

## ***Protection of sensitive electronic components in harsh environmental conditions using high performance plastics***

**Sensors for data capture are often used at sites with very harsh environmental conditions or strict cleanliness requirements. In the chemical industry for example, sensors often have to operate in corrosive atmospheres or in the case of liquid level monitoring, immersed in aggressive chemical solutions.**

Extremely strict hygiene and cleanliness requirements also apply in the food processing sector. For example, electronic components such as sensors or probes may come into contact with the product or be within the spraying range of different kinds of foodstuffs. The aggressive cleaning agents and the steam used in this sector pose further challenges.

In general, these environmental parameters can often be difficult for the sensor manufacturers to determine and they can only define or influence the operating parameters at the end customer's site to a limited degree. To ensure the correct functioning of the sensitive and often very costly electronics, these components should be adequately protected against any critical or harsh

environmental conditions.

High performance plastics such as polytetrafluoroethylene (PTFE), fluorinated ethylene propylene (FEP), and perfluoroalkoxy polymers (PFA) have established themselves on the market as a means of protecting these components against various influences.

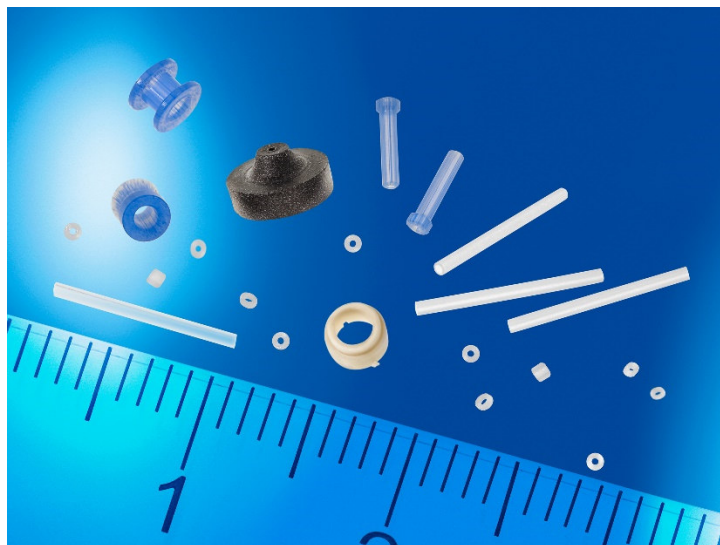
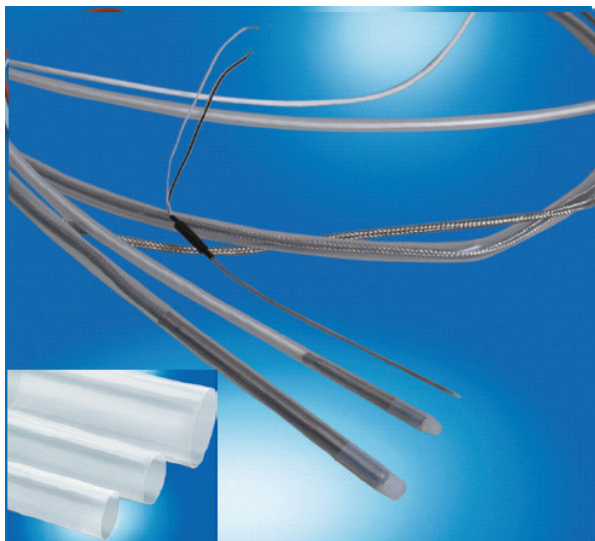
Turned and milled parts, tubing, plugs, filters, or pipes made from these materials offer a wealth of possibilities for protecting sensitive electronic components such as sensors, probes or thermal sensors. In principle, the challenge is to ensure that the environmental influences have no direct contact with the electronics.

One of the solutions for sealing sensors against air and media is dual heat-shrinkable tubing (Fig.2).



**Fig. 1: Shrink-wrapped and welded food tank sensor (hygienic design)**

Dual heat-shrink tubing is designed especially for this situation as the ends can be sealed against media and air with a watertight connection. Dual heat-shrinkable tubing consists of two tubes assembled one inside the other.



**Fig 2: Product examples: dual heat-shrinkable tubing**      **Fig 3: Injection molded and turned micro components**

The outer heat-shrinkable tube is made of Polytetraflon® PTFE and has a higher temperature resistance than the inner tube made of Moldflon® FEP or Moldflon® PFA. This combination allows the inner tube to act as a kind of hot-melt adhesive when heated or shrunk. It liquefies completely and thus reliably seals any gaps or slits and balances out any geometrical transitions. Dual heat-shrinkable tubing with a wall thickness of 0.4 mm (after shrinking) or for an object diameter of up to 25 mm is available as standard.

This shrinking allows a wide variety of requirements in the food sector, such as hygienic design (EHEDG guidelines) to be fulfilled reliably under controlled process conditions.

Components coated with this dual heat-shrinkable tubing and sealed against air and media can be exposed to continuous operating temperatures of up to 260°C, depending on the design. The PTFE materials also have some fundamental positive properties such as almost universal chemical resistance and anti-adhesion, which can be useful in many applications.

To seal larger components, it is possible to use plugs made of Polytetraflon® PTFE or Moldflon® PFA, whereby the dual heat-shrinking tubing connects to the plugs and provides a reliable seal against media and air.

Materials with various approvals—e.g., FDA, WRAS, W270, ACS, or USP Class VI—as well as electrically conductive materials or materials with very high thermal conductivity are now widely available.

The reliable manufacturing practices of ElringKlinger Kunststofftechnik GmbH and the quality of products that come into contact with food are verified at the company's production locations which are regularly certified in accordance with good manufacturing practices (GMP). Other advantages of high performance plastics are the weight of the components and the flexibility of the materials when compared to standard stainless steels solutions.

As sensors and electronic components are becoming increasingly small and complex, ElringKlinger Kunststofftechnik GmbH also focuses on the production of complex miniature

components (Fig. 3).

Using existing micro turning and milling machines, miniature components with an outside diameter of 0.5 mm and inside diameter of 0.1 mm can be created for individual customer specifications under controlled process conditions. A broad spectrum of possible materials are also available for these components.

Modern manufacturing processes, such as turning, milling, tube extrusion, micro machining and heat shrink encapsulation systems are among the company's core competences. These can range from single unit to large scale production and all in accordance with Class 8 cleanroom requirements if desired.

**Contact**  
ElringKlinger Kunststofftechnik GmbH  
Etzelstr. 10  
DE-74321 Bietigheim-Bissingen  
Phone +49 7142 583-0  
Fax +49 7142 583-200  
bie.maschinenbau@elringklinger.com  
www.elringklinger-engineered-plastics.com