



THE DIFFERENCES AND BENEFITS OF SWAGED CONDUIT FITTINGS VS. SHUTTLE MOLDED CONDUIT FITTINGS

Synopsis

Cable assemblies consist of two main components: a cable, the tightly wound bundles of wire, and a conduit, the protective tubing or sleeve that surrounds the cable. Many applications require a conduit to preserve the integrity of the wire bundles from repeated push-pull and pull-pull cycles. The conduit is trapped in place within the assembly using end fittings.

There are a number of processes available that are used to affix end fittings to a conduit. In this paper, we will focus on swaged and shuttle molded conduit fittings. During design and selection of the conduit assembly, users have a wide range of options to choose from and should consider the component's manufacturing process, geometry, performance characteristics and material type.

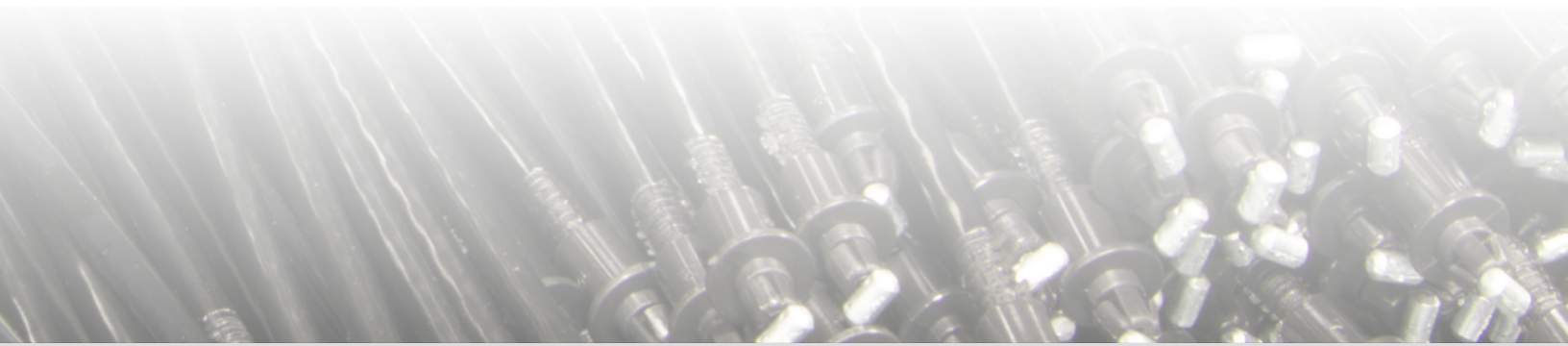
Understanding the Swaged and Shuttle Molded Manufacturing Process

Swaged Conduit Fittings

➤ Via Mechanical Deformation

Swaged fittings are machined using alloy steels and other metals. They offer dependable tensile and yield strength, elongation, hardness and creep.

Swaging involves mechanically bonding an end fitting over the conduit, using either a handheld tool or hydraulic crimping process. The applied force compresses the inner surface of the end fitting, creating a permanent, clamped mechanical bond around the conduit.





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Shuttle Molded Conduit Fittings

➤ Via Shuttle Injection Molding

Shuttle molded (also known as overmolded) components are typically made using one of a variety of polymer resins and selection is determined by the material's properties.

In this injection molding process (vertical shuttle molding), there are two bottom mold halves and one top mold half. Upon the first bottom half molding with the top half, the press automatically loads an insert such as the conduit end fitting. When the process is completed, the molding is ejected and the machine reloads a new top and bottom half, and also inserts a new conduit fitting. Almost any commercially available thermoplastic resin can be shuttle molded.

Shuttle injection molding saves the expense of using a large die during the process. It also adds a greater degree of flexibility in manufacturing. With multiple die halves, one can design components with more than one cavity for part insertion.





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Swaged and Shuttle Molded Conduit Fitting Characteristics

Swaged Conduit Fittings	Shuttle Molded Conduit Fittings
Less expensive to produce for low volume runs	Press time can be greatly reduced as this process can incorporate multiple bottom die halves to allow for insert loading. A large, single die is not necessary, thereby lowering costs. In addition, secondary finishing is not required
Varied holding strength, but also dependent on a number of design factors (swaging method, geometry, cable diameter, etc.)	Extremely cost effective for larger volumes when compared to a crimping process
Commonly used for an array of standard applications	Custom designed fittings for specific application requirements.
Machined components	Strength dependent on resin type and properties





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Additional Selection Factors to Consider:

- Cable Diameter
- Load Capacity
- Fitting Geometry
- Fitting Type
- Material
- Manufacturing Process
- Fitting Length

Swaged vs. Shuttle Molded Fitting Selection is an Application Specific Process

There is a considerable performance overlay involved when choosing between swaged and shuttle molded components:

1. The application dictates the component choice

Choosing the proper fitting, design and geometry are primary considerations for each application. If the application requires adjustment, a swaged threaded terminal is the best option; whereas, applications with a fixed point typically use shuttle molded components for ease of installation and greater variety.

2. The swaging process itself influences holding strength

For high load applications, swaged steel components are the option of choice. The swaging process, along with other factors, can be tailored to meet the required load.

For lighter load applications, shuttle molded fittings are typically used. They provide a an array of designs to match specific requirements and when using CMA's standard molded fittings, are less expensive.

