OptiMel

Whitepaper
Low Pressure Moulding

Technology, Application, Equipment

Low Pressure Moulding (LPM)

Low Pressure Moulding (LPM) is a process for protecting electric and electronic components from external influences. It had its beginnings in the late 1980s with the sealing of connectors. The first applications were initially in the French automotive industry: Sensitive electronic components, which in themselves were already elaborately encapsulated, were to be additionally protected against moisture penetration via the necessary wiring. A few years later, the first housings were replaced: The encapsulation was carried out directly in the LPM process. The possible areas of application gradually expanded to include other components and industries.

Contents

What is Low Pressure Moulding ?

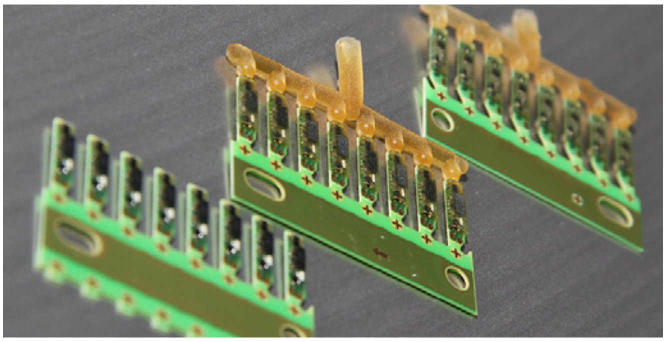
Low Pressure Moulding (LPM) is a process for moulding and protecting electric and electronic components (e.g. printed circuit boards or sensors) from vibrations, shocks and jolts. LPM insulates against heat, cold, moisture, weather in general and electrical energy. The moulding is cost-effective, space saving, and customisable. The technology is also used to form grommets and strain reliefs for connectors, for example. Amorphous thermoplastic polyamides and polyolefin are predominantly used in LPM. Both materials combine a favourable viscosity spectrum with a wide application temperature range from -50 to 150 °C.

Analysing the distinction of plastic injection moulding and 2-component moulding to LPM helps to better classify the technology. The LPM process takes place at 5 to 60 bar, a much lower pressure than in the classic injection moulding process. In this way, it is also possible to directly encase sensitive components such as printed circuit boards or sensors.
Moulding with reactive - or 2-component - materials involves mixing processes and sometimes longer curing times. In contrast, the cycle times with LPM are limited to pure moulding, which takes approx. 10 to 60 seconds depending on the size and contour of the components. The utilized materials do not have to be mixed and there is no reaction or curing time. The components are immediately ready for further processing. Due to processing taking place in a closed moulding cavity, the contour can be defined as in injection moulding. In many cases, this eliminates the need for additional housing.

The continuous development of the LPM process ensures an ever-widening range of applications. The use and combination of materials with a wide range of properties in conjunction with a wide range of processing variants offer enormous potential for ever new, innovative moulding solutions.

How does Low Pressure Moulding work?

In the LPM process, the component to be protected is placed in a project-specific moulding tool and encased in the moulding material. Thermoplastic hot-melt adhesives, also known as hot melts, are ordinarily used as moulding compounds. The predominantly pollutant-free materials, based on dimer fatty acid, are heated and thereby liquefied in the melting unit. They are then injected into moulds at low pressures and solidify on cooling.



The processing temperatures lie typically between 160 and 240 °C, approx. 40 to 50 °C above the respective softening point of the material used. The hot, liquid material is introduced into the mould at a very low pressure. The viscosity is usually between 1 and 10 Pas and the consistency is comparable to that of liquid honey. In this way, a relatively low injection pressure, typically 5 to 25 bar, is sufficient to introduce the materials into the moulding cavity. Due to this property, moulding sensitive components such as printed circuit boards and sensors is also possible. If special higher viscous materials are to be used or if the geometry of the component that is to be over-moulded requires higher pressures, up to 48 bar can be implemented. Should it be necessary due to special cases, pressures lower than 5 and higher than 48 bar can also be achieved. The materials begin to solidify again as soon as they flow into the relatively cold mould. Depending on the process' requirements, the mould temperature should be between room temperature and approx. 60 °C. A constant temperature is crucial to be able to guarantee adequate process reliability.

As soon as the mould cavity is filled, the material flowing in attains the pre-set pressure. The subsequent holding pressure phase is necessary to reduce material shrinkage. At the same time, the cooling process begins: The material hits the outer walls of the moulding cavity and cools down within a very short time. The complete moulding cycle on average takes between 10 and 60 seconds. An additional housing, which is filled as with potting, is not necessary with Low Pressure Moulding. Here, the moulding can be realised directly in the mould. Additional steps relating to processing or storage are not necessary. The component can be processed immediately without curing or reactivation times.

Despite the relatively high processing temperatures, the moulding of temperature-sensitive components is also possible. In addition, an appropriate mould design influences the material flow in regard to temperature control. Due to the high thermal conductivity of the mould body (mainly made of aluminium), the components do not come into contact with the full processing temperature, or only for a very short amount of time.

For special applications, polyolefins may also be used instead of thermoplastic polyamides. Both product classes form a secure and durable bond with many materials. This is a purely physical process. A chemical reaction as with 2-component materials does not take place. The adhesive properties of the utilized materials protect components up to IP68 with a suitable combination of materials. The right combination of carrier material, moulding material type and process is important for building up the adhesion bridges.

A descriptive explanation of the LPM process may be found via the following link.

Watch now!

Applications of Low Pressure Moulding

Against the backdrop of increasingly compressed installation space and growing power densities, the demands on the design of electric and electronic components are rising. Encapsulation processes and materials are among the decisive factors for the durability of electrical and electronic assemblies.

