

Frequently Asked Questions

Moldman™ Machines Low-Pressure Molding - Frequently Asked Questions

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Applications:

1. Can you over-mold a PCB with surface mounted components?

Yes, it is no problem to over-mold a populated circuit board without damaging boards/components or reflowing solder. Tests show that material injected at 218°C (425°F) typically will cool down to less than 150°C (300°F) by the time it reaches the board.

2. Is the final component distorted in any way with this process?

No, not if proper design guidelines are followed. (Uneven encapsulation such as a very thick material section on one side of a PCB with a thin layer on the other could result in warping).

3. Will the part maintain dimensional stability after molding?

Shrinkage ranges from 1 to 1.5% for the different Macromelt® materials.

4. How are air bubbles avoided in the final molded part?

Ensuring that the moldset is vented correctly and optimizing the injection profile is the key to avoiding air bubbles. Densely populated circuit boards may require several steps in the injection profile to avoid any "shadow effects" behind components. We will typically start by optimizing molding parameters with translucent materials to detect if voids occur, and then change to black materials for production.

5. Can batteries be over-molded without reducing their effectiveness?

Yes, many types of batteries are being successfully over-molded with Macromelt. However, simple prototype over-molding for a particular battery is recommended before starting full-scale production.

6. Which wires, cables, circuit boards and solder masks do these materials adhere to?

Macromelt® adheres well to most substrates including PVC wires and PCB's. Henkel Corporation offers adhesion testing of their Macromelt® materials on any specific substrates; this type of testing will identify the most suitable material for a given application.

7. When should this technology be considered for grommets and strain relief molding?

The adhesive properties of the Macromelt® material will offer great seal and strain relief to most wire and cable materials. When true strain relief is needed especially for sensitive cables/applications such as Cat 6 patch cords and RJ-connectors, the Macromelt® materials are superior.

8. Are over-molded parts water proof?

Over-molded components will typically meet or exceed IP 67 rating for the type of environment it is capable of operating in. This means they are dust tight and protected against the effects of immersion. The selection of Macromelt® material grade is critical as there are different degrees of water resistance.

Macromelt™ Materials:

1. What is Macromelt®?

Macromelt® is group of high performance polyamide adhesives. They are essentially reformulated hot melts with strong adhesive properties designed specifically for over-molding electronics. Macromelt® is a thermoplastic material that solidifies simply by cooling down. It does not cross-link or release any toxic fumes.

2. What is the minimum tolerance that the Macromelt, materials can hold?

Tolerances of 0.1mm (+/- 0.004") can be met on smaller components.

3. Can material regrind be used?

For applications where adhesive properties are critical, regrind should not be used. The regrind material may contain a small amount of mold release agent, which could compromise adhesive properties. Furthermore, the mechanical properties of the material will degrade some from repeated re-melting. For non-critical applications the runners can simply be thrown back into the melt reservoir without any regrinding. It is strongly recommended to confirm that components molded from "regrind" material meet specifications.

4. How do Macromelt® materials compare to engineered resins economically?

Macromelt® rarely replaces traditional plastic materials directly. If a component can be molded successfully with PVC, there is typically no reason to consider Macromelt®. If PVC molding results in high scrap levels as a result of high injection pressure, Low-Pressure Molding may be more economical as a result of reduced scrap. Typically, the Low-Pressure Molding operation is an alternative to potting as it replaces several manufacturing operations. Over-molding with Macromelt® is typically a single step process. When a component is over-molded with Macromelt® there is normally no need for a separate plastic housing. The over-molding material becomes the housing.

5. Who will provide technical support for the materials?

Henkel will supply material support. Application engineering and support such as prototypes and the development of molding parameters will be supplied by Moldman Machines.

6. What is the delivery time for materials?

The Macromelt® OM line of products are manufactured in Italy and warehoused in the US. Henkel generally keeps about 2 tons of each material above forecasted volumes. Drop shipments to NAFTA customers usually take 5 business days from the point the order is made with Henkel customer service. Other Macromelt® materials (used for molding) are manufactured in the US and are readily available.

7. How are the materials packaged?

Should they be dried prior to use? Materials are shipped in double walled 20 kg (44 lbs.) bags. The materials are nylon-like and will absorb some moisture from the air. The materials are shipped at the recommended level of 0.2% moisture and should be kept in an air-tight container after the bag has been opened.

