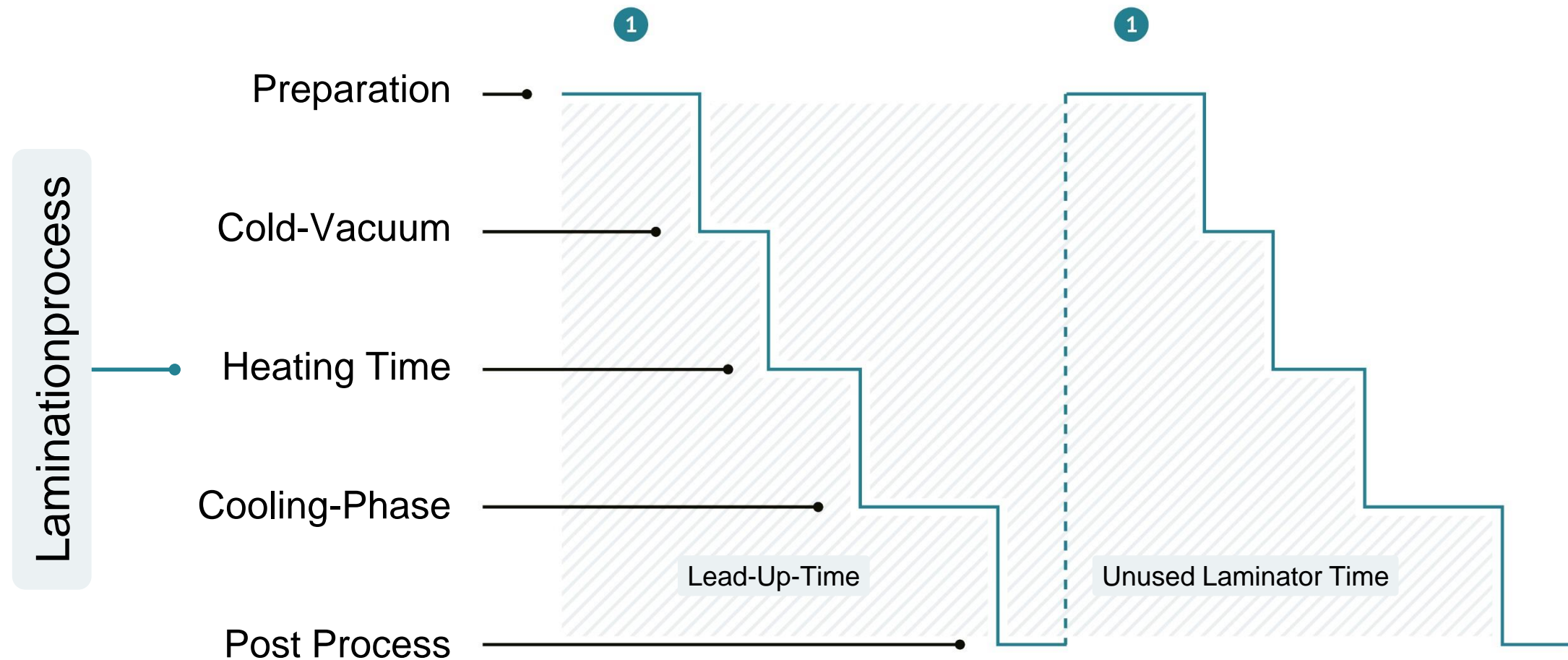


- Design inside the glass, printed PVB, Extraordinary Laminations, Embed Holders
- Offset Glass, Drilled Glass, any Geometries or Sizes