Originally developed for and in collaboration with the automotive industry, the process has now become an established manufacturing technology in many areas of electronics production and is used in various industries. Some typical fields of application are presented below.

Connectors and grommets

LPM realises the housing and sealing for plug connections and grommets with integrated strain relief and bend protection.
A custom-made moulding cavity, clamping plates and mating connectors in the mould ensure a defined position of the components and, if necessary, their sealing.

Sensors

Sensors can be encapsulated completely or partially using the LPM process. Important measuring areas can be kept free of moulding and at the same time other electronic areas can be protected in a media-tight manner. The adhesive properties of the materials play a decisive role here.

Printed circuit boards

Printed circuit boards can also be moulded thanks to the low pressure in the LPM process.
The moulding serves to protect the components from vibration, moisture, contamination, contact and mechanical stress without affecting or even damaging them through the process.

Microswitches

LPM ensures the long-term functional maintenance of microswitches by protecting them from moisture penetration.

Housing replacement

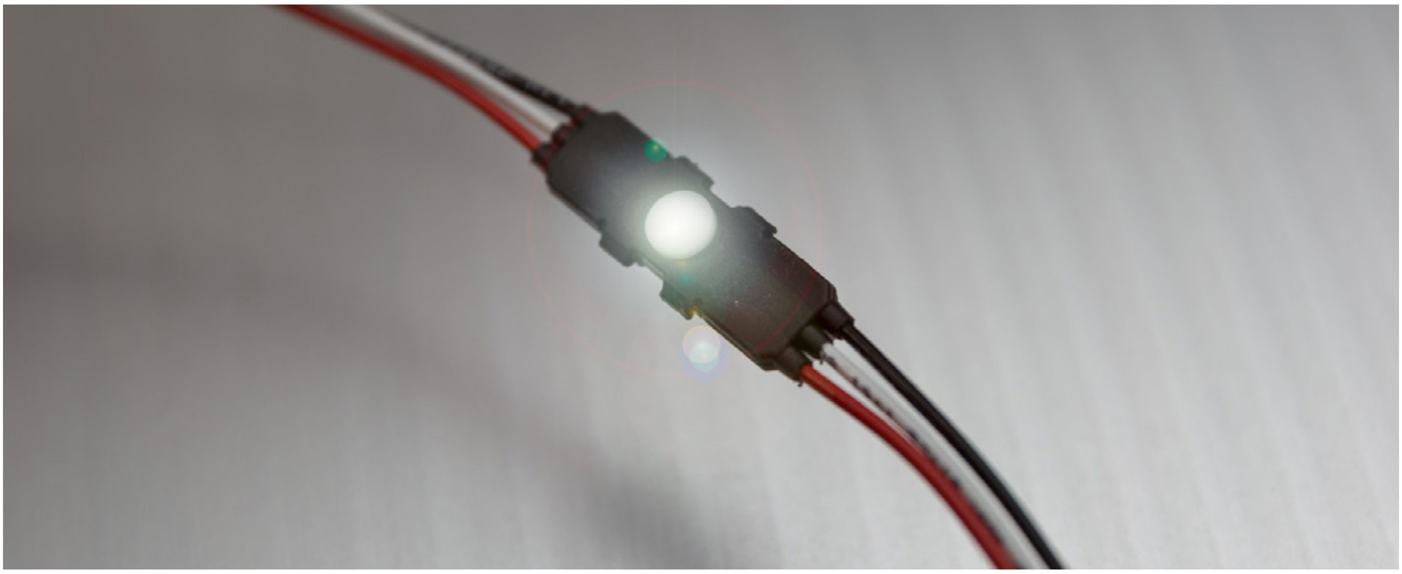
The combination of individual moulding and sealing in one process step also results in advantages for production, including higher quantities per time unit and cost savings due to fewer process steps.

Requirements for adhesion - Physical principles

The following chapter deals with the prerequisites for adhesion and the influence of the carrier substrates. It informs which properties play an essential role in adhesion and what to look out for.

Moulding materials

- Material structure of the moulding materials used: Amorphous molecular structure with relatively short chain length. This structure results in a relatively low melting and processing viscosity.
- This results in good wetting of the substrate materials as long as the surface tensions are at a similar level (e.g. semi-crystalline polyamides).
- Polyamides and polyolefins have different surface tensions (e.g. polyolefin matches cross-linked materials).
- The material can only wet in a liquid state.
  - ➔ If it cools down and its viscosity increases, it is no longer able to build up the required number of physical connections.



Carrier materials

- Matching surface tension ➔ as already mentioned, surface tension of carrier and moulding materials should be at a similar level.
- As far as adhesion with certain material groups is concerned, it is difficult to make a general statement, because structure and surface tension may differ depending on the formulation.
- It is also difficult to make a statement on whether and to what extent adhesion can be achieved (e.g. polycarbonate).
- Possibly the surface structure can also play a role in this.
- The surfaces of the substrate materials must be clean, free of grease and release agents.
- Surface treatment, e.g. with plasma, can change the surface tension with the aim of achieving adhesion.
- Caution: Changes to the base materials (not all PCBs are the same) in ongoing projects (without prior testing of adhesion) can lead to component failures.
- Plasticisers outgas from the base materials at different temperatures. The critical outgassing temperature must therefore always be kept in mind. Otherwise, outgassing plasticisers will form a separating layer between the component and the moulding over time and adhesion will be lost. The result is component failure in the field.
- The processing of the carrier materials is also important:
  ➔ If plastics have been cooled down too quickly during their production, the shrinking process can either slow down or come to a complete standstill.
  ➔ If they are then exposed to a higher temperature again during moulding or in use, the shrinking process starts again ➔ „shrinking away“ leading to loss of adhesion.

