By David Crooks

Taking the Right Approach to Plastic Enclosures

Now, more than ever, **plastic** enclosures offer cost-effective **value** for customized electronics **packaging**.

Standard enclosures do not remain standard for long. In no time, engineers put holes, cutouts, and recesses into pristine boxes. This process is necessary to make the enclosure functional. There are connections to be wired, switches to mount, and readouts to view. Every design is different and every application unique. All applications seem to require customizing the enclosure.

Plastic enclosures, prized for their ability to survive hostile environments, are easily modified, making plastic a good choice for smaller volume OEMs. But the growing need for more complex modifications — beyond simple holes — is now forcing OEMs to outsource their customization work, thereby increasing their costs.

Seeking to solve this problem, progressive enclosure manufacturers are offering full customization services. Complex machining is now easily accomplished with new, high-speed computer controlled machines, specifically constructed for machining plastic enclosures.

Over the last few years, the cost of these machines has dropped significantly, while their capabilities have increased dramatically. This equipment enables enclosure manufacturers to offer cost-effective customization services for even small runs of modified enclosures. Holes, slots, cutouts, milled recesses, and more are all possible, quickly and at a reasonable cost.

So how does the design engineer begin to deal with the variety of plastic enclosures and the impact of customizing on each? What factors impact cost? How can the engineer design for lowest cost? What documentation should the designer be prepared to provide the manufacturer? What happens when unit volumes become really large?

Let's examine each of these five questions below.

1. How does the design engineer begin to deal with the variety of plastic enclosures and the impact of customizing on each?

The simplest way is to contact the manufacturer. The engineer should look for a manufacturer with a wide selection of enclosures suitable for his proposed environment, and most important, one that offers customization services. The manufacturer's technical staff can help guide the engineer to select the proper enclosure and also suggest cost effective customization methods.

2. What factors impact cost?

Many items affect cost. There is a one-time engineering charge to review the design and program the computer numerical control (CNC) machinery. There is also the cost required to set up the CNC machine, which is a recurring cost with each machining run of enclosures. Of course, the actual modifications affect cost. A large cutout for a DIN meter is more expensive than a small round hole and milled recess is more expensive than an open slot. The total time to machine the modification determines the cost. In addition, one of the most significant cost drivers is the number of enclosure sides being modified because each side requires its own program (a one-time cost) and each side requires set-up (a recurring cost). For example, two holes on two sides is more costly than four holes on one side. Also, remember that the cover, lid, or door is an entirely separate part requiring a separate set-up and program.

3. How can the engineer design for the lowest cost?

The designer can control cost by understanding that different machining operations can require different tools. Tool changes, even when automatically done, require time. And, more time equals more money. In many cases, a simple design change minimizes tool changes. For example, does that cutout corner radius really need to be 1 mm, or can it be 1.5 mm? The manufacturer will usually offer suggestions to reduce cost, but it never hurts to ask if any design changes might lower total costs. Also keep in mind that tight tolerances can be achieved in machining holes and hole pattern relationships, but specifying excessively tight tolerances costs money. The repeatability of machined patterns, unit to unit, is excellent, but the nature of plastic means that overall enclosure dimensions may change slightly due to molding process variations. Dimensioning to piece part centerlines and mold parting lines minimizes the impact of these variations and results in lower overall cost. The manufacturer's engineer can assist in this area.

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Customization and CNC

Customization can impact enclosure selection. Enclosure size, the operating environment, and the NEMA rating are the main criteria when selecting an enclosure. It is likely that multiple choices exist, but a review of the proposed customized features may eliminate some styles of enclosures. For example, a cable gland may be required for wire entry. If a threaded mounting hole is required, a thin wall enclosure is not suitable for threading and a thicker wall enclosure must be selected. Alternatively, the use of a backing nut enables simple through-hole mounting and would permit using a thin wall enclosure.

Customization with CNC machinery is cost-effective up to single runs of 1,000 pieces. If the product takes off, then the smart choice is to move from customization of standard enclosures to customized molding based upon standard enclosures. Most progressive molders can modify their standard product molds to produce a fully customized piece directly from the mold. The cost for custom modifications of a standard mold is usually far less than the cost of an entirely new mold. The advantage, besides lower piece part cost, is that the transition from customized enclosure to custom molded enclosure is transparent to the end consumer.

Engineers can create cost-effective electronic designs with plastic enclosures such as these from Fibox Enclosures.

4. What documentation should the designer be prepared to provide the manufacturer?

Ideally, the designer should provide the manufacturer with a computer-aided design (CAD) file indicating modifications. Most plastic enclosure manufacturers supply CAD files of their enclosures. Using the manufacturer's files as the starting point ensures dimensional accuracy, simplifies drawing interpretation, and eliminates errors. While a CAD file is ideal, most enclosure manufacturers can work with just about anything. However, anything less than a CAD file forces the manufacturer to generate one, at a cost to the buyer. Using a manufacturer's files during design will speed the process and lower overall costs.

5. What happens when unit volume becomes really large?

Larger production runs can lower costs but only up to a point. Ideally, one wants to have a large enough production run to minimize the impact of set-up costs. The good news is set-up costs are lower with today's new machines. As a result, the size of cost-effective runs has decreased. The advantage of smaller runs to the OEM is significant, with less money tied up in work in progress and a lower risk of inventory obsolescence should a design change occur.

Now, more than ever, plastic enclosures offer cost-effective value for customized electronics packaging. Customization no longer requires a third-party supplier. It has moved back to the enclosure source. Specialized CNC machines permit enclosure manufacturers to offer extensive customization services at lower cost and faster turnaround times. When the volume takes off, plastic allows substituting customized molding for CNC customization. With a basic understanding of the process and the input required, the design engineer can now obtain the most cost-effective solution for all ranges of piece part volume.

David Crooks is general manager of Fibox Enclosures, 810 Cromwell Park Dr., Ste. R, Glen Burnie, MD 21061.
He has been active in the industrial and OEM enclosure industry for 22 years, primarily working with NEMA and IEC designs and European manufacturers. He received a bachelor's degree in electrical engineering from Case Western Reserve University.
He can be reached at 888-342-6987 or dcrooks@fiboxusa.com.