

How to successfully specify a connector for your application

Selecting the most appropriate connector for individual applications is a complex process. Here, Stéphane Rohrbach outlines the various points which engineers should consider.

Although they play an essential role in the operation of electrical devices, connectors are often overlooked in the overall design process. By duly considering the design of the project's connector and its associated cable components, the engineer will be rewarded with a more trouble-free design effort and, ultimately, a more reliable product. However, selecting the most appropriate connector for an application is challenging and complex; while many parameters need to be taken into account, different applications may dictate different priorities.

If the connector is rarely unplugged from the device, the connector solution can be limited to basic functionalities. But if the connector frequently needs to be plugged and unplugged, a more detailed approach to connector selection is required. When manoeuvrability becomes a critical parameter for end-users, connectors of circular shape are generally preferred.

Conveniently gripped, even with gloves, they also have the advantage to be easily engineered with keying systems. The alignment mechanism of a keying system precisely guides the connection making the mating process simpler and faster, even feasible blind. Keying systems not only provide additional convenience but they also increase the life span of the product as proper alignment of mating connectors prevents miss-connection of and damage of the contacts.

The main function of a connector is to transmit energy - such as power, signal, light, gas, or liquid - between two separate devices. Defining the exact nature of these energies should happen very early in the selection process as it strongly influences the overall connector and cable system design (Fig. 1).

Power transmission will need multipole - often high voltage - connection types. For signals, there are several options: coaxial connection types ideal for radio frequency transmissions, or multipole for low frequency signals. Light will need a fibre optic connection, while gas and liquids will require fluid connectors. A same connector can be hybrid and simultaneously transmit a combination of different energies. Having one connection mixing several functionalities is simplifying the equipment design and making it less bulky. While desirable, combining all connecting functions in a single connector is not always feasible, mainly because of the cable. In fact, the cable diameter depends on the functions we want a connector to perform and not all cable sizes are physically feasible or readily available in the market. So the feasibility of the cable design has to be checked first, then a connector solution can be engineered accordingly.

The operating environment is another important point to consider as it strongly impacts the specific requirements of each application. Equipment used indoor won't have the same ruggedness needs as if used outdoor, or in harsh environments (Fig. 2); a connection that has to be immersed or exposed to very special conditions, such as vacuum or chemical products, will require sealing properties. Some applications may be subject to standards imposed by regulatory agencies such as the International Electrotechnical Commission (IEC), or the European Commission (CE). All those factors will influence the selection of a connector design, size and material. For example, metallic connector bodies are more rugged and durable but plastic ones are lighter and more flexible in terms of design shape or colour options. Defining which material is best in the absolute is impossible, what matters is which one is the most appropriate given the operating conditions the connector will face.

Some applications require the connection to be secured against accidental pull on the cable. Locking connectors can mainly be of the three following kinds: screw-type connectors, bayonet connectors or push-pull connectors. Once plugged the two first systems needs the end-user to perform an extra

operation to secure the connection, while the last system is integrated into the connector and automatically locks the connection when plugged. For frequent use, a self-locking system proves to be more adapted.

Not only is it important to consider end-users' convenience when designing an application, but the same consideration should also be given to technicians' needs. The complexity of the connector assembly process should play a role in the connector selection. Some connector body shapes, such as right-angle or miniature plugs, can optimise the equipment bulk and please end-users but might be more delicate to assemble for technicians, inducing extra cost. Fortunately, not all decisions involve trade-offs between end-users and technicians' expectations. For instance, contacts can be soldered - more appropriate for the assembly of small and tailor-made series - or crimped - suitable for large and standard series - and the method chosen has no impact on the final performance of the connection.

In conclusion, there is no perfect connector solution. Parameters such as connection frequency, energies to be transmitted, operating environment, need of a secured connection or not, end-users and assembly technicians' needs, have to be carefully considered. Understanding the specific requirements each application demands is essential to successfully select a connector solution.

Stéphane Rohrbach is Engineering Director at Fischer Connectors SA, Saint-Prex, Switzerland.

www.fischerconnectors.com

Fig.1. Connection types can be of very different nature, such as multipole low/ high voltage, liquid/gaz and hybrid.



Fig. 2. Medical applications need to support demanding operating environments.

