PALPILOT

TURN KEY SOLUTIONS.

PALPILOT WHITE PAPER 1 | 2021

CUSTOM OVERMOLD

ABSTRACT

According to the latest statistics in the US Bishop Report 2020, sequentially, orders and sales for push-pull connectors continue to increase year after year. Simultaneously, the demand for custom connector overmolds continue to increase in turn. More and more consumers want their own style, an overmold to stand out amongst others.*

Overmolding, in brief, is a process in which combines a wire/cable and connector by injection molding to create a form of bend relief between the two. In today's world it is not difficult to have seen one in some point in time, i.e. our phone charger has a type of bend relief. The difficulty we are seeing more lately is the complexity of requirements in which cable assemblies and overmolds must adhere too.

In multiple industries, i.e. industrial, medical, military, e-mobile, and energy, Palpilot is constantly searching to provide cutting edge technology and the utmost high performance connector to withstand chemicals, temperature, pull force, withhold water tightness integrity, and all without compromise of quality. In the medical sector, the approval procedures for requirements continue to update year after year. In order to accommodate these requirements, Palpilot manufacturers and engineers are heavily involved in the development process for providing overmold material while also providing providing an affordable solution. The snap on bend relief may continue to be the fall back due to its low cost; however, client specific overmolds are slowly making their way to the top.

This white paper demonstrates how Palpilot can present compliant overmold technologies and materials based on its push-pull connectors and assemblies.

*THE BISHOP REPORT 12 | 2020, ISSUE NO.337

CONTENT

INTRODUCTION

Maintaining functioning technology is key when in the field in order to reduce the risk of any kind of danger. Whether it is in the industrial, military, or medical setting, having an electrical shortage can jeopardize this safety.

When there is not a complete bond between the overmold, cable, and connector, there becomes a risk of water and moisture seepage, or build up of debris, that can travel down the cable into the connector and disrupt the terminations. Many times the overmold will bond near the outer edges, but not throughout the entire length of the overmold. When it comes to having the overmold bond to the cable jacket, it is important to note that certain materials will bond more effectively than other materials.

OVERVIEW OF TECHNOLOGY

Along with engineering expertise that incorporates tribal knowledge and the long history of manufacturing, is the ongoing solution for producing overmolds that are chemical resistant, meet low and high temperatures, and the different scales of durometer. Palpilot's aim is to guarantee fit, form, and function do not compromise the integrity of the cable. During the injection process, the cable and connector are placed in a tool to be overmolded, in which, the injection material will flow into the tool cavity surrounding the cable and connector at the appointed locations. Gates within the tool create flow and stop gaps within the injected material. Several refinements of the tool can take place prior to achieving the perfect overmold.

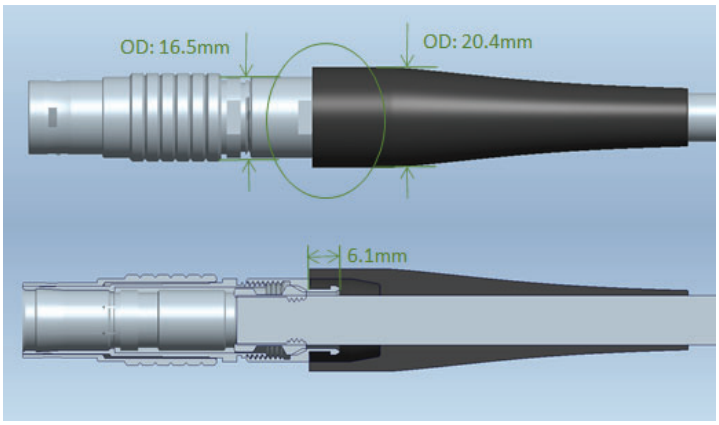
Palpilot has a wide selection of overmold, sizes, and capabilities, for both metal and plastic connectors that adhere to several acceptable jacketed materials. Palpilot also works with its customers who have their own overmold design to be incorporated into our technologies and meet the required performance of their designed application. At Palpilot we strive to offer cutting edge materials and pleasing aesthetics without compromise to fit, form, or function.