1.5 THE TRANSFER PLATE SYSTEM

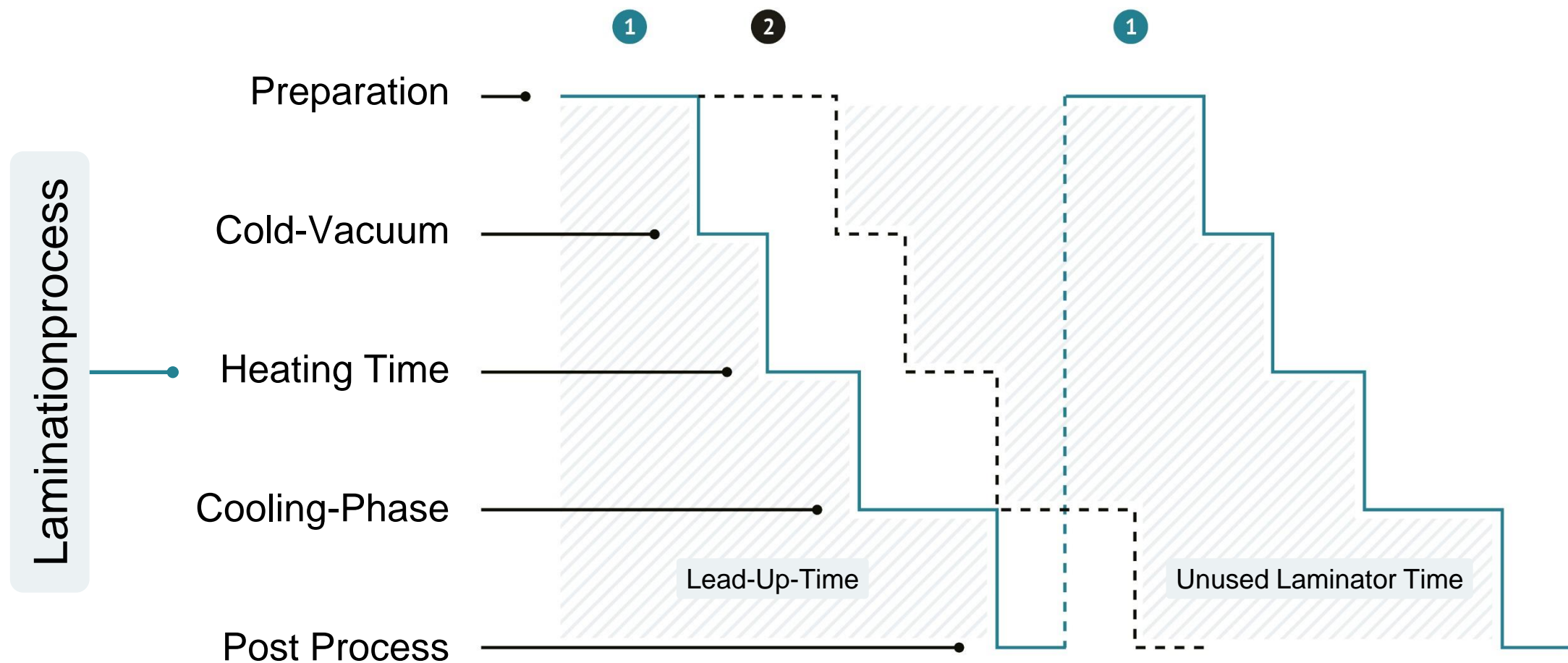
Inefficient Stroke

Cycle with only one transfer plate



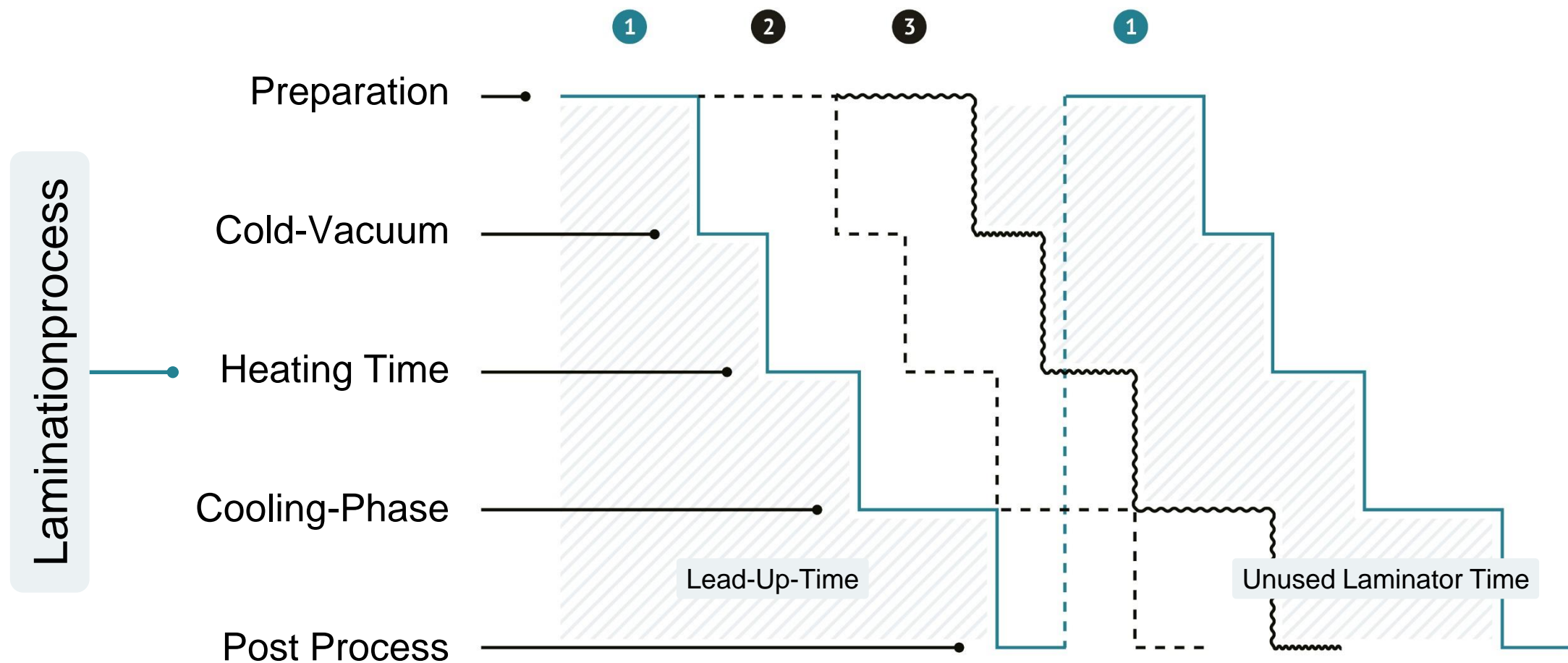
Improved Stroke

Cycle with two transfer plates



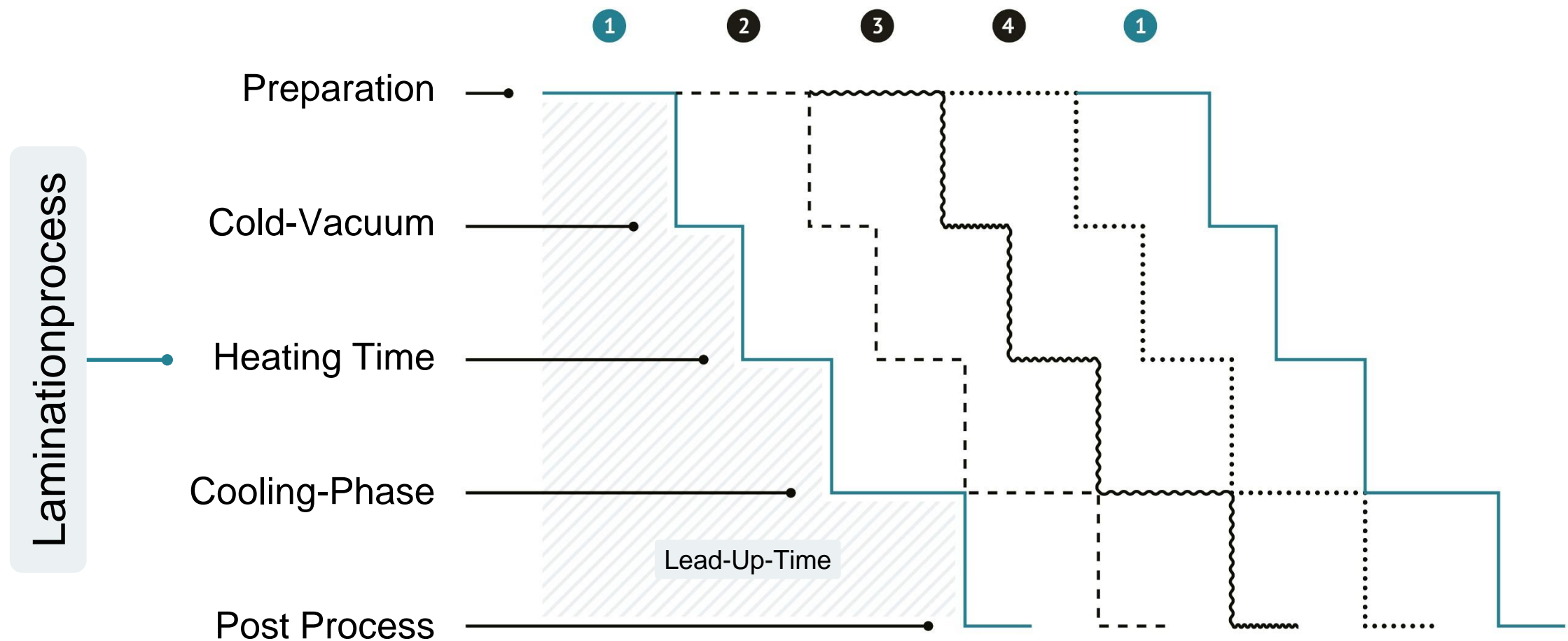
More Improved Stroke

Cycle with three transfer plates



Perfect Strokes

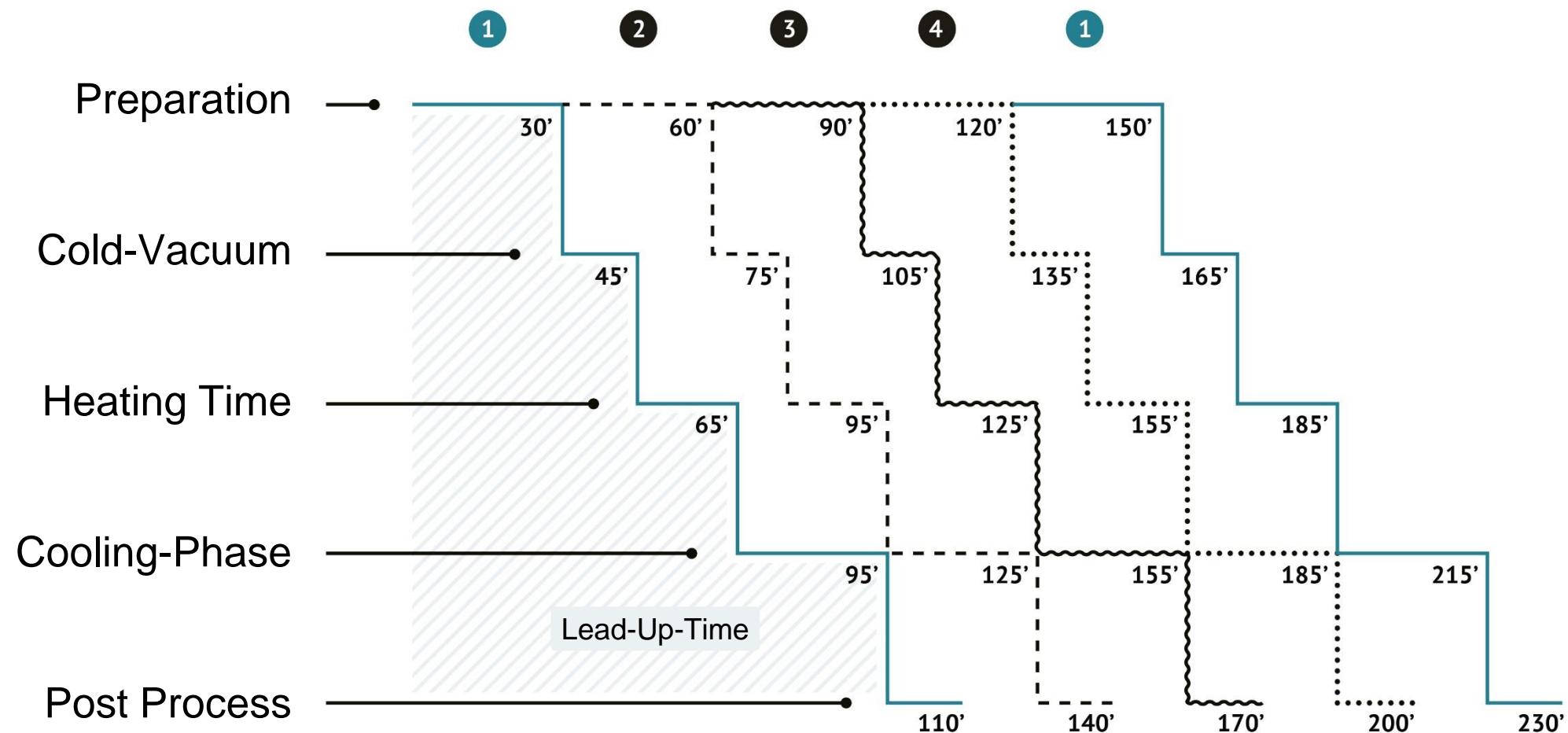
Cycle with four transfer plates



Example 1

4 transfer plates, regular products

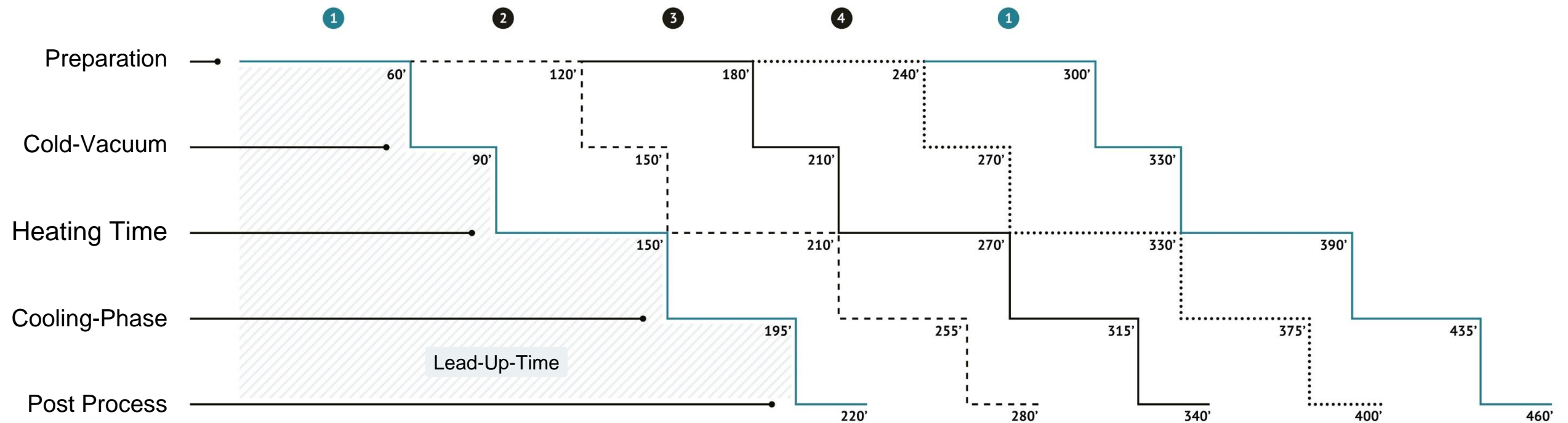
- e.g. 2x4 mm toughened glass with 0.76mm PVB



Example 2

4 transfer plates, more challenging procuts

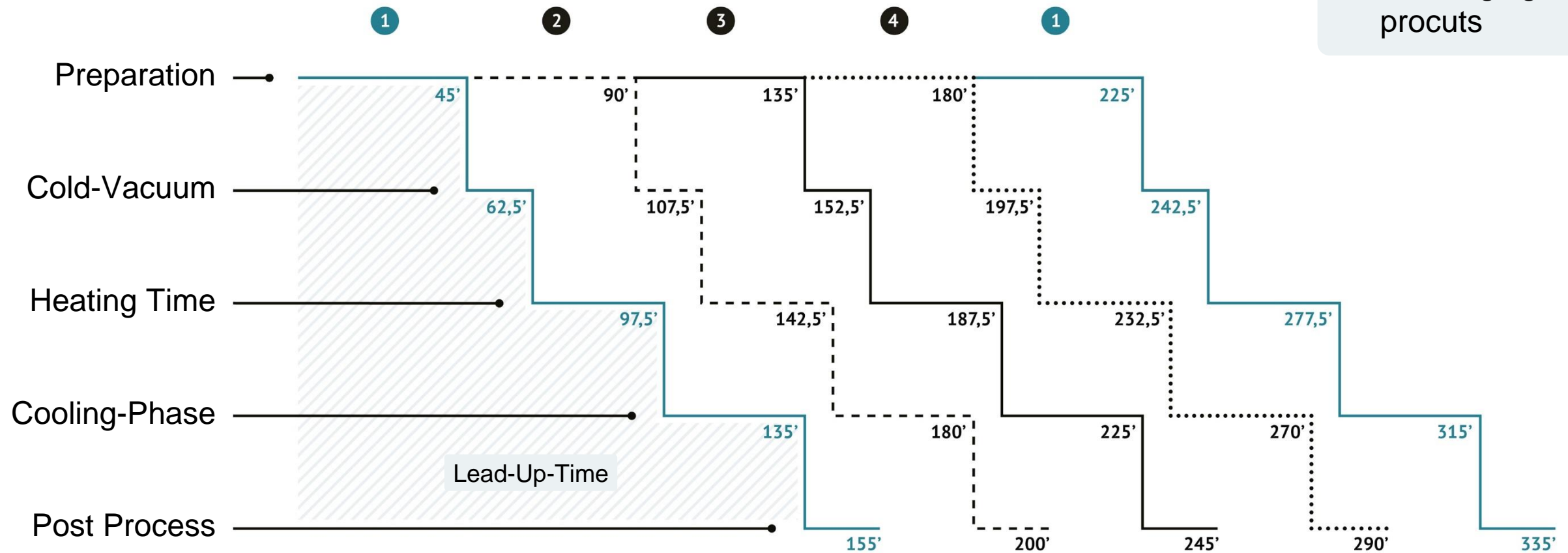
- e.g.
Bulletresistant
glass (BR7 with
SentryGlas®) or
