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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.

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What is Low Pressure Moulding ?

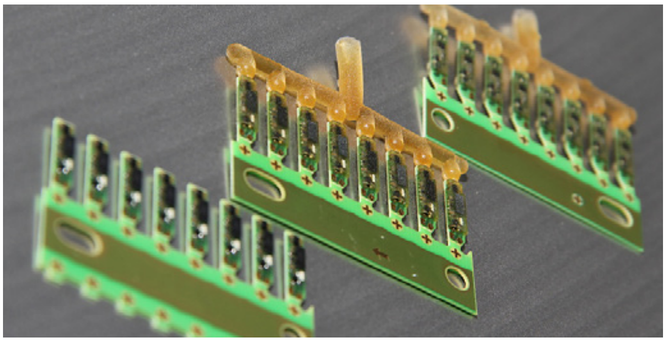
Low Pressure Moulding (LPM) is a process for moulding and protecting electric and electronic components (e.g. printed circuit boards or sensors) from vibrations, shocks and jolts. LPM insulates against heat, cold, moisture, weather in general and electrical energy. The moulding is cost-effective, space 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.

You can request the complete WhitePaper free of charge under the following link:

▶ WhitePaper

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