8. What is the typical shrinkage of the materials?

Shrinkage varies during injection and can usually be controlled by packing the mold with pressure. The shrinkage rate 24 hours after injection is 1 to 1.5%, depending on the grade of material.

9. Do dyes and pigments, added for color, change the material properties?

Generally, there isn't a dramatic change in properties (i.e. black versions of the products are similar to amber). The pigment is extruded into the amber Macromelt material. However, any colored material, which requires opacity (i.e. white), would need a significant quantity of inorganic filler, which will affect most of the properties.

10. What is the typical viscosity of the material?

Macromelt molding materials typically have a viscosity range of 2500-5000 cP at 210°C (410°F).

Low Pressure Molding Process:

1. How long is a typical injection cycle?

The molding cycle is dependent on the size and material section thickness of the component. Typical cycle times range from 25 to 45 seconds. Multiple cavity moldsets can be used to reduce the actual molding drop rate.

2. What is a typical injection temperature for these materials?

Melt reservoir temperature ranges from 190 to 230°C (370 to 450°F). Depending on moldset design, this would typically correspond to cavity temperatures of 135 to 180°C (275 to 355°F).

3. Do the molds need to be heated?

No, moldsets are typically cooled to approximately 20°C (68°F). The Moldman™ series of machines require no direct moldset cooling since the mold platens have chilled water circulating through them.

4. What is the lowest pressure that parts can be molded?

2 Bar (30 psig) is typically the lowest practical pressure. For anything lower the runner and gate design become very critical. Injection pressures from 4 bar to 20 bar (60 psig to 300 psig) are typical.

5. How do you control the filling of the cavity?

The Moldman™ series of machines offer programmable injection profiles. A typical profile would consist of filling 90% of the volume into the cavity at relatively high flow rate and then packing at low pressure. Packing pressures are typically from 50 to 150 psig and such pressures will not over-pack a cavity. Packing is critical to prevent sink and voids as the Macromelt® material will shrink when they transition from liquid to solid phase.

6. Are any special de-gating tools required?

No. There are none required.

7. How are the molds cooled?

The Moldman™ series have permanent water connections on the side of the machines. This feature allows you to run chilled water through the mold platens. moldsets are then cooled via the water-cooled mold platens. Typical mold temperature is around 20°C (68°F).

8. How do you ensure sealing of the component?

Selecting the appropriate Macromelt® material best suited to the application is the key to sufficient sealing of the component. Typically the best surface wetting of the component occurs with lower viscosity material at relatively high temperatures. Higher packing pressure may also help ensure surface wetting and sealing. The component design is also crucial. Low-Pressure molding works best when encapsulating around a component versus filling into a housing.

9. Can a conventional heated screw and barrel type machine be used for molding?

This has been accomplished a few times and unsuccessfully a lot of times. Macromelt has very low viscosity at the correct processing temperatures compared to engineering plastics. This low viscosity can cause the material to bleed backwards through the screw and essentially glue it together. Moldman™ machines use positive displacement gear pumps designed for lower viscosity fluids to inject the molten material into the cavities.

10. How much waste do you get with this process?

Typically the material in the runner and gate is waste. This can represent anything from a few percent to 35% for very small components. When runners can be recycled for less critical applications, the waste is zero.

Moldman™ Low Pressure Molding Machines:

1. Does Moldman™ Machines provide start-up training for the machines?

Yes. Training at our facility is included. Start-up and training typically takes 4 to 6 hours depending on the number of operators. Training at customer facility is quoted separately.

2. Who will provide maintenance and user support for the machines?

Detailed maintenance guidelines are supplied with the machines and it essential to set up your own in-house scheduled maintenance. Keeping the melt reservoir clean is the single most important step towards success with this technology. Moldman™ Machines and their local distributors will also be available for support.

3. Is the gear pump on the Moldman™ machines designed for the shot or does it work with a PLC profile?

The gear pump motor is run through a variable frequency drive with a PLC control. The Moldman™ series offers programmable/multi-step injection profiles.

4. What is the delivery time for machines?

Typically 10 to 12 weeks.