switchable glass
with EVA



Example 3













4 transfer plates, procuts mix

- Any type of interlayer can be used
- Product mix with 50% regular and 50% challenging procuts



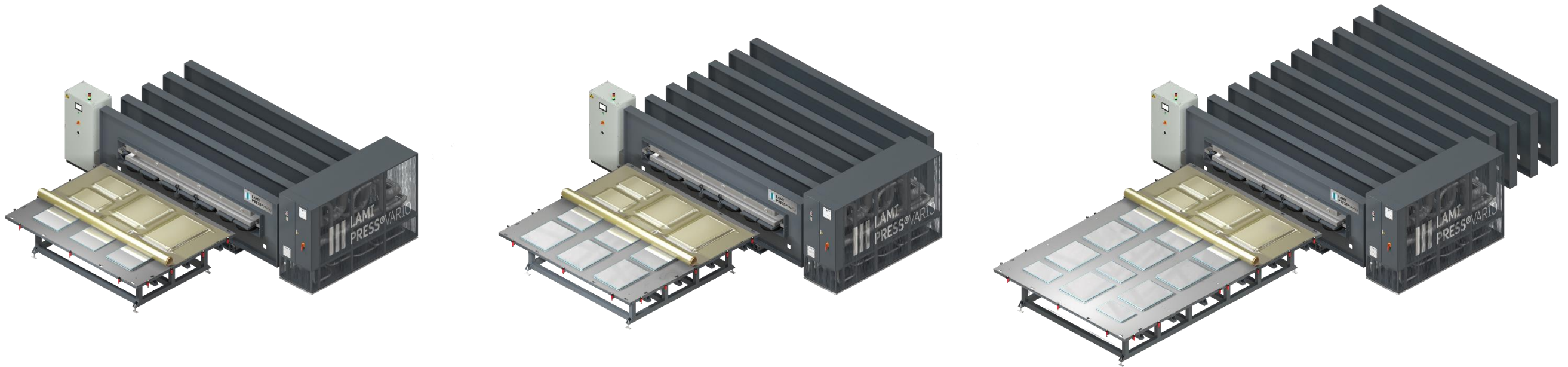
Production Planning

Possible Cycles/Shifts

	8 Hour Shift				16 Hour Shift				24 Hour Shift			
Number transfer plates												
Regular Glass Products (Cycle Time 30 Minutes – Total 110 Min)												
Cycles/Day	4	8	11	13	8	16	24	29	14	27	40	48
More Challenging Glass Products (Cycle Time 60 Minutes – Total 220 Min)												
Cycles/Day	2	3	4	5	4	8	11	13	7	13	19	24
Glassproduct-Mix 50/50 (Cycle Time 45 Minutes – Total 165 Min)												
Cycles/Day	2	4	6	8	5	10	15	18	9	18	27	32

