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Cross-Mating Connectors– the Danger Zone ›

The world of connectors is vast, varied and sometimes confusing. Customers are faced with choosing between large numbers of remarkably similar connectors. This can be problematic at times of high demand or market instability when shortages or long delivery times might tempt customers to substitute components from alternative sources. If two connectors from different manufacturers are used together, this is called cross-mating.

In order to provide excellent connector solutions to customers, Molex connector systems are designed and manufactured by engineers who have an extensive amount of experience. These solutions are the result of our engineers' application of their extensive design, testing and certification expertise. Connectors manufactured by other sources may not offer the same level of design quality and therefore may not be compatible. The cross-mating of connectors from different sources, regardless of their apparent similarities, has the potential to cause significant problems. These problems may include use of a connector that does not function properly or as intended, proves to be unreliable, or even presents a dangerous safety hazard.

These safety and reliability concerns are becoming even more important as the demand for power increases. Modern market trends, including the increased popularity of new smart devices and the rapid expansion of internet usage with the introduction of 5G telecommunications, are seeing connectors deployed in consumer applications in addition to their traditional industrial use. Equipment in scenarios ranging from the latest switches and servers used in data centers to the latest battery-powered garden equipment is at risk from the mixing of connectors. Customer experience in real-world applications has highlighted the dangers of cross-mating. In general, cross-mating Molex connectors with competitors' products can result in connection failures and possible equipment damage.

As a result, Molex cannot guarantee the performance of its connectors when they are cross-mated with products from other sources. In identifying the dangers that cross-mating presents, it is important to understand why these dangers arise.

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DIFFERENCES IN DESIGN

Connectors come in a wide variety of shapes and sizes. While many designs are unique, there are also many products that look superficially similar. This is made more complicated for the customer because of the use of standardized pitches and contact sizes.

The pitch of a connector is defined as the distance between the center of one contact and the center of its neighbor. For many years, designers within the electronics industry have adopted a range of common pitch sizes that do much to ease the task of creating new products. Many connectors use these common pitches, some of the most common being 2.54 and 2.00mm. There are many other options available, both large and small.

The use of a standardized pitch size for a connector does not, however, guarantee that it is compatible with another connector that uses the same pitch. There are examples even within the Molex range. Both the Milli-Grid and the Micro-Lock Plus connector systems use a pitch size of 2.00 mm, but they are not compatible. Even when two connectors appear to be identical, the possibility of internal dimensional differences helps prevent them from being used together.

DIFFERENT MATERIALS

Connector manufacturers employ a range of different materials in the production of their products. Each alternative provides advantages in certain situations, but there is no one material that will provide superior performance in all applications. Therefore, is it vital that customers understand the importance of choosing the correct material for their design.

The shell provides mechanical and environmental protection. These shells can be made from a wide range of plastic or metals, according to the intended application. By mixing connectors from different manufacturers, the customer runs the risk of introducing two incompatible materials that can affect the function of their design.

When designing plastic-shelled connectors, the manufacturer will select materials that are suitable for the electrical and thermal performance required. If a connector from another source uses an inferior material, there are important safety implications. For example, Molex's Fit Family Connectors offer a range of high-power options. The Mega-Fit Connector uses a housing material with an operating temperature of 105°C that has been subjected to Glow-Wire testing. If this connector is mated with one from a different manufacturer, the safety afforded by the Glow Wire test is invalidated. The other connector might be designed with a material that is not rated for the same operating temperature as the Mega-Fit Connector and might therefore create a hazard.

Other products use metal alloys in the connector shell, where there are other risks associated with mixing dissimilar materials. Many metal-shelled connectors are designed for use in harsh environments, where they are exposed to water and other contaminants. Alloys react to these contaminants in different ways, and by ensuring that both mating parts of the connector system are compatible, the risk of damage to the design is minimized.

Mega-Fit Single Row Connector

ASSEMBLY AND INSTALLATION

One of the most important aspects of connector performance, and yet often overlooked, is the quality of the assembly. Even the most capable connector, manufactured from the finest materials, can be compromised if it is installed incorrectly. It is therefore vital that installation and assembly be regarded as a key part of the connector system.

Molex publishes detailed assembly instructions in its applications and tooling specifications and does so for all of its connectors. These instructions include a range of information, including recommended cable sizes, instructions for preparing the components and a list of the tools required to mate them correctly.

Not all manufacturers publish such detailed instructions for the assembly of their connectors and, critically, their instructions may differ significantly from Molex's application and tooling specifications. This represents a considerable risk if not managed correctly. Assembling connectors without using the correct instructions or tooling means that their electrical and mechanical performance cannot be guaranteed

Proper Connection

Improper Connection

CHANGE CONTROL

Manufacturers sometimes find it necessary to alter the specifications of a connector. This may be as simple as the location in which the part is produced, or it can be as significant as a change in the dimensions of the connector. In some cases, it may even be necessary to retire a part number completely and replace it with a new product.

Whatever the reason, responsible manufacturers like Molex will inform customers using a product change notification (PCN). The PCN document will detail which parts are affected, the nature of the change being made and what actions the customer needs to take. Equipped with this information, customers can plan accordingly, which may include purchasing sufficient stock for their long-term requirements or designing their equipment to accommodate the change.

However, manufacturers are only able to control the changes related to their own products. If a customer were to use products from multiple sources, even if they appeared compatible, a change to one or the other product could introduce potential dangers.

QUALIFICATIONS AND WARRANTIES

For all these reasons, cross-mating of connectors raises critical issues with respect to the testing and qualification of a product. When a manufacturer like Molex introduces a new product range, it will generally be the result of years of design, testing and qualification efforts.

A connector may appear to be a simple product, but it is more than just a single plug or socket. It represents a combination of mechanical design, materials selection, production processes and assembly procedures. A plug is paired with a socket, and then with the contacts and tooling required to terminate them. The connector therefore functions as part of a system in which each element depends on the correct functioning of all other components. When a connector is certified, it is tested as a part of the complete system. Cross-mating with a component that has not been part of this testing renders any certification invalid. Because the manufacturer has been unable to test and certify the use of connectors from other sources, the warranty that is normally provided becomes void.

CONCLUSION

In times of market instability, there may be considerable pressure to find alternative sources of components, both to ensure reliable delivery and to reduce costs. With easy access to the global connector industry, buyers and engineers may be tempted to replace connectors with others that appear to be identical.

However great the savings may appear, there are unseen risks in mixing connectors from different manufacturers. At the very least, the potential quality issues that arise from faulty installations can be damaging to reputations. In the worst-case scenarios, they may create serious safety concerns.

By adopting connector systems from Molex, not only can customers be confident that the products will perform reliably in their equipment, but they also have the support of a global manufacturer with decades of experience in creating connector systems for many applications.

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