Rethinking is required: Plastic housings make life easier for heavy-duty connectors

Today, machine and connector manufacturers predict an increase in the need for pluggable interfaces on production machines due to "smart factory" requirements. There is much to indicate that instead of conventional industrial connector housings made of metal, more plastic housings will be used (Figure 1).

Figure 1 Industrial connector Heavycon: The "smart" cable gland is realised by the bayonet interlocking; the precise marking slot (at the top right of the housing) eases the latching in of the markers.

High degree of flexibility despite mass production

There are numerous reasons for the increased production of heavy-duty connectors made of plastic. Reducing weight or material costs is no longer the only user concern, rather greater flexibility during production and application of plastic connectors. This becomes clear when you take a closer look at the Heavycon Evo housing series from Phoenix Contact: Using plastic as a housing material makes it possible to produce more complex connector geometries at low costs. The bayonet interlocking for the variable selection of the cable outlet can be produced from plastic relatively cheaply, while the user also saves significantly on
logistics and storage with this connector version. With just a small number of connector sleeve housing and cable gland variants, the connector from the Heavycon Evo series can be combined into numerous connector combinations. In this way, the series already fulfills important requirements of the future smart factory: a large variety of applications - manufactured according to the conditions of mass production.

The housings of the Heavycon Evo series feature a latching slot which makes professional marking solutions possible. It was only possible to produce the precise geometry of such a marking slot with great effort – if at all - using conventional metal die casting, which also meant high costs. Connector marking, which is durable and does not fade, is essential however, especially where machines and systems are pre-mounted in modular design, and then need to be assembled quickly and without error at the installation site.

If they are made of durable plastic, the locking latches can be easily disassembled from the panel housing in case of replacement or mirrored mounting to the hood housing side. Metallic locking latches on metallic connector housings are usually riveted. If the latches are damaged, the complete panel housing often needs to be replaced. This is also very expensive and time-consuming.

Already today, manufacturers of machines for the smart production of the future can profit from the flexibility of a "smart" connector housing. Furthermore, they are assured of the ability to react flexibly to future modifications or extensions to the machine by adapting the interface. In order to be flexible regarding power, signals, and data, we recommend using a system with modular contact inserts that are assembled to an application-specific pin connector pattern. Such systems - e.g. Heavycon modular from Phoenix Contact - are compatible with the plastic housings of the connectors. They were developed with the aim of enabling highly flexible application with standard components from serial production (Figure 2).

Figure 2 "Smart" connectors: With modular contact inserts for data, signals, and power, the use of heavy-duty connectors is more flexible and convenient

Plastic housings in harsh environments

Intake manifolds made of plastic improve the efficiency of modern engines because they optimise the flow characteristics. Fuel tanks made of plastic can be designed according to
individual requirements - this not only reduces the vehicle weight, but the available space can be utilised better as well. In addition to the automotive industry, the aeronautic industry in particular provides numerous examples for the use of high-quality plastic composites. The Airbus A380, for example, consists of up to 25 percent of plastic, which is reinforced by carbon fibers. This results in a reduction in kerosene consumption by 15 percent. The proportion of plastic in a Boeing 787 – also known as the Dreamliner - already lies at 50 percent, which implies even lower emissions of harmful gases while flying.

The example of the terminal box shows how glass-fiber reinforced plastics are used in industrial environments even under extreme ambient conditions (Figure 3). The process industry, for example, has already been employing appropriately certified polyester boxes in potentially explosive areas (degree of protection Ex e) for quite some time. The tests required for this - impact strength, fall test, temperature cycles - are passed by modern industrial plastics just as well as metallic materials (Figure 4).

Connector housings for rough application conditions are already known to most machine manufacturers from the field of CEE connecting devices. Even for outdoor applications - e.g. construction machines, event technology, or fairground rides - such plug connections made of robust plastic have been employed for many years (Figure 5).

**Evaluating the housing function over the service life**

The examples listed here - terminal boxes, CEE plug connections, and housings of the Heavycon Evo connector series - have one thing in common: they protect internal electrical contact points against the intrusion of dirt and water, and offer high-quality touch proofness for the user. This touch proofness is of major importance in particular with a plug connection, because the connector housing is in the user's hand when plugging or unplugging the connection. A PE connection of the housing is
not necessary if the housing consists of non-conductive material. By omitting the PE contact the connection is carried out quicker and with less fault risk - this is also an advantage of the plastic housing.

Plastic materials that were selected according to suitable criteria improve the ecological balance over the entire service life of a product - without any cost disadvantage for the user. Plastics consume less energy than steel or aluminum during the manufacturing process and they can be recycled with low energy consumption. In order to quantify the resource consumption during the entire product service life, the term "ecological rucksack" is often used. The comparisons can be quite varied depending on the type of application and the plastic. In direct comparison with industrial plastic, aluminum as a material always bears a significantly heavier ecological rucksack in the balance – the factor lies at 15 here. The cumulated energy demand (CED) for procuring, manufacturing, usage, and disposal of aluminum is 193 MJ/kg, which is almost twice as much as for the plastic polyamide. The CED, however, makes up just a small proportion of the ecological balance. The consumption of water, raw materials, and auxiliary materials also increases the gap between plastics and metal even further.

Summary

Although many machine and system designers find it difficult to break with old habits and replace the metallic connector housings in established machine models with plastic housings, the manufacturers of plastic connector housings report an increase in demand. This shows that planners and designers of machines and systems are looking intensely at using plastic for connectors, at least for new applications and new machine generations.

Comparing the technical data of metal and plastic connector housings shows that there are hardly any reasons against employing plastics in the application ranges described above. Only under extreme temperature requirements, such as in the offshore field or for applications that require a total shielding due to their EMC susceptibility, is a metallic housing absolutely necessary. For all other applications, which do not fall under these two criteria, a user is always well-advised in considering the plastic variant.

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