2 LAMIPRESS MODELS

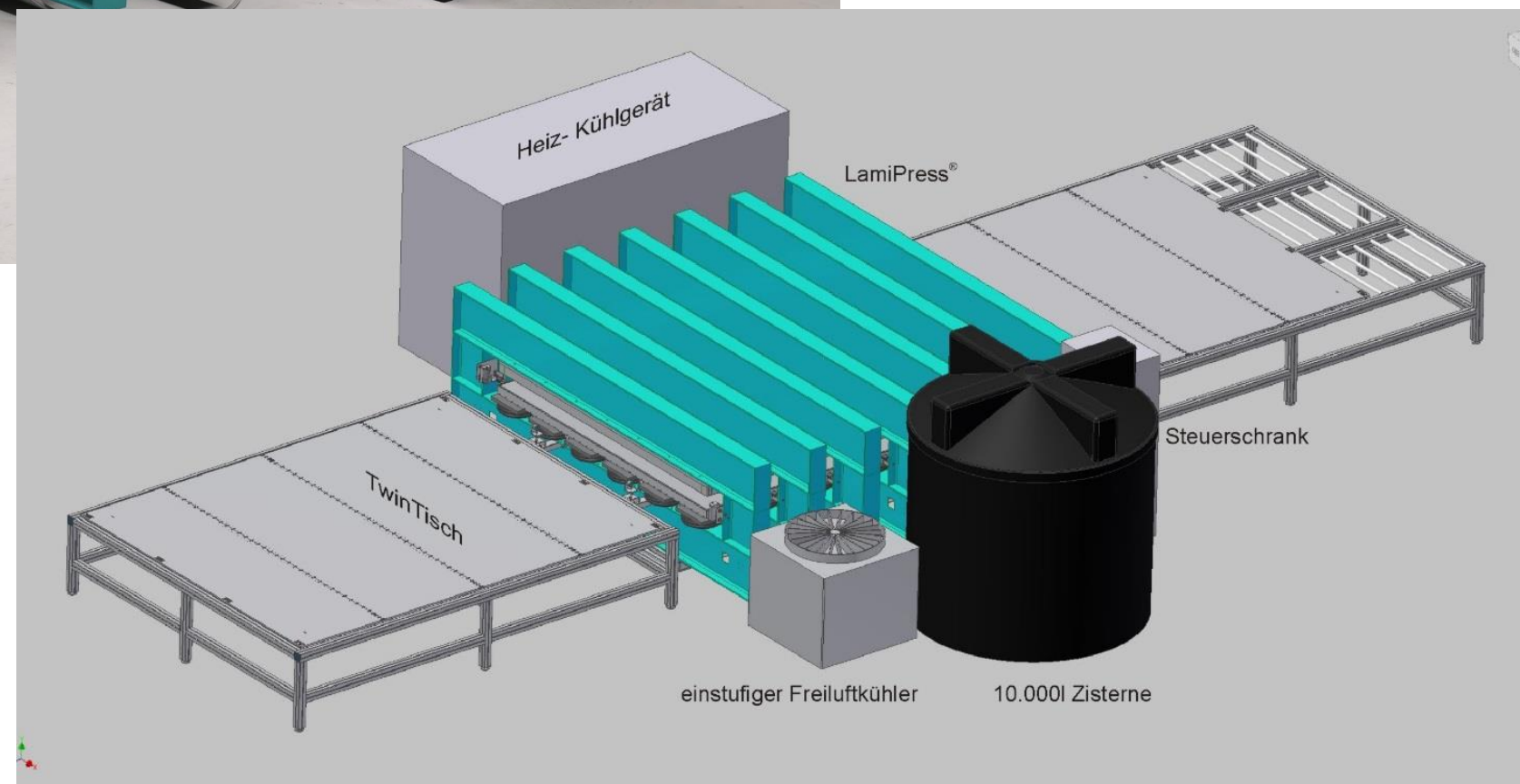
2.1 The Modular System



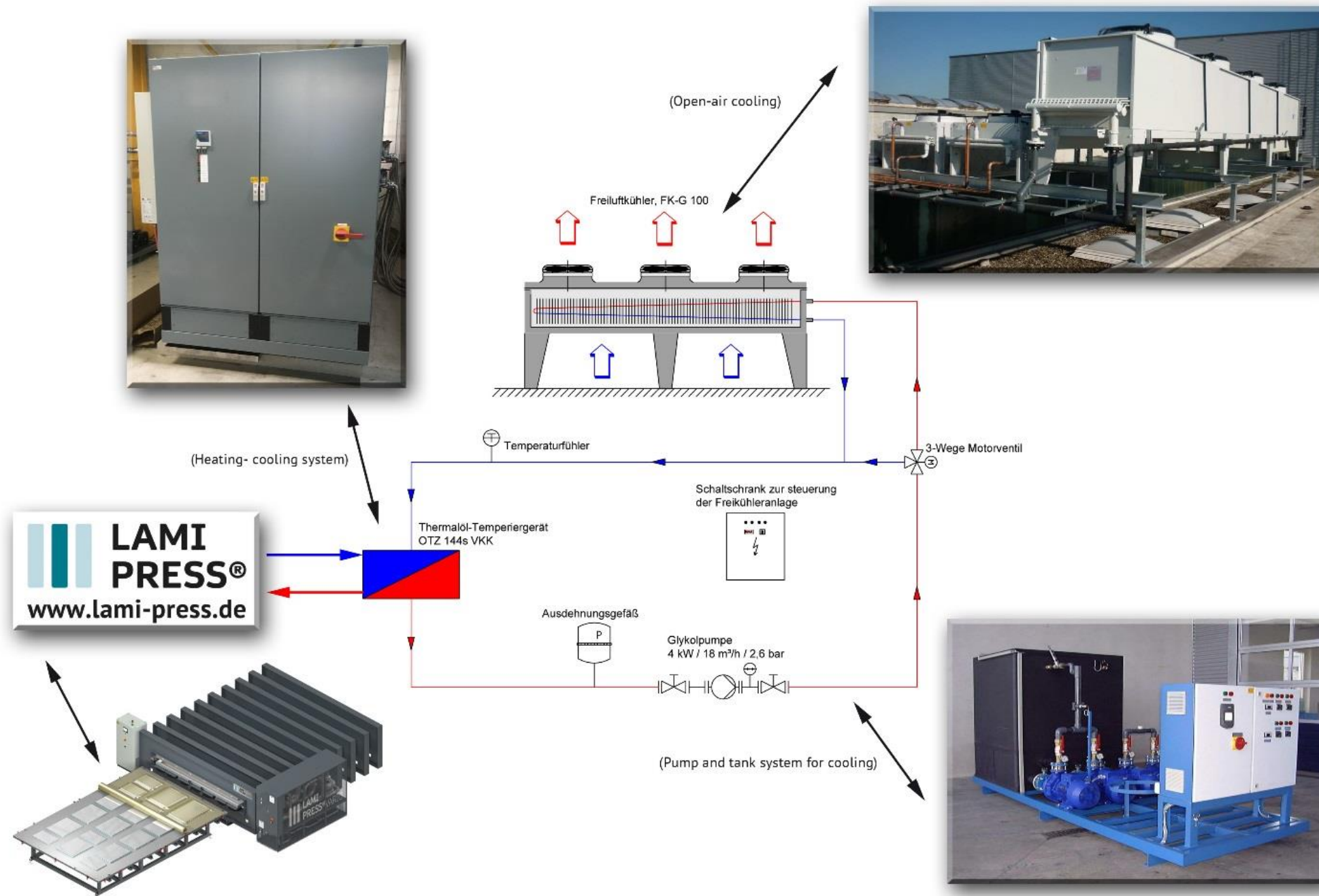
We develop, design and construction every LamiPress® to our customers desires and needs.

Factors such as the desired daily output, available space, shifts, size of the finished products, Budget etc. define the dimensioning of the LamiPress®.

