Optimization Through Customization

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Many engineers and purchasing agents think it is more expensive to custom design a component or assembly these days when often customization can save on total costs. How can this be when an off-the-shelf unit typically is less expensive than its custom-produced counterpart? The varying answers to that question have led more and more manufacturing engineers to consider customization routinely as part of their design process. They have found that a decision to customize a part or develop a custom design for a complex assembly can yield the most cost-effective and optimized results without compromising design integrity.

Standardization or meeting an industry standard assumes a lower risk, since the part is available from multiple sources. Lowered risk can also mean reduced product inconsistencies and higher reliability. This is due to the fact that standard parts have been tested in different applications over time and have accrued a proven record of specifications and predictable performance. Taking these factors into consideration, the standard seems to offer what at the outset appears to be a quicker, easier, and cheaper solution for an application.

While this seems simple enough, just because a part is called standard does not imply that it is in stock. It means that its specifications are standard and often the manufacturer must schedule and produce an order. Since this may not meet the desired timetable, a custom alternative still may be worthwhile. It may fulfill the requirement better within a suitable schedule.

So, when is customization appropriate?

An off-the-shelf component has limits on size, performance, and specific operating environments. Today’s companies, particularly those seeking innovation and an advantage over their competition, may find that a custom-built solution can actually provide a lower total cost in the end.

First, when a standard unit is taken from stock that requires some level of modification in order to meet a specification, it becomes a custom unit. Simply re-lubricating bearings to meet specific performance specifications also customizes what once was a standard unit. Or, replacement of bearings for higher grade or tighter tolerances for less radial play and longer life means that the customization effort has begun. However, it should be noted that as several standardization parts are used to achieve desired results instead of one customized part, there are more opportunities for failure. The implication here is that a custom design might use fewer parts, which means fewer errors.

Constraints on space also may be an important consideration for customization, especially when performance is tightly toleranced or needs to be maintained. If a standard part or assembly is specified for a project with a small envelope just to save dollars, it may cause rebuilding across other subassemblies, thereby increasing the costs of engineering and time. The old adage that “time is money” frequently comes into play in regards to development time. However, a custom-house engineer often is equipped with the requisite expertise to solve specification

problems right from the beginning and resolve manufacturability in advance of the production stage, so timing may become a non-issue.

Even materials may need to be changed to meet performance expectations. Precipart [1], for example, was contacted by a major national research laboratory that had received funding to test magnetic fields and study how they were disrupted by nonmagnetic entities. The testing protocol required a vane that was moved in the magnetic field by a drive system. Common speed reducers typically incorporating magnetic steels could not be used. Precipart was contracted to produce a dimensionally standard design using all nonmagnetic materials, including brass housing, Vespel gears, and a beryllium copper retainer ring to achieve the desired specifications. This was a win-win situation for the laboratory and the project.

Another point sometimes used against specifying custom parts is that they typically require tooling or fixtures. While this may appear to be an added expense to production costs, the custom part actually may provide a competitive advantage for the entire assembly phase. At the same time it may deliver benefits to customers in achieving higher performance without any compromise. Many times these kinds of upfront, nonrecurring costs typically are amortized over a large volume order, which then makes any added cost negligible, especially if there is potential for repeat business.

Customization must be a serious contender when standardized components are reviewed and analyzed by management. Typically, they'll weigh the costs and benefits of a buy or customized decision. It may appear that initial outlays are small for the in-house alternative, but then there are purchasing costs that include purchase orders, inspection and inventory holding costs. Additionally, manufacturing costs, such as labor, benefits, workstations and floor space, must be accrued to the assembly phase. On the other hand, outsourced customization may offer solutions for total cost reduction and control without any compromises in performance.

In another example, a medical device manufacturer decided a review of its medical drug delivery system that used a pair of catalog gears in its original design was

necessary. Since these plastic gears were molded rather than machined, the unit's variation was inherently greater than what would have occurred with machined gears. As a result, the variation was translated into unacceptable output performance. A subsequent feasibility study undertaken by Precipart engineers determined that the worm gear produced the most variation. The study further found that replacement of both gears would not be necessary, but that a newly installed worm with machined specifications could provide the desired predictable outcome. This small difference in design made a large difference in performance that became acceptable to the manufacturer.

Some project managers believe customization causes lead times to increase. While this is true in certain instances, standard parts or assemblies may not fully fit the total design requirements. Although lead times for custom products can run somewhat longer initially, subsequent deliveries become routine. An experienced supplier can eliminate problems and non-conformance issues in the outsourced engineering phase and production process so that when the custom solution is delivered, it is ready to install.

Customization most often provides value to the original equipment manufacturer. In the field of medical devices, most devices actually mature at an accelerated rate and are constantly replaced by improved designs that are usually smaller and multi-functional. At the same time, these devices provide higher levels of reliability and accuracy. For example, some diagnostic technologies, such as cardiosonography, were performed originally with relatively primitive devices due to their size and accuracy. Current designs, which are more streamlined, require expertise to achieve their unique design and manufacturing technology. They must be developed and constructed using non-standard components.

Customization should not be considered a last or high-end choice, but instead should be evaluated as a highly appropriate option when the commercial market cannot offer the size, performance, weight or material required for a cost-effective and timely solution. Perhaps engineers should take a cue from the British, who have a better term for customization. They call the resulting products "purpose-built" designs.

Exactly right.

Links:
[1] http://www.precipart.com/