Metals

- Metal components are a special case: In the conventional LPM process, the moulding materials do not build up sufficient adhesion bridges to metallic inserts because these dissipate the heat too quickly. This problem could be solved with additional steps in the process, such as heating the inserts outside of the moulding tool. A much more efficient, high-quality and safe solution is the new LPM process especially for metallic inserts. For more information, see page 18.

Further processing

- Different temperatures and thus different energy states lead to different freedom of movement of the molecules.
- During rapid cooling (LPM process), the molecules are „frozen“ based on a high energetic state.
- Molecules have the tendency to reassume their position in the current energetic state (based on the current temperature), i.e. the material reworks its structures (usually up to 48 hours).
- During this time, the material can be further processed. Test procedures etc. should not yet take place in this time window.

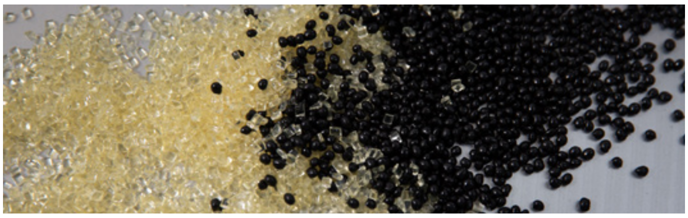
Moulding materials

Low Pressure Moulding mainly uses pollutant-free dimer fatty acid-based materials as moulding compounds. These predominantly used amorphous thermoplastic polyamides, or polyolefins used in addition, combine a favourable viscosity spectrum with a wide application temperature range from -50 to 150 °C. The thermoplastics, also known as hot melt adhesives or hot melts, become mouldable when heated and retain the desired shape when cooled.

The materials used in LPM differ from other thermoplastics in two properties:

Viscosity:

At a processing temperature of 160 to 240 °C, the viscosity is comparatively low, typically about 1 to 10 Pas. Materials with low viscosity can be introduced into a cavity at low pressure. Thus, it is possible to use gear pumps, piston pumps or special pressure-reduced extruders to convey the materials. Low injection pressure is of utmost importance when encapsulating sensitive electronic components.



Adhesion:

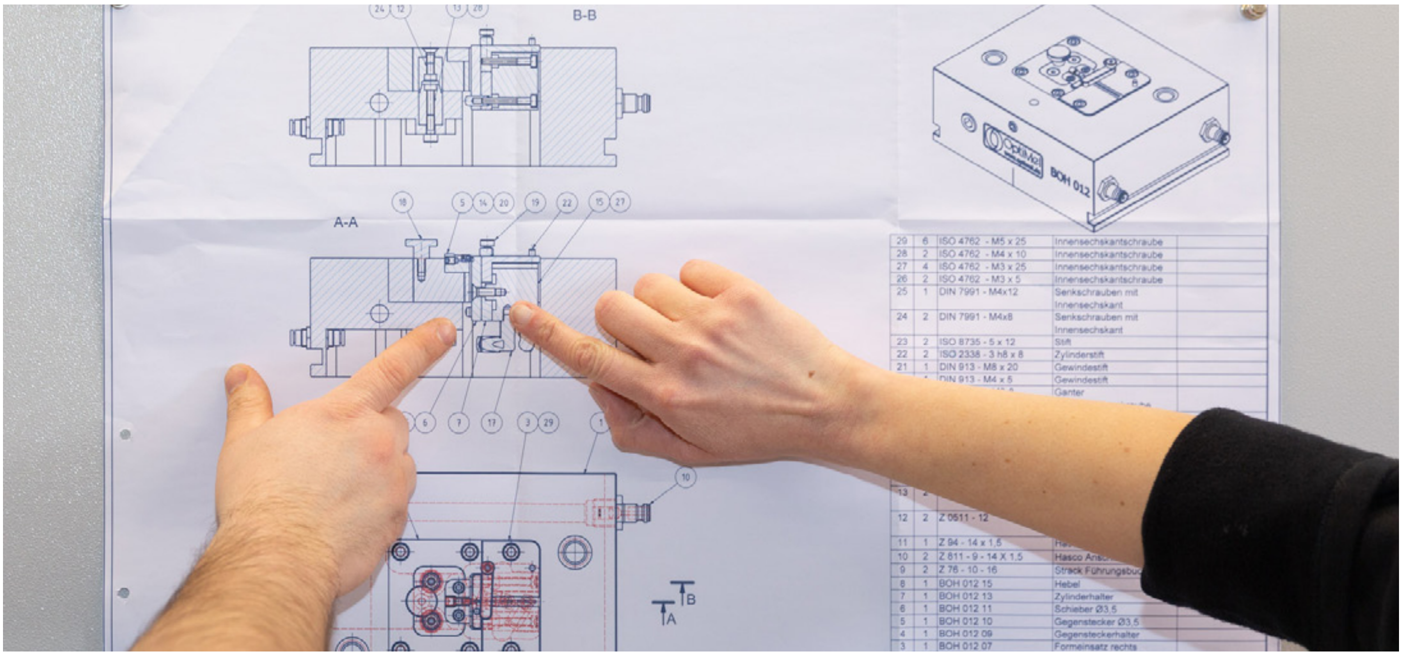
The general adhesion properties of this particular type of thermoplastic allow for sealing capabilities up to IP68. The type of adhesion is purely physical.

Compared to thermosets, the materials primarily have processing advantages:

- No mixing of components is required.
- Thermoplastics are cleaner and easier to process (re-meltable granules that physically set).
- No process accelerators with in part toxic properties (e.g. cyanoacrylates) are used.
- The very short setting times enable a high production speed.

