

## **Low temperature application of plastic products**

### **Basics**

Plastics are synthetically produced organic macromolecular materials. Along with the chemical and molecular structure of the material, the orientation and arrangement of the macromolecules is decisive for the final material characteristics.

Temperature affects the condition of the plastic, changing the fundamental characteristics of the material

With **increasing temperature** the molecular chains within the plastic matrix can move and glide across each other more easily providing increased plasticity and elastic energy absorption capability, resulting in greater resistance to damage caused by impact loads.

**Decreasing temperatures** reduce the mobility of the molecules relative to one another more and more until the so-called 'glass temperature' is reached, the point at which the intermolecular mobility of the molecular chains is reduced to zero. Below the glass temperature only the mobility of individual molecules remains but even this reduces further and further with falling temperature causing increased material stiffness and brittleness.

**Special high quality material additives are used in PMA products to modify mechanical characteristics of the raw material.**

**Especially the performance characteristic at very low temperatures can be improved using adequate and efficient additives.**

### **Selection and Application of PMA cable protection products for low temperatures**

The specified minimum application temperature is based on the physical characteristics of the product.

It takes into consideration the **material compound**, the **product design**, expectable impact loads and other external influences.

For very low temperature applications the influence upon the basic material characteristics must be considered in order to select suitable products.

Products made from specially modified PA6 compound are suitable for low temperature applications down to -40°C.

Specially modified PA12 compounds also exhibit very good characteristics at -40°C or even lower temperatures and are particularly well suited to dynamic applications in cold environments.

A well equipped in house laboratory allows PMA to test its products extensively, not only according to the internationally recognized standards but also to its own generally more severe internal standards. The results demonstrate the extraordinary strength and performance of PMA products also at low temperatures.

### **Application of PMA cable protection systems below the specified minimum temperature**

Application at lower temperatures than specified in PMA's technical datasheets will not adversely affect the system integrity or sealing performance. However, reduced flexibility and impact resistance should be considered and assessed for each specific application. In applications exposed to impact loads additional protection may be required and should be considered e.g. with a metal shielding plate.

### **Monitoring and maintenance**

Impact loads may cause damage to the cable protection system, which may still protect and maintain a failure-free function of the electrical or signal connection. The probability of repeated impact in exactly the same position during operation is quite low.

Products applied in critical areas such as low temperature with increased impact hazard should therefore be monitored frequently by authorized persons for damage or other effects.

In case of irregularities or obvious damage to the protection system the affected components should be replaced accordingly to re-achieve full-protection effect.

Maintenance programs should include frequent visual inspection of relevant products in critical applications.

### **At your service**

The correct product choice at low temperature is decisive in determining the lifespan of the system in a particular application.

PMA will gladly provide application engineering support upon request and samples for application tests to consider all relevant boundary conditions and to achieve best possible results.