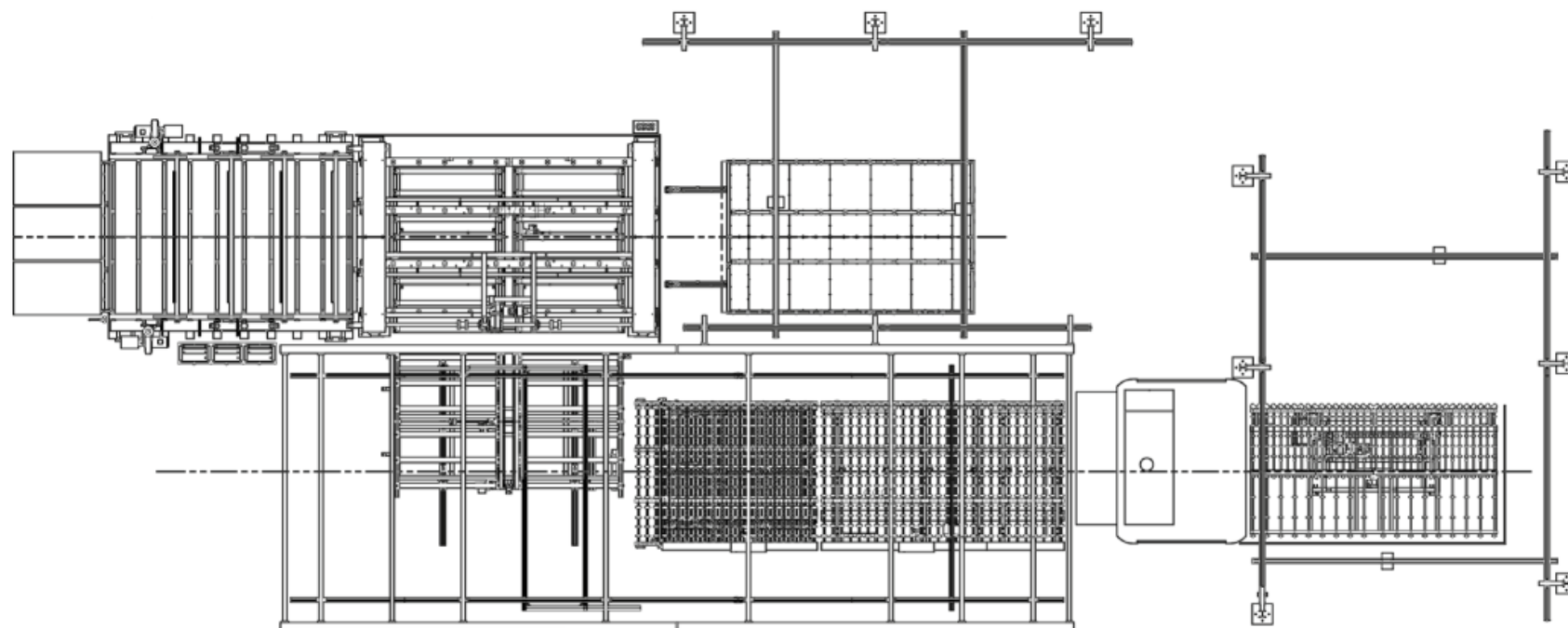
2.1 Twin-Tisch-Option with Cooling Tanks



2.2 Open-Air Cooling



2.3 Full Automatization by HEGLA

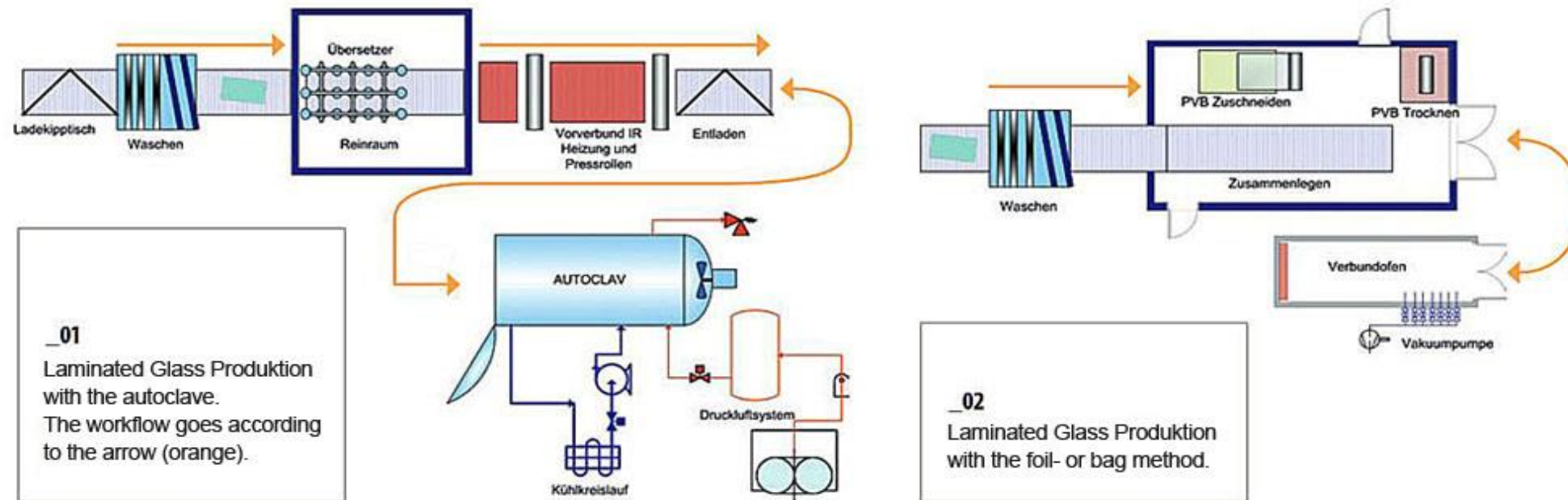


3 COMPARISON

3.1 Overview

- Autoclave
- Autoclave-Free
- Autoclave Vacuumbag
- LamiPress

3.1 Overview



3.2 Strengths and Weaknesses of the Autoclave Pre-Lamination Line

Strengths

- **Output**
- **Possibility to Automatize**

Weaknesses

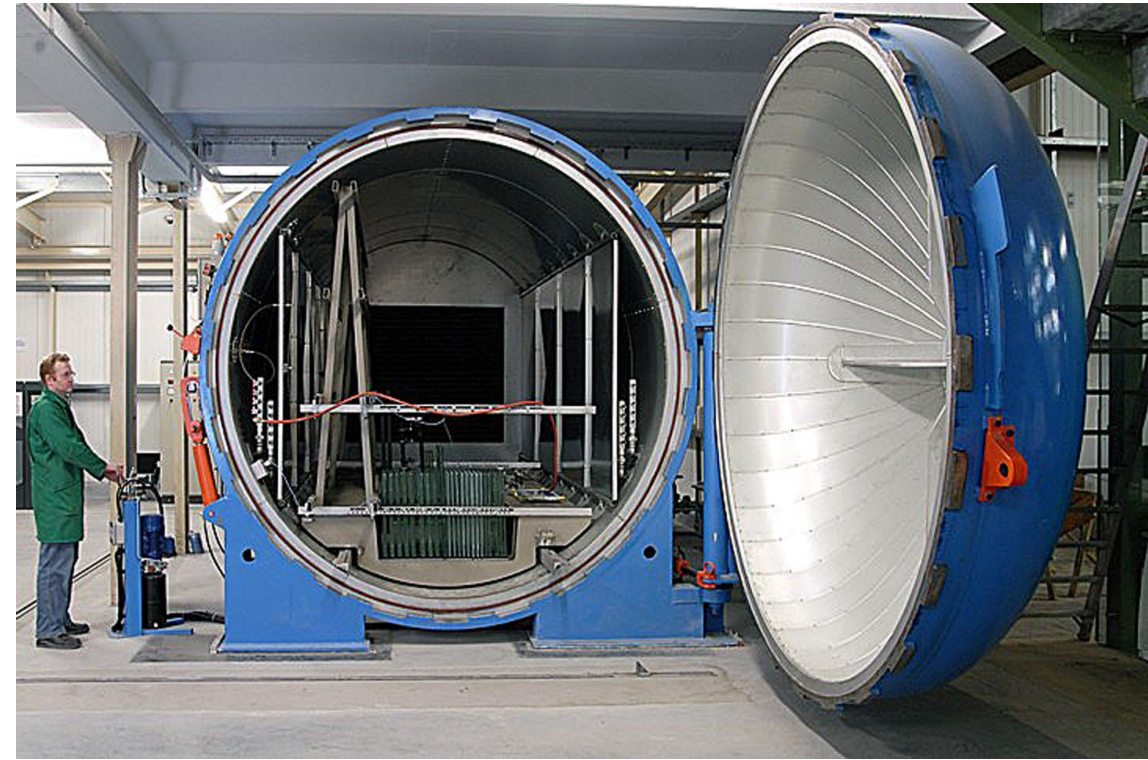
- **Acquisition Costs** Autoclave , Prelamination Line, Periphery, Climate Room, Water Cooling, Heating, Ventilation
- **Running Costs** Convection, Cycle Times
- **Utilization** – 2 Options: Accumulating Orders while long Delivery Times, Unefficient Cycles
- **Products** all non PVB-Based (Air Extraction / Autoclave Line), Thicker Sentry Laminates (Infrared Hearters), Toughened Glass (Clipping), Drillings
- **Maintenance** High Pressure Container
- **Space** Tough to add into existing production, uses up a lot of space

Result

Incomparable when it comes to efficiency in mass production (for example 2x4 mm Float with PVB Jumbo Sized).