The wide selection of different material types makes it possible to adjust to the respective project requirements:

- UV resistance - individual materials are already partially UV-stable or UV-resistant; in addition, UV stabilisers can be added.
- Chemical resistance - different material types offer different kinds of resistance to slightly weak acids and/ or bases, oils as well as alcohol-free cleaning agents (if necessary also in combination).
- Durability against weather influences over a longer period of time - for example 85°C / 85% humidity.
- Specific special properties for individual material types, for example improved hydrolysis resistance.
- Insulation resistance (or moisture insulation resistance)- the materials usually have insulating properties, sometimes also under the influence of moisture.
- Mechanical properties - depending on the combination of materials, the moulding achieves a strength in a range from Shore A40 to D60.
- Thermal conductivity - the standard materials have no thermal conductivity of 0.1 W/mk, but an increa sed conductivity of 0.8 to 1 W/mk is achieved by special types.
- Electrical conductivity/ dielectric strength - the materials are usually non-conductive. The dielectric strength is 20kV/mm.
- All Technomelt® moulding materials are based on renewable raw materials and feature clean processing properties, without solvents or other harmful substances.
- The hot melts are RoHS-Reach compliant.
- Many materials are UL listed and achieve flame classes in the range of UL94 V-0 and V-2.



Low Pressure Moulding tools

The decisive factor for the technical implementation of each project is the corresponding moulding tool. Every single tool is individually developed, designed and manufactured for the respective project. The design of the tools results from the combination of customer requirements and material- and process-related principles. Individual design features are comparable to those of classic injection moulding technology. A significant difference results from the properties of the utilized moulding materials. Low viscous thermoplastic hot melts are processed at low pressures and have adhesive properties - two essential points to consider in mould design.

The moulds are made of aluminium or steel, depending on the requirements. Aluminium scores with low material costs, shorter processing times in machining production and good thermal conductivity. Steel is used for mould inserts for abrasive inserts and moving parts such as sliders or mechanical ejectors.

As aluminium has a higher thermal conductivity than steel, it also offers advantages when demoulding moulded components. Less adhesion to the mould cavity is created in the process. Furthermore, improved demoulding can also be achieved with mould release agents or, much more efficiently, with permanent coatings.

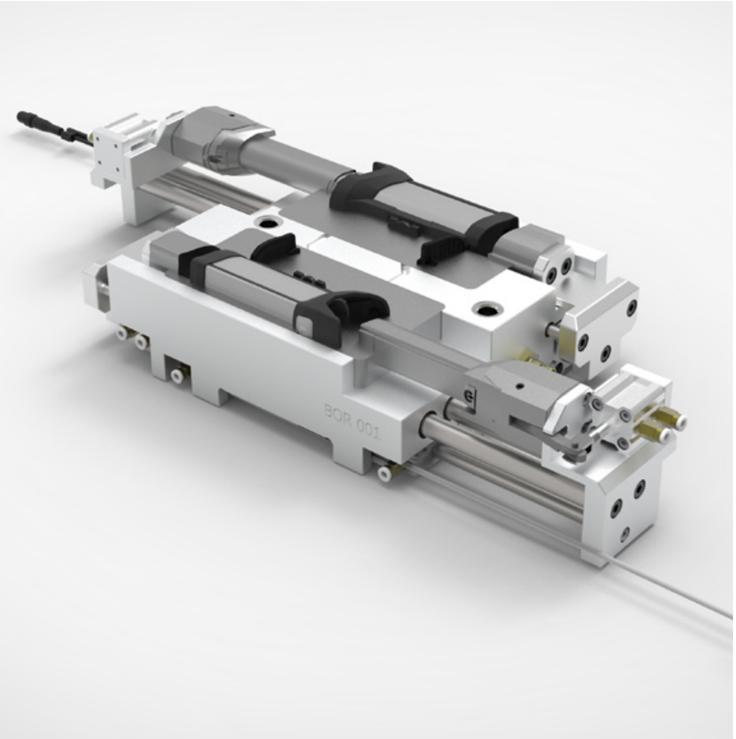
Each moulding tool is individually adapted to the project requirements.

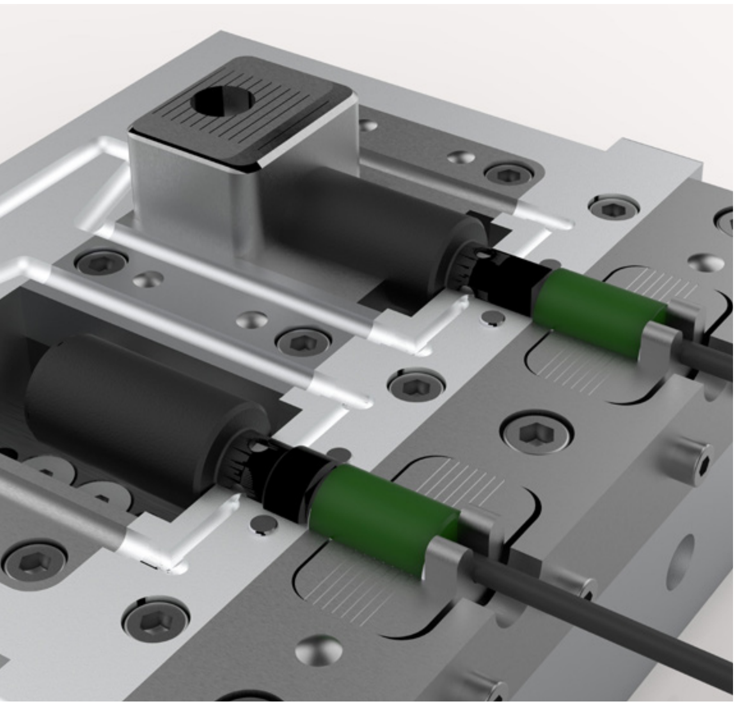
Process optimisation can be decisively influenced by the moulding tool. In the following, various possibilities will be presented:

1. Component fixture for positioning, for optimised demoulding and component geometry

2. Specific sprue routing for multiplication of cavities with simultaneous flow path shortening and reduced waste volume, for optimised temperature control

3. 2-stage processes for centring components, avoiding air pockets and combining material properties.





