



DON'T OVERLOOK THESE 5 FACTORS WHEN SPECIFYING SEALED OR RUGGED CONNECTORS

A SWITCHCRAFT & CONXALL WHITE PAPER



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A H E I C O C O M P A N Y

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Products manufactured for the industrial sector and outdoor use face exposure to water and moisture in the form of regular cleanings, rain, snow and immersion in water. Excessive heat, extreme cold, dust, daily exposure to UV rays – even fire – can also be a part of the environmental mix. In all of these instances the design engineer will specify a sealed or rugged connector.

The industry accepted standard that specifies performance expectations for sealed connectors is the IP rating. These ratings – from IP22 (protection against insertion of fingers and exposure to intermittent dripping water) to IP69K (total dust ingress protection and substantial moisture protection) – are well known, widely followed and serve our industry well. So, we won't do another rehash of IP ratings and their specs. Instead, in this Switchcraft & Conxall white paper we focus on practical workplace considerations that can sometimes be overlooked when specifying sealed or rugged connectors.

The big picture: Carefully consider the operating environment for your product and the operational demands it will face.

Your manufacturing objective is a profitable, high-performing product that offers your customer good value and helps your company grow its market share. Pricing pressures being what they are though, you don't want to specify a connector rating that's overkill for the level of actual protection you need. On the other hand, not enough protection or durability and you run the risk of sub-par performance or increased failure rates, degrading your brand and potentially your bottom line.

To avoid either of the above dilemmas make sure you thoroughly consider the operating environment for – and the operational demands placed on – your product. For example, in addition to the typical hazards we've mentioned, here are five related considerations:

1. **Exposure to liquids other than water** - It could be a chemical solvent, it could be oil, grease or something else. Plus, as with water exposure, you'll want to know what level of exposure there will be - splash, direct spray, immersion - how often it will occur, and for how long the exposure will last. Is the exposure occasional, for minutes at a time, hours on end, or continuous?

IP ratings of course can define the sealing level of connectors with regard to water. But exposure to substances other than that are not part of the IP ratings scope and will require a detailed review of the materials used to manufacture the connector.

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- 2. Plastic or metal housings? Consider the rating *and* the demands put on your product.** - Connectors with a plastic housing are always going to cost less than those with a metal housing. Durability, as we all know, is another story.

Case in point: Our customer ordered connectors for use on all-weather, heavy-duty industrial equipment and started with one of our plastic series. This line had an outdoor rating and provided the needed connections at the right price.

Ultimately though, the combination of the operating environment and the operational demands placed on the equipment proved to be too much for the plastic to handle. So the customer retooled using a connector line that featured metal housing. Not though, before incurring downtime and lost productivity.

One of the key factors to be considered in your choice of housing material, as illustrated in the above example, is the demands that will be placed on your product. And the level of those demands can largely be determined by whether your product or equipment remains stationary – say, a cell tower – or is highly mobile such as with a tractor or excavator. In the case of the former, you'll likely do just fine with plastic, with the latter you'll probably want a connector with metal housing.

Another pertinent point to keep in mind pertaining to plastic is potential cracking issues in operating environments subject to extreme fluctuations of cold and heat. The expansion and contraction may cause cracks in the plastic shells which could then open the contacts.

Other operational questions to consider with regard to durability/ruggedness and plastic/metal include: 1) Is the connector likely to be stepped on? 2) Is the connector likely to be jostled, jiggled or jerked on?

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- 3. Rated connectors do not always perform up to their rating, nor is there always 100% agreement on what the ratings mean.** - For instance, consider this comment from a design engineer professional posted on one of the industry's most popular blogs: "Going to higher ratings than are strictly necessary is sometimes necessary to get protection desired." Certainly, using a connector with a higher rating than you may actually need is one way to ensure you get the needed protection. The downside to that approach is that you may be adding unnecessary cost to your product.

Another way is to work closely with the professionals at the company that manufactures and/or distributes your connector so that you both have a clear understanding of the demands of your operating environment. Again, that starts with you being fully aware of conditions your product is likely to encounter and the physical demands that will be placed on your product.

On a related note, we occasionally find that there can be differing viewpoints on what a specific IP rating even implies. This doesn't happen often, but it happens. For example, we recently had an inquiry on a connector to be used on a fountain pump. In this application the connector – save for maintenance – would be underwater for the life of its operation. In other words, permanently.

The rep for the pump company insisted that an IP68-rated connector was a suitable choice. As prolonged immersion is the terminology used in the IP68 specification – and prolonged does not equate to permanent – we chose not to quote the business.

That's why at Switchcraft we peg our IP68 rating to the NEMA 250 6P standard. NEMA 250 6P defines "prolonged" as 24 hour immersion in six feet of water (1.8 meters). No ambiguity there.

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4. **Temperature ratings: Consider both the ambient temperature and the temperature rise caused by current flow** – For example, you'd specify a much different temperature rating for a connector to be used on a cell tower in the Death Valley area as opposed to one used in Anchorage, Alaska. (And for the Death Valley location you'd also give strong consideration to what level of UV protection you needed.) Sure, we're using an extreme example here to make the point – once again – to always carefully consider all aspects of your operating environment when specifying your connector.
5. **EMI/RFI shielding**– Failure to consider this factor can affect much more than productivity and profits. It can affect the health and well-being of employees and in medical applications, potentially the life of a patient. EMI and RFI of course refer to electromagnetic and radio frequency interference.

For example, say you have two pieces of equipment that are next to each other that are performing different functions. Depending on how sensitive their signals are, if the equipment's electrical components lack shielding, you can get cross talk or bleed through from one piece of equipment to the other. When this happens it can garble your signal and cause your equipment to malfunction. For instance, in a factory setting a lack of shielding could interfere with a machine's safety features and result in bodily harm. In a medical setting, lack of shielding on a heart monitor can shut it down, endangering the patient's life.

In summary, we return to the key point we made at the beginning of this paper and have emphasized throughout. When specifying a sealed connector for harsh operating environments that will function well in the face of rugged use...carefully consider all aspects of the operating environment and the operational demands your product will face. Thoroughly define the operating environment for your product and how your product will be operated. Seek as much input as you can get from your own research and experience, from employees, from customers and from your suppliers. This extra time, thought and input will ensure that you select a connector that delivers maximum performance for minimum cost.

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About SWITCHCRAFT®

SWITCHCRAFT®, Inc. is a leading US-based manufacturer of connectors, jacks, plugs, switches, molded cable assemblies and patchbays. SWITCHCRAFT® products are used in a variety of applications from broadcast and pro audio to medical, transportation and other industrial applications. Products are sold direct to customers and through networks of stocking distributors. Founded in 1946, SWITCHCRAFT® is headquartered in Chicago, IL USA.

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