For Safety Glass Starters and medium sized enterprises (different individual sizes, no specialty glass) there are better alternatives.

3.2 Strengths and Weaknesses of the Autoclave Pre-Lamination Line



3.3 Strengths and Weaknesses of the Autoclave Free System

Strengths

- Acquisition costs
- Promises to laminate multiple different interlayers (PVB, EVA, Sentry)

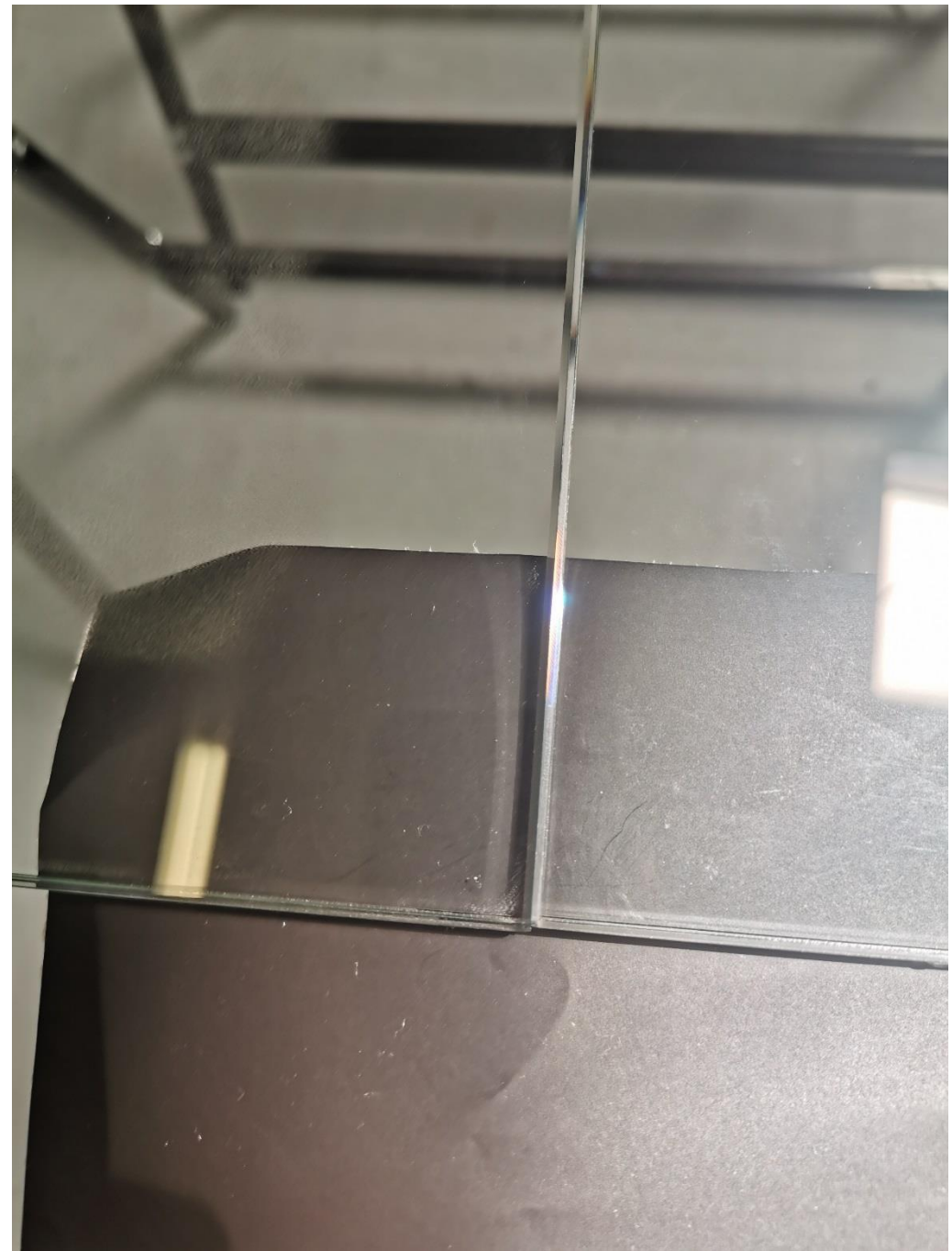
Weaknesses

- **High Breakage**
 - **Bubble Development** Pressure on edges through the vacuum – the more extraordinary the products, the worse is the outcome quality (Triangles, Squares)
 - **Dried PVB** To eliminate those issues (Drying ovens 4% Humidity)
 - **In a running production very inefficient**, only the first layers are dried enough to be used
 - **Unlaminated Spaces** no pressure –The more uneven the glass, the worse the outcome(Tempered)
 - **Uneven Temperature Distribution** through the multiple layers, hard to overlook the process
- **Unlikely to get Certified for Safety Glass Products** Dried Interlayers are very porous
- **Running Costs** Convectional Heat, Heating and Cooling Costs

Result

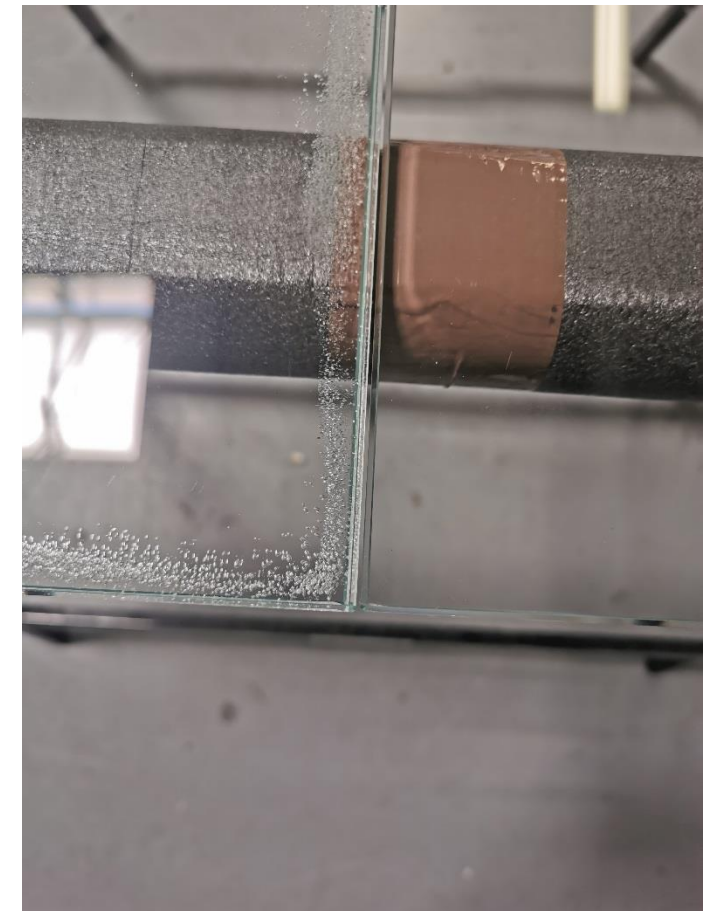
The Low-Seeming Acquisition costs rise through the need of optional features. The wide variety of products has a high breakage and/or low quality results
Not designated for industrial sized production.