1. Component fixture:

Component geometry: The customer-specific outer contour determines the component fixture. Different versions of the component fixture are possible: Pins, mating connectors, sliders, support surfaces, clamping plates for cable routing or fixing.

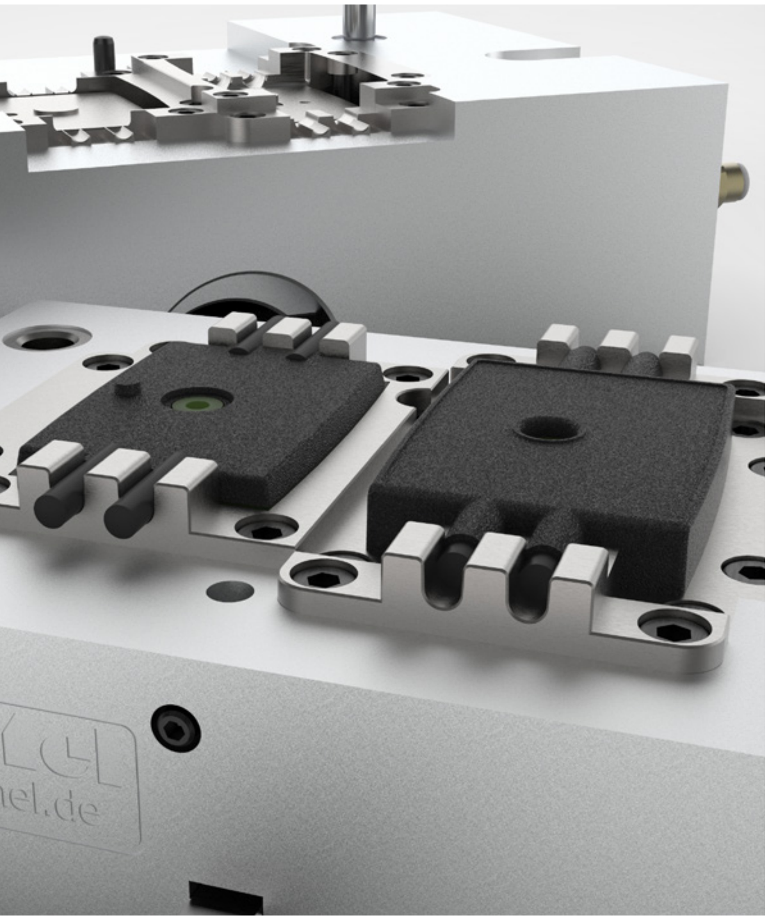
Positioning: The component fixture allows safe positioning, for example, cables running in clamping plates that hold the component in position (without „floating up"), or a component lying on pins, for example, if the component does not have to be enclosed completely tightly, or pullable pins for tight moulding. If a component cannot be securely positioned in the cavity (example: PCB with cable on only one side would „float" in the moulding), the use of a 2-step moulding is possible (see 3.).

Optimised demoulding: Component fixtures can be designed in combination with the component geometry to facilitate demoulding, for example mating connectors or sliders. Mechanical ejectors or pneumatic demoulding aids ensure easier demoulding, resulting in a greater freedom in the choice of component fixture.

2. Specific sprue routing

Multiple cavities: Balanced material distribution to all cavities with simultaneous flow path shortening. In many cases, vertical sprue routing proves to be advantageous.

Optimised temperature control: The sprue should be designed in such a way that all areas of the component fill evenly without the material freezing beforehand. In addition, temperature-sensitive components should not be situated in the primary material flow and thus will only be exposed to a reduced processing temperature.



3. 2-stage processes:

Centring of components: So that PCBs, for example, lie centrally in the moulding and do not „float" into the outer areas, they can be positioned in a cavity and initially only poured from one side. In the first step, the fixing takes place via the pre-moulding contour and in the second step the shaping of the final component geometry.

Avoidance of air pockets: In the case of circuit boards with high-build assembly, air often accumulates underneath and is trapped during the moulding process. In the cooling material, this air can rise but can no longer escape, so that it forms air bubbles in the moulding. In order to displace the air, the contour can be formed to the lower edge of the components in a step pre-moulding. In the second moulding step, the final contour is formed above the assembly.

Reduction of material volume processed in one cycle: Optics and haptics are optimised. In the first step, for example, 80% is filled and shrink marks are accepted. In the second step, the main encapsulation with 20% material can optimise the surface.

Combination of material properties: If the project has requirements that cannot be met with one material, such as optimal adhesion to a specific substrate and UV or autoclave resistance. In this case, it is recommended to carry out the pre-moulding with a material that achieves the required adhesion to ensure tightness. The main moulding is then carried out with a material that meets the requirements for external resistance.

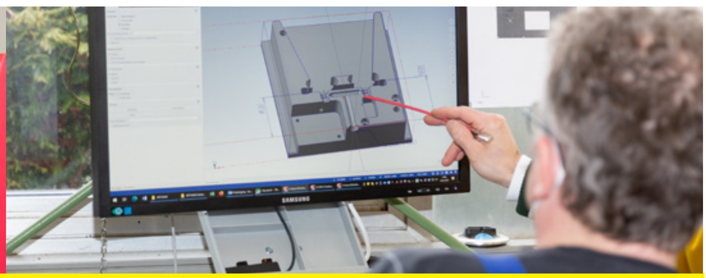
When the main cavity is poured, the parting line melts again and the materials have excellent adhesion to each other, so that tightness is guaranteed without restriction in the case of 2-step moulding.

