



## Manual for Permanent Vacuum Bag (PVB) Piekenbrink Composite GmbH

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For compaction and curing of composite materials physical vacuum can be used. The practical realization is usually carried out by films/foils + sealing cord or vacuum bags which are usable several times, if required (permanent vacuum bags PVB's).

PVB's offered by Piekenbrink Composite GmbH have a number of specific features which we would like to introduce:

- Made from 2K polymer material of high quality
- Temperature resistance up to 200 °C (in special cases up to 230 °C)
- Reusable
- Special sealing and tool geometry guarantee reproducible processes
- Static vacuum, autoclave conditions up to 10 bar or RIM / RTM applications
- Resistant to most materials, partly with visible aging, but without much technical influence
- Special material and tempering ensures no fumes and annealing of hood material in the composite material
- Extreme tool surfaces can be implemented
- Alternative vacuum seal, if the tool does not have a sealing groove (existing tools, flat tools, Galvano technique etc.)

### Procurement:

In general, the PVB is produced by the tool provided by the customer or by doubles made from the specific tool. In this case the PVB surface is simulated by covering process in consideration of continuous sealing, component layout and specific characteristics of the PVB. In case of multiple production we have the opportunity to reduce delivery times, costs and expenses.

Talk to our purchasing department!

### Use:

The PVB replaces the well-known method of vacuum evacuation by foil / sealing tape. This means that the process of covering and the vacuum structure (perforated film, vacuum breather) are used unchanged. It is only to consider if more vacuum breather in the outer tool area is requested as it may be favourable if the PVB does not come in contact with the tool (e. g. improvement of PVB movement).

The PVB has a circulating sealing groove. It will roughly be aligned with the sealing outline and adjusted to the tool area. Subsequently, the sealing groove is positioned, forced by vacuum and finally pushed into groove. This process may be carried out by hand or rubber roller. After the sealing groove is completely sealed evacuation of the tool area is to be started, which means that the PVB is not yet completely fixed and remains movable. This ensures a perfect position of the PVB.



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It must be ensured that no wrinkles and extensions are left. In some cases distinctive areas (e. g. negative edges) are marked as positioning support which can be used repeatedly as a guide. An exact positioning of the PVB is essential, especially in case of first use (start-up).

The material in the molecular area is fluent. Wrinkles may arise during several cycles resulting in faster wear of the PVB. Only if the PVB is exactly positioned under vacuum minor deviations are compensated during the first cycles, material tensions are reduced, surplus material gets shrunk.

Prerequisite is always an exact positioning of the PVB's during the first cycles. After a number of cycles the exact positioning can considerably be reduced – start-up of the hood is finished.

Please note that non-compliance of the correct start-up causes shrinkage of the PVB without restriction.

If the tool is equipped with check-valve couplings and the vacuum piping is tight, a vacuum without any additional vacuum sources is possible without significant loss, e. g. for tool transfer from the lay-up station to the autoclave.

### Maintenance / Servicing / Handling in General:

The PVB's are made from very durable 2K elastomer + reinforcing fabric. Nevertheless, the PVB's must be treated with utmost caution. Sharp objects (nails, jewellery, watches, tools, cured laminates, resin residues) may destroy the hood from the first use on.

### Storage:

PVB's are generally to be stored in moderately folded condition in appropriate boxes (plastic box, cardboard box lined with vacuum breather). Small PVB's can be stored completely flat or folded once only. Big hoods should be rolled up, if required, on cardboard roll cores.

Basically, there are no requirements with regard to the storage environment, since the conditions are much higher by using. Only damages / external influences (mechanical influences, use by unauthorized personnel as well as dust / dirt and strong sunlight) must be avoided.



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### Cleaning:

The PVB's are self-releasing, but tend to static charge. After the curing cycle the vacuum is released by means of gentle lifting of the sealing groove. Following, the PVB must be rolled up from the outside to the inside. In case of wrinkling sharp edges / areas are formed due to resin-impregnated vacuum breather or sharp areas in the form of cured composite material or tool set do exist in general.

After lifting the PVB is to be cleaned simply by shaking or compressed air. Residues or contaminants can be removed by using a hand brush. Strong electrostatic charging and, thus, strong dust adhesion can be reduced by using a water bath and subsequent compressed air (use always safety goggles!). The PVB's do not need any tools / release agents such as talc or other dry or liquid release agents. In some cases, the self-releasing may be reduced (dry vacuum breather stays attached). This can be solved by the use of an additional release film.

### Repair:

Due to self-releasing properties of the material successful repair is only possible to a limited extent. Small cuts / cracks may be repaired by the use of RTV1 silicone and reinforcing fabric. Do not treat surfaces previously, but remove loose dirt. Wet the slit and the surrounding area with RTV1 and, following, add lamination and reinforcing fabric. Finally, apply another layer, also on the opposite side and let it cure for 12 hours.

Depending on the type of damage or the type of repair the use of those PVB's contain risks. Note: If a very high amount of composite application allows absolutely no production failures, the repaired PVB's may be used only as substitute PVB's.

### Complaints:

The PVB is a manufacturing tool which is subject to mediocre production fluctuations. We grant the design of the PVB to the best of knowledge and belief and according to our experience regarding simulation, layout etc. In some cases, only a modified second PVB production leads to the requested results.

However, it may arise that the durability of the hood is, without external influences, considerably reduced under specific conditions (geometry, material / composite, hardness conditions etc.).

For this reason, we can only accept complaints by the customer if the provided tool is appropriately processed. This also enables us to recognize requirements of the customer and adjustments in the future hood production, if necessary.



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### Specific Tool Design:

Typically, the tool for the production of a vacuum bag requires a preferably even and free area around the tool (see also "Sealing Groove Specification"). PVB production is simplified and durability is increased, if the following instructions are observed:

- Cover the whole tool with vacuum breather close to the sealing groove, if possible. It prevents sticking of the PVB and the PVB remains movable. The external tool areas are mostly fixed by screws / bolts, loose parts etc. Covering with vacuum breather reduces those dangerous areas.
- Screws / bolts / sharpened-edged, loose parts should not influence the PVB
- All edges should be provided with radii: Min R3 or chamfer 3x45 °
- Loose parts should be released to prevent the PVB from being clamped.

We recommend getting in contact with Piekenbrink Composite GmbH before procurement of the tool to ensure an optimal tool design.

In order to protect our technical know-how and also our customers against plagiarism and imitations which are not in compliance with the performance requirements some of our products are patented.

We kindly ask you to consider this fact if sensitive information is transferred to third parties (vacuum bag specification / sealing groove specification) or PVB's are purchased from third parties or competitors.

If you have any questions do not hesitate to contact our purchasing department and / or our technical experts.

### Our Patents in Detail:

<b>Title</b>	<b>Patent No./ Utility Patent No.</b>	<b>European Patent No.</b>	<b>Status</b>
Vacuum bag device (with V-sealing)	10 2011 014 758	2643150	patented
Heated vacuum bag device	20 2011 004 357.6	2637834	patented
Vacuum bag device (with alternative sealing)	20 2011 004 365.7	2637833	patented
Heated block stamp device	10 2012 108 690	///	patented
Segmented mould device	10 2014 106 272.8	///	patent pending