3.3 Strengths and Weaknesses of the Autoclave Free System



2x4 mm Float mit 0,76 mm PVB

3.3 Strengths and Weaknesses of the Autoclave Free System



2x5 mm Tempered Glass
with 1,52 mm PVB

3.3 Strengths and Weaknesses of the Autoclave Free System



2x4 mm Tempered Glass
with 1,52 mm PVB

3.3 Strengths and Weaknesses of the Autoclave Vacuumbag

Strengths

- **Product Spectrum (All interlayers and glass types)** pressure and vacuum are the parameters involved

Weaknesses

- **Vacuumbag is a blessing and a curse**
 - **High effort Preparation** 2 workers produce ca. 50 m²
 - **High supply waste** because Vacuumbags can rarely be reused
 - **Low Efficiency inside the Autoclave** Vacuumbags have to be placed horizontally
- **Quality** Edge Offset and Edgepitching (Vacuumbag surrounds the glass uncontrollably)
- **Running costs**
 - **Long Cycle times due to convectional heat** no even longer than the regular Autoclave system due to the fact that the vacuumbag isolates the heat from the laminates
 - **Supply Waste / Workers**

Result

Good addition to the existing Autoclave. Offers Autoclave users the chance to supply customers with a certain spectrum of specialty products on top of their everyday safety glass production. Embedding a vacuumbag into on a regular safety glass production takes away the mass production advantage of the autoclave and make it very inefficient

3.4 Strengths and Weaknesses of the Autoclave Vacuumbag



3.5 Strengths and Weaknesses of the LamiPress

Strengths

- **Product Spectrum (All known interlayers- Glass Types and Geometries)** due to the simultaneous use of vacuum and pressure, which can be controlled to use
- **Safe Process Breakage** <1% according to Flachglas Nord Ost, Glas Schneider Hachenburg
- **Highest Safety Glass Quality** same in area as on the edges
- **Certificates** for Safety Glass, for multiple products. E.g. with SentryGlass
- **Easy to Work with**
- **Low Running Costs** less waste, low amount of labor required, high energy efficiency
- **Flexibility**
 - **Short Cycles** due to contact heat (most efficient form of heat transfer)
 - **Re-Lamination possible/Single Cycles possible** Delivery on time and pleased customers
 - **High Usage of every cycle** multiple interlayers/glass thicknesses in one cycle
- **Machine optional features and automatization line by HEGLA**
 - **Each LamiPress is a unicum** Built according to your available space and products – Any Output is possible
 - **No hidden costs** no expensive climate rooms needed – 20°C / 35% humidity works every time
 - **Automatization can be added later on** – Start off smaller, the LamiPress grows with you

3.5 Strengths and Weaknesses of the LamiPress

Weaknesses

- **Acquisition costs in medial range** with a fast amortisation and the best economical factors
- **Start-Up-Character:** Ways to eliminate that:
 - **Know-How from FVG** Product tests, Certificates
 - **References and Plants to visit:** Pilkington Gelsenkirchen, Semco Gießen, TU Darmstadt

Result

For the regular mass production PVB Safety Glass the Lami Press might not be the perfect fit. Other than that, the Laminator has the perfect technical requirements to serve not only today's glass market, but also the market of the future with all the Value-Added products one can think of.

Ideal for SafetyGlass beginners, Tempered Glass Oven users or existing Safety Glass Productions to upgrade their products spectrum and separate themselves from the rest. No more late deliveries, no more breakage, no more hassle.

3.6 Comparison overview

	Autoclave	Autoclave-free	Autoklav-Vacuumbag	LAMIPRESS®
Products	<ul style="list-style-type: none"> Mainly limited to PVB based products 	<ul style="list-style-type: none"> Mainly limited to EVA foil based products Under certain circumstances, PVB foil is possible as well 	<ul style="list-style-type: none"> Can laminate either PVB or EVA foils 	<ul style="list-style-type: none"> PVB and EVA foils can both be laminated More extraordinary foils such as SentryGlas® are predestined for the laminator It is easily possible to laminate multiple, different foils in the same cycle
Production	<ul style="list-style-type: none"> Incomparable when it comes to efficiency in mass jumbo sized production Lack in economical production for extraordinary or smaller sizes Long Cycletimes Unreliable availability with insufficient flexibility 	<ul style="list-style-type: none"> High breakage and quality deficits with non-EVA foil based laminations Low Output Unreliable availability with insufficient flexibility 	<ul style="list-style-type: none"> Quality issues such as edgepitching, delamination or movement Vacuumbag can only be used once in most cases Inefficient placement inside the autoclave, a lot of unused capacity (horizontal) Unreliable availability with insufficient flexibility 	<ul style="list-style-type: none"> Cycle times of under 45 minutes due to contact heat (with optimized process) Breakage under 1% (reliable process) Highest quality, no delamination No further needed consumable supplies
Costs	<ul style="list-style-type: none"> High running and acquisition costs (especially due to the inefficient use of convection heat) 	<ul style="list-style-type: none"> Evidently low acquisition costs High secondary costs due to the need of climate and clean rooms High running costs (especially for the use of convection heat) 	<ul style="list-style-type: none"> High running and acquisition costs Same energetic expenditures while producing less output 	<ul style="list-style-type: none"> Fair Acquisition costs (No further secondary costs) Low running costs (most efficient technology)

3.7 The future

The trend in the industry clearly leans towards functionality inside the glass.

Regular products lost a lot of value in their profit margins and the development of improving the process has peaked.

Value-Added and safety glass products with a high profit margin simply can not be laminated with the regular Autoclave-System. With upgrades it might be for some, but the margin is shrinking incredibly. The only known-of alternative, the Autoclave-free systems, have major issues in quality and do not possess a reliable process.

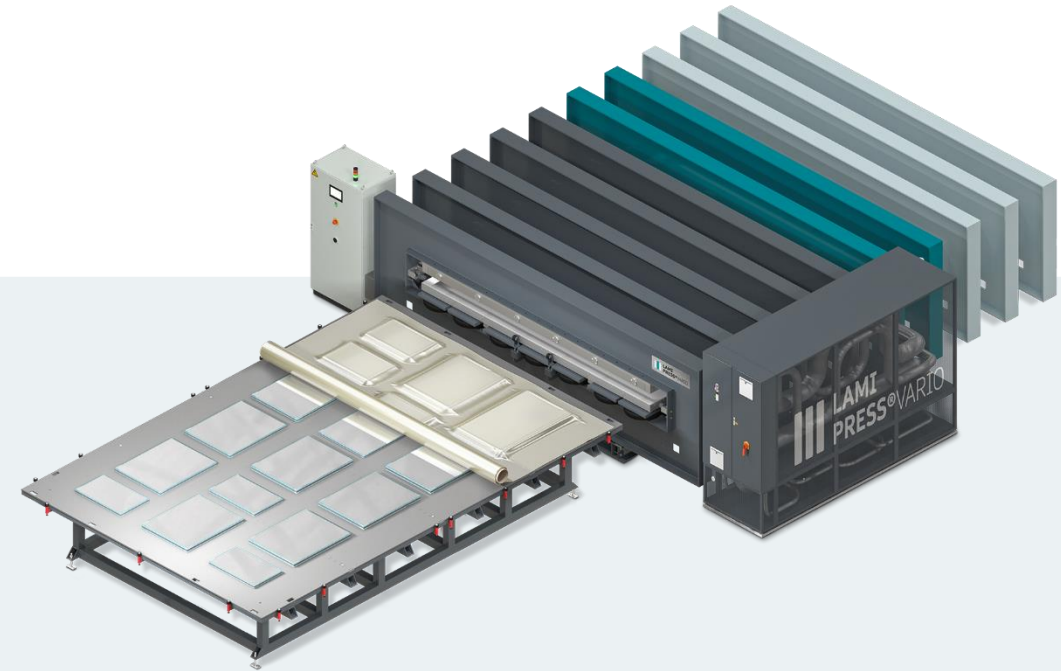
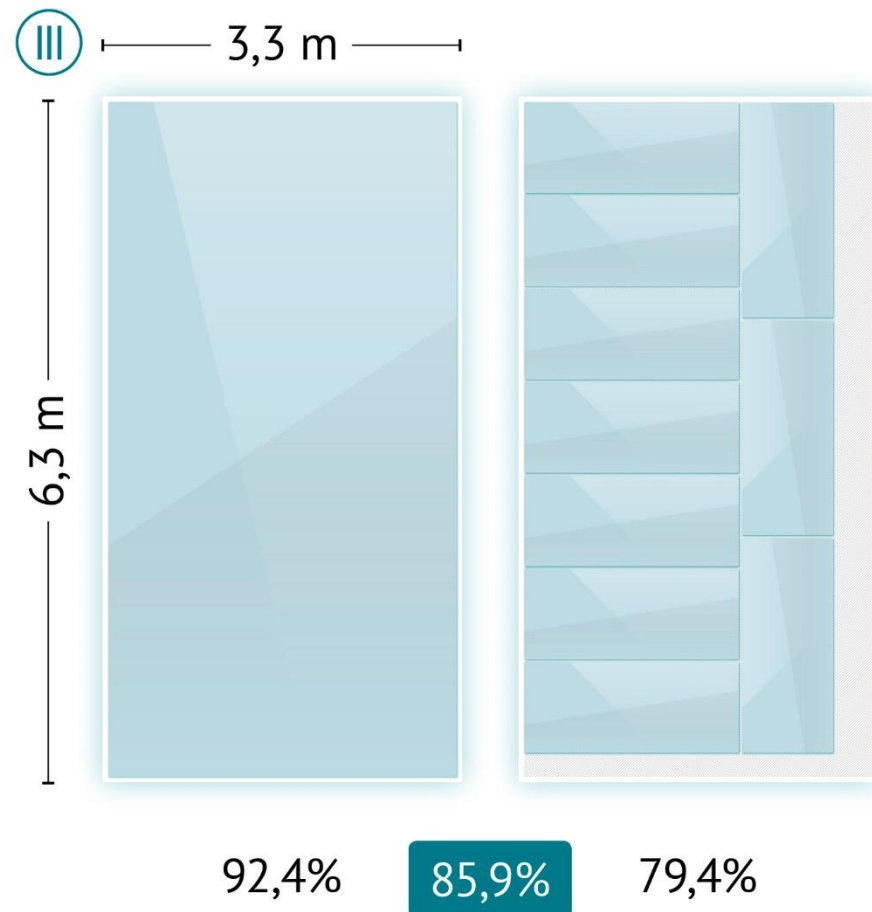
But the LamiPress® possibilities do not end here. As where our competition has to stagnate due to the fact that they simply can not laminate future trend projects is just the right time for us to begin. This is where the work starts for our research department. What seems technologically impossible can be resolved with the unique habits of the LamiPress®.