Prototyping and sample production

The creation of samples and prototypes is an important building block for the implementation of a project. Feasibility analyses and tests can be carried out on the basis of prototypes. Using sample tools that are close to series production, the design data are checked for correct implementation and adapted if necessary.
In addition, the basic process parameters for subsequent series production are determined.

Mold flow analyses

In order to check the component geometry and mould cavity before building the mould and to correct them if necessary, a mould flow analysis can be created. This involves combining design data with the properties of the moulding material to simulate its behaviour during the moulding process.
It enables a detailed analysis in advance and avoids costly subsequent adjustments to the tool.



Low Pressure Moulding-machine systems

LPM is suitable for special components with small quantities as well as for series production. Each project involves a technically and economically optimised process consisting of the ensemble of the individual interaction of moulding materials, process parameters, tool design and production equipment.

The modular machine systems can be adapted to almost any project and production-related requirements. They also enable demanding projects such as the processing of particularly large components and components with complex geometries or very extensive and multiform assembly. In addition, there are various melting and conveying systems, clamping units and safety concepts. Special set-ups can also be realised in this context.

Continuous further development in recent years has resulted in many additional advantages in terms of production possibilities and equipment.

Main features of the gear pump:

- Pressure and speed (rpm) can be controlled separately from each other
- With a multi-stage filling process, e.g. in the case of long flow paths, it is possible to fill quickly and then press slowly. This also helps to avoid over moulding.
- The option of filling very slowly allows better air displacement and thus reduces airbubbles in complex components.

Advantages of the piston pump:

- Cost efficient
- Easy to maintain and less prone to wear
- Simple and effective design with low susceptibility to errors

Melting and conveying systems

Originally, melting and conveying the moulding materials was mainly done by tank units with gear pumps. These are available with different tank volumes and melting capacities.
OptiMel initially used piston pumps only in the smaller series for several years. Today, they are also used in other series in order to be able to flexibly select the right technology for each project.

A few years ago, the extruder technology known from injection moulding also found its way into LPM. It offers advantages for material processing, especially when it comes to processing small moulding material quantities or processing several different materials, i.e. when a change to other material types and colours is required.
The materials are melted in the extruder as needed, while in the tank units a certain processing quantity is always kept at temperature. For high processing quantities, this has hardly any effect, but for smaller processing quantities, a clear advantage can be achieved here by reducing the thermal load on the material.

OptiMel has developed special extruder systems that are optimally tailored to the requirements of the LPM process. Pressure peaks typical of extruders are avoided here, so that particularly sensitive components can also be processed. A piston unit was installed downstream of the LPM extruder. The capacity of this unit can be adapted to the respective moulding quantities and thus only contains the amount of material that is required for the next, immediately upcoming moulding cycles. The piston unit is filled via the extruder. Melting and filling processes are thus decoupled from each other. The advantages of both concepts are optimally utilised.

Sliding tables, rotary tables

Sliding tables in the X-axis have the advantage of eliminating handling time from the cycle time. In the moulding position below the clamping unit, there is a lower mould section. While the moulding cycle is running at this location, part removal and reloading can take place at the second position in the second mould base. With optimal coordination between cycle time and handling time, the process can be made much more efficient.

With increasing process automation, rotary tables are increasingly being used. Here, too, the handling and moulding positions are decoupled, whereby the fixed removal position makes it easier to work with automatic handling systems. With a third position, a rotary table can also be used to decouple the moulding and holding time from the cooling time. With optimal process coordination, this also enables a more efficient process design.

Moulding direction

Based on the project requirements, a whole range of possibilities has been developed in regard to the mechanical design of the machines over the years. The vertical variant was added to the horizontal moulding direction. In vertical orientation, multiple cavities can be realised easily and efficiently - with several nozzles and/or direct placement at the respective cavity or between the cavities. Vertical moulding allows a higher degree of freedom in the position and number of sprue points and thus a higher degree of freedom in the part geometry. Shorter sprue paths or even completely sprue-free moulding can be realised. This saves material and enables better temperature control.

Hot runner systems

Hot runner systems have also been used for some years. Analogous to the applications in the classic injection moulding process, there are the advantages of multiple injection points that can be used in a targeted manner here as well. This ensures, among other things, that in addition to large component surfaces with long flow paths, multiple cavities with the same temperature profile and corresponding temperature constancy can also be moulded. The geometry of the hot runner systems with the number and distribution of the nozzles is oriented to the individual project and the corresponding mould concept.

Control of the machines

The introduction of modern bus systems and the use of programmable logic controllers in the melters have opened up new possibilities. By means of a plug-in hybrid connection between the moulding station and the melting unit, a wide variety of melting systems can now be operated on one and the same machine.

The connected melting device is automatically recognised. The machine software reacts automatically to different operating principles, e.g. extruder or gear pump. Operating screens are adapted and corresponding parameters are clearly displayed.

Modern and flexible control concepts increasingly offer extensive possibilities for individual programme adaptations, such as process monitoring, data acquisition or integration into a higher-level control system. This makes it possible to implement a high degree of automation in production.