5. Are there demo units that can be leased for prototyping?

Prototyping is typically performed at Moldman™ Machines facilities. For leasing of equipment, please contact Moldman™ Machines for details.

6. How many parameters will need to be set prior to molding?

6.1. Installation of the moldset/setting of zero (closed moldset parameter)

6.2. The ejector system is activated if applicable

6.3. The injection parameters including temperature, pressure, injection time and cooling time are set. Including the installation of the moldset, the complete set-up typically takes less than 15 minutes. When a moldset is run-in for the first time, extra time must be allowed for optimization of parameters.

7. Will a special technician need to be trained in setting up the machine?

All molding parameter entry is via the touch screen. The training for this will take no more than 1 hour and is also fully detailed in the operations manual.

8. What features are on the PLC controller?

The PLC controls temperature of reservoir, manifold and hose, clamp operation, injection cycle including profiles and pump speed (VFD), ejector operation and some safety functions. All parameters are entered through the simple touch screen menu.

9. What are the more frequent maintenance items on the equipment?

Most problems are caused by insufficient upkeep of the melt reservoir. If the melt reservoir is not cleaned on a regular basis, charred material will build up on the fins, reducing the heat transfer to the material. This can lead to "short shots" (incomplete over-molds) and various blockages. If the material is left in the reservoir for days at high temperatures, it will get more viscous and eventually not flow. A melt filter and a pressure control valve must be replaced/serviced as per the maintenance guidelines. The injection nozzle and the pump seal will require replacement periodically.

Moldsets for Low Pressure Molding

1. What are the best materials for the construction of the molds?

7075 Aluminum is well suited for moldset manufacturing. Aluminum offers excellent heat transfer (i.e. short cycle times). Aluminum moldsets are relatively soft and care must be taken not to damage the cavity surface. If the component to be over-molded has steel or hard glass filled components, it is recommended to have steel inserts in this area of the cavity. This is generally required when molding connectors. Moldsets can also be manufactured from tool steel such as P-20. It may be required to cross drill steel moldsets to ensure sufficient cavity cooling.

2. Can the mold be plated to eliminate mold release?

The Macromelt® materials have strong adhesive properties and tend to stick to most surfaces. It may be possible to use some coating for permanent mold release, but we cannot recommend any specific coating systems at this time.

3. What kind of mold release is recommended?

After extensive testing of a wide range of mold release agents, one product has shown superior performance. Mono-Coat E-255 from Chem-Trend Incorporated. Phone no. (517) 546-4520. We do not recommend the use of Silicone based release agents when over-molding electronic components. Silicone can migrate over time resulting in partial electrical insulation and non-functional components.

4. What type of flow analysis is done prior to mold design?

None typically. However, existing software packages for mold flow analysis can be used for this technology as long as material viscosity is taken into account.

5. What are the maximum dimensions for a moldset for use on the Moldman™ ?

Please click on the moldset tap for details.

6. What is the delivery time for production moldsets?

Cavist can recommend specific tool-makers. Typical lead time is 6 to 8 weeks.

7. Are multi-cavity molds practical considering the single station machine only has 1 ton clamping force and the shuttle and rotary machines only has a maximum of 5 ton clamping force?

Multi cavity molds are normally used for all production molding. 1 ton of clamping force may sound limiting, but with packing pressures rarely exceeding 10 bar (145 psig) this will normally allow for cavity cross sectional area of at least 80 square centimeters (12 square inches).

8. Will a molding profile be pre-determined for moldsets provided by The Cavist Corporation?

Yes, a moldset from Cavist will be documented so that all molding parameters can be entered directly. Some minor fine-tuning may be required as a result of different ambient conditions.

9. Are the gates on the mold much different than those used in traditional engineered plastics?

Typical gates are 1.5 mm to 2mm (0.060" to 0.080") diameter and 0.5 mm (0.020") long. A tapered design is normally recommended to ensure the gate brakes consistently from the component without any cutting.

10. What would be the price for prototyping?

For a typical production moldset? Cavist typically offers prototyping services for \$3,500 to \$7,000 which would include 10 to 50 completed parts for testing. The price range for production moldsets will vary widely depending on number and type of cavities. Four-cavity moldsets for single station machines can range from \$ 15,000 to \$ 25,000.

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