



50 Cambridge Drive, Monroe CT 06468 USA  
+1 203.590.2000 | +1 800.332.AXEL  
www.axelplastics.com

## Technical Guide

# Focus On: Patterns, Plugs, Masters, and New Molds

If you have purchased a new mold from a supplier, it is important to follow your supplier's recommendation for proper preparation of that mold before beginning production. Many mold suppliers pre-condition their molds, so it is important to ask how the mold has been treated and what their recommendation is before applying any release product or producing your first parts.

### Plugs, Masters and Patterns

If you are making new molds, you may be working from a plug, or pattern that has been created using various materials including, wood, clay, waxes, putties, foams etc. Under these conditions, we suggest using paste wax and PVA to release the mold. Many moldmakers use this technique to create a first mold, which they will then sand and polish. This sanded and polished mold is then used to mold a finished part, and then this FRP part is used to make the final production mold. This procedure will yield very fine results, however it is costly and time consuming and not practical when creating large molds.

For those who hope to create a good quality production mold from a plug or pattern, remember that the effort should be made in creating the best surface possible on that plug or pattern, rather than sanding the new mold that you make from it. Sanding, patching, or re-working a new mold will never result in a quality, long lasting production mold.

If your plug, pattern, or master has been created with tooling board, or other hard material and finished with a surfacing primer and sealing resin (like Duratec® or similar), or is a gel-coated FRP part (a master) it may be possible to use a semi-permanent release system to produce your mold. Although multiple releases are not the objective when creating a new mold, some moldmakers choose to use a semi-perm rather than PVA because they want to create a perfect surface on their new mold. Remember that if the pattern or plug that has been newly created and surfaced with resin, there will be unreacted, "free styrene" present. Selection of

appropriate finishing materials and curing these properly is of paramount importance. Remember to also clean all surfaces well to remove all polishing compounds and waxes before applying mold sealer and release to create your new mold.

Masters are generally finished FRP parts that are used to create multiple new molds. If the master is well cured and has been previously used, a semi-permanent release system is fine for creating new molds. In the case of new FRP masters, pay careful attention to good cure on this part before using it to create your new mold.

### Building New Molds

When building new molds, it is critical to: 1) ensure a clean surface on the pattern, plug or master 2) select an appropriate tooling resin; 3) use the proper type and amount of catalyst 4) cure resins in an optimum temperature range. A mold that has been made with poorly catalyzed resin or built at low ambient temperatures will result in a new mold that will contain large amounts of unreacted styrene and have a low barcol hardness. No amount of post curing will resolve this problem. The result will be a low-quality mold with probable poor release. A "soft" mold will have a short life in production and is likely to produce poor quality parts.

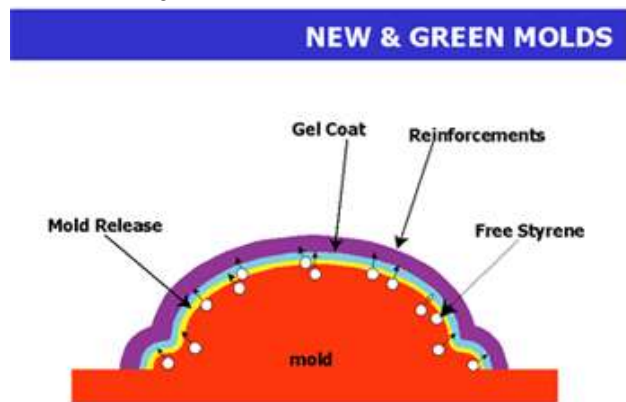
To reduce the incidence of molding problems, remember that the following concerns apply to both seasoned and new molds. These concerns include: maintaining an optimum & consistent gel-coat thickness; a controlled schedule for lamination; proper maintenance & operation of spray equipment; and attention not only to ambient temperature, but also to the temperature of mold surfaces and materials (like resin and release).

### Using New Molds

Even when well built, it is a known, and accepted fact that the resins used to create fiberglass molds do not fully cross-link. This means that there is always some un-reacted styrene in the gel coat of the mold and in the reinforcing layers of laminate. It is this un-

reacted, “free styrene” that can cause sticking on the first de-molding, or hazing (a cloudy appearance on the mold surface) after the first part or parts. Heat that is generated when the first parts are molded will drive un-reacted styrene up and out of the mold. In extreme cases, this styrene vapor can degrade or destroy the release coating. The severity of styrene migration in new molds depends on the amount of unreacted styrene that is present in the new mold, and also by the amount of heat that is generated by the part during its cure.

Heat, or sun curing new molds before their first use, will help drive excess styrene out and minimize problems. Another method that is popular is to prepare the new mold with sealer and release and then apply a well catalyzed gel coat; allow this to fully cure; and then blow this off the new mold with compressed air. This process will help to drive excess styrene from the new mold. An easy and complete release of the gel coat will indicate what you can expect on first de-molding. Preparation for production following the “blow coat” process will depend on what release system was used prior to “blow coating”.