OptiMel Schmelzgußtechnik GmbH divides its range of production equipment into four different lines:

OptiMel Baseline

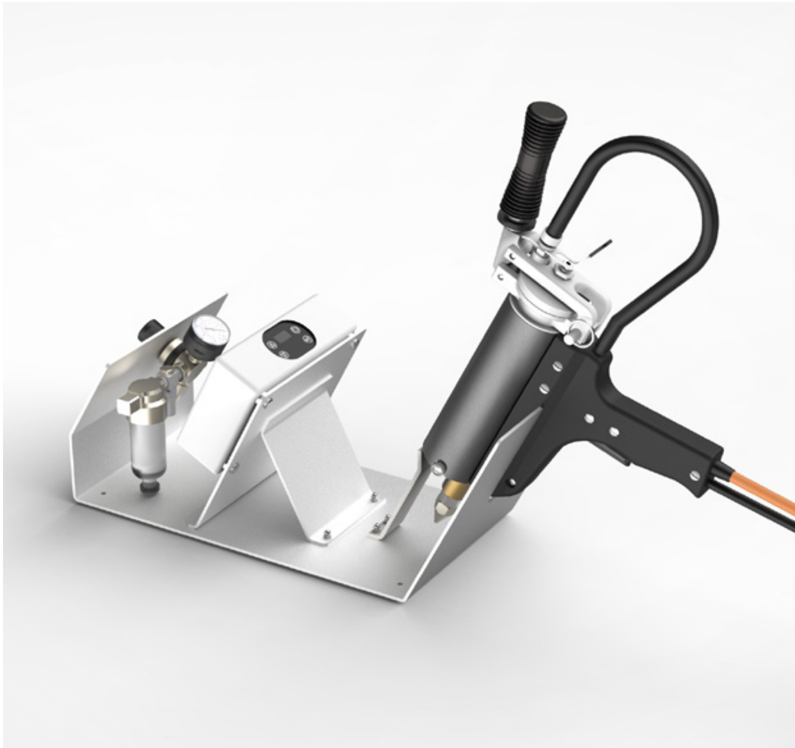
The **BASEline series** combines compact design and convenient operation. The adapted melting unit with double-acting piston pump and a melting capacity of approx. 1 kg/h enables optimum processing of small to medium shot weights and/or quantities. The available clamping force of 9/12 kN is suitable for moulding surfaces up to approx. 3,000 mm². This series reliably covers the basic requirements of the LPM and is suitable for a wide range of projects. Different assembly variants of horizontal, vertical, single or sliding table are possible.

OptiMel Flexline

The **FLEXline series** offers maximum flexibility in terms of design and peripherals. Project-related adaptations of individual components are just as possible as special programming or integration into a complete production line. In addition, various application systems including the hot runner system with different nozzle geometries and arrangements are available. The melting units can be optimally adapted to the requirements of the respective project with different melting and conveying systems and, in the event of different or changing project requirements, can be exchanged at any time.

OptiMel Labline

The **LABline** offers a selection of small devices, adapted to the requirements of LPM technology, for prototyping new projects and producing very small series. The basis here is the manual moulding gun with a 0.2-litre tank for filling the moulding materials in granulate form. In order to achieve process stability and reproducibility in terms of cycle time during this manual processing, a time control can be connected. In addition, corresponding manual clamping devices are available for trial and series moulds.



OptiMel Customline

The **CUSTOMline** offers complete customised solutions for special project requirements beyond the series lines. Here, components of the other series can be used and, in addition, individually designed solutions can be worked with.

Process and parameter

Generally speaking, „the devil is in the detail".
The more precisely and carefully those responsible for the project illuminate and take into account all details in the planning and trial phase, the fewer difficulties are to be expected in production.
The process must be adapted as best as possible to the requirements of the project and the component.
And: When adjusting the process, always change only one parameter per test. So: pressure OR time OR temperature...

The following considerations are of particular focus in process planning:

The right balance between process time (cycle) and handling time is important for determining the appropriate machine design (e.g. sliding table yes/no) and the moulding tool design (e.g. number of moulding cavities).

1. The filling time is the most important factor in determining the cycle times. In addition to the filling of the cavity, this also includes post-pressing, during which the set moulding pressure is achieved and the material shrinkage is compensated.
This is explained in the following video:

▶ Watch now!

The determination of the optimum filling time also depends on the final requirements of the component:

a. Example: If exact dimensional compliance and/ or flawless surface appearance play a central role, the filling time should not be shortened in favour of a shorter process (fully compensate for material shrinkage).

b. The total cycle time is usually five times the pure filling time. (Re-pressing takes 4 times as long as filling to compensate as much as possible for material shrinkage).

2. The determination of the optimum holding time depends on the geometry of the sprue point and the length of the sprue channel.

a. The shorter the sprue and the larger the sprue point, the longer the holding time should be.

b. The holding time must be exactly long enough for the sprue point to be frozen and to prevent any still liquid material in the moulding cavity from relaxing.

3. The optimum cooling time has been reached,

a. When no more deformations can occur in the moulding during demoulding (handling tempe-rature approx. 40 to max. 60 °C).

b. The thicker the layer of moulding, the longer the cooling time.

4 Determination of the correct moulding temperature:

a It is usually 40 to 50°C above the softening point of the material used.

b In addition, various project factors are decisive
- E.g. with long flow paths and/or thin layers, the material processing temperature must be increased ➜ lower viscosity ➜ better flow.
- An increase in temperature also causes better adhesion: Lower viscosity ➜ better wetting ➜ better adhesion.

c For materials with a lower softening point, the basic processing temperature can be increased and, if necessary, additional mould tempering can be used.

d If the softening point of the material is quite high, i.e. the basic processing temperature is already close to 250°C and a further increase is only possible to a limited extent, a mould temperature control (50- max. 60°C) should in any case provide additional support.

e In general, the moulding temperature should be adjusted in detail to achieve the best possible moulding result while not thermally stressing the material more than necessary.