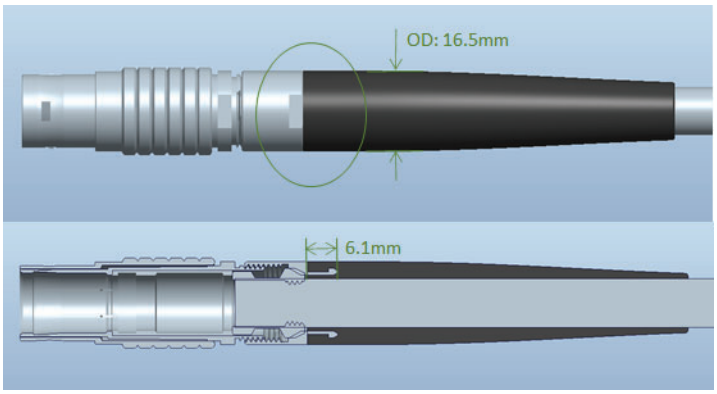
CUSTOM OVERMOLD CHALLENGES

01 | OVERMOLD BONDING

As discussed earlier, the overmolding process can take several trials before the overmold is finalized. Through visual inspection it is important to make sure there are no defects in the overmold. Having a good alignment from the overmold with the cable and connector will minimize any chance of having defective parts in future builds.

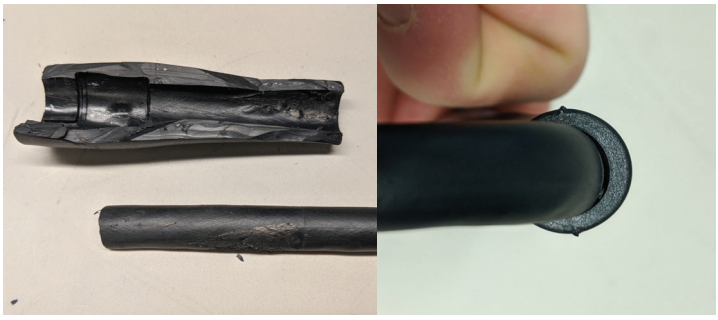
As an example, the picture to the top right shows the Palpilot connector OD is 16.50mm whereas the strain relief OD is 20.40mm. It is important to note that this strain relief design would cause the overmold to misalign horizontally with the connector and mis-bond to the connector. By reducing the strain relief OD from 20.40mm to 16.15mm, this will offer a smoother transition from the overmold to the connector as seen in the middle picture.





Additionally, it is commonly known that by using the same overmold material as the cable jacket material, it will greatly aid in the bonding process, i.e. PVC cable jacket material and PVC overmold material. However, this is not always the case when using the same materials to have a complete bond throughout the entire length of the overmold. Furthermore, what happens if the overmold material is different from the cable jacket material, will it still work? Palpilot's extensive engineering team has discovered a pre-treatment material to add to the exterior of the cable jacket where the overmold will be located, thus eliminating this issue and providing a complete bond.

If we take a look at the lower left picture we can see that the bonding occurs right where the gates are located. However, as you get further from the gates, there is little if any bonding occurring here. Both the cable jacket and the bend relief look undamaged when peeled apart except for the area surrounding the gates. By using a pre-treatment to the cable's exterior, we are able to solve this issue. Moreover, by looking at the lower right picture we can see there is some gapping between the cable and overmold. When we bend the cable sharply at this area, it begins to show the gap in the non-bonded sections of the bend relief. Again, by using a pre-treatment to this area, we are able to eliminate this issue.