The products of the future will be LamiPress® products. As of now we are working on super Thinglass-Sentry laminations, Rounded Glass and Vacuumglass.

4 TALKING NUMBERS

Example

Jumbo Size



Machine Details

Lengths/Width: 6,3m x 3,3m

Area: 20,79 m²

Efficiency: 85,9%

Basic Price: 525.000 Euro

Total price: 640.500 Euro
(with 4 Transfer Plates)

Open Air Cooling: 110.000
Euro

Usage in Cycles

Energie (kWh): 220

Water: Non w/ tanks

Output Formula

$$\text{Size} \times \text{Efficiency} \times \text{Cycles} \times \text{Work Days} = \text{Output/Year}$$












Laminator Planning

Production Planning

This is possible because we can calculate with a breakage of lower than 1%. **Advantages of the LAMIPRESS®**,

Amortization In One Year

Required profit/m² for amortization in one year

	8h Shift, 300 Work Days				16h Shifts, 300 Work Days				24h Shift, 365 Work Days			
Number of Transfer Plates												

Regular Glass Products (e.g. PVB, EVA)

Cycles/Day	4	8	11	13	8	16	24	29	14	27	40	48
Output m ² /Year	21.430	42.861	58.933	69.649	42.861	85.721	128.582	155.370	91.257	175.997	260.736	312.883
Amortization in one year (€/m ²)	24,50	13,15	10,21	9,20	12,25	6,57	4,68	4,12	5,75	3,20	2,31	2,05

Challenging Glass Products (e.g. Sentry Glas®, switchable film)

Cycles/Day	2	3	4	5	4	8	11	13	7	13	19	24
Output m ² /Year	10.715	16.073	21.430	26.788	21.430	42.861	58.933	69.649	45.629	84.739	123.849	156.441
Amortization in one year (€/m ²)	49,00	35,06	28,09	23,91	24,50	13,15	10,21	9,20	11,51	6,65	4,86	4,09

Glass Products Mix (50/50 e.g. PVB, EVA, SentryGlass®) [Example Calculation on next page](#)

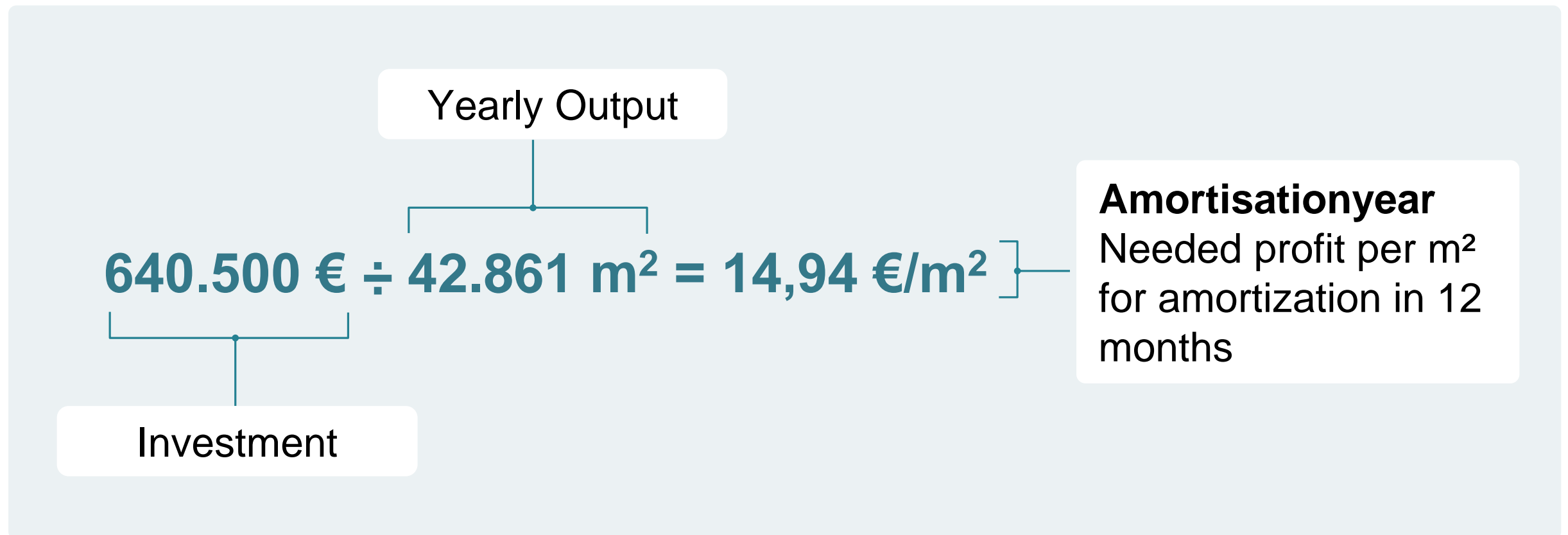
Cycles/Day	2	4	6	8	5	10	15	18	9	18	27	32
Output m ² /Year	10.715	21.430	32.145	42.861	26.788	53.576	80.364	96.436	58.666	117.331	175.997	208.589
Amortization in one year (€/m ²)	49,00	26,29	18,73	14,94	19,60	10,52	7,49	6,64	8,95	4,80	3,42	3,07



Numbers are for the amortization of exclusively the LAMIPRESS®.

Amortisation in one year

Produktmix, 4 Transfer Plates, 8h Shift at 300 work days



Profit/m²

29,88 €/m²



14,94 €/m²



7,47 €/m²

Time for Amortization

6 Months



12 Months



24 Months



Numbers are for the amortization of exclusively the LAMIPRESS®.

Amortisation in one year

Produktmix, 4 Transfer Plates, 8h Shift at 300 work days

Profit Margin

$$14,94 \text{ €/m}^2 \div 0,15 = 99,60 \text{ €}$$

Profit per m²

Median Selling Price
Point for Products
Mix e.g. Safety Glass
from Tempered
Glass, SentryGlass-
Products or Switchable
films

Profit Margin

20%



15%



10%

Time for Amortization

9 Months



12 Months



18 Months

LAMIPRESS® VARIO –
An Investment that pays off!
THANK YOU!



Fotoverbundglas Marl GmbH
Zechenstraße 7c | D-45772 Marl
Tel.: +(49) 2365 3173
Fax: +(49) 2365 36355
fotoverbundglas@online.de

www.lami-press.de