

Connector Design and Material Selection of Medical Equipment 医疗设备连接器设计与材料选择

Connector design, application and material selection of medical equipment

Connectors for medical devices face many unique challenges. They must be able to withstand frequent connection and disconnection cycles, provide continuous accurate performance guarantees in high-risk situations, and withstand frequent cleaning, sterilization and disinfection. It is also affected by rough treatment, shock and vibration, as well as extreme conditions in the high-pressure steam and pressure chamber.

In particular, the medical diagnosis and monitoring equipment can be started or used up to 5 million times, and these repeatedly used settings require higher quality of connectors. Therefore, it is very important to choose the right connector. Off the shelf, hybrid version, or customized solution?

The first consideration for engineers is to decide whether to use off the shelf connectors, hybrid versions, or custom solutions.

Off the shelf products have been sold on the market, and there are many configurations to choose from. Such products often require lower investment in engineering and tooling, but have a long lead time and higher unit cost.

Hybrid version provides customized overmolded features on existing connectors. Compared with the ready-made products, this kind of products improve the performance and aesthetic value, and compared with the fully customized connector, its design cost and engineering cost are lower, but the lead time is also longer.

Custom is a product designed and manufactured for a specific customer, device or application. Using custom connectors will make it easier to integrate components or electronic components, as well as add marks or logos. The initial investment in engineering and mold making is generally high, but depending on production, such solutions will be more cost-effective in the long run.

Consider each application

In many cases, customized or hybrid solutions are more popular than off the shelf solutions, especially when there are some special considerations.

For example, in a disposal room where dozens or more different cables and connectors are used at the same time, medical personnel will face the risk of misconnection of cables and equipment. The ready-made connector can be equipped with different colors of plastic clad housing, and this hybrid product can clearly indicate which connector to connect with which device.



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Peek seals can withstand heating, cooling and reheating without degradation, and material manufacturers are now offering a mixture of PEEK and other materials for greater performance benefits. For example, PolyOne's peek based hybrid materials can withstand higher temperature than standard peek, have better post-treatment shrinkage control performance and better colorability, and their glass transition temperature is 104°F higher than standard peek formula, which means they can withstand higher operating temperature and high-temperature sterilization without warping deformation.

Fischer's cable components use silicone resin for high-temperature insulation. Adding a low friction coating on the cable can also make the treatment, cleaning and disinfection of medical equipment easier and smoother.

Lemo's Redel SP connector is made of a proprietary polysulfone (PPSU) material, which can achieve longer and more sterilization cycles and high chemical resistance. PPSU is a thermoplastic polymer material, which is famous for its toughness and stability at high temperature. This FDA approved material does not contain BPA chemicals. These connectors are often used in baby care products such as newborn incubators. BPA is a kind of heterogeneous estrogen, which means it has the characteristics similar to estrogen, which has attracted people's attention on its applicability in some consumer goods and food containers. The European Union and Canada have banned the use of BPA in baby bottles. In recent years, some manufacturers have introduced BPA Free components for medical applications to solve these problems.

Medical devices are entering a new development space, need to handle more information transmission, and provide better treatment and nursing performance than ever before. The materials used in these machines are constantly evolving to provide better performance under constant pressure.