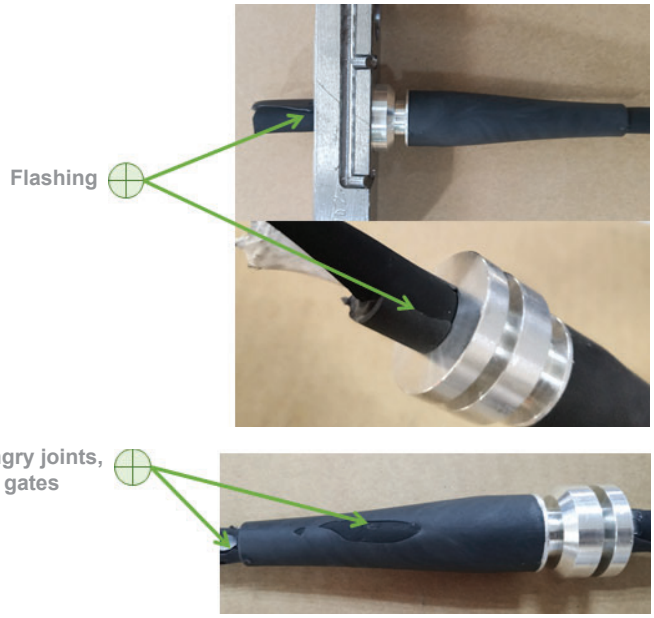
02 | MATERIAL SHRINKAGE

In addition to the alignment of the overmold, one of the more important steps to address is making sure there is no sign of "material shrinkage," "hungry joints," or "flashing", etc. in the overmold. These kinds of issues can occur in a variety of ways and is evidence that although the original design may look good on paper, it may not hold true during production.

Shrinkage- When looking to the image on our right, here we can see an example of "flashing." This will occur when there is a gap or any form of exit where the overmold can find its way during the injection process.

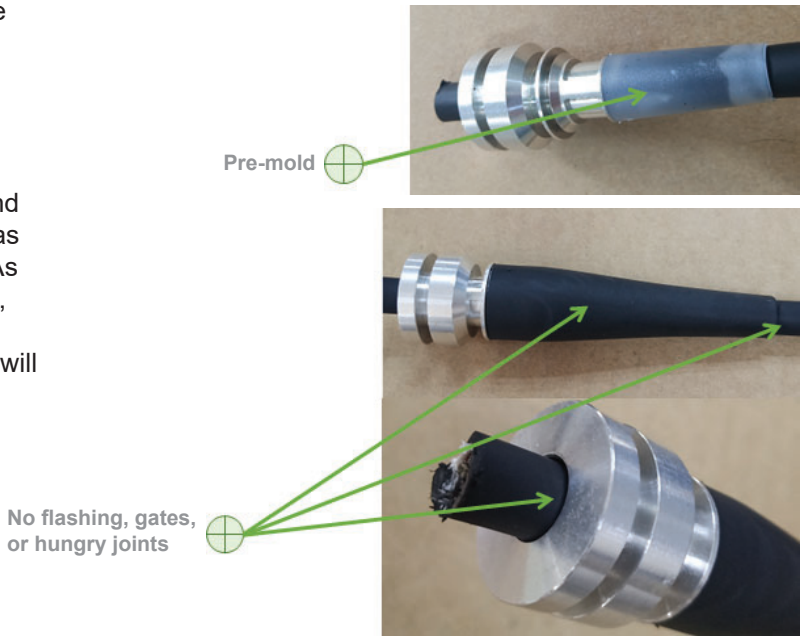
Just below we can see an example of "hungry joints" or "material shrinkage." This will occur when there is not enough room for the overmold to fill in during the injection molding process. When this process occurs, you will reveal the integrity of the overmold.

Once the overmold is produced, visual inspection identifies cracks, deep marks, or dents at the location of the tool gates.



Pre-mold- One solution used to eliminate any issue of hungry joints is by implementing a pre-mold before the overmold.