## PVA

Few molders like using PVA. However, PVA is an inexpensive insurance against the risk of damaging or ruining a brand new mold. PVA is not soluble in styrene (but easily soluble in water) which is why it protects the mold so well. PVA can be used by itself, or applied on top of the release system that you intend to ultimately use.

If you decide to use PVA as an extra barrier of protection over some types of sealers or release, you may encounter difficulty in getting the PVA to wet on top. This is especially true if you are applying PVA on top of a semi-permanent release, as these systems are generally more slippery than waxes or polymeric releases. Your supplier of PVA can offer some guidelines for this operation. Rexco, a major

manufacturer of PVA, offers formulations with different flow characteristics. They suggest that when PVA is applied to a slippery surface it should be sprayed on with an initial fog coat and then gradually and repeatedly sprayed until the desired thickness is achieved (for additional information, contact [www.rexco.com](http://www.rexco.com).)

## MoldWiz® or PasteWiz®

If you have built your own molds and you plan to use a polymeric liquid release or a paste wax (MoldWiz® or PasteWiz®) we recommend using PVA for the initial break-in period. PVA acts as a barrier, preventing migrating “free styrene” in the new mold from reacting with the gel-coat or resin being used to create the part – the consequence of this would bond the part with the new mold. PVA offers extra protection, and the heat that is generated in the first few de-moldings with PVA allows the mold to gradually cure more completely and rid itself of “free styrene”.

If you intend to use a MoldWiz® or PasteWiz® release in your final production, AXEL recommends preparing your new mold with the release product(s) of your choice, following the recommended application instructions for each product. Following this, PVA should be applied on top. When the first part is de-molded some of the PVA will probably remain on the mold. This remaining PVA should be removed using a soft, clean, cloth that is wet with water and then the mold should be thoroughly wiped dry. Following this, apply another coat of release, follow with PVA, and then mold again. Continue this procedure of release plus PVA until all the PVA comes off with the molded part. At this point you can generally apply 2 coats of MoldWiz® or PasteWiz® and begin molding production without any PVA.

Every mold will vary on the number of cycles for which you must apply PVA. Usually, 2-4 applications are sufficient before the PVA comes off completely with the molded part. However, on a properly constructed mold, where a sealer and mold release are applied correctly, the PVA may release with the first de-molding. If there is a spot in which the PVA repeatedly does not release from the mold, then you have either a mold geometry problem, or more likely, a soft spot. Spots in the mold that have not reached a proper hardness interfere with easy and smooth mold release. These spots may be due to uneven and incomplete catalyzation, and therefore contain un-reacted styrene. Styrene bleed-out often appears on molds as dull, discolored or white spots with a rough texture. Styrene build-up can

accumulate fast so when buildup occurs in an area, that area should be maintained more frequently. Failure to address build-up promptly and routinely can compromise release and the production of good and uniform molded parts.

### **XTEND® Semi-Permanent Release Systems**

With the increased usage of semi-permanent mold releases in the production area, many molders now use the same products to create new molds and to mold the first parts from new molds.

When properly applied and cured, semi-permanent mold releases can provide a good barrier between a new mold and the first part. For this reason, manufacturers who use semi-permanent releases frequently choose to forego PVA break-in, the additional application time it requires and the poor part cosmetics that result when PVA is used.

To compensate for the new molds, many molders apply an extra coat of mold sealer and 2 or more extra coats of release. If you intend to use an XTEND semi-permanent mold release on a new or green mold, we recommend a minimum of 3 coats of XTR sealer with a minimum of 30 minutes cure between coats, and a minimum of 3 hours after the last coat of sealer. Extra cure time and application under appropriate temperature conditions are more important than applying coat after coat with too little time to cure. If the ambient temperature is low, try using lamps or heaters to warm the mold surface and the molding area. After the sealer is well cured, 4-6 coats of release should be applied. These should also be allowed additional cure time. Permit 30 minutes between each coat and after the final coat of release has been applied, the mold should be left for a minimum of 3 hours, or preferably overnight, to cure before molding.

Remember that these are guidelines – each molder should assess the quality of their molds and decide if they are appropriate in their situation.

Never cover the mold until the sealer or release has totally flashed off. If you wish to cover the mold, cotton bed sheets are preferable to plastic films which do not breathe and can inhibit the cure. Plastic sheeting is also a much greater magnet for dust.

Semi-permanent release systems can also be used on patterns or plugs, dependent on the type and quality of the materials that have been used in its construction. As previously mentioned, a plug, master, or pattern with a good FRP surface can utilize a semi-permanent release system by following the

guidelines above and generally adding an additional coat of sealer and release.

For additional information on semi-permanent mold release, please read AXEL's Focus On: Handling Semi-Permanent Mold Release and also refer to Technical Data Sheets (TDS) for each product.