3. Environmental and operating temperature ranges are other considerations

In extreme conditions, swaged steel components are ideal. Plated carbon steel or stainless steel fittings are great options for corrosive environments where strength and resistance to the elements are needed. In more protected environments, shuttle molded fittings can be used without concern of damage.

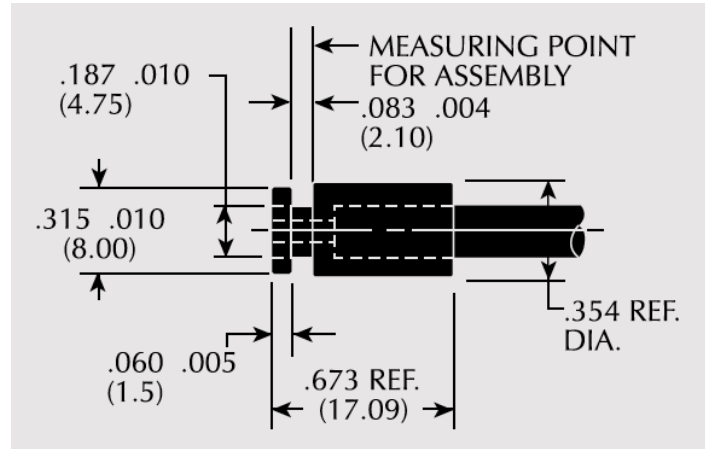


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Shuttle Molded Material Selection

For shuttle molded conduit fittings, the material selection is based on the temperature, strength and flexibility requirements of the overall design. Other aspects to consider are:

- Operating environment temperature ranges
- Axial and side loaded requirements
- Chemical or contaminant exposure
- Mating or mounting method
- Overall part functionality



Common Resins Used For Shuttle Molded Conduit Fittings

Material	Properties	Typical Uses
Polypropylene	Low cost, flexible, low strength and low temperature ranges	Handles and bushings
Acetal	Moderate cost, good strength, low impact, moderate stiffness and temperature ranges	Standard fittings, ferrules, bushings, and flags
Nylon 6	Semi-flexible, good impact resistance and good performance at higher temperature ranges	Conduit fittings, ferrules, and bushings
Nylon 6/6 Glass Reinforced	Higher stiffness, good strength, and good performance at high temperature ranges	Bushings, levers, brackets, and handles



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Tooling Cost
Differential:
Swaged vs.
Shuttle Molded
Components

Due to tooling costs, shuttle molded components are more affordable in high volumes; while swaged components built with steel fittings are more affordable in low volume applications.

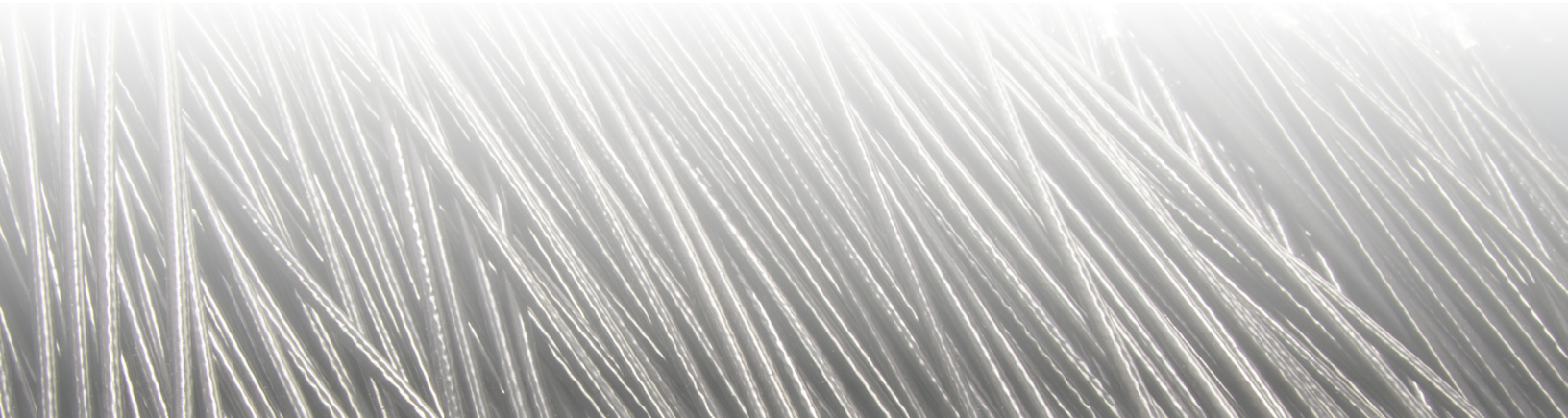
Swaged and Shuttle Molded Component Examples

Swaged Conduit Fittings

- > Tubes
- > Plain Conduit Fitting / Caps
- > Threaded Terminals
- > Snap Ring

Shuttle Molded Conduit Fittings

- > End Coupling
- > Collar
- > Flag Fitting / Slotted Flag
- > Snap-in Bushing
- > Push-in Bushing





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Choosing the Right Conduit Fitting with CMA Cable

CMA Cable offers an array of swaged and shuttle molded components for conduit end fittings. To view our complete selection, please visit our catalog. We offer both consulting and design assistance, backed by seasoned engineers who help you navigate the selection process and make the right decision for your application needs.

If you have questions or are interested in speaking with us about the proper selection of a cable assembly, we are happy to help. Please contact us by email or phone.

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