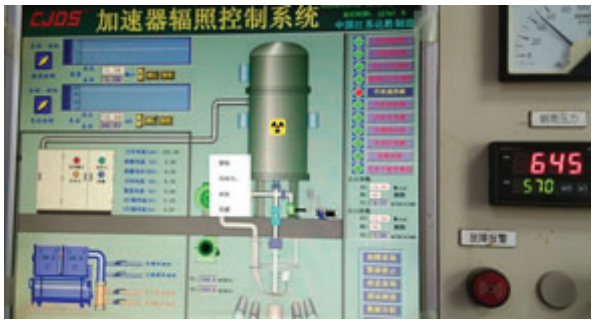
When faced with any issues of flashing or hungry joints, a pre-mold helps seal any kind of gap to keep this from occurring, as well as creating a securer bond for the overmold. As we take a look at the examples on the right, adding a pre-mold helps eliminate flashing, hungry joints, and gates. Using a pre-mold will also help support IP67/68 assemblies in mated condition.



03 | AREAS OF APPLICATION

Some of the more recent challenges in today's industries we have been facing are the extreme temperatures that are needed to be met.

As an example of an application, Palpilot conquered the challenge of producing an assembly that was required to be ozone free, salt/fog resistant, meet rapid temperature fluctuations of -60C to 105C, IP68, and resistant to a large range of chemical materials. Additionally, the connector had to maintain its multi-contact integrity, including Coax 50 Ohms and several mixed contacts and AWG wires. The challenging factor for the Palpilot engineering team was to find high grade materials for both the overmold and raw cable.

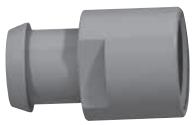


Control System for Accelerator Irradiation

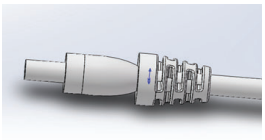
Through numerous material testings, Palpilot experimented with multiple variations of PVC, TPE, XLPE, and other raw materials. XLPE cable jacket for example, must be irradiated to achieve its temperature property; however the overmold is a more intricate process. The irradiated process is achieved through electron accelerator irradiation cross-linking, which is able to change the physical properties and enhance the mechanical strength to make the XLPE material. After irradiating the XLPE material, it is more resistant to heat, cold, and anti-aging.

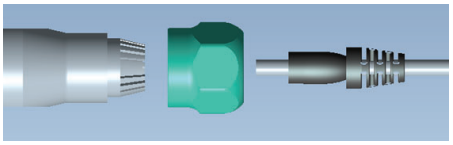
Another challenge Palpilot met was designing an overmold strain relief to a connector with a standard backnut. Normally when overmolding a connector, a backnut designed for a bend relief must be used so that the mold has something to secure itself too when pulled on. To solve this, Palpilot designed a molded strain relief with an internal section that is inserted into the backnut and exits the back position. As the backnut is screwed onto the connector, the connector's collet system clamps down tightly and secures the inner mold. This effectively achieves a high pull force, preventing the mold from being pulled out.

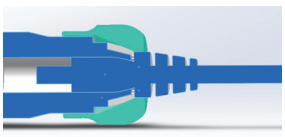
Palpilot continues to challenge its engineering and manufacturing teams to strive in producing cutting edge materials and capabilities that reduce cost and keep high performance to the customer.


Backnut for Bend Relief


Standard Backnut


New Design


Assembly Process

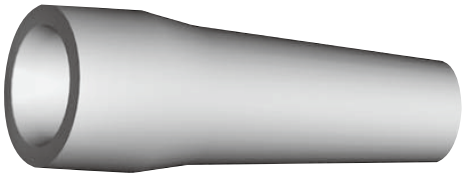


STRAIN RELIEF SOLUTIONS

Mechanical Bend Relief, when to use a snap on bend relief?