5 Determining the optimum moulding pressure

a In principle, the following applies: To protect the component, select the pressure as low as possible and as high as necessary.

b The deciding factors include moulding thickness, length of flow paths and the shrinkage behaviour of the respective overall process.

c If the set pressure is too low, shrinkage marks will appear during the holding pressure and cooling process - recognisable by distinct indentations or shiny spots on the surface.

d If the set moulding pressure is too high or not adapted to the mould geometries and clamping forces of the system, this can lead to significant overmoulding. Furthermore, always pay attention to pressure-sensitive components and adjust the overall system pressure accordingly (e.g. relay applications with thin, heat-sensitive housings or PCBs with pressure-sensitive assembly).

Depending on the type and specifics of the project in question, it can be helpful to work not with a set rigid value for both temperature and pressure, but with a profile targeted over the injection period.

Innovations in Low Pressure Moulding

LPM is continuously optimised. New innovative processes and further technical development enable more and more areas of application for a wide range of industries. Special challenges are solved with equipment and processes as well as with new materials.

The most important innovations, advancements and new fields of application are presented once more in compact form in the following overview:

Extruder technology specifically for LPM
Special HotMelt extruders have been used in the LPM process for several years. They allow the moulding materials to be melted very quickly and as required. This prevents the macromolecules of the materials from breaking apart („cracking") if they have to be kept at processing temperature for a longer period of time. OptiMel has developed an extruder system that is specially adapted to the conditions and parameters of LPM. A special design uses the advantages of an extruder when melting the material and realises the injection via an additional piston unit. With this method, pressure peaks can be avoided and the advantages of extruder machine systems can be combined with the requirements for processing sensitive electronic components.

Further information:

▶ datasheet „Extruder"

Thermally conductive moulding materials
On the one hand, electronic components are becoming smaller and smaller, and on the other hand they generate more and more energy. Accordingly, heat dissipation is an absolute necessity that must be solved on the material side. Based on these market requirements, Henkel has developed a new type of material that has an increased thermal conductivity of 0.8 to 1.0 W/mK.

▶ overview of Technomelt® moulding materials.

Revolutionary production process for adhesion to metallic materials
In the conventional LPM process, the moulding materials do not build up sufficient adhesion bridges to metallic inserts, as these dissipate the heat too quickly. Therefore, the LPM process has not been suitable for dense moulding on metallic components until now. An innovative piece of equipment has been developed which, for the first time, can achieve metal adhesion in LPM efficiently and reliably in a single step. It enables targeted heating of the components directly in the mould and thus the formation of adhesion bridges in the moulding process without time-consuming pre- or post-processing. With integrated induction equipment as well as a specially developed modular tool system, a qualitative and flexible solution was created that can be adapted to the requirements of the individual project.

The combination of injection and inductive reactivation in one combined process step makes the LPM process efficient, reasonable and of high quality for metallic inserts for the first time.

The LPM system solution can be individually adapted to the customers' requirements. In this way, users from a wide range of industrial sectors benefit from higher efficiency, lower costs and reduced susceptibility to errors.

▶ press report ▶ to the Video

Moulding materials for medical technology
With three new materials launched by Henkel, extended requirements for the production of components in medical technology can now be covered. The materials Loctite PA 6732, Loctite PA 6682 and Loctite PA 6951 have been tested to ISO 10993 for biocompatibility including skin sensitisation and open up numerous new application possibilities in medical technology.

▶ Further information

Voyager Research Project -
LPM in the Photovoltaic Industry
OptiMel is an industrial development partner in the research project „Voyager-PV“ of the Leibnitz University of Hanover (LUH), the Institute for Solar Energy Research in Hameln, the University of Stuttgart and three other industrial companies. The project aims to achieve greater efficiency and reliability of PV systems at lower costs by integrating electronics and inverters into solar modules. Newly available, state-of-the-art and thermally conductive thermoplastics can now contri-bute to the success of the project, which is funded by the German Federal Ministry for Economic Affairs and Energy.

Together with their project partners, OptiMel is testing and investigating the possibilities of applying the LPM process and corresponding combinations of the different moulding materials in such a way that they enable direct moulding of electronics on a solar panel with all the associated production and application requirements. The newly available thermal conductivity thermoplastics are helping the project to succeed. Together, the project partners are continuously developing the processes to adapt the LPM process to the requirements of the photovoltaic industry.

▶ press report of Leibniz University of Hannover

(coordinator of the project)

The benefits of Low Pressure Moulding at a glance

- Processing takes place at a much lower pressure (5 to 40 bar) than in the classic injection moulding process, therefore sensitive components such as printed circuit boards or sensors can also be encapsulated.

- In contrast to 2-component moulding, the clear advantage lies in significantly shorter cycle times. A time-intensive curing process - which may be further extended by downstream annealing - is offset by short cooling times with direct further processing. The total cycle time with LPM is usually between 10 and 60 s.

- Furthermore, in contrast to 2-component moulding, LPM does not require a housing to be manufactured separately. In many cases, this results in significant savings in production costs.

- LPM offers a lot of potential for adaptation, not least because of the systematic modular design of the production equipment and the many possible variations of the individual components.

- The processing equipment can be adapted to almost any project and production-related requirements. Even demanding projects such as the processing of large PCBs or a high degree of automation in production can be realised.

About OptiMel

Originally born of a development group, OptiMel was founded in 1995 by Henkel KGaA as a machine and project partner for newly developed thermoplastic hot melts. In the meantime, the Low Pressure Moulding based on this procedure has become a recognised process for the protection of electric and electronic components.

OptiMel has been an independent full-service provider in this field since 2001. With our experience of over 25 years, our extensive and flexible processing equipment as well as comprehensive consulting and services, we offer tailor-made solutions for every project.

OptiMel is your one-stop shop for everything you need to successfully use Low Pressure Moulding for your projects: Project consulting, production equipment, moulding material, service.

Through innovative processes, technical development and a close partnership with Henkel as the manufacturer of Technomelt® materials, we are constantly expanding the application possibilities of LPM technology.

Connect with us:

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