A mechanical bend relief is primarily for prototyping validation and cost sensitive applications for low volume builds. They can be used in a wide variety of applications and industries where IP rating is not a factor, and if there is no concern for rough environment or pull force. Snap on bend reliefs are typically provided in PUR or Silicone material where temperatures range from -50C to 200C. However, the silicone material can handle up to 230C for a short period of time. Snap on bend reliefs support seven standard RAL colors and although they are more readily available than an overmold, they do have their drawbacks.

Bend reliefs are hollow and can collect particulates in the gap between the cable and bend relief. They are limited in flexibility due to the set durometer and risk popping off easily.



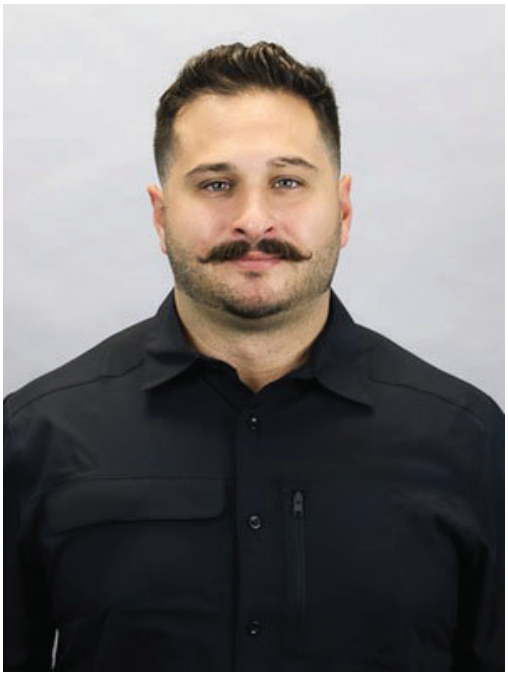
Overmold, when to use an overmold?

An overmold is ideal for water tightness, pull force, chemical resistance, and rough applications. With an overmold, you have a secure bond that helps support IP67/68 assemblies in mated condition. A wide variety of durometers can be supported, anywhere between flexible and stiff depending on preference. They are not hollow and will not collect particulates. Different style options and shapes such as serrated or straight are supported. Finally, an overmold has the ability to implement customer logos, arrows for alignment, and a wide variety of RAL and Pantone color options for customer branding.

Apart from the tooling cost, overmold will cost fewer dollars per unit price helping minimize costs and provide a safer product in the field for the future. Snap on bend reliefs may seem cost effective initially; however, overmolding will be more beneficial in the long run. Alongside the standard connector bend relief and overmold, Palpilot continues to make it possible for consumer specific solutions. Our focus is to guarantee our support and continue to maximize safety for operators and patients.

How clients and manufacturers are able to work together and meet this standard has been shown in this white paper on plastic and metal push pull connectors provided by the company Palpilot.

AUTHOR

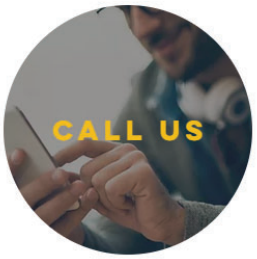


Chris Cisi is Mechanical/Electrical Engineer / FAE for Palpilot's interconnect solutions, metal and plastic series. In his role he is responsible for the US Southern Region focusing on push pull connectors in the industrial and medical industries. While interacting with many customers in the industrial and medical sectors, he has found the demand for "custom" overmolds to increase year after year.

Chris Cisi graduated with a BS Degree from Texas Christian University and a M.Ed. from Grand Canyon University.

GET IN TOUCH

We'd love to hear from you!



Northern California Office
(408) 855-8866
contact@palpilot.com
500 Yosemite Drive, Milpitas, CA 95035

Southern California Office
(714) 460-0718
contact@palpilot.com
15991 Red Hill Ave. Suite 102 Tustin, CA 92780

All dimensions are in mm. Some figures are used for illustration only. This publication is available as a PDF file that can be downloaded from **